Pilot Project to Assess Mortality Among Former Chromium Smelter Workers

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16. Abstract (Limit: 200 words) A mortality study of former workers from four chromate production facilities in northern New Jersey was conducted, and the feasibility of identifying and notifying workers from closed facilities without access to personnel records or recent address information was examined. An attempt was made to assemble a cohort of individuals who would be interested in participating in future studies for the early detection of lung cancer. Social Security records were used to identify a cohort of 3,408 former workers from the four facilities. It was possible to trace 83% of the total cohort. Of these, 1,787 workers were deceased. At least 65.4% of the cohort presumed to be alive received notification. Mortality analysis indicated that workers at these facilities remained at an elevated risk for the development of lung cancer more than 20 years after the end of their employment. A cluster of bladder cancer among former black workers was noted at one facility. There were 306 former chromate workers who expressed interest in participating in a lung cancer screening program. Another 41 were interested in receiving more information. The author notes that in spite of the absence of personnel records or recent addresses, it was possible to determine the vital status of over 80% of all former workers and over and 90% of former workers with more than 1 year of work at these facilities.

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Table of Contents

List of Abbreviations

CL	=	Confidence Limit
ICD	=	International Classification of Diseases
IRS	=	Internal Revenue Service
NJDT	=	New Jersey Department of Taxation
PCMR	=	Proportionate Cancer Mortality Ratio
PMR	=	Proportionate Mortality Ratio

List of Tables

List of Tables (continued)

List of Tables (continued)

SIGNIFICANT FINDINGS

MORTALITY ANALYSIS

Results of the mortality analysis indicate former white male workers from four chromium smelters remain at an elevated risk for lung cancer more than 20 years after the end of their employment (Table XXIV). This is probably also true for former black workers up to 20 years after the end of their employment, but because of the limitation of a smaller sample size the elevation was not statistically significant (Table XXII). A cluster of bladder cancer among former black workers from only one facility was found. These bladder cancers are continuing to occur. The public health implications of these findings are that this group of former workers would benefit from intervention activity that included targeting cigarette smoking cessation and early detection programs for lung and bladder cancer.

HIGH RISK NOTIFICATION

Despite the absence of personnel records or recent addresses, this project was able to determine the vital status of 83.1% of all former workers and 91.6% of former workers with more than one year of work at these facilities. Among those former workers who were possibly alive, 64.5% of all workers and 78.2% of the workers with more than one year of work were known to have received notification. Since not all workers who received notification returned a questionnaire, a certain percentage of the remaining 35.5% who were possibly alive are assumed to have received notification. In a separate study of this cohort, eighty three percent reported they were glad they were notified, 17% unsure and 1% wished they had not been notified (Needleman, 1993). The public health implications of the findings are that state health departments and non-governmental bodies, without access to addresses from the Internal Revenue Service, can conduct high risk notification of former workers in the absence of any employer personnel records. If one had access to employer records or NIOSH's access to addresses from Internal Revenue Service, notification could be performed even more efficiently and effectively.

ASSEMBLY OF COHORT FOR FURTHER TESTING

We have identified 306 former chromate workers who have expressed interest in participating in a lung cancer screening program. Another 41 were interested in receiving more information. The public health implications of this finding are that approximately 50% of the respondents of a high risk notification project are interested in further screening and involvement. This data on the percentage of respondents who are interested in screening needs to be integrated into any high risk notification programs that are initiated.

ABSTRACT

The purpose of this study was to perform high risk notification, conduct a mortality analysis and determine the feasibility of amassing a cohort of individuals who would be interested in participating in future studies for the early detection of lung cancer. The study subjects were 3,408 former chromate workers from four facilities in Northern New Jersey. They had worked at these facilities between 1937 and 1971.

Eighty three percent of the total cohort and 91.6% of the workers with more than one year duration of work were traced. One thousand seven hundred eighty-seven (52%) were deceased. Of the 48% of the cohort presumed to be alive, at least 65.4% received notification. Among workers with more than one year duration of work the percentage was 78.2%.

The overall risk for lung cancer was a PCMR of 1.49 (CL 1.27 - 1.74) for white men and 1.29 (CL .96 - 2.69) for black men. These risks increased with increasing duration of employment and latency since time of first employment. The PCMR for greater than 20 years duration of work and more than 20 years since first exposure was 1.94 (CL 1.15 - 3.06) for white men and 3.08 (CL 1.13 - 6.71) for black men. The risk for lung cancer for white men remains elevated years after exposure has ceased (PCMR, 1.29 (CL 1.03 - 1.60)) for greater than 20 years since last employed).

Three hundred and six individuals expressed an interest in participating in a screening clinic for lung cancer.

BACKGROUND

The carcinogenic potential of chromium compounds has been extensively reviewed (IARC, 1980; Norseth, 1981; Hayes 1982; EPA, 1984; Langard, 1990). The International Agency for Research on Cancer (1980) concluded that there was sufficient evidence that hexavalent chromium compounds were carcinogenic in humans. Risk estimates have ranged from a low of less than a two-fold to a thirty-fold increase of lung cancer.

Case reports of lung cancer among chromate production workers were first reported in the German medical literature in the 1930's. The first health study of workers in the United States was reported in 1948 (Machle, 1948). This study of workers in all the plants in the United States where chromates and bichromates were made from chromite ore (four in New Jersey, one in New York, one in Ohio, and one in Maryland) found that 22% of all deaths were due to cancer of the respiratory system. The Public Health Service studied these same plants in the early 1950's (Public Health Service, 1953). A majority of the workers had perforated nasal septums (57%) and there was a 29-fold increase in deaths from respiratory cancer. Black workers had higher morbidity and mortality. Seventy-seven percent of the black workers had perforated nasal septums versus 50% among white workers. There was an 80-fold increase in deaths from lung cancer among black workers versus 15-fold increase among white workers. Prevalence of smoking among black and white workers was similar, 84% and 81% respectively. There were more heavy smokers among whites versus blacks (32% versus 12%).

More recent studies of the workers at the plant in Maryland have shown reduced risks of lung cancer with latter year of hiring (Hayes, 1979). How much of the decreasing risk of lung cancer among workers in this plant with latter year of hiring can be attributed to improvements in working conditions with decreased exposure versus inadequate time from first exposure to evaluate the full risk of lung cancer among more recent hires cannot be determined.

Subsequent to these studies, all seven plants have closed. The Maryland plant, which closed in the mid-1980's,

was the last of these plants to close. Two new facilities have opened in North Carolina and Texas.

The Public Health Service concluded its report in 1953 by recommending: "It is recommended that all employees who have worked 5 years or more in the chromate industry should be x-rayed every 3 months, and their films should be read by a competent roentgenologist. The study of the morbidity and mortality experience of workers in chromate plants should be continued. The local health department should follow-up chromate workers who have worked in the industry 5 years or more."

No such follow-up was instituted until our project was initiated. Included in our study are the four original New Jersey plants and the new plant in Texas. The University of Massachusetts at Amherst is conducting a study at the plant in North Carolina.

There is typically a long latency period between exposure to a carcinogen and the onset of clinically diagnosed cancer. This period is potentially a time when tests for early diagnosis of the cancer could be used to decrease mortality and morbidity from an historical exposure. Unfortunately at this time, other than improvements in technical quality, there have been no changes in screening tests for lung cancer in the last 30 years. Large screening trials comparing various frequencies of chest x-rays and sputum cytology have not proven effective in reducing mortality from lung cancer (Berlin, 1984).

New techniques to improve early diagnosis are needed. Techniques that have been investigated include measurement of chromosomal rearrangements (sister chromatid exchange and/or chromosomal aberrations) (Takehisa, 1982); oncogenes (ras oncoprotein (p 21)) (Brandt-Rauf, 1992); cellular abnormalities such as micronuclei (Lippman, 1990) or monoclonal antibodies of specific lung cancer antigens (Tockman, 1988).

Even in the absence of effective screening tests, the notification of former workers of their increased risk of an adverse outcome has been advocated (Bayer, 1987; Millar, 1989). Notification may allow targeting of educational

efforts, such as smoking cessation programs, to modify the risk (Stanbury, 1987) or inform workers of their legal rights (Connor, 1989).

SPECIFIC AIMS

The first aim was to perform a mortality study of former workers from four chromate production plants. For workers in this cohort, there is a minimum of 20 years since first exposure. A majority of the worker's first exposure will have been more than 30 years ago. We have been able to assess whether the risk of chromium associated lung cancer persists after exposure ceases.

A second aim was to examine the feasibility of identifying and notifying workers from previously existing facilities in the absence of any personnel records or recent address information. All four facilities in northern New Jersey are closed (two in 1954, one in 1964, and one in 1971). Plant records were generally non-existent and the study needed to rely on national data bases such as those maintained by the Internal Revenue Service and the Social Security Administration.

The third aim was to determine the feasibility of assembling a cohort of individuals with previous occupational exposure who would be interested in participating in a screening program for investigating new approaches to the early diagnosis of lung cancer. The actual tests to be researched were to be determined after the cohort was assembled.

METHODS

1. Identification of Cohort

The cohort was compiled from Social Security Administration "941" forms that are submitted by corporations

on a quarterly basis. These forms contain a worker's name, social security number, and the employer's quarterly contribution on that worker to Social Security.

Quarterly Social Security records for the following dates were obtained: Plant A, 1951 until its closure in 1954; Plant B, 1951 until its closure in 1971; Plant C, 1937 until its closure in 1964; Plant D, 1937 until its closure in 1954; and Plant E (new plant in Texas), 1957 until 1964. A total of 5,104 workers were identified. The only activity at plants A-D was the production of chromates. Chromate production is only a part of the activity at Plant E. Because of this, the 1,696 workers from plant E have not been included in the analysis. The quarterly records were used to determine duration of employment.

2. Vital Status Determination and Notification

The following sequential steps were taken to trace individuals (individuals did not receive a second contact if they responded to a previous contact, nor were the next of kin of deceased individuals contacted): (1) Identification of deceased individuals from Social Security and other governmental records provided to outside commercial firms; (2) A mailing by the Internal Revenue Service (IRS); (3) Identification of additional dead individuals from New Jersey Death Tapes maintained by the New Jersey Department of Health; (4) A mailing to individuals who filed New Jersey income tax forms; (5) Placement of three newspaper advertisements in Texas; (6) A second mailing by the Internal Revenue Service; (7) Identification of addresses by the Social Security Administration of individuals or dependents receiving benefits; (8) Identification of phone numbers in the local phone book from city where the Texas facility is located; (9) New Jersey motor vehicles records; and (10) the National Death Index.

A more detailed description of the methods to assemble the cohort and notify members of the cohort is contained in the published paper attached in Appendix I. The actual letters and questionnaires used are contained in Appendix II.

3. Mortality Analysis

For the mortality study the major sources used to identify deaths were the Social Security Administration, the National Death Index and the computerized death tapes of the New Jersey Department of Health.

Death certificates were coded by trained nosologists. For the majority of deaths we used the cause of death codes assigned by the New Jersey Department of Health Vital Statistics' personnel. All causes of death were converted to the 9th International Classification of Diseases.

Proportionate mortality ratios (PMR) were calculated for the three companies (one company owned two facilities, facilities A & B) together as well as individually. We used the O/E System, Version 3.5 developed by the National Cancer Institute to perform the mortality analysis. Analyses were done evaluating duration of work, latency from first employment and duration since cessation of work. Duration and time of hire were based on quarters reported by social security. For facility A and B we only had one quarter's report for each year and we assumed the individual worked the whole year that a quarter was reported. For individuals who reached their social security wage limit and would only have three quarters in a year but the years before and after that year showed the individual working we assumed the person had worked the full year.

We also performed proportionate cancer mortality ratios (PCMR) using the O/E System, Version 3.5. Ninety-five percent confidence intervals were calculated for all PMR and PCMR's.

We performed all analyses using U.S. general population deaths to generate the expected mortality events. All PMRs were adjusted by five year age and five year time period of death categories. Analyses were gender and race specific. Given the small number of women only overall proportionate mortality ratios were performed for white women. There were two deaths among black women. This is an insufficient number of deaths for analysis. Death certificates from eight men were not included in the analysis because no information on race was available.

RESULTS

1. Vital Status

There were 3,408 individuals identified who had worked at facilities A - D. Facility A and B had 710 workers; facility C had 848, and facility D had 1,891. Forty-one individuals had worked at more than one facility.

The vital status of the cohort is shown in Table I. Approximately half had died. Thirty-one percent were presumed to be alive. Seventeen percent neither completed a questionnaire nor were noted to have a current address by either the Social Security Administration (SSA) or the New Jersey Department of Taxation (NJDT). If no questionnaire was completed and no address was provided by SSA or NJDT the person was considered lost to followup. Among those who had worked more than one year at a chromium plant, approximately 62% had died, 30% had completed a questionnaire and only 8% had neither completed a questionnaire nor were known to have a current address.

A higher percentage of workers from facility A and B were known to have died. Additionally, a lower percentage from these two facilities were lost to followup. The percentage lost to followup from all of the facilities decreased among the workers with more than one year of work.

Of the 1,046 presumed to be alive, 790 (75.5%) completed a questionnaire and 256 were listed by Social Security as currently receiving benefits or by the New Jersey Department of Taxation as paying taxes (Table II). The response rate among longer duration employees was slightly higher, 83% versus 76% for the one year or less employees (Table II).

Of the 1,787 individuals who were known to have died, death certificates were located on approximately 92% (Table III). There was no difference in our ability to find death certificates on the longer duration versus short duration employees (Table III).

2. Proportionate Mortality Analysis

The PMRs for white men, black men, and white women are shown in Tables IV - VI. For white men there were 1,196 deaths . There was a statistical increase for death from all cancer, digestive cancer, stomach cancer and lung cancer. There is a statistically significant decrease for death for vascular lesions of the central nervous system and all external causes of death including motor vehicle accidents and suicide (Table IV).

For black men there were 377 deaths. There was a statistically significant increase for death for all cancer, lung cancer, bladder cancer and diseases of the digestive system. There were no statistically significant decreases (Table V).

For white women there were 55 deaths. There was a statistically significant increase for death from chronic rheumatic heart disease (Table VI).

For black women there were only two deaths and no analysis was done.

The PCMRs are shown for white and black men in Table VII and Table VIII. For white men there were 159 deaths from lung cancer. The PCMR was 1.49. The 95% confidence limit was 1.27 - 1.74 (Table VII). For black men there were 51 deaths from lung cancer and eight deaths from bladder cancer. The PCMR for lung cancer was 1.29. The 95% confidence limit was .96 - 1.69. The PCMR for bladder cancer was 3.42. The 95% confidence limit was 1.47 - 6.75 (Table VIII).

The PMRs and PCMRs for white and black men for selected cancer by time since first employed are shown in Tables IX - XII. For white men the PMRs from all malignancies and lung cancer are statistically increased for all latencies. For digestive cancer the PMR is statistically increased only for 0 - 10 years after beginning work. Prostate cancer is statistically decreased for the time period greater than 20 years since first hired (Table IX).

For PCMRs only lung cancer remains statistically increased while prostate cancer remains statistically decreased (Table X).

For black men the PMR is statistically significant for all malignant neoplasms, lung cancer and bladder cancer. This is found only for the longer latency causes of death (Table XI). For the PCMR lung cancer remains statistically elevated for deaths 10 - 20 years since first exposure and for bladder cancer for deaths greater than 20 years since first exposure (Table XII).

The PMRs and PCMRs for white and black men for selected cancers by duration of employment are shown in Tables XIII and XVI. For all malignant neoplasms and lung cancer the PMR is statistically increased in the deaths of white men who worked greater than 1 through 10, greater than 10 through 20 and greater than 20 years (Table XIII). Deaths from prostate cancer is statistically decreased for those who worked less than or equal to one year. For the PCMR analysis lung cancer remained statistically increased for white men who worked more than 1 but no more than 10, 10 through 20 and greater than 20 years. Death from prostate cancer remained reduced in those working 1 year or less (Table XIV).

For black men there are statistically increased PMRs for death from all malignant neoplasms for duration of employment from greater than 1 through 10 years and greater than 10 through 20 years; for lung cancer for work greater than 1 year through 10 years, greater than 10 through 20 years and greater than 20 years; and for bladder cancer for duration of work 1 year or less (Table XV). For the PCMRs statistical increases were found for lung cancer deaths for deaths among black men with greater than 20 years duration of work and for bladder cancer for deaths less than or equal to 1 year duration of work (Table XVI).

Additional analyses were performed for lung cancer. The PMRs and PCMRs by time from first employed and duration of employment for black and white men are shown in Tables XVII - XX.

For black men there was a statistically significant increased PMR for death from lung cancer for duration of work less than or equal to 1 year and greater than 10 through 20 years from first hire, duration of work greater than 10 through 20 years with a similar latency period and duration greater than 20 years with a similar latency period (Table XVII). The same time periods except less than 1 year duration of work showed statistically increased PCMRs (Table XVIII).

For white men there was a statistically significant increased PMR for death from lung cancer for duration of work greater than 1 through 10 years with a latency less than 10 years and greater than 20 years, duration of work greater than 10 through 20 years with a similar latency period, and a duration of work greater than 20 years with a similar latency period (Table XIX). The same time periods showed statistically increased PCMRs (Table XX).

Lung cancer PMRs and PCMRs were also analyzed by time since last worked (Tables XXI - XXIV). For black men the PMRs for death from lung cancer were statistically increased for latency since last worked less than or equal to 10 years and for greater than 10 through 20 years last worked. A statistical increase was found within duration categories greater than 10 through 20 and greater than 20 years for 0 - 10 years since last worked and 1 year or less duration of work and greater than 10 through 20 years since last worked (Table XXI). For the PCMR only death for lung cancer within 0 - 10 years since last worked was statistically significant. This was found for both the greater than 10 through 20 year and greater than 20 year duration group (Table XXII).

For white men the PMRs for lung cancer were statistically increased for less than or equal to 10 years and greater than 20 years since last worked. This was found within all duration categories except less than or equal to 1 year for 0 - 10 years since last worked. It was also found among workers who had greater than 1 through 10 years duration of work and a latency of greater than 20 years since last worked (Table XXIII). The PCMR for lung cancer remained statistically significant except for the greater than 1 through 10 year group with more than 20 years since last worked (Table XXIV).

Tables XXV - XXVIII presents the PMR and PCMR by five year periods by duration of years worked. Generally both the PMRs and PCMRs for both white and black men are lower in the decades of the 1970's and 1980's than in the 1940's, 1950's and 1960's. Almost all PMRs and PCMRs are greater than 1.00 in all decades.

Lung cancer PMRs and PCMRs for black and white men by facility, duration, latency from time first employed and latency since last employed are shown in Tables XXIX and XXXI. Statistically significant increases in PMR for white men were found in facilities C and D for deaths occurring among men with greater than 1 year through 10 year duration of work, and greater than 10 through 20 years duration of work. For facility D a significant increase in the PMR for lung cancer was found among white men who had worked greater than 20 years duration. For the PCMR there were statistically significant elevations among workers at facility D who had worked greater than 1 through 10 years and greater than 20 years. Among white men who had worked at facility C there was a significant elevation in PCMR among men who had worked greater than 10 through 20 years (Table XXIX). For black men there was a statistically significant increase in PMRs for lung cancer among those who had worked at facility D for greater than 1 year through 10 years and greater than 10 years through 20 years, at facility C greater than 10 through 20 years and at facility A or B for greater than 20 years (Table XXIX). There were no statistically significant PCMRs.

Table XXX shows the results of PMR and PCMRs by time from first employed for lung cancer by race and facility. Black men who worked at facility D had a statistically significant increase in PMRs for lung cancer greater than 10 through 20 years and greater than 20 years after first working at the facility. The PCMR was elevated only among deaths that occurred greater than 10 through 20 years from time of hire (Table XXX). For white men elevated PMRs for lung cancer was seen in all facilities 0 - 10 years after first hire and greater than 10 through 20 years and greater than 20 years after first hire in workers from facilities C and D. The PCMRs were elevated for lung cancer in facility A/B and D for the 0 - 10 years after first hire, greater than 10 through 20 years and greater than 20 years from first hire for facilities C and D (Table XXX).

PMRs and PCMRs for lung cancer by time since last employed are shown in Table XXXI. For white men, PMRs for lung cancer were statistically elevated from all facilities 0 - 10 years after last worked, greater than 10 through 20 years at facility D and greater than 20 years at facility C and D. The PCMRs were statistically significant for lung cancer for white men only in facilities A/B and D, 0 - 10 years after last worked (Table XXXI). For black men the PMRs for lung cancer were statistically significant in facility A/B and D, 0 - 10 years after last worked and greater than 10 through 20 years in facility D. The only statistically significant PCMR was in facility D, 0 -10 years after last worked (Table XXXI).

Tables XXXII and XXXIII show the PMR and PCMRs for lung cancer by five year time intervals by facility. Generally PMR and PCMRs are lower in the more recent time periods although almost all are greater than 1.00.

The statistically significant increase in bladder cancer PMR and PCMR for black workers was seen among those who worked 1 year or less, greater than 20 years after first hire at facility D. Seven of the eight deaths from bladder cancer were among facility D employees. Five had worked between 1944 and 1947. The other two individuals had worked in 1951. The eighth death among a black worker from bladder cancer was from facility C. He developed his cancer more than 20 years after hire after having worked for 22 years from 1939 - 1961. The PMR and PCMRs for bladder cancer for this one death were elevated but not statistically significant. Bladder cancer among white men was not elevated. There were five deaths from bladder cancer among white men. Four occurred 20 years after first hire and 1, 0 - 10 years after first hire. Of the white men who died of bladder cancer, two had worked for 1 year or less, 1 for greater than 1 through 10 years, 1 for greater than 10 years through 20 years and 1 for greater than 20 years. Two had occurred among workers from facility A/B, one from facility C and two from facility D. Both of the two deaths among white men from bladder cancer at facility D were among workers who had worked less than one year in 1945 or 1948. One occurred greater than 20 years and the other less than 10 years after first hire.

Of the eight deaths not included in the analysis because information on race was not available, one person from

facility A/B died of laryngeal cancer and one person from facility D died of cancer of the digestive organs unspecified.

3. Notification

The responses from the questionnaires completed by 792 former workers is shown in Table XXXIV for all the responders as well as by facility. Approximately 70% of the responders live in New Jersey or an adjoining state.

Forty-three percent would be interested in attending a lung cancer screening clinic. Seventy-seven percent are white and 19% are black. Ninety percent are men. A majority state they are in good to excellent health. Sixteen percent are still smoking cigarettes. Because of missing data on the questionnaires, another 14% could still be smoking. Thirty-one percent have a perforated nasal septum. Twenty percent have scars from chrome ulcers. Ten percent have a history of cancer. The average age of birth is 1925, the median 1924, and the range is from 1900 - 1957. There is variation in the responses between workers from the different facilities for interest in attending a lung cancer screening clinic (29.5% - 63.6%), for race (4.6% - 28.2%), for current smoking status (13.6% - 21.7% and another 11.5% - 14.9% possibly still smoking), for a perforated nasal septum (26.5% - 37.1%), for scarring from chrome ulcers (10.2% - 31.8%) and average age of birth (1920 - 1931). A large percentage of responders had worked one year or less at a facility (51.1%) (Table XXXIV). Except for facility A/B they had all begun work more than 20 years ago.

Table XXXV shows the duration of employment and latency from time first employed among deceased individuals whose death certificates were located and used in the analysis. Individuals who died were likely to have had a longer duration of employment (20.8% of the deceased workers had greater than 10 years duration of employment versus 8.8% among those still alive).

DISCUSSION

The mortality experience of workers from the four facilities owned by three companies that we studied have been previously studied (Machle, 1948; Public Health Service 1953). Machle in 1948 found that 17 - 27% of deaths from 1930 - 1947 in these four facilities were secondary to lung cancer. This was a 16 fold increase. He did not include workers who left the facility. The Public Health Service included three facilities in addition to the ones we studied. They found a 29 fold increase in lung cancer during the 1940's. This risk was 14 fold among white workers and 80 fold for black workers.

Lung cancer was the cause of 13.4% of the deaths in our study. We found a 1.90 (CL 1.62 -2.22) risk for lung cancer among white male workers (Table IV) and 1.80 (CL 1.34 - 2.37) for black male workers (Table V). Given the limitations of a PMR analysis, a more valid estimate of the risk is probably the PCMR. This showed a risk of lung cancer for white male workers of 1.49 (CL 1.27 - 1.74) (Table VII) and 1.29 (CL .96 - 1.69) for black male workers (Table VIII). The risk increased with the number of years worked. The PCMR for lung cancer for white men increased from 1.22 (CL .92 - 1.60) to 1.55 (CL 1.18 - 2.00) to 1.82 (CL 1.21 - 2.63) to 1.94 (CL 1.15 - 3.06) with increasing years worked (Table XIV). For black men the PCMRs for lung cancer increased from 1.00 (CL .59 - 1.57) to 1.20 (CL .70 - 1.92 to 1.83 (CL .88 - 3.37) to 3.08 (CL 1.13 - 6.71) for increasing duration of employment.

The higher PCMRs were seen in the longer duration workers with more than ten years since date of employment (Table XVIII and Table XX).

Only a very small percentage of the lung cancer deaths in our study occurred during the time period studied by either Machle or the Public Health Service. Only 4.9% of all deaths and 6.9% of lung cancer deaths among white men and 2.9% of all deaths and 5.8% of lung cancer deaths among black men in our study occurred before 1950. The risk of lung cancer has decreased with time elapsed from last exposure (Tables XXII and XXIV). The risk is still elevated for white men more than 20 years after last exposure but was not found for black men. This difference for a continuing risk among former white and black workers may be partially secondary to

differences in the distribution of white and black workers by facility and small sample size (Table XXXI).

No attempt was made to separate out exposure to hexavalent versus trivalent chromium. Previous industrial hygiene studies of these facilities have shown exposure to chromium of both valences throughout the plant (Public Health Service, 1953).

A cluster of bladder cancer among black men who worked for one year or less at facility D in the 1940's and early 1950's was found. No known bladder carcinogens are mentioned in the industrial hygiene discussion from historical reports (Public Health Service, 1953). The bladder cancers are occurring more than 20 years after start of employment. The last was reported in 1990.

Limitations of our mortality analysis include the fact that 10.9% of all workers could not be traced and 8.4% of workers with more than one year could not be traced. Because we used data systems that were likely to identify if someone were alive (Internal Revenue Service, Federal and State, and Social Security Administration records of those receiving benefits) or died in the last ten to 30 years (National Death Index, New Jersey Vital Statistics and Social Security records) we suspect that many of the individuals not traced died previous to the availability of computerized records of death. This would not bias the current risk of lung cancer in this cohort, but might cause us to underestimate the historical risk. Another limitation is that we depended on social security records to define our cohort. For facilities A/B we had no records before 1951. For facility C we had no records before 1937. For facility D we had limited personnel records before 1937 but our main data source were social security records which began in 1937. One hundred and fifty eight (11.4%) of our cohort from facility C and D was working in 1937 and 133 (48.8%) of the cohort from facility A/B was working in 1951. We do not know how long before 1937 or 1951 respectively they were working. This lack of information about work before 1937 or 1951 would cause us to overestimate the risk for shorter duration work and shorter latency from first hire.

We did not have access to information about cigarette smoking among deceased workers. We know from

historical data that 81.1% of chromate workers smoked cigarettes previous to 1950. Seventy percent of living workers who responded to the questionnaire had ever smoked cigarettes, and 16% - 30.2% continued to smoke. These percentages are similar to general population percentages from these time periods. Overall, there was no increase in other cigarette related diseases. For white men the PMR for emphysema was 1.12 (CL .66 - 1.77) and for black men the PMR was .43 (CL .01 - 2.39). For laryngeal cancer the PCMR was .80 (CL .21 - 2.04) for white men and .46 (CL .01 - 2.56) for black men. For atherosclerotic heart disease the PMR was .98 (CL .89 - 1.08) for white men and .87 (CL .69 - 1.08) for black men. There was an increase in bladder cancer in black men but this was specific to a cluster of disease in one facility. Only by continued follow up of the 790 individuals on whom we have smoking data can we address the issue of interaction between smoking and chromium exposure.

Because of deficits in heart disease in our cohort and the known phenomenon that the healthy worker effect will cause the PMR to be an overestimate of the true risk, we calculated PCMRs throughout our analysis. The PCMR is less biased by the healthy worker effect and is therefore a better predictor of the true risk. We did not draw any conclusions not supported by the PCMR analysis.

As we categorized our study group by race, facility, duration and latency our sample size became smaller. Because of this we had insufficient statistical power in many of these subgroups to show a statistically elevated risks. However, the trends with duration and latency are supportive of the causal relationship between work in these facilities and lung cancer.

We did not include Company E in the analysis as during the process of tracing we learned that this company produced multiple products and that only a relatively small percentage of the workforce was involved in chromium production.

In addition to performing the mortality analysis, we performed a high risk worker notification. We were able

to do this on cohorts for whom we had no address and who had last worked 20 - 40 years before we began our project. Quarterly social security 941 records with individual social security numbers are available on all U.S. employees since 1937. This data base allows both government and nongovernmental entities to put together cohorts of previously exposed workers. Accordingly, the availability of employer personnel records is not an issue for determining the feasibility of high-risk worker notification. The availability of personnel records or a more recent time since last worked would decrease costs and increase the percentage of workers who could be contacted. As shown in Table I we could not determine the vital status on 16.9% of all workers and 8.4% of workers with more than one year duration of work (Table I). For facility A/D which closed 19 years ago, the respective percentages were 10.5% and 4.7% as compared to facility D which closed 36 years ago 20.4% and 16.4% (Table I). A more complete description of our tracing procedure is contained in Appendix I.

Our costs for tracing individuals, which include the mortality analysis, was $25.47 per individual. Given the knowledge we acquired during the process as well as economics of scale we believe we could reduce these costs by up to 50% per person if we were to do subsequent notification on multiple cohorts.

Three hundred and six individuals expressed an interest in participating in a future lung screening clinic. Another 41 requested more information about lung cancer. Of those who indicated they were not interested, a major concern was about distance or travel to the screening site although no site was mentioned in any of the material that was provided. Willingness to participate was the same whether or not the respondent lived in New Jersey or an adjoining state. Potentially a larger number of the 790 workers who returned the questionnaire would participate if the testing was something that could be done by their personal physician. Over 90% had seen a doctor within two years previous to responding to the questionnaire and over 90% said they had health insurance.

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List of Publications/Future Publications

Completed

Rosenman KD, Stanbury M, Lemon A, Solice-Sample G, Kalush A. High-Risk Notification of Chromate and Bichromate Production Workers. American Journal of Industrial Medicine 1993; 23:125-134.

Planned

Rosenman KD. Mortality Experience of Former Chromate Production Workers.

Rosenman KD. Former Chromate Production Workers: Is Secondary Prevention Feasible?

Table I. Vital Status of Cohort

	Dead				Live				Unknown			
	All		>1 year		All		>1 year		All		>1 year	
	#	%	#	%	#	%	#	%	#	%	#	%
Facility A & B	300	(42.3)	226	(50.9)	335	(47.2)	197	(44.4)	75	(10.5)	21	(4.7)
Facility C	453	(53.4)	299	(62.7)	278	(32.8)	144	(30.2)	117	(13.8)	34	(7.1)
Facility D	1060	(56.1)	452	(68.7)	445	(23.5)	131	(19.9)	386	(20.4)	75	(11.4)
Overall	1787[a]	(52.4)	959[b]	(61.6)	1046[c]	(30.7)	467[d]	(30.0)	575[e]	(16.9)	130	(8.4)

[a]Twenty-six had worked at more than one facility and are included only once in the total.

[b]Eighteen had worked at more than one facility and are included only once in the total.

[c]Twelve had worked at more than one facility and are included only once in the total.

[d]Five had worked at more than one facility and are included only once in the total.

[e]Three had worked at more than one facility and are included only once in the total.

Table II. Source of Information by Facility for Individuals Identified to be Alive

	Questionnaire Received		Current Address Identified by Social Security or New Jersey Department of Taxation	
	All	>1 year	All	>1 year
	# %	# %	# %	# %
Facility A & B	244(72.8)	154(78.2)	91(27.2)	43(21.8)
Facility C	222(79.9)	127(88.2)	56(20.1)	17(11.8)
Facility D	330(74.2)	109(82.6)	115(25.8)	23(17.4)
Overall	790[a](75.5)	386[b](82.7)	256[c](24.5)	81[d](17.3)

[a]Six had worked at more than one facility and are included only once in the total.

[b]Four had worked at more than one facility and are included only once in the total.

[c]Six had worked at more than one facility and are included only once in the total.

[d]Two had worked at more than one facility and are included only once in the total.

Table III. Number and Percent by Facility with Death Certificate Obtained

	Death Certificate				No Death Certificate			
	All		>1 year		All		>1 year	
	#	%	#	%	#	%	#	%
Facility A & B	284	(94.7)	218	(96.5)	16	(5.3)	8	(3.5)
Facility C	416	(91.8)	275	(92.0)	37	(8.2)	24	(8.0)
Facility D	965	(91.0)	412	(91.2)	95	(9.0)	40	(8.8)
Overall	1639[a]	(91.7)	887[b]	(92.5)	148	(8.3)	72	(7.5)

[a]Twenty-six had worked at more than one facility and are included only once in the total.

[b]Eighteen had worked at more than one facility and are included only once in the total.

Proportionate Mortality Ratios For White Men

Table IV-- Observed, Expected, Observed/Expected & Confidence Intervals by Cause Codes as Structured in the Ref. Data Base.
Stratified by: Race = White
Sex = Male

CAUSE	OBS	EXP	O/E	LL	UL	CHISQ
MLG ALL MALIGNANT NEOPLASMS	344	256.904	1.34	1.20	1.49	38.31
INF ALL INFECTIVE AND PARASITIC DISEASE	14	17.187	0.81	0.44	1.37	0.62
TUB ALL TUBERCULOSIS	3	8.263	0.36	0.07	1.06	3.48
BUC CANCER OF BUCCAL CAVITY AND PHARYNX	6	7.294	0.82	0.30	1.79	0.23
DIG CANCER OF DIGESTIVE ORGANS AND PERITONEUM (1925- APPROXIMATE)	94	72.263	1.30	1.05	1.59	6.98
ESO CANCER OF ESOPHAGUS (1925- APPROXIMATE)	9	6.129	1.47	0.67	2.79	1.35
STO CANCER OF STOMACH	24	13.164	1.82	1.17	2.71	9.04
LGI CANCER OF LARGE INTESTINE (1925- APPROXIMATE)	24	24.787	0.97	0.62	1.44	0.03
RCT CANCER OF RECTUM (1925- APPROXIMATE)	13	7.374	1.76	0.94	3.01	4.32
LIV ALL CANCER OF LIVER (1925- APPROXIMATE) 1970+ - PRIMARY ONLY	9	5.108	1.76	0.80	3.34	2.98
PAN CANCER OF PANCREAS (1925- APPROXIMATE)	12	13.548	0.89	0.46	1.55	0.18
RSP CANCER OF RESPIRATORY SYSTEM (1925- APPROXIMATE)	169	88.107	1.92	1.64	2.23	81.62
LRX CANCER OF LARYNX (1925-, 1930- APPROXIMATE)	4	3.631	1.10	0.30	2.82	0.04
LNG ALL CANCER OF LUNG - PRIMARY AND SECONDARY (1925-,1930- APPROXIMAT	159	83.652	1.90	1.62	2.22	74.27
BON CANCER OF BONE (1925-,1930-,1945- APPROXIMATE)	0	0.934	0.00	0.00	3.93	0.93
SKN CANCER OF SKIN	3	4.227	0.71	0.14	2.07	0.36
BRE CANCER OF BREAST	0	0.324	0.00	0.00	11.31	0.32
CER CANCER OF CERVIX UTERI (1950+ ONLY)	0	0.000	0.00	???	???	0.00
COR CANCER OF CORPUS UTERI (1950+ ONLY)	0	0.000	0.00	???	???	0.00
UTE CANCER OF ALL UTERUS (1930+ ONLY)	0	0.000	0.00	???	???	0.00
OFG CANCER OF OTHER GENITAL ORGANS (1930+ ONLY)	0	0.000	0.00	???	???	0.00
AFG CANCER OF ALL GENITAL ORGANS	0	0.000	0.00	???	???	0.00
PRO CANCER OF PROSTATE (1925- APPROXIMATE)	13	21.730	0.60	0.32	1.02	3.60
TST CANCER OF TESTIS (OTHER GENITAL ORGANS 1925-49)(1925-,1930- APPROX	0	0.777	0.00	0.00	4.72	0.78
BLA CANCER OF BLADDER (1925- APPROXIMATE)	5	8.104	0.62	0.20	1.44	1.20
KID CANCER OF KIDNEY (1925- APPROXIMATE)	4	6.156	0.65	0.17	1.66	0.76
EYE CANCER OF EYE (1950+ ONLY)	0	0.191	0.00	0.00	19.19	0.19
BRN CANCER OF BRAIN AND OTHER CENTRAL NERVOUS SYSTEM (1925- APPROXIMAT	5	6.051	0.83	0.27	1.93	0.18
THY CANCER OF THYROID (1950+ ONLY)	0	0.451	0.00	0.00	8.13	0.45
LYM LYMPHOSARCOMA AND RETICULOSARCOMA (1950+ ONLY)	4	3.886	1.03	0.28	2.64	0.00
HDG HODGKIN'S DISEASE (1940-,1945- APPROXIMATE)	1	1.820	0.55	0.01	3.06	0.37
MMY MULTIPLE MYELOMA	2	3.421	0.58	0.07	2.11	0.59
LEU LEUKEMIA AND ALEUKEMIA	11	9.495	1.16	0.58	2.07	0.24
OLY CANCER OF OTHER LYMPHATIC TISSUE (1950+ ONLY)	5	7.191	0.70	0.22	1.62	0.67
ALP ALL LYMPHOPOIETIC CANCER	21	22.826	0.92	0.57	1.41	0.15
BNG BENIGN NEOPLASMS	3	2.793	1.07	0.22	3.14	0.02
AEM ALLERGIC,ENDOCRINE,METABOLIC,NUTRITIONAL DISEASES (1950+ ONLY)	21	19.971	1.05	0.65	1.61	0.05
DBT DIABETES MELLITUS	17	17.332	0.98	0.57	1.57	0.01
BFO ALL DISEASES OF BLOOD AND BLOOD-FORMING ORGANS (1925-,1930- APPROX	4	3.007	1.33	0.36	3.41	0.33
PSY MENTAL,PSYCHONEUROTIC,AND PERSONALITY DISORDERS (1950+ ONLY)	4	5.726	0.70	0.19	1.79	0.52
NRV ALL DISEASES OF NERVOUS SYSTEM AND SENSE ORGANS	9	11.282	0.80	0.36	1.51	0.47
CRS ALL DISEASES OF CIRCULATORY SYSTEM	589	634.096	0.93	0.86	1.01	7.01
RHD CHRONIC RHEUMATIC HEART DISEASE(1925- APPROXIMATE)	6	8.655	0.69	0.25	1.51	0.83
AHD ARTERIOSCLEROTIC HEART DISEASE,INCLUDING CHD (1925- APPROXIMATE)	423	429.801	0.98	0.89	1.08	0.17
VAS ALL VASCULAR LESIONS OF CNS	84	84.722	0.76	0.58	0.96	5.55
RSD ALL RESPIRATORY DISEASES (1925-,1930- APPROXIMATE)	88	84.048	1.05	0.84	1.29	0.20
PNM ALL PNEUMONIA (1925-,1930- APPROXIMATE)	28	29.891	0.94	0.62	1.35	0.12
EMP EMPHYSEMA (1950-,1955 APPROXIMATE)	18	16.056	1.12	0.66	1.77	0.24

AST ASTHMA (1925-,1930- APPROXIMATE)	1	2.368	0.42	0.01	2.35	0.79
DGS ALL DISEASES OF DIGESTIVE SYSTEM	57	51.701	1.10	0.83	1.43	0.57
GDU ALL GASTRIC AND DUODENAL ULCER	6	7.558	0.79	0.29	1.73	0.32
CRL CIRRHOSIS OF LIVER	20	23.643	0.85	0.52	1.31	10.58
GUS ALL DISEASES OF GENITO-URINARY SYSTEM	15	19.116	0.78	0.44	1.29	0.91
NPH CHRONIC NEPHRITIS	2	4.247	0.47	0.05	1.70	1.20
SCT ALL DISEASES OF THE SKIN AND CELLULAR TISSUE	0	0.950	0.00	0.00	3.86	0.95
BOM ALL DISEASES OF THE BONES AND ORGANS OF MOVEMENT	1	1.929	0.52	0.01	2.88	0.45
SEN SYMPTOMS,SENILITY,AND ILL DEFINED CONDITIONS	8	11.669	0.69	0.30	1.35	1.17
EXT ALL EXTERNAL CAUSES OF DEATH	39	72.021	0.54	0.38	0.74	17.52
ACC ALL ACCIDENTS	24	48.288	0.50	0.32	0.74	13.52
MVA MOTOR VEHICLE ACCIDENTS	4	19.558	0.20	0.06	0.52	13.12
SCD SUICIDE	9	18.436	0.49	0.22	0.93	4.98

Proportionate Mortality Ratios For Black Men

Table V -- Observed, Expected, Observed/Expected & Confidance Intervals by Cause Codes as Structured in the Ref. Data Base.
Stratified by: Race = Non-white
Sex = Male

CAUSE	OBS	EXP	O/E	LL	UL	CHISQ
MLG ALL MALIGNANT NEOPLASMS	122	85.423	1.43	1.19	1.71	20.80
INF ALL INFECTIVE AND PARASITIC DISEASE	7	9.658	0.72	0.29	1.49	0.78
TUB ALL TUBERCULOSIS	4	4.662	0.86	0.23	2.20	0.10
BUC CANCER OF BUCCAL CAVITY AND PHARYNX	3	3.018	0.99	0.20	2.90	0.00
DIG CANCER OF DIGESTIVE ORGANS AND PERITONEUM (1925- APPROXIMATE)	27	25.318	1.07	0.70	1.55	0.12
ESO CANCER OF ESOPHAGUS (1925- APPROXIMATE)	6	5.124	1.17	0.43	2.55	0.15
STO CANCER OF STOMACH	4	5.611	0.71	0.19	1.83	0.47
LGI CANCER OF LARGE INTESTINE (1925- APPROXIMATE)	4	5.842	0.68	0.18	1.75	0.59
RCT CANCER OF RECTUM (1925- APPROXIMATE)	4	1.519	2.63	0.71	6.74	4.07
LIV ALL CANCER OF LIVER (1925- APPROXIMATE) 1970+ - PRIMARY ONLY	2	2.014	0.99	0.11	3.59	0.00
PAN CANCER OF PANCREAS (1925- APPROXIMATE)	5	4.445	1.12	0.36	2.63	0.07
RSP CANCER OF RESPIRATORY SYSTEM (1925- APPROXIMATE)	52	30.089	1.73	1.29	2.27	17.65
LRX CANCER OF LARYNX (1925-, 1930- APPROXIMATE)	1	1.514	0.66	0.01	3.68	0.18
LNG ALL CANCER OF LUNG - PRIMARY AND SECONDARY (1925-,1930- APPROXIMAT	51	28.306	1.80	1.34	2.37	20.01
BON CANCER OF BONE (1925-,1930-,1945- APPROXIMATE)	1	0.224	4.46	0.06	24.80	2.68
SKN CANCER OF SKIN	0	0.440	0.00	0.00	8.33	0.44
BRE CANCER OF BREAST	1	0.123	8.11	0.11	45.14	6.24
CER CANCER OF CERVIX UTERI (1950+ ONLY)	0	0.000	0.00	???	???	0.00
COR CANCER OF CORPUS UTERI (1950+ ONLY)	0	0.000	0.00	???	???	0.00
UTE CANCER OF ALL UTERUS (1930+ ONLY)	0	0.000	0.00	???	???	0.00
OFG CANCER OF OTHER GENITAL ORGANS (1930+ ONLY)	0	0.000	0.00	???	???	0.00
AFG CANCER OF ALL GENITAL ORGANS	0	0.000	0.00	???	???	0.00
PRO CANCER OF PROSTATE (1925- APPROXIMATE)	15	9.859	1.52	0.85	2.51	2.79
TST CANCER OF TESTIS (OTHER GENITAL ORGANS 1925-49)(1925-,1930- APPROX	0	0.250	0.00	0.00	14.69	0.25
BLA CANCER OF BLADDER (1925- APPROXIMATE)	8	1.557	5.14	2.21	10.12	26.78
KID CANCER OF KIDNEY (1925- APPROXIMATE)	3	1.317	2.28	0.46	6.66	2.16
EYE CANCER OF EYE (1950+ ONLY)	0	0.013	0.00	0.00	287.47	0.01
BRN CANCER OF BRAIN AND OTHER CENTRAL NERVOUS SYSTEM (1925- APPROXIMAT	1	0.895	1.12	0.01	6.21	0.01
THY CANCER OF THYROID (1950+ ONLY)	0	0.099	0.00	0.00	36.90	0.10
LYM LYMPHOSARCOMA AND RETICULOSARCOMA (1950+ ONLY)	0	0.622	0.00	0.00	5.90	0.62
HDG HODGKIN'S DISEASE (1940-,1945- APPROXIMATE)	0	0.354	0.00	0.00	10.35	0.35
MMY MULTIPLE MYELOMA	1	1.746	0.57	0.01	3.19	0.32
LEU LEUKEMIA AND ALEUKEMIA	1	1.912	0.52	0.01	2.91	0.44
OLY CANCER OF OTHER LYMPHATIC TISSUE (1950+ ONLY)	3	2.479	1.21	0.24	3.54	0.11
ALP ALL LYMPHOPOIETIC CANCER	4	5.417	0.74	0.20	1.89	0.38
BNG BENIGN NEOPLASMS	1	0.919	1.09	0.01	6.05	0.01
AEM ALLERGIC,ENDOCRINE,METABOLIC,NUTRITIONAL DISEASES (1950+ ONLY)	14	8.394	1.67	0.91	2.80	3.84
DBT DIABETES MELLITUS	12	6.893	1.74	0.90	3.04	3.86
BFO ALL DISEASES OF BLOOD AND BLOOD-FORMING ORGANS (1925-,1930- APPROX	0	0.952	0.00	0.00	3.86	0.95
PSY MENTAL,PSYCHONEUROTIC,AND PERSONALITY DISORDERS (1950+ ONLY)	6	3.857	1.56	0.57	3.39	1.21
NRV ALL DISEASES OF NERVOUS SYSTEM AND SENSE ORGANS	4	3.394	1.18	0.32	3.02	0.11
CRS ALL DISEASES OF CIRCULATORY SYSTEM	136	172.399	0.79	0.66	0.93	14.54
RHD CHRONIC RHEUMATIC HEART DISEASE(1925- APPROXIMATE)	3	1.657	1.81	0.36	5.29	1.10
AHD ARTERIOSCLEROTIC HEART DISEASE,INCLUDING CHD (1925- APPROXIMATE)	80	91.866	0.87	0.69	1.08	2.06
VAS ALL VASCULAR LESIONS OF CNS	24	33.645	0.71	0.46	1.06	3.07
RSD ALL RESPIRATORY DISEASES (1925-,1930- APPROXIMATE)	22	23.018	0.96	0.60	1.45	0.05
PNM ALL PNEUMONIA (1925-,1930- APPROXIMATE)	11	11.506	0.96	0.48	1.71	0.02
EMP EMPHYSEMA (1950-,1955 APPROXIMATE)	1	2.325	0.43	0.01	2.39	0.76

AST ASTHMA (1925-,1930- APPROXIMATE)	0	0.904	0.00	0.00	4.06	0.91
DGS ALL DISEASES OF DIGESTIVE SYSTEM	29	16.848	1.72	1.15	2.47	9.25
GDU ALL GASTRIC AND DUODENAL ULCER	4	1.679	2.38	0.64	6.10	3.22
CRL CIRRHOSIS OF LIVER	11	8.251	1.33	0.66	2.39	0.95
GUS ALL DISEASES OF GENITO-URINARY SYSTEM	5	9.868	0.51	0.18	1.18	2.48
NPH CHRONIC NEPHRITIS	0	2.511	0.00	0.00	1.46	2.54
SCT ALL DISEASES OF THE SKIN AND CELLULAR TISSUE	0	0.720	0.00	0.00	5.09	0.72
BOM ALL DISEASES OF THE BONES AND ORGANS OF MOVEMENT	1	0.622	1.61	0.02	8.94	0.23
SEN SYMPTOMS,SENILITY,AND ILL DEFINED CONDITIONS	6	9.822	0.61	0.22	1.33	1.53
EXT ALL EXTERNAL CAUSES OF DEATH	23	30.343	0.76	0.48	1.14	2.12
ACC ALL ACCIDENTS	14	18.289	0.77	0.42	1.28	1.09
MVA MOTOR VEHICLE ACCIDENTS	4	6.870	0.58	0.16	1.49	1.24
SCD SUICIDE	2	1.868	1.07	0.12	3.87	0.01

Proportionate Mortality Ratios For White Women

Table VI -- Observed, Expected, Observed/Expected & Confidence Intervals by Cause Codes as Structured in the Ref. Data Base.
Stratified by: Race = White
Sex = Female

CAUSE	OBS	EXP	O/E	LL	UL	CHISQ
MLG ALL MALIGNANT NEOPLASMS	9	13.948	0.65	0.29	1.22	2.53
INF ALL INFECTIVE AND PARASITIC DISEASE	1	0.735	1.36	0.02	7.57	0.10
TUB ALL TUBERCULOSIS	0	0.255	0.00	0.00	14.38	0.29
BUC CANCER OF BUCCAL CAVITY AND PHARYNX	0	0.188	0.00	0.00	19.48	0.19
DIG CANCER OF DIGESTIVE ORGANS AND PERITONEUM (1925- APPROXIMATE)	4	3.651	1.10	0.29	2.80	0.04
ESO CANCER OF ESOPHAGUS (1925- APPROXIMATE)	0	0.133	0.00	0.00	27.59	0.13
STO CANCER OF STOMACH	0	0.404	0.00	0.00	9.09	0.41
LGI CANCER OF LARGE INTESTINE (1925- APPROXIMATE)	3	1.647	1.82	0.37	5.32	1.15
RCT CANCER OF RECTUM (1925- APPROXIMATE)	0	0.298	0.00	0.00	12.31	0.30
LIV ALL CANCER OF LIVER (1925- APPROXIMATE) 1970+ - PRIMARY ONLY	0	0.302	0.00	0.00	12.13	0.30
PAN CANCER OF PANCREAS (1925- APPROXIMATE)	1	0.729	1.37	0.02	7.64	0.10
RSP CANCER OF RESPIRATORY SYSTEM (1925- APPROXIMATE)	1	2.283	0.44	0.01	2.44	0.77
LRX CANCER OF LARYNX (1925-, 1930- APPROXIMATE)	0	0.044	0.00	0.00	83.84	0.04
LNG ALL CANCER OF LUNG - PRIMARY AND SECONDARY (1925-,1930- APPROXIMAT	1	2.213	0.45	0.01	2.51	0.71
BON CANCER OF BONE (1925-,1930-,1945- APPROXIMATE)	0	0.035	0.00	0.00	106.31	0.03
SKN CANCER OF SKIN	0	0.181	0.00	0.00	20.22	0.18
BRE CANCER OF BREAST	2	2.730	0.73	0.08	2.64	0.21
CER CANCER OF CERVIX UTERI (1950+ ONLY)	0	0.361	0.00	0.00	10.15	0.37
COR CANCER OF CORPUS UTERI (1950+ ONLY)	0	0.437	0.00	0.00	8.39	0.44
UTE CANCER OF ALL UTERUS (1930+ ONLY)	0	0.832	0.00	0.00	4.41	0.85
OFG CANCER OF OTHER GENITAL ORGANS (1930+ ONLY)	1	0.937	1.07	0.01	5.94	0.00
AFG CANCER OF ALL GENITAL ORGANS	1	1.773	0.56	0.01	3.14	0.35
PRO CANCER OF PROSTATE (1925- APPROXIMATE)	0	0.000	0.00	???	???	0.00
TST CANCER OF TESTIS (OTHER GENITAL ORGANS 1925-49)(1925-,1930- APPROX	0	0.000	0.00	???	???	0.00
BLA CANCER OF BLADDER (1925- APPROXIMATE)	0	0.192	0.00	0.00	19.11	0.19
KID CANCER OF KIDNEY (1925- APPROXIMATE)	0	0.234	0.00	0.00	15.68	0.24
EYE CANCER OF EYE (1950+ ONLY)	0	0.011	0.00	0.00	332.96	0.01
BRN CANCER OF BRAIN AND OTHER CENTRAL NERVOUS SYSTEM (1925- APPROXIMAT	1	0.310	3.23	0.04	17.96	1.55
THY CANCER OF THYROID (1950+ ONLY)	0	0.046	0.00	0.00	80.18	0.05
LYM LYMPHOSARCOMA AND RETICULOSARCOMA (1950+ ONLY)	0	0.189	0.00	0.00	19.39	0.19
HDG HODGKIN'S DISEASE (1940-,1945- APPROXIMATE)	0	0.069	0.00	0.00	53.48	0.07
MMY MULTIPLE MYELOMA	0	0.214	0.00	0.00	17.14	0.21
LEU LEUKEMIA AND ALEUKEMIA	0	0.457	0.00	0.00	8.03	0.46
OLY CANCER OF OTHER LYMPHATIC TISSUE (1950+ ONLY)	0	0.494	0.00	0.00	7.42	0.50
ALP ALL LYMPHOPOIETIC CANCER	0	1.233	0.00	0.00	2.97	1.26
BNG BENIGN NEOPLASMS	1	0.201	4.98	0.07	27.69	3.19
AEM ALLERGIC,ENDOCRINE,METABOLIC,NUTRITIONAL DISEASES (1950+ ONLY)	1	1.605	0.62	0.01	3.47	0.24
DBT DIABETES MELLITUS	1	1.314	0.76	0.01	4.23	0.08
BFO ALL DISEASES OF BLOOD AND BLOOD-FORMING ORGANS (1925-,1930- APPROX	0	0.185	0.00	0.00	19.83	0.19
PSY MENTAL,PSYCHONEUROTIC,AND PERSONALITY DISORDERS (1950+ ONLY)	0	0.296	0.00	0.00	12.41	0.30
NRV ALL DISEASES OF NERVOUS SYSTEM AND SENSE ORGANS	1	0.713	1.40	0.02	7.80	0.12
CRS ALL DISEASES OF CIRCULATORY SYSTEM	35	27.849	1.26	0.88	1.75	4.08
RHD CHRONIC RHEUMATIC HEART DISEASE(1925- APPROXIMATE)	3	0.503	5.96	1.20	17.42	12.60
AHD ARTERIOSCLEROTIC HEART DISEASE,INCLUDING CHD (1925- APPROXIMATE)	20	16.446	1.22	0.74	1.88	1.14
VAS ALL VASCULAR LESIONS OF CNS	6	5.398	1.11	0.41	2.42	0.08
RSD ALL RESPIRATORY DISEASES (1925-,1930- APPROXIMATE)	3	3.350	0.90	0.18	2.62	0.04
PNM ALL PNEUMONIA (1925-,1930- APPROXIMATE)	2	1.463	1.37	0.15	4.93	0.20
EMP EMPHYSEMA (1950-,1955 APPROXIMATE)	1	0.328	3.05	0.04	16.95	1.38

AST ASTHMA (1925-,1930- APPROXIMATE)	0	0.121	0.00	0.00	30.36	0.12
DGS ALL DISEASES OF DIGESTIVE SYSTEM	2	2.156	0.93	0.10	3.35	0.01
GDU ALL GASTRIC AND DUODENAL ULCER	0	0.202	0.00	0.00	18.13	0.20
CRL CIRRHOSIS OF LIVER	0	0.755	0.00	0.00	4.86	0.78
GUS ALL DISEASES OF GENITO-URINARY SYSTEM	1	0.908	1.10	0.01	6.13	0.01
NPH CHRONIC NEPHRITIS	0	0.120	0.00	0.00	30.51	0.12
SCT ALL DISEASES OF THE SKIN AND CELLULAR TISSUE	0	0.090	0.00	0.00	40.85	0.09
BOM ALL DISEASES OF THE BONES AND ORGANS OF MOVEMENT	0	0.236	0.00	0.00	15.52	0.24
SEN SYMPTOMS,SENILITY,AND ILL DEFINED CONDITIONS	0	0.493	0.00	0.00	7.45	0.50
EXT ALL EXTERNAL CAUSES OF DEATH	1	1.866	0.54	0.01	2.98	0.43
ACC ALL ACCIDENTS	0	1.340	0.00	0.00	2.74	1.39
MVA MOTOR VEHICLE ACCIDENTS	0	0.517	0.00	0.00	7.10	0.53
SCD SUICIDE	1	0.382	2.62	0.03	14.56	1.02

Proportionate Cancer Mortality Ratios For White Men

Table VII- Observed, Expected, Observed/Expected & Confidence Intervals by Cause Codes as Structured in the Ref. Data Base.
Stratified by: Race = White
Sex = Male

CAUSE	OBS	EXP	O/E	LL	UL	CHISQ
BUC CANCER OF BUCCAL CAVITY AND PHARYNX	6	10.170	0.59	0.22	1.28	1.77
DIG CANCER OF DIGESTIVE ORGANS AND PERITONEUM (1925- APPROXIMATE)	84	101.738	0.92	0.75	1.13	0.86
ESO CANCER OF ESOPHAGUS (1925- APPROXIMATE)	9	8.312	1.08	0.49	2.06	0.06
STO CANCER OF STOMACH	24	20.688	1.16	0.74	1.73	0.58
LGI CANCER OF LARGE INTESTINE (1925- APPROXIMATE)	24	33.242	0.72	0.46	1.07	2.85
RCT CANCER OF RECTUM (1925- APPROXIMATE)	13	10.851	1.20	0.64	2.05	0.44
LIV ALL CANCER OF LIVER (1925- APPROXIMATE) 1970+ - PRIMARY ONLY	9	7.565	1.19	0.54	2.26	0.28
PAN CANCER OF PANCREAS (1925- APPROXIMATE)	12	18.140	0.66	0.34	1.16	2.20
RSP CANCER OF RESPIRATORY SYSTEM (1925- APPROXIMATE)	169	113.021	1.50	1.28	1.74	42.80
LRX CANCER OF LARYNX (1925-, 1930- APPROXIMATE)	4	5.029	0.80	0.21	2.04	0.21
LNG ALL CANCER OF LUNG - PRIMARY AND SECONDARY (1925-,1930- APPROXIMAT	159	106.903	1.49	1.27	1.74	38.20
BON CANCER OF BONE (1925-,1930-,1945- APPROXIMATE)	0	1.488	0.00	0.00	2.46	1.50
SKN CANCER OF SKIN	3	5.557	0.54	0.11	1.58	1.20
BRE CANCER OF BREAST	0	0.427	0.00	0.00	8.59	0.43
CER CANCER OF CERVIX UTERI (1950+ ONLY)	0	0.000	0.00	???	???	0.00
COR CANCER OF CORPUS UTERI (1950+ ONLY)	0	0.000	0.00	???	???	0.00
UTE CANCER OF ALL UTERUS (1930+ ONLY)	0	0.000	0.00	???	???	0.00
OFG CANCER OF OTHER GENITAL ORGANS (1930+ ONLY)	0	0.000	0.00	???	???	0.00
AFG CANCER OF ALL GENITAL ORGANS	0	0.000	0.00	???	???	0.00
PRO CANCER OF PROSTATE (1925- APPROXIMATE)	13	28.153	0.46	0.25	0.79	9.30
TST CANCER OF TESTIS (OTHER GENITAL ORGANS 1925-49)(1925-,1930- APPROX	0	1.203	0.00	0.00	3.05	1.22
BLA CANCER OF BLADDER (1925- APPROXIMATE)	5	11.024	0.45	0.15	1.06	3.42
KID CANCER OF KIDNEY (1925- APPROXIMATE)	4	8.260	0.48	0.13	1.24	2.25
EYE CANCER OF EYE (1950+ ONLY)	0	0.255	0.00	0.00	14.37	0.26
BRN CANCER OF BRAIN AND OTHER CENTRAL NERVOUS SYSTEM (1925- APPROXIMAT	5	8.368	0.60	0.19	1.39	1.41
THY CANCER OF THYROID (1950+ ONLY)	0	0.603	0.00	0.00	6.08	0.60
LYM LYMPHOSARCOMA AND RETICULOSARCOMA (1950+ ONLY)	4	5.179	0.77	0.21	1.98	0.27
HDG HODGKIN'S DISEASE (1940-,1945- APPROXIMATE)	1	2.845	0.35	0.00	1.96	1.23
MMY MULTIPLE MYELOMA	2	4.310	0.46	0.05	1.68	1.26
LEU LEUKEMIA AND ALEUKEMIA	11	12.848	0.86	0.43	1.53	0.28
OLY CANCER OF OTHER LYMPHATIC TISSUE (1950+ ONLY)	5	8.861	0.56	0.18	1.32	1.74
ALP ALL LYMPHOPOIETIC CANCER	21	30.253	0.69	0.43	1.06	3.13

Proportionate Cancer Mortality Ratios For Black Men

Table VIII Observed, Expected, Observed/Expected & Confidence Intervals by Cause Codes as Structured in the Ref. Data Base.
Stratified by: Race = Non-white
Sex = Male

CAUSE	OBS	EXP	O/E	LL	UL	CHISQ
BUC CANCER OF BUCCAL CAVITY AND PHARYNX	3	4.234	0.71	0.14	2.07	0.37
DIG CANCER OF DIGESTIVE ORGANS AND PERITONEUM (1925- APPROXIMATE)	27	37.172	0.73	0.48	1.06	4.06
ESO CANCER OF ESOPHAGUS (1925- APPROXIMATE)	6	7.280	0.82	0.30	1.79	0.24
STO CANCER OF STOMACH	4	8.714	0.46	0.12	1.18	2.81
LGI CANCER OF LARGE INTESTINE (1925- APPROXIMATE)	4	8.291	0.48	0.13	1.24	2.39
RCT CANCER OF RECTUM (1925- APPROXIMATE)	4	2.288	1.75	0.47	4.48	1.31
LIV ALL CANCER OF LIVER (1925- APPROXIMATE) 1970+ - PRIMARY ONLY	2	3.071	0.65	0.07	2.35	0.38
PAN CANCER OF PANCREAS (1925- APPROXIMATE)	5	6.420	0.78	0.25	1.82	0.33
RSP CANCER OF RESPIRATORY SYSTEM (1925- APPROXIMATE)	52	42.253	1.23	0.92	1.61	3.53
LRX CANCER OF LARYNX (1925-, 1930- APPROXIMATE)	1	2.172	0.46	0.01	2.56	0.64
LNG ALL CANCER OF LUNG - PRIMARY AND SECONDARY (1925-,1930- APPROXIMAT	51	38.686	1.29	0.96	1.69	4.90
BON CANCER OF BONE (1925-,1930-,1945- APPROXIMATE)	1	0.368	2.72	0.04	15.14	1.09
SKN CANCER OF SKIN	0	0.635	0.00	0.00	5.78	0.64
BRE CANCER OF BREAST	1	0.180	5.54	0.07	30.83	3.73
CER CANCER OF CERVIX UTERI (1950+ ONLY)	0	0.000	0.00	???	???	0.00
COR CANCER OF CORPUS UTERI (1950+ ONLY)	0	0.000	0.00	???	???	0.00
UTE CANCER OF ALL UTERUS (1930+ ONLY)	0	0.000	0.00	???	???	0.00
OFG CANCER OF OTHER GENITAL ORGANS (1930+ ONLY)	0	0.000	0.00	???	???	0.00
AFG CANCER OF ALL GENITAL ORGANS	0	0.000	0.00	???	???	0.00
PRO CANCER OF PROSTATE (1925- APPROXIMATE)	15	13.629	1.10	0.62	1.82	0.16
TST CANCER OF TESTIS (OTHER GENITAL ORGANS 1925-49)(1925-,1930- APPROX	0	0.405	0.00	0.00	9.05	0.41
BLA CANCER OF BLADDER (1925- APPROXIMATE)	8	2.336	3.42	1.47	6.75	14.03
KID CANCER OF KIDNEY (1925- APPROXIMATE)	3	1.878	1.60	0.32	4.67	0.68
EYE CANCER OF EYE (1950+ ONLY)	0	0.014	0.00	0.00	267.42	0.01
BRN CANCER OF BRAIN AND OTHER CENTRAL NERVOUS SYSTEM (1925- APPROXIMAT	1	1.333	0.75	0.01	4.17	0.08
THY CANCER OF THYROID (1950+ ONLY)	0	0.134	0.00	0.00	27.44	0.13
LYM LYMPHOSARCOMA AND RETICULOSARCOMA (1950+ ONLY)	0	0.924	0.00	0.00	3.97	0.93
HDG HODGKIN'S DISEASE (1940-,1945- APPROXIMATE)	0	0.553	0.00	0.00	6.64	0.56
MMY MULTIPLE MYELOMA	1	2.447	0.41	0.01	2.27	0.87
LEU LEUKEMIA AND ALEUKEMIA	1	2.764	0.36	0.00	2.01	1.15
OLY CANCER OF OTHER LYMPHATIC TISSUE (1950+ ONLY)	3	3.438	0.87	0.18	2.55	0.06
ALP ALL LYMPHOPOIETIC CANCER	4	7.744	0.52	0.14	1.32	1.94

Table IX.

Proportionate Mortality Ratios for White Men
for Selected Cancers by Latency from Time First Employed

Latency (years)

Type of Cancer	0-10 years Obs.	PMR	CL	>10-20 years Obs.	PMR	CL	>20 years Obs.	PMR	CL	All Obs.	PMR	CL
All Malignant Neoplasms	43	2.29*	(1.66-3.08)	5	1.45*	(1.11-1.87)	242	1.23*	(1.08-1.39)	344	1.34*	(1.20-1.49)
Digestive	16	2.26*	(1.29-3.67)	18	1.40	(.83-2.22)	60	1.15	(.87-1.47)	94	1.30*	(1.05-1.59)
Esophagus	1	2.10	(.03-11.66)	1	.99	(.01-5.48)	7	1.51	(.60-3.11)	9	1.47	(.67-2.79)
Stomach	4	1.88	(.51-4.82)	6	2.04	(.75-4.45)	14	1.73	(.94-2.90)	24	1.82*	(1.17-2.71)
Colo/rectal	6	2.26*	(1.04-4.94)	5	.95	(.41-2.23)	26	1.07	(.73-1.57)	37	1.00	(.71-1.41)
Liver	2	3.01	(.34-10.87)	1	.97	(.01-5.40)	6	1.76	(.64-3.83)	9	1.76	(.80-3.34)
Lung	17	4.17*	(2.43-6.68)	29	2.49*	(1.67-3.58)	113	1.66*	(1.37-2.00)	159	1.90*	(1.62-2.22)
Prostate	3	3.23	(.65-9.44)	1	.37	(.00-2.07)	9	.50*	(.23-.94)	13	.60	(.32-1.02)
Bladder	1	1.65	(.02-9.20)	0	-	-	4	.64	(.17-1.65)	5	.62	(.20-1.44)

*P<.05

Table X.

Proportionate Cancer Mortality Ratios for White Men
for Selected Cancers by Latency from Time First Employed

Latency (years)

Type of Cancer	0-10 years Obs.	PCMR	CL	>10-20 years Obs.	PCMR	CL	>20 years Obs.	PCMR	CL	All Obs.	PCMR	CL
Digestive	16	.94	(.54-1.53)	18	.90	(.53-1.42)	60	.93	(.71-1.19)	94	.92	(.75-1.13)
Esophagus	1	.91	(.01-5.07)	1	.66	(.01-3.68)	7	1.23	(.49-2.53)	9	1.08	(.49-2.06)
Stomach	4	.74	(.20-1.91)	6	1.19	(.43-2.58)	14	1.36	(.75-2.29)	24	1.16	(.74-1.73)
Colo/rectal	6	.96	(.44-2.10)	5	.62	(.62-1.60)	26	.87	(.60-1.28)	37	.84	(.61-1.16)
Liver	2	1.24	(.14-4.48)	1	.59	(.01-3.31)	6	1.40	(.51-3.06)	9	1.19	(.54-2.26)
Lung	17	1.93*	(1.12-3.08)	29	1.87*	(1.25-2.68)	113	1.37*	(1.13-1.65)	159	1.49*	(1.27-1.74)
Prostate	3	1.58	(.32-4.62)	1	.24	(.00-1.34)	9	.41*	(.19-.77)	13	.46	(.25-.79)
Bladder	1	.73	(.01-4.05)	0	-	-	4	.53	(.14-1.35)	5	.45	(.15-1.06)

*P<.05

Table XI.

Proportionate Mortality Ratios for Black Men
for Selected Cancers by Latency from Time First Employed

Latency (years)

Type of Cancer	0-10 years Obs.	PMR	CL	>10-20 years Obs.	PMR	CL	>20 years Obs.	PMR	CL	All Obs.	PMR	CL
All Malignant Neoplasms	2	1.06	(.12-3.83)	16	1.92*	(1.11-3.11)	104	1.38*	(1.13-1.68)	122	1.43*	(1.19-1.71)
Digestive	1	1.37	(.02-7.61)	3	1.06	(.21-3.09)	23	1.06	(.67-1.59)	27	1.07	(.70-1.55)
Esophagus	0	-	-	1	1.73	(.02-9.64)	5	1.13	(.36-2.63)	6	1.17	(.43-2.55)
Stomach	1	3.92	(.05-21.81)	0	-	-	3	.66	(.13-1.92)	4	.71	(.19-1.83)
Colo/rectal	0	-	-	1	1.45	(.26-8.23)	7	1.08	(.52-2.22)	8	1.09	(.55-2.15)
Liver	0	-	-	0	-	-	2	1.21	(.14-4.35)	2	.99	(.11-3.59)
Lung	1	2.38	(.03-13.27)	11	4.40*	(2.19-7.87)	39	1.54*	(1.09-2.10)	51	1.80*	(1.34-2.37)
Prostate	0	-	-	1	1.65	(.02-9.17)	14	1.53	(.83-2.56)	15	1.52	(.85-2.51)
Bladder	0	-	-	0	-	-	8	5.96*	(2.56-11.74)	8	5.14*	(2.21-10.12)

*P<.05

Table XII.

Proportionate Cancer Mortality Ratios for Black Men
for Selected Cancers by Latency from Time First Employed

Latency (years)

Type of Cancer	0-10 years Obs.	PCMR	CL	>10-20 years Obs.	PCMR	CL	>20 years Obs.	PCMR	CL	All Obs.	PCMR	CL
Digestive	1	1.23	(.02-6.84)	3	.51	(.10-1.49)	23	.75	(.48-1.13)	27	.73	(.48-1.06)
Esophagus	0	-	-	1	.96	(.01-5.33)	5	.82	(.26-1.91)	6	.82	(.30-1.79)
Stomach	1	3.31	(.04-18.43)	0	-	-	3	.46	(.09-1.34)	4	.46	(.12-1.18)
Colo/rectal	0	-	-	1	.74	(.13-4.18)	7	.77	(.38-1.60)	8	.76	(.39-1.50)
Liver	0	-	-	0	-	-	2	.85	(.10-3.06)	2	.65	(.07-2.35)
Lung	1	1.99	(.03-11.05)	11	2.60*	(1.29-4.65)	39	1.12	(.79-1.53)	51	1.29	(.96-1.69)
Prostate	0	-	-	1	.98	(.01-5.45)	14	1.11	(.61-1.87)	15	1.10	(.62-1.82)
Bladder	0	-	-	0	-	-	8	4.14*	(1.78-8.16)	8	3.42*	(1.47-6.75)

*P<.05

Table XIII.

Proportionate Mortality Ratios for White Men
for Selected Cancers by Duration of Employment

Duration (years)

Type of Cancer	≤1 years Obs.	PMR	CL	>1-10 years Obs.	PMR	CL	>10-20 years Obs.	PMR	CL	>20 years Obs.	PMR	CL	All Obs.	PCMR	CL
All Malignant Neoplasms	127	1.09	(.91-1.29)	129	1.53*	(1.28-1.81)	57	1.61*	(1.22-2.08)	31	1.54*	(1.05-2.19)	344	1.34*	(1.20-1.49)
Digestive	42	1.36	(.98-1.83)	34	1.37	(.95-1.92)	15	1.39	(.78-2.30)	3	.52	(.10-1.52)	94	1.30*	(1.05-1.5)
Esophagus	3	1.07	(.22-3.13)	3	1.48	(.30-4.32)	3	3.55	(.71-10.38)	0	-	-	9	1.47	(.67-2.79)
Stomach	10	2.00	(.96-3.68)	10	2.02	(.97-3.71)	2	.91	(.10-3.30)	2	1.94	(.22-7.00)	24	1.82*	(.74-1.73)
Colo/rectal	19	1.35	(.86-2.11)	13	1.21	(.71-2.07)	5	1.06	(.45-2.48)	0	-	-	37	1.00	(.71-1.41)
Liver	4	1.93	(.52-4.95)	2	1.10	(.12-3.96)	2	2.48	(.28-8.95)	1	2.44	(.03-13.55)	9	1.76	(.80-3.34)
Lung	54	1.33	(1.00-1.74)	59	2.24*	(1.70-2.89)	28	2.66*	(1.77-3.85)	18	2.87*	(1.70-4.54)	159	1.90*	(1.62-2.22)
Prostate	2	.22*	(.02-.78)	10	1.42	(.68-2.61)	0	-	-	1	.48	(.01-2.67)	13	.60	(.32-1.02)
Bladder	2	.59	(.07-2.13)	1	.37	(.00-2.05)	1	.78	(.01-4.33)	1	1.39	(.02-7.72)	5	.62	(.20-1.44)

*P<.05

Table XIV.

Proportionate Cancer Mortality Ratios for White Men
for Selected Cancers by Duration of Employment

Duration (years)

Type of Cancer	≤1 years			>1-10 years			>10-20 years			>20 years			ALL		
	Obs.	PCMR	CL	Obs.	PCMR	CL	Obs.	PCMR	CL	Obs.	PCMR	CL	Obs.	PCMR	CL
Digestive	42	1.26	(.91-1.71)	34	.83	(.57-1.16)	15	.82	(.46-1.36)	3	.32*	(.07-.95)	94	.92	(.75-1.13)
Esophagus	3	1.00	(.20-2.93)	3	.93	(.19-2.72)	3	2.20	(.44-6.44)	0	-	-	9	1.08	(.49-2.06)
Stomach	10	1.91	(.92-3.52)	10	1.05	(.50-1.93)	2	.49	(.05-1.76)	2	1.84	(.12-3.91)	24	1.16	(.74-1.73)
Colo/rectal	19	1.25	(.80-1.95)	13	.76	(.44-1.30)	5	.64	(.27-1.50)	0	-	-	37	.84	(.61-1.16)
Liver	4	1.81	(.49-4.64)	2	.61	(.07-2.21)	2	1.42	(.16-5.11)	1	1.47	(.02-8.19)	9	1.19	(.54-2.26)
Lung	54	1.22	(.92-1.60)	59	1.55*	(1.18-2.00)	28	1.82*	(1.21-2.63)	18	1.94*	(1.15-3.06)	159	1.49*	(1.27-1.74)
Prostate	2	.20*	(.02-.72)	10	1.05	(.50-1.92)	0	-	-	1	.34	(.00-1.91)	13	.46*	(.25-.79)
Bladder	2	.55	(.06-1.99)	1	.24	(.00-1.35)	1	.46	(.01-2.57)	1	.90	(.01-5.02)	5	.45	(.15-1.06)

*P<.05

Table XV.

Proportionate Mortality Ratios for Black Men
for Selected Cancers by Duration of Employment

Duration (years)

Type of Cancer	≤1 years Obs.	PMR	CL	>1-10 years Obs.	PMR	CL	>10-20 years Obs.	PMR	CL	>20 years Obs.	PMR	CL	All Obs.	PMR	CL
All Malignant Neoplasms	53	1.17	(.87-1.53)	44	1.15*	(1.09-2.02)	18	2.40*	(1.42-3.80)	7	2.11	(.84-4.34)	122	1.43*	(.48-1.06)
Digestive	12	.92	(.47-1.60)	11	1.25	(.62-2.24)	4	1.70	(.46-4.36)	0	-	-	27	1.07	(.70-1.55)
Esophagus	2	.73	(.08-2.65)	4	2.29	(.62-5.88)	0	-	-	0	-	-	6	1.17	(.43-2.55)
Stomach	2	.73	(.08-2.65)	2	1.00	(.11-3.60)	0	-	-	0	-	-	4	.71	(.19-1.83)
Colo/rectal	5	1.30	(.56-3.04)	1	.39	(.07-2.21)	2	3.00	(.82-10.94)	0	-	-	8	1.09	(.55-2.15)
Liver	0	-	-	1	1.41	(.02-7.85)	1	5.19	(.07-28.37)	0	-	-	2	.99	(.11-3.59)
Lung	18	1.15	(.68-1.82)	17	1.80*	(1.05-2.88)	10	4.31*	(2.60-7.93)	6	6.30	(2.30-3.71)	51	1.80*	(1.34-2.37)
Prostate	8	1.57	(.68-3.10)	4	1.16	(.31-2.97)	3	3.20	(.64-9.36)	0	-	-	15	1.52	(.85-2.51)
Bladder	7	9.03*	(3.62-18.60)	1	1.79	(.02-9.98)	0	-	-	0	-	-	8	5.14*	(2.21-10.12)

*P<.05

Table XVI.

Proportionate Cancer Mortality Ratios for Black Men for Selected Cancers by Duration of Employment

Duration (years)

Type of Cancer	≤1 years Obs.	PCMR	CL	>1-10 years Obs.	PCMR	CL	>10-20 years Obs.	PCMR	CL	>20 years Obs.	PCMR	CL	All Obs.	PCMR	CL
Digestive	12	.79	(.41-1.37)	11	.81	(.41-1.46)	4	.65	(.17-1.66)	0	-	-	27	.73	(.48-1.06)
Esophagus	2	.67	(.08-2.42)	4	1.50	(.40-3.84)	0	-	-	0	-	-	6	.82	(.30-1.79)
Stomach	2	.64	(.07-2.29)	2	.62	(.07-2.23)	0	-	-	0	-	-	4	.46	(.12-1.18)
Colo/rectal	5	1.07	(.46-2.51)	1	.26	(.05-1.47)	2	1.26	(.35-4.60)	0	-	-	8	.76	(.39-1.50)
Liver	0	-	-	1	.89	(.01-4.97)	1	1.82	(.02-10.13)	0	-	-	2	.65	(.07-2.35)
Lung	18	1.00	(.59-1.57)	17	1.20	(.70-1.92)	10	1.83	(.88-3.37)	6	3.08*	(1.13-6.71)	51	1.29	(.96-1.69)
Prostate	8	1.23	(.53-2.43)	4	.84	(.23-2.15)	3	1.53	(.31-4.46)	0	-	-	15	1.10	(.62-1.82)
Bladder	7	7.38*	(2.96-15.20)	1	1.15	(.02-6.40)	0	-	-	0	-	-	8	3.42*	(1.47-6.75)

*P<.05

Table XVII. Proportionate Mortality Ratios for Black Men for Lung Cancer by Duration of Employment and Latency from Time First Employed

Duration (years)	Latency (years) 0-10 Obs.	PMR	CL	>10-20 Obs.	PMR	CL	>20 Obs.	PMR	CL	All Obs.	PMR	CL
≤1	0	-	-	4	4.15*	(1.12-10.62)	14	.97	(.53-1.62)	18	1.15	(.68-1.82)
>1-10	1	3.66	(.05-20.39)	2	1.82	(.20-6.58)	14	1.73	(.95-7.91)	17	1.80*	(1.05-2.88)
>10-20				5	11.38*	(4.86-21.65)	5	2.66	(.86-6.21)	10	4.31*	(2.60-7.93)
>20							6	6.30*	(2.30-13.71)	6	6.30*	(2.30-13.71)
All	1	2.38	(.03-13.27)	11	4.40*	(2.19-7.87)	39	1.54*	(1.09-2.10)	51	1.80*	(1.34-2.37)

*P<.05

Table XVIII. Proportionate Cancer Mortality Ratios for Lung Cancer for Black Men by Duration of Employment and Latency from Time First Employed

Duration (years)	Latency (years) 0-10 Obs.	PCMR	CL	>10-20 Obs.	PCMR	CL	>20 Obs.	PCMR	CL	All Obs.	PCMR	CL
≤1	0	-	-	4	2.75	(.74-7.03)	14	.84	(.46-1.41)	18	1.00	(.59-1.57)
>1-10	1	1.99	(.03-11.05)	2	1.28	(.14-4.60)	14	1.16	(.63-1.94)	17	1.20	(.70-1.92)
>10-20				5	4.12*	(1.33-9.62)	5	1.18	(.38-2.75)	10	1.83	(.88-3.37)
>20							6	3.08*	(1.13-6.71)	6	3.08*	(1.13-6.71)
All	1	1.99	(.03-11.05)	11	2.60*	(1.29-4.65)	39	1.12	(.79-1.53)	51	1.29	(.96-1.69)

*P<.05

Table XIX. Proportionate Mortality Ratios for White Men for Lung Cancer by Duration of Employment and Latency from Time First Employed

Duration (years)	Latency (years) 0-10 Obs.	PMR	CL	>10-20 Obs.	PMR	CL	>20 Obs.	PMR	CL	All Obs.	PMR	CL
≤1	2	2.17	(.24-7.84)	5	1.21	(.39-2.82)	47	1.33	(.97-1.76)	54	1.33	(1.00-1.74)
>1-10	15	4.86*	(2.72-8.01)	8	1.98	(.85-3.90)	36	1.87*	(1.31-2.59)	59	2.24*	(1.70-2.89)
>10-20				16	4.63*	(2.64-7.52)	12	1.71	(.88-2.99)	28	2.66*	(1.77-3.85)
>20							18	2.87*	(1.70-4.54)	18	2.87*	(1.70-4.54)
All	17	4.17*	(2.43-6.68)	29	2.49*	(1.67-3.58)	113	1.66*	(1.37-2.00)	159	1.90*	(1.62-2.22)

*P<.05

Table XX.

Proportionate Cancer Mortality Ratios for Lung Cancer for White Men By Duration of Employment and Latency from Time First Employed

Duration (years)	Latency (years) 0-10 Obs.	PCMR	CL	>10-20 Obs.	PCMR	CL	>20 Obs.	PCMR	CL	All Obs.	PCMR	CL
≤1	2	1.97	(.22-7.10)	5	1.37	(.44-3.20)	47	1.19	(.87-1.58)	54	1.22	(.92-1.60)
>1-10	15	1.92*	(1.07-3.17)	8	1.53	(.66-3.01)	36	1.44*	(1.01-1.99)	59	1.55*	(1.18-2.00)
>10-20	———			16	2.40*	(1.37-3.90)	12	1.37	(.71-2.40)	28	1.82*	(1.21-2.63)
>20	———			———			18	1.94*	(1.15-3.06)	18	1.94*	(1.15-3.06)
All	17	1.93*	(1.12-3.08)	29	1.87*	(1.25-2.68)	113	1.37*	(1.13-1.65)	159	1.49*	(1.27-1.74)

*P<.05

Table XXI. Proportionate Mortality Ratios for Black Men for Lung Cancer by Duration of Employment and Latency from Time Last Employed

Duration (years)	Latency (years) 0-10 Obs.	PMR	CL	>10-20 Obs.	PMR	CL	>20 Obs.	PMR	CL	All Obs.	PMR	CL
≤1	0	-	-	4	3.87*	(1.04-9.90)	14	.97	(.53-1.63)	18	1.15	(.68-1.82)
>1-10	3	4.01	(.81-11.72)	3	1.45	(.29-4.25)	11	1.66	(.83-2.97)	17	1.80*	(1.05-2.88)
>10-20	7	10.47*	(5.07-21.60)	2	2.45	(.28-8.85)	1	1.26	(.02-7.02)	10	4.31*	(2.63-7.93)
>20	5	8.75*	(2.82-20.41)	1	2.88	(.51-16.32)	0	-	-	6	6.30*	(2.70-13.71)
All	15	6.99*	(4.23-11.53)	10	2.35*	(1.16-3.93)	26	1.19	(.78-1.74)	51	1.80*	(1.34-2.37)

*P<.05

Table XXII.

Proportionate Cancer Mortality Ratios for Lung Cancer for Black Men by Duration of Employment and Latency from Time Last Employed

Duration (years)	Latency (years) 0-10 Obs.	PCMR	CL	>10-20 Obs.	PCMR	CL	>20 Obs.	PCMR	CL	All Obs.	PCMR	CL
≤1	0	-	-	4	2.75	(.74-7.03)	14	.84	(.46-1.41)	18	1.00	(.59-1.57)
>1-10	3	1.95	(.39-5.69)	3	1.25	(.25-3.64)	11	1.07	(.54-1.92)	17	1.20	(.70-1.92)
>10-20	7	4.34*	(2.10-8.96)	2	.91	(.10-3.29)	1	.78	(.01-4.35)	10	1.83	(.88-3.37)
>20	5	3.28*	(1.06-7.66)	1	1.26	(.22-7.11)	0	-	-	6	3.08*	(1.13-6.71)
All	15	3.20*	(2.13-5.81)	10	1.45	(.79-2.70)	26	.92	(.60-1.35)	51	1.29	(.96-1.69)

*P<.05

Table XXIII. Proportionate Mortality Ratios for White Men for Lung Cancer by Duration of Employment and Latency from Time Last Employed

Duration (years)	Latency (years) 0-10 Obs.	PMR	CL	>10-20 Obs.	PMR	CL	>20 Obs.	PMR	CL	All Obs.	PMR	CL
≤1	2	2.17	(.24-7.84)	5	1.16	(.37-2.70)	47	1.33	(.98-1.77)	54	1.33	(1.00-1.74)
>1-10	20	4.17*	(2.55-6.44)	8	1.55	(.67-3.06)	31	1.89*	(1.28-2.68)	59	2.24*	(1.70-2.89)
>10-20	19	3.87*	(2.33-6.05)	7	1.93	(.77-3.97)	2	1.01	(.11-3.64)	28	2.66*	(1.77-3.85)
>20	11	4.23*	(2.11-7.57)	4	1.68	(.45-4.31)	3	2.32	(.47-6.77)	18	2.87*	(1.70-4.54)
All	52	3.93*	(2.94-5.16)	24	1.55	(.99-2.30)	83	1.51*	(1.20-1.87)	159	1.90*	(1.62-2.22)

*P<.05

Table XXIV.

Proportionate Cancer Mortality Ratios for Lung Cancer for White Men by Duration of Employment and Latency from Time Last Employed

Duration (years)	Latency (years) 0-10 Obs.	PCMR	CL	>10-20 Obs.	PCMR	CL	>20 Obs.	PCMR	CL	All Obs.	PCMR	CL
≤1	2	1.97	(.22-7.10)	5	1.37	(.44-3.20)	47	1.19	(.87-1.58)	54	1.22	(.92-1.60)
>1-10	20	1.89*	(1.15-2.91)	8	1.44	(.62-2.84)	31	1.42	(.96-2.01)	59	1.55*	(1.18-2.00)
>10-20	19	2.15*	(1.29-3.35)	7	1.40	(.56-2.89)	2	1.28	(.14-4.62)	28	1.82*	(1.21-2.63)
>20	11	2.50*	(1.24-4.47)	4	1.10	(.30-2.81)	3	2.40	(.48-7.01)	18	1.94*	(1.15-3.06)
All	52	2.09*	(1.56-2.74)	24	1.35	(.86-2.00)	83	1.29*	(1.03-1.60)	159	1.49*	(1.27-1.74)

*P<.05

Table XXV. Proportionate Mortality Ratios for Lung Cancer by Time of Death and Duration of Employment for Black Men

Year of Death	All		Duration (years) ≤1		>1-10		>10-20		>20	
	Obs.	PMR	Obs.	PMR	Obs.	PMR	Obs.	PMR	Obs.	PMR
1940-1944	1	203.2	0	-	1	203.20	0	-	0	-
1945-1949	2	19.19	0	-	0	-	2	67.92	0	-
1950-1954	2	16.11	0	-	1	19.42	1	21.12	0	-
1955-1959	5	11.42	1	6.79	2	9.14	1	26.65	1	29.17
1960-1964	4	4.05	1	4.53	0	-	1	3.77	2	12.15
1965-1969	4	1.90	2	2.14	1	1.11	1	4.54	0	-
1970-1974	7	1.56	1	.47	3	1.81	2	6.82	1	2.09
1975-1979	6	1.08	4	1.13	1	.62	1	2.90	0	-
1980-1984	13	1.75	5	1.12	7	2.90	0	-	1	8.32
1985-1989	6	1.06	3	1.01	1	.49	1	1.96	1	7.93
>1990	1	.71	1	.87	0	-	0	-	0	-
All	51	1.80	18	1.15	17	1.80	10	4.31	6	6.30

Table XXVI. Proportionate Cancer Mortality Ratios for Lung Cancer by Time of Death and Duration of Employment for Black Men

Year of Death	All		Duration (years) ≤1		>1-10		>10-20		>20	
	Obs.	PCMR	Obs.	PCMR	Obs.	PCMR	Obs.	PCMR	Obs.	PCMR
1940-1944	1	9.74	0	-	1	9.74	0	-	0	-
1945-1949	2	7.09	0	-	0	-	2	7.09	0	-
1950-1954	2	6.18	0	-	1	7.13	1	5.45	0	-
1955-1959	5	4.49	1	4.07	2	4.50	1	4.46	1	5.03
1960-1964	4	2.17	1	4.22	0	-	1	1.82	2	3.54
1965-1969	4	1.27	2	1.73	1	.84	1	1.25	0	-
1970-1974	7	1.18	1	.69	3	.99	2	2.98	1	1.32
1975-1979	6	.77	4	1.05	1	.31	1	1.29	0	-
1980-1984	13	1.38	5	1.07	7	1.94	0	-	1	2.53
1985-1989	6	.80	3	.64	1	.52	1	2.05	1	2.49
>1990	1	.46	1	.55	0	-	0	-	0	-
All	51	1.29	18	1.00	17	1.20	10	1.83	6	3.08

Table XXVII. Proportionate Mortality Ratios for Lung Cancer by Time of Death and Duration of Employment for White Men

Year of Death	All		Duration (years) ≤1		>1-10		>10-20		>20	
	Obs.	PMR	Obs.	PMR	Obs.	PMR	Obs.	PMR	Obs.	PMR
1940-1944	4	10.68	0	-	4	11.26	0	-	0	-
1945-1949	7	6.99	0	-	6	8.67	1	5.51	0	-
1950-1954	14	7.08	1	3.01	4	4.92	7	11.16	2	9.71
1955-1959	6	2.00	1	1.56	1	.77	3	3.53	1	4.79
1960-1964	15	2.92	2	1.14	6	3.83	3	2.69	4	5.66
1965-1969	14	1.72	3	.84	6	2.33	4	3.14	1	1.47
1970-1974	19	1.74	11	1.84	3	1.02	1	.73	4	6.30
1975-1979	21	1.43	8	1.07	5	1.19	5	2.74	3	2.44
1980-1984	29	1.69	12	1.41	12	2.01	3	1.74	2	2.23
1985-1989	22	1.33	11	1.20	9	1.96	1	.78	1	.68
>1990	8	1.69	5	1.72	3	2.27	0	-	0	-
All	159	1.90	54	1.33	59	2.24	28	2.66	18	2.87

Table XXVIII. Proportionate Cancer Mortality Ratios for Lung Cancer by Time of Death and Duration of Employment for White Men

Year of Death	All		Duration (years) ≤1		>1-10		>10-20		>20	
	Obs.	PCMR	Obs.	PCMR	Obs.	PCMR	Obs.	PCMR	Obs.	PCMR
1940-1944	4	3.12	0	-	4	3.12	0	-	0	-
1945-1949	7	2.20	0	-	6	2.29	1	1.80	0	-
1950-1954	14	2.68	1	1.46	4	1.85	7	4.10	2	2.96
1955-1959	6	1.32	1	1.84	1	.60	3	1.62	1	2.14
1960-1964	15	1.93	2	1.19	6	2.13	3	1.94	4	2.31
1965-1969	14	1.64	3	1.06	6	1.72	4	2.38	1	1.95
1970-1974	19	1.23	11	1.45	3	.74	1	.47	4	2.39
1975-1979	21	1.52	8	1.24	5	1.33	5	2.39	3	1.99
1980-1984	29	1.33	12	1.34	12	1.55	3	.91	2	1.07
1985-1989	22	1.33	11	1.19	9	1.51	1	1.84	1	1.16
>1990	8	.92	5	.81	3	1.21	0	-	0	-
All	159	1.49	54	1.22	59	1.55	28	1.82	18	1.94

Table XXIX. Proportionate Mortality and Proportionate Cancer Mortality Ratios for Lung Cancer by Race, Facility and Duration of Employment

		Duration (years) ≤1			>1-10			>10-20			>20			All		
		Obs.	PMR	PCMR	Obs.	PMR	PCMR	Obs.	PMR	PCMR	Obs.	PMR	PCMR	Obs.	PMR	PCMR
Facility A & B	B	1	.85	.97	0	-	-	3	2.90	2.23	3	9.71*	2.54	7	1.95	1.48
	W	6	1.47	1.43	12	1.83	1.28	9	2.05	1.53	2	1.57	1.37	29	1.80*	1.39
Facility C	B	2	1.40	1.06	1	1.72	1.47	3	5.91*	2.65	0	-	-	6	2.39	1.62
	W	14	1.58	1.68	19	2.52*	1.42	14	3.49*	2.28*	5	1.52	1.40	52	2.20*	1.65*
Facility D	B	15	1.12	.94	17	2.16*	1.39	5	4.32*	1.53	2	5.73	4.09	39	1.71*	1.22
	W	34	1.18	1.06	31	2.36*	1.82*	7	3.29*	1.87	9	6.54*	2.56*	81	1.78*	1.44*
ALL	B	18	1.15	1.00	17[a]	1.80*	1.20	10[a]	4.31*	1.83	6[a]	6.30*	3.08*	51[b]	1.80*	1.29
	W	54	1.33	1.22	59[a]	2.24*	1.55*	28[a]	2.66*	1.82*	18[a]	2.87*	1.94*	159[b]	1.90*	1.49*

*P<.05

[a]The sum of the observed deaths by duration category does not sum to all observed deaths by duration category because an individual who worked in multiple facilities may be in different duration categories in each facility.

[b]The sum of all observed deaths by individual facilities does not sum to the observed of all deaths as some individuals worked at multiple facilities.

Table XXX. Proportionate Mortality and Proportionate Cancer Mortality Ratios for Lung Cancer by Race, Facility and Latency from Time First Employed

		Latency (years)											
		0-10			>10-20			>20			All		
		Obs.	PMR	PCMR	Obs.	PMR	PCMR	Obs.	PMR	PCMR	Obs.	PMR	PCMR
Facility A & B	B	0	-	-	4	2.56	1.94	3	1.66	1.31	7	1.95	1.48
	W	8	3.79*	1.72*	11	2.23*	1.71	10	1.10	1.01	29	1.80*	1.39
Facility C	B	0	-	-	2	8.18	3.02	4	1.77	1.32	6	2.39	1.62
	W	3	3.31*	1.63	14	4.11*	2.45*	35	1.81*	1.46*	52	2.20*	1.65*
Facility D	B	1	4.93	9.74	6	6.62*	3.35*	32	1.48*	1.07	39	1.71*	1.22
	W	7	5.61*	2.73*	6	1.56	1.31	68	1.68*	1.38*	81	1.78*	1.44*
ALL	B	1	2.38	1.99	11[a]	4.40*	2.60*	39	1.54*	1.12	51[b]	1.80*	1.29
	W	17[a]	4.17*	1.93*	29[a]	2.49*	1.87*	113	1.66*	1.37*	159[b]	1.90*	1.49*

*P<.05

[a]The sum of the observed deaths by category of latency does not sum to all observed deaths by category of latency because an individual who worked in multiple facilities may be in different latency categories in each facility.

[b]The sum of all observed deaths by individual facilities does not sum to the observed of all deaths as some individuals worked at multiple facilities.

Table XXXI. Proportionate Mortality and Proportionate Cancer Mortality Ratios for Lung Cancer by Race, Facility and Latency from Time Last Employed

		Latency (years) 0-10			>10-20			>20			All		
		Obs.	PMR	PCMR	Obs.	PMR	PCMR	Obs.	PMR	PCMR	Obs.	PMR	PCMR
Facility A & B	B	4	3.84*	1.83	3	1.77	1.69	0	-	-	7	1.95	1.48
	W	19	3.17*	1.78*	6	1.03	1.06	4	.93	.87	29	1.80*	1.39
Facility C	B	1	7.57	2.40	2	4.58	1.96	3	1.54	1.33	6	2.39	1.53
	W	19	4.50*	2.48	9	1.77	1.26	24	1.67*	1.44	52	2.20*	1.65*
Facility D	B	9	9.24*	4.33*	7	2.98*	1.62	23	1.18	.90	39	1.71*	1.22
	W	15	4.81*	2.20*	11	2.14*	1.79	55	1.48*	1.27	81	1.78	1.44*
ALL	B	15[a]	6.99*	3.20*	10[a]	2.35*	1.45	26	1.19	.92	51[b]	1.80*	1.29
	W	52[a]	3.93*	2.09*	24[a]	1.55	1.35	83	1.51*	1.29*	159[b]	1.90*	1.49*

*P<.05

[a]The sum of the observed deaths by category of latency does not sum to all observed deaths by category of latency because an individual who worked in multiple facilities may be in different latency categories in each facility.

[b]The sum of all observed deaths by individual facilities does not sum to the observed of all deaths as some individuals worked at multiple facilities.

Table XXXII. Proportionate Mortality and Proportionate Cancer Mortality Ratios for Lung Cancer Among White Men by Facility Employed and Year of Death

Year of Death	Facility A & B Obs.	PMR	PCMR	Facility C Obs.	PMR	PCMR	Facility D Obs.	PMR	PCMR
1940-1944	0	-	-	2	7.42	2.26	2	21.14	5.01
1945-1949	0	-	-	3	6.95	2.03	4	7.02	2.35
1950-1954	5	10.44	3.60	6	7.71	2.63	4	5.29	2.24
1955-1959	0	-	-	3	3.39	3.04	3	2.11	1.38
1960-1964	5	3.43	2.99	5	4.16	1.78	5	2.02	1.51
1965-1969	5	3.70	1.87	4	1.56	2.11	5	1.14	1.27
1970-1974	3	1.70	.85	7	1.95	1.53	11	1.85	1.30
1975-1979	4	1.92	1.82	5	1.25	1.34	12	1.34	1.52
1980-1984	6	1.62	1.40	6	1.38	.81	17	1.81	1.61
1985-1989	1	.27	.42	9	1.92	2.24	12	1.39	1.18
>1990	0	-	-	2	2.19	1.40	6	2.07	1.03
All	29	1.80	1.39	52	2.20	1.65	81	1.78	1.44

Table XXXIII. Proportionate Mortality and Proportionate Cancer Mortality Ratios for Lung Cancer Among Black Men by Facility Employed and Year of Death

Year of Death	Facility A & B			Facility C			Facility D		
	Obs.	PMR	PCMR	Obs.	PMR	PCMR	Obs.	PMR	PCMR
1940-1944	0	-	-	0	-	-	1	203.20	9.74
1945-1949	0	-	-	1	53.99	7.09	1	11.67	7.09
1950-1954	0	-	-	0	-	-	2	16.11	6.18
1955-1959	0	-	-	1	26.32	4.07	4	10.14	4.61
1960-1964	1	9.96	3.63	0	-	-	4	4.71	2.55
1965-1969	0	-	-	0	-	-	4	2.14	1.38
1970-1974	3	4.06	2.65	0	-	-	4	1.07	.84
1975-1979	0	-	-	2	4.76	2.09	4	.85	.66
1980-1984	2	2.83	2.50	1	1.24	1.30	10	1.66	1.27
1985-1989	1	.88	.84	1	1.27	.76	4	1.04	.74
>1990	0	-	-	0	-	-	1	.85	.55
All	7	1.95	1.48	6	2.39	1.62	39	1.71	1.22

Table XXXIV. Responses from Questionnaires of Living Workers by Facility

	All[a] Number/Percent[b]		Facility A & B Number/Percent		Facility C Number/Percent		Facility D Number/Percent	
Currently live in NJ or Adjoining State	551	(70.6)	168	(68.9)	177	(79.4)	210	(63.6)
Interested in attending lung cancer screening clinic	306	(43.0)	140	(63.6)	80	(39.2)	86	(29.5)
Interested in attending lung cancer screening clinic and currently live in DE, NJ, NY or PA	219	(44.2)	97	(64.2)	66	(40.7)	56	(29.9)
Race								
White	597	(77.2)	147	(61.0)	206	(95.4)	249	(77.1)
Black	149	(19.3)	68	(28.2)	10	(4.6)	73	(22.6)
Hispanic	18	(2.3)	18	(7.5)	0	-	0	-
Other	9	(1.2)	8	(3.3)	0	-	1	(.3)
Gender								
Male	707	(89.5)	231	(94.7)	197	(88.7)	284	(86.1)
Female	83	(10.5)	13	(5.3)	25	(11.3)	46	(13.9)
Health Status								
Excellent	89	(15.9)	24	(12.9)	29	(17.2)	37	(17.7)
Good	262	(46.9)	84	(45.2)	83	(49.1)	95	(45.5)
Fair	150	(26.8)	58	(31.2)	40	(23.7)	55	(26.3)
Poor	58	(10.4)	20	(10.8)	17	(10.0)	22	(10.5)
Cigarettes								
Current/Unknown[c]	108/92	(16.3/13.9)	49/32	(21.7/14.2)	26/22	(13.6/11.5)	36/38	(14.1/14.9)
Never	196	(29.5)	71	(31.4)	54	(28.3)	71	(27.8)
Ever	468	(70.5)	155	(68.6)	134	(70.7)	184	(72.2)
Pack-years(average)	37.8		33.7		39.2		40.5	
Perforated nasal septum	204	(30.7)	82	(37.1)	50	(26.5)	75	(28.8)

Table XXXIV. (continued) Responses from Questionnaires of Living Workers by Facility

	All[a] Number/Percent[b]		Facility A & B Number/Percent		Facility C Number/Percent		Facility D Number/Percent	
Scars from Chrome ulcers	128	(19.5)	70	(31.8)	36	(19.3)	26	(10.2)
History of Cancer	69	(10.1)	20	(8.9)	21	(10.7)	29	(10.9)
Average birth date (range)	1925 (1900-1957)		1931 (1901-1957)		1924 (1901-1942)		1920 (1900-1935)	
Duration of Employment								
≤1 year	404	(51.1)	90	(36.9)	95	(42.8)	222	(67.3)
>1-10 years	317	(40.1)	113	(46.3)	103	(46.4)	105	(31.8)
>10-20 years	51	(6.5)	27	(11.1)	20	(9.0)	3	(.9)
>20 years	18	(2.3)	14	(5.7)	4	(1.8)	0	-
Time from First Employed								
>10-20	62	(7.8)	62	(25.4)	0	-	0	-
>20	728	(92.2)	182	(74.6)	222	(100.0)	330	(100.0)
Total	790		244		222		330	

[a]The number of respondents in the all column is smaller than the sum of respondents from the facilities because individuals who worked in more than one facility were only counted once.

[b]Percentages which are in parentheses are based on the number of respondents who answered the question, because of rounding the totals of the percentages do not always equal 100%.

[c]Because of missing data there is a percentage of respondents whose current smoking status is unknown.

Table XXXV. Duration of Employment and Latency from Time First Employed Among the Deceased Workers Whose Death Certificates were Located and Used in the Analysis

Time from First Employed	Facility A/B				Facility C				Facility D				All*				All*
	B		W		B		W		B		W		B		W		
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	# (%)
0-10	6	(13.3)	45	(19.3)	1	(3.0)	33	(9.1)	14	(4.6)	44	(7.1)	21	(5.6)	119	(9.9)	140 (8.9)
>10-20	22	(48.9)	82	(35.2)	5	(15.2)	68	(18.8)	25	(8.2)	72	(11.6)	49	(13.0)	216	(18.1)	265 (16.8)
>20	17	(37.8)	106	(45.5)	27	(81.8)	261	(72.1)	267	(87.2)	504	(81.3)	307	(81.4)	861	(72.0)	1168 (74.3)
Duration																	
≤1	16	(35.6)	50	(21.5)	18	(54.6)	114	(39.8)	161	(52.6)	360	(58.1)	191	(50.7)	512	(42.8)	703 (44.7)
>1-10	12	(26.7)	110	(47.2)	8	(24.2)	122	(33.7)	115	(37.6)	188	(30.3)	133	(35.3)	410	(34.3)	543 (34.5)
>10-20	14	(31.1)	61	(26.2)	7	(21.2)	77	(21.3)	21	(6.9)	41	(6.6)	37	(9.8)	178	(14.9)	215 (13.7)
>20	3	(6.7)	12	(5.2)	0	–	49	(13.5)	9	(2.9)	31	(5.0)	16	(4.2)	96	(8.0)	112 (13.7)

*The number of respondents in the all column is smaller than the sum of respondents from the facilities because individuals who worked in more than one facility were only counted once.