MOX

A User's Guide

J. A. Buchanan
E. S. Gilbert

March 1984

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PREFACE

This document has been developed on-line using a VAX computer. The form used allows MOX users to interactively scan the document file on any terminal and easily create copies by queueing the file to any output device. Having the document in this form also simplifies the process of updating and distributing documentation to report on future enhancements to MOX.

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INTRODUCTION TO MOX

What is MOX?

MOX is a computer program. It is designed to be used as a tool in assessing the relationship of occupational exposure and mortality from several specific causes in a large cohort or follow-up study. MOX stands for Mortality and Occupational eXposure analysis.

What computers will MOX work on?

MOX is tailored for use only on Digital Equipment Corporation's family of VAX (Virtual Address eXtension) computers. MOX is written in VAX-11 version 3.0 FORTRAN.

What type of methodology does MOX use?

MOX assesses the relationship of occupational exposure and mortality from several causes without reference to an outside population. The statistical tests employed take full advantage of whatever quantitative exposure data is available and provide appropriate treatment of data on exposure accumulated over time. The statistical tests also allow control for potentially confounding variables such as age, calendar year, length of employment, etc. The statistical methodology used can be considered an sdaptation of the Mantel-Haenszel method [1], or an application of Cox's proportional hazards model [2]. Although the program is designed for population-based cohort analysis, it is also possible to use MOX to conduct "proportional mortality analyses", if only data on deaths are available.

What type of methodology do other computer programs for analyzing occupational mortality use?

Other commonly used computer programs [3,4] for analyzing occupational mortality data calculate standard mortality ratios (SMRs) for several causes of death. The SMR is defined as $100 \times (\text{observed deaths} / \text{expected deaths})$, where expected deaths are calculated by applying age-sex-race-calendar year specific death rates for the U.S. population* to the person-year distribution of the study population (see Monson [3] for further details on this method). Confidence intervals and statistical tests for whether or not these SMRs differ significantly from 100 are also provided. SMRs may also be calculated separately for various exposure categories, length of employment categories, etc.

* SMRs may also be calculated from other external populations but the use of U.S. rates is the most common application of this method.

How does the "MOX" approach compare with the "SMR" approach?

MOX is similar in that it also calculates observed and expected deaths for several causes for various categories defined by exposure or other variables, and assesses statistical significance of the differences. However, the expected deaths (or expecteds) in MOX are not calculated from U.S. rates, but rather from rates based on the combined categories of the study population. With "SMR analysis" the expecteds are the number of deaths expected if U.S. rates prevail, while in MOX they are the number of deaths expected if death rates for the study population do not vary by exposure category. MOX expecteds can also be controlled for age, sex, race and calendar year (as with the SMR approach) and, in addition, can be controlled for length of employment, length of follow-up and other user-defined variables. (This is not possible with the SMR approach because U.S. rates cannot be broken down by such variables.)

Finally, unlike other available computer programs, MOX provides statistical tests for whether or not death rates increase with an increase in exposure (or other variables). Such tests can be based on individual exposures or on scores assigned to exposure categories. In the latter case, the test is Mantel's test for trend [5] (see page 14 for further detail).

What are the advantages of making internal comparisons rather than introducing rates from an external population?

Although comparing mortality in the study population with that of an external control (such as the U.S. population) is an important first step in analyzing occupational mortality data, such comparisons are often difficult to interpret because of the bias introduced by such factors as pre-employment selection, health insurance, and medical surveillance programs. This bias is often referred to as the "healthy worker effect" [6]. Also, in many studies, incomplete ascertainment of deaths in the study population may make external comparisons difficult to interpret.

If the SMR approach is used primarily to compare various subgroups (with different exposure levels), shouldn't the problems related to the use of an external population disappear?

This is not necessarily true because the healthy worker effect often varies by age and other factors. If the exposure groups are not completely comparable with respect to these factors, bias may be introduced (see Gaffey [7] and Cook [8], for example). In addition, as noted above, it is not reasonable to control SMRs for factors for which separate U.S. rates are not available, except by conducting separate analyses for various subgroups. When this is done, numbers are frequently too small to be meaningful. Finally, simply assessing whether or not SMRs for various exposure groups differ from 100 (see page 2) is not as powerful, or as relevant a test, as testing for an increase in death rates with increasing exposure, as is done in MOX.

How should one decide when to use the MOX approach and when to use the SMR approach?

In most populations both approaches are useful, but the relative contributions of the two methods will depend on the type of exposure data available, and on the distribution of exposures in the study population. Because the MOX approach is based on internal comparisons, MOX will be most useful for analyzing populations with good exposure data, considerable variability in exposure, and/or a relatively large subgroup with little or no exposure. In other situations, MOX can still be useful provided there is some basis for determining exposure differences within the population, but one would probably want to supplement such analyses by calculating SMRs based on external rates.

Finally, if the entire study population is exposed in a fairly uniform manner, or if the available data is inadequate to differentiate exposure groups, comparisons with an external control via SMRs will probably provide the most meaningful analysis. However, even in this situation, supplemental analyses based on MOX, with length of employment or other variables used as surrogates for exposure, may provide added insights.

What sort of exposure data will MOX handle?

MOX is designed to handle the situation in which one has a quantitative exposure measurement for each worker for each year of employment. However, MOX can handle exposure data in nearly any form with proper recoding (see page 29).

What special problems are introduced by exposure which is chronic, i.e., gradually accumulated over time?

If one were to consider only the final accumulated exposure total for each worker, the analyses would be biased toward a positive correlation of survival and exposure simply because those workers that survive the longest have the most opportunity to accumulate exposure. (This bias is discussed by Enterline [9]). This means that each worker's entire exposure history must be considered. In addition, exposure is very likely to be correlated with such time dependent variables as age, calendar year, length of employment, etc., which may in themselves be related to mortality (creating a potential source of confounding). Finally, the relationship of the timing of the exposures and any effects which occur is more difficult to investigate with a chronic exposure.

How does MOX handle the special problems introduced by chronic exposure?

The basic unit of analysis for MOX (as well as for other computer programs designed for use in cohort studies) is the person-year. It can be defined as one year in the follow-up of one person. Associated with each person-year is the accumulated exposure at that time, as well as values for variables such as age, calendar year, length of employment (which change as a worker is followed through time), plus values for variables such as race and sex which do not change with time. Expected deaths and other test statistics are all based on person-years which have been allocated by exposure, in addition to other control variables.

How does MOX deal with a possible latent period?

It is possible to introduce a "lag" G between the exposure and the effect by defining the exposure associated with a given person-year as the accumulated exposure G years prior to that time.

What control variables can be included in analyses conducted with MOX?

The user can choose to control analyses for several variables including age, calendar year, follow-up time, length of employment, job category and as many as five non-time dependent user defined variables (common choices would be sex, race and initial year of employment). For each of the variables selected, the user determines the definitions of the categories to be used.

Two of these variables are selected as the primary and secondary control variables, and provide the basis for the vertical and horizontal categories, respectively, in the various tables that are printed. These two variables must be chosen from among the three variables age, calendar year and follow-up time, and are the variables that generally require the most categories.

What type of statistical summaries does MOX provide?

MOX provides observed and expected deaths by exposure category, estimated relative risks and the results of various statistical tests for several specific causes of death (see page 15).

How are various causes of death identified?

It is assumed that deaths are coded to the Eighth Revision of the International Classification of Diseases (ICD). A complete list of the causes for which MOX provides various statistical tests is given in Appendix I.

What else does MOX provide?

In addition to the summaries noted above, MOX provides tables of person-years and (as an option) deaths for any selected causes. The tables are distributed by the variables chosen as the primary and secondary control variables, and by exposure categories. Tables of exposure means and variances are also provided in a like manner. Finally, all of the above can be obtained broken down by the other control variables included in the analysis (i.e., length of employment, sex, etc.).

Does MOX provide estimates of the effects of exposure?

MOX provides only statistical tests for the association of exposure and mortality, plus the relative risks for each exposure category. However, the summary tables noted above could be edited and used as input for statistical programs such as RUMMAGE [10] or GLIM [11].

DESCRIPTION OF MOX METHODOLOGY AND OUTPUT

A. Notation

The following notation is needed to adequately describe MOX methodology and output: (This is not the notation used in the program itself.)

$n = 1, \dots, N$ indexes workers in the study

$i = 1, \dots, I$ indexes control strata

$j = 1, \dots, J$ indexes exposure categories

$k = 1, \dots, K$ indexes years in the study for worker n

$z_n(k)$ = the accumulated exposure, for worker n , G years prior to the beginning of year k (where G is a lag period specified by the user)

$w_n(k)$ = the index of the exposure category associated with $z_n(k)$

$x_n(k)$ = the index of the stratum of worker n at the beginning of year k

P_i = the number of person-years in stratum i (i.e. such that $x_n(k) = i$)

R_i = the set of exposures $z_n(k)$ associated with the person-years in stratum i (i.e. such that $x_n(k) = i$)

MU_i = the mean of the exposures in R_i

SIG_i^2 = the variance of the exposures in R_i

P_{ij} = the number of person-years in stratum i and exposure category j (i.e. such that $x_n(k) = i$ and $w_n(k) = j$)

S_j = the score assigned to exposure category j , commonly taken to be the mean of all exposures $z_n(k)$ in exposure category j (i.e. such that $w_n(k) = j$)

$D_n(k) = 1$ if worker n dies of the cause of interest in year k , 0 otherwise

d_i = the number of deaths from the cause of interest in stratum i

d_{ij} = the number of deaths from the cause of interest in stratum i , exposure category j

B. Study Population and Exposure Distribution Description

MOX first goes through the entire data file to determine person-year and exposure distributions for the study population. For each worker n , MOX goes through each year of follow-up k and determines the $x_n(k)$ (i.e. classifies all years with respect to strata defined by the categories of the control variables chosen). It also classifies the exposure associated with each person-year, $z_n(k)$, into one of the J specified categories and uses this $z_n(k)$ in calculating the exposure mean (MU_i), variance (SIG_i^2), and other required quantities for the appropriate stratum.

All person-years are considered to start on January 1 of a particular calendar year, with age and other time-related variables expressed by their truncated integer values in years at that time. Most commonly, analyses will include person-years from some specified minimal period after employment until the person is either dead or lost to follow-up. Alternative choices, however, can be specified by the user. After printing all user specifications and related processing information, a set of tables is produced by MOX (see appendix H). These tables include the following information:

I. "PERSON-YEARS AT RISK"

These tables give the number of person-years (P_i) in the study classified by the control variables. For the example in appendix H, the primary variable is taken to be age grouped in single year intervals, while the secondary variable is taken to be calendar year grouped in 5-year intervals.

II. "DEATHS FROM ALL CAUSES"
"DEATHS FROM ALL CANCERS"

These tables give the deaths from all causes and all cancers (d_i).

Distributions of deaths from other causes can be obtained by specifying any ICD code ranges.

III. "EXPOSURE MEANS", "EXPOSURE VARIANCES"

These tables present the means (μ_i) and variances (σ_i^2) respectively of the exposures associated with the person-years in the strata defined by the control variables.

IV. "PERSON-YEARS IN EXPOSURE CATEGORY j " ($j = 1, \dots, J$)

These tables present the number of person-years in each of the specified exposure categories by stratum (P_{ij}).

V. "DEATHS FROM ALL CAUSES IN EXPOSURE CATEGORY j "
"DEATHS FROM ALL CANCERS IN EXPOSURE CATEGORY j "

These tables present the d_{ij} , and can be obtained for other causes of deaths by specifying any ICD code ranges.

VI. "TOTAL EXPOSURE**X", X=1,2,3,4

These tables give the sums of $\sum_n [z(k)]^X$ for each stratum defined by

the primary and secondary control variables. For most applications of MOX there will be no reason to print these tables, however, display of these sums is available as an option.

The above tables may be obtained separately for each stratum i determined by all of the stratification variables, and may also be obtained collapsed over all but the primary and secondary variables. In the example in appendix H, age and calendar year were the only stratification variables. If, for instance, length of employment had also been selected as a stratification variable with two categories (less than 10 years and 10 or more years), separate tables for each of these two strata could have been obtained.

C. Description of the methods used by MOX to relate exposure and mortality from several causes

In this section a detailed description of the methodology employed in MOX is given. The output produced by MOX relating exposure and mortality from several causes is described in Section D. The analysis based on grouped exposure data is described first, since this may be more easily understood by those accustomed to SMR type analyses. To analyze data using the MOX approach, expected deaths in each exposure category and stratum are calculated by multiplying the number of person-years in that category and stratum by the death rate for the combined exposure categories in that stratum. The total number of deaths expected in a given exposure category is obtained by summing over strata. That is, the total number of deaths expected in category j is given by

$$E = \sum_j P_i d_{ij} / P_i \quad (1)$$

The total number of observed deaths in category j is given by

$$O_{jij} = \sum_i d_{ij} \quad \text{Note that } \sum_j E_{jj} = \sum_j O_{jj} = d_j$$

As a summary measure for each exposure category, the Mantel-Haenszel [1] relative risk, as adapted for a cohort study, is calculated. This relative risk is given by

$$MHRR_j = \left[\sum_i d_{ij} (P_{ji} - P_{ij}) / P_{ij} \right] / \left[\sum_i (d_{ji} - d_{ij}) P_{ji} / P_{ij} \right] \quad (2)$$

and can be thought of as the risk of category j relative to the pooled remaining categories.

A test of whether the number of deaths observed in category j differs significantly from that expected can be obtained by calculating the Mantel-Haenszel test statistic with the remaining J-1 categories pooled, and the finite population correction factor omitted. That is, the approximately normally distributed test statistics are given by

$$T_j = (O_{jj} - E_{jj}) / \left[\sum_i d_{ji} P_{ji} (P_{ji} - P_{ij}) / P_{ij} \right]^{1/2} \quad (3)$$

Upper and lower 95% confidence limits for the relative risks may be obtained using the test based procedure of

$$\text{Miettinen [13] as } MHRR_j^{1-1.96/T_j} \quad (4)$$

More generally, 1 - alpha level confidence intervals could be calculated by substituting the alpha/2 percentage point of a standard normal distribution for the value 1.96.

Mantel-Haenszel also describe the calculation of a test statistic for assessing overall differences in the relative risks for the J exposure categories. This statistic, which under the null hypothesis of no differences in mortality among the exposure categories, has a chi-square distribution with J-1 degrees of freedom. It is defined as follows:

$$X^2 = \sum_j \sum_k (O_{jk} - E_{jk})(O_{jk} - E_{jk}) v_{jk}^{-1} \quad (5)$$

where v_{jk}^{-1} is an element of the inverse of the matrix defined by

$$v_{jk} = \sum_i n_{ij} P_{ij} (1 - P_{ij}) \text{ for } j=k \text{ and}$$

$$v_{jk} = -\sum_i n_{ij} P_{ij} P_{ik} \text{ for } j \text{ not } = k$$

Mantel's test for trend [5] as adapted for a cohort study by Hakulinen [14] can be obtained by calculating the approximately normally distributed test statistic given by

$$Y = \sum_j S_j (O_j - E_j) / \left\{ \sum_i d_i \left[\sum_j S_j^2 P_{ij} / P_{ij} - \left(\sum_j S_j P_{ij} / P_{ij} \right)^2 \right] \right\}^{1/2} \quad (6)$$

where the S_j designate exposure values or scores assigned to the J categories.

Unless otherwise specified, MOX uses the average of the exposure values within an exposure category as the score for the category. It is evident that the numerator of this statistic will be large when large excesses $(O_j - E_j)$ are associated with large S_j .

The numerator of this statistic can also be written as

$$\sum_i \sum_j S_j d_{ij} - \sum_i d_i \sum_j S_j P_{ij} / P_{ij}$$

In this form, it is evident that the statistic could be calculated even if categories were so fine that only one exposure value was included in each category, which would be equivalent to analyzing ungrouped exposure data. In this case, many of the d_{ij} and P_{ij} would be zero.

For ungrouped exposure data, an alternative way of writing the statistic Y is

$$Y = \left[\sum_z \sum_n D(k) z(k) - \sum_i d_i \mu_i \right] / \left[\sum_i d_i \sigma_i^2 \right]^{1/2} \quad (7)$$

In this form, the numerator may be viewed as the difference between the sum of the exposures of workers who die of the cause of interest and the sum of the mean exposures of similar workers (same stratum) at risk of dying.

D. Description of output giving results of analyses relating exposure and mortality

RESULTS OF ANALYSES BASED ON UNGROUPED EXPOSURE DATA (see page 30 of Appendix H for example)

NUMBER OF DEATHS: $d = \sum_i d_i$

OBSERVED MEAN: The mean of the exposures at death of the workers dying of the cause of interest, $\sum_n \sum_k D(k) z(k) / d$.

EXPECTED MEAN: The expected mean of the exposures at death assuming mortality does not depend upon exposure, $\sum_i d_i \mu_i / d$.

TOTAL VARIANCE: $\sum_i d_i \sigma_i^2$, used in the denominator of the test statistic.

TREND TEST STATISTIC: The statistic used to test for an association of exposure and mortality from the cause of interest. See Y_z , equation (7) on page 15.

UNADJUSTED ONE-TAILED P-VALUE: This is the p-value for the test for trend and will be the probability that a standard normal variable exceeds Y_z .

ADJUSTED ONE-TAILED P-VALUE: This will be the unadjusted p-value given above plus a term based on the third and fourth moments of the exposure distributions. The adjustment is obtained from an Edgeworth series expansion as described in [12], and should provide a more accurate assessment of the p-value when exposure distributions deviate substantially from normality. This adjustment is probably not adequate when extreme outliers are present; in fact, adjusted p-values which exceed unity may occasionally result.

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA (see page 38 of Appendix H for example)

OBSERVED FREQUENCIES: O_j = the number of deaths observed in exposure category j .

EXPECTED FREQUENCIES: E_j = the number of deaths expected in exposure category j if death rates do not vary by exposure. See equation (1) on page 12.

RELATIVE RISKS: These are the Mantel-Haenszel relative risks of category j relative to the pooled remaining categories. These risks are the MHRR j given by equation (2) on page 13.

TEST STATISTICS: These are the Mantel-Haenszel test statistics for assessing whether the relative risks for categories j differ significantly from unity. See T_j defined by equation (3) on page 13.

UPPER AND LOWER BOUNDS FOR THE RELATIVE RISKS: These are the 95% confidence limits obtained by applying the test based procedure of Miettinen [13] and are given by equation (4) on page 13.

NUMBER OF DEATHS: d

OBSERVED MEAN SCORE: Similar to the observed mean based on ungrouped exposure data but with scores S_j replacing the exposure values, given by $\sum_j S_j O_j / d$.

EXPECTED MEAN SCORE: Similar to the expected mean based on ungrouped exposure data but with scores S_j replacing the exposure values, given by $\sum_j S_j E_j / d$.

TOTAL VARIANCE: $\sum_i d_i \left[\sum_j S_j^2 P_{ij} / P_i - \left(\sum_j S_j P_{ij} / P_i \right)^2 \right]$

from the denominator of equation (6) on page 14.

TREND TEST STATISTIC: The statistic used to test for an association of exposure and mortality from the cause of interest. See Y_S , equation (6) on page 14.

UNADJUSTED ONE-TAILED P-VALUE: This is the p-value for the test for trend and will be the probability that a standard normal variable exceeds $\frac{Y}{S}$.

ADJUSTED ONE-TAILED P-VALUE: This will be the unadjusted p-value given above plus a term based on the third and fourth moments of the grouped exposure distributions. The adjustment is obtained from an Edgeworth series expansion as described in [12], and should provide a more accurate assessment of the p-value when exposure distributions deviate substantially from normality. This adjustment is probably not adequate when extreme outliers are present; in fact, adjusted p-values which exceed unity may occasionally result.

CHI-SQUARE TEST FOR HOMOGENEITY
(J-1 DEGREES OF FREEDOM):

This test statistic is designed to detect overall deviations of observed and expected deaths. See the definition of X^2 given in equation (5) on page 14.

PREPARING TO USE MOX

(NOTE: Part 1 of this section is a discussion of basic techniques used in computer-based population studies. You may wish to skim the material or simply skip to Part 2, page 25)

PART 1. THE CASE AS THE UNIT OF ANALYSIS

A case consists of all the information gathered about a particular individual. Each unit of information is called a variable, and each case within a study group contains one value for each of these variables. For instance, the study group sample illustrated in Figure 1 (page 20) contains a unique research number; birth, hire, termination and death dates; sex, race, job and cause of death codes; and the amount of exposure received annually in the years 1950 thru 1955. The case of every other individual in this study group would also consist of these same variables in the same order.

	Research #	Record #	Birth Date	Hire Date	Termination Date	Death Date
(1)	135791357	1	1927	1950	1953	-999
(2)	246802468	1	1925	1950	-999	-999
(3)	357913579	1	1920	1951	1954	1954
(4)	468024680	1	1917	1951	1952	1953
(5)	579135791	1	1915	1952	-999	-999
(6)	680246802	1	1912	1952	-999	-999
(7)	791357913	1	1910	1953	1955	1955
(8)	802468024	1	1905	1953	1954	1955
(9)	913579135	1	1900	1954	-999	-999
(10)	024680246	1	1895	1954	-999	-999

	Research #	Record #	Sex Code	Race Code	Job Code	Cause Of Death Code
(1)	135791357	2	1	1	2	-99
(2)	246802468	2	1	1	2	-99
(3)	357913579	2	2	1	4	162
(4)	468024680	2	1	2	3	151
(5)	579135791	2	1	1	1	-99
(6)	680246802	2	1	1	1	-99
(7)	791357913	2	1	2	2	410
(8)	802468024	2	2	1	4	530
(9)	913579135	2	1	1	1	-99
(10)	024680246	2	1	1	3	-99

	Research #	Record #	1950 Exposure	1951 Exposure	1952 Exposure
(1)	135791357	3	01500	00700	01800
(2)	246802468	3	02100	01300	02300
(3)	357913579	3	-9999	00250	00200
(4)	468024680	3	-9999	00400	01600
(5)	579135791	3	-9999	-9999	00100
(6)	680246802	3	-9999	-9999	00150
(7)	791357913	3	-9999	-9999	-9999
(8)	802468024	3	-9999	-9999	-9999
(9)	913579135	3	-9999	-9999	-9999
(10)	024680246	3	-9999	-9999	-9999

	Research #	Record #	1953 Exposure	1954 Exposure	1955 Exposure
(1)	135791357	4	01200	-9999	-9999
(2)	246802468	4	01700	01400	01800
(3)	357913579	4	00300	00500	-9999
(4)	468024680	4	-9999	-9999	-9999
(5)	579135791	4	00150	00100	00100
(6)	680246802	4	00000	00200	00150
(7)	791357913	4	02300	03100	01700
(8)	802468024	4	00300	00250	-9999
(9)	913579135	4	-9999	00100	00150
(10)	024680246	4	-9999	01100	01600

FIGURE 1. SAMPLE STUDY GROUP

CODING VARIABLES

The information gathered in any type of study is usually coded to simplify the process of recording it on machine-readable media. A coding scheme equates numeric or alphabetic characters to each value of some or all of the variables. This speeds data entry by reducing the number of key strokes and allows the information to be represented in far less space than would otherwise be possible. For example, in our study group sample we have coded each worker as being in one of four general job categories. Let us suppose the job categories are white collar, nuclear, craftsmen and service. By equating white collar with a numeric 1; nuclear with a numeric 2; and so on, we have represented each category with a single digit. As a rule, variables are recorded so that each case occupies one or more 80-character records. This, of course, is mandatory if you are using punched cards; but regardless of the recording medium being used, it is a good practice to limit the size of each record. The size selected should allow your system editor to easily manipulate the records; and, if possible, should permit each record to be displayed on a single line by both your terminal and printer.

VARIABLE TYPES

A variable may be coded either numerically or alphanumerically. The distinction between the two types is important because each is processed differently by the computer. A numeric variable may be represented by a single digit, such as a code for sex; or by multiple digits, such as a research number, as shown in our sample. This type of variable can be used in mathematical operations. On the other hand, an alphanumeric variable is represented by any combination of characters and cannot be used in mathematical operations. Thus, although it is always possible to recode an alphanumeric value into a numeric form; it makes good sense to use only numerically coded variables in the first place. This grants the flexibility of operating on each variable in whatever ways prove necessary.

CODING MISSING VALUES

Quite often, in any type of population study, values for all variables are not available. A missing value code must then be substituted to distinguish missing data from true zero values. The code selected must be such that confusion with an actual value is avoided. It is wise to choose a code of the same size and type as the field allotted for the particular variable. In our sample, a code of -999 is used for all date variables, four character numeric fields; a code of -99 for the cause of death variable, a three character numeric field; and a code of -9999 for all exposure variables, five character numeric fields. Note that a legitimate value for any of these variables would be greater than or equal to zero.

CASE IDENTIFICATION AND SEQUENCING

A field for case identification is often reserved in each record of each case. This variable should contain a unique research number derived from characteristics peculiar to the individual; for example, a social security or payroll number. In addition, it is useful to reserve a field in each record for record sequencing, as in our sample. This gives you the capability of sorting your file by case identification and record number if necessary, perhaps after updating.

THE USE OF BINARY SUBFILES

The cases selected by MOX for processing may be saved on a permanent binary (unformatted) subfile. We refer to it as a subfile because it generally consists of a subset of the cases in a study group. However, it may just as well contain a binary representation of all of the cases. Substituting this type of file for the original formatted one in subsequent processing offers distinct advantages. Binary representation of data results from formatted (externally-coded) data being converted into a machine-readable (internal) form. In analyzing large study groups, a great deal of time is spent reading formatted data and waiting for system software to convert them into an internal form. Because a binary file contains the results of this time consuming process, this step may be eliminated in any future processing of the study group. Using a binary file for input may reduce processing times by as much as a factor of ten.

Another consideration is the amount of storage space required by a study group file. Formatted data requires one byte (character) of storage for each position of each record. Binary data requires either two or four bytes for each variable. Short integer variables may be represented by two bytes, long integer and single precision floating variables require four bytes apiece. To illustrate the difference in storage requirements let us look at the study group sample again. Each case in the formatted mode would use 92 bytes exclusive of spacing between fields. Assuming that the exposure fields each use four bytes (single precision floating), the research number fields also use four bytes (long integer) and that all other variables use two bytes apiece (short integer); then each case in binary form would require 64 bytes. Note also that in a formatted file each space between fields occupies a position whereas a binary file contains no spacing. Thus, any decrease (or possible increase) in storage demands resulting from data conversion is dependent upon the nature of your study group, the coding scheme used to record the information and whether all cases, or just selected ones, are saved. In most environments, the unlikely prospect of even a sizeable increase would be more than offset by the benefit of greatly reduced processing times.

Binary files, of course, cannot be altered and they do require additional time as well as storage to create. Consequently, if you are contemplating editing or updating a formatted file before performing another MOX run there is nothing to be gained by creating a subfile. Once your study group is fairly stable, however, it pays to make a subfile of all of your cases. This way, regardless of the cases chosen for inclusion in an analysis, you can use this subfile instead of your formatted file. If you are frequently selecting the same cases, it would also pay to create a subfile of just the selected cases.

PART 2. PROCESSING CONSIDERATIONS

Operating on a VAX, and processing data as soon as it is read, allows MOX to handle very large study groups. The VAX, a virtual memory machine, uses disk storage as an extension of core memory. Therefore, the actual number of cases that can be processed depends upon the amount of temporary disk storage and core memory available to you. Users should be aware, however, that results from processing a very large number of cases (over 100,000) may not be accurate unless precautions are taken. Exposure related numerical quantities may become so large that they overflow their allotted space in memory, or suffer from serious roundoff error. In addition to steps taken by MOX to limit such problems, the user may prevent their occurrence by scaling large exposure values. This is a good practice to follow regardless of the size of your study group.

For example, assume that our sample in Figure 1 (page 20) has radiation exposure recorded in millirems. Dividing each value by 1000 will convert the readings into rems. This will allow exposure readings to be accurately accumulated over a larger number of cases. Scaling is performed by the user by manipulating the data after it is read, but before it is processed by MOX.

A more efficient method of scaling may be used if the exposure variables are recorded without decimal points, i.e., as integer values. For instance, to scale the exposure data in our sample it is only necessary to modify the format used to read it. Reading each variable as an (F5.3) value rather than as an (F5.0) value is equivalent to dividing the values by 1000.

Normally data are read from a disk file. If the data reside on a storage medium other than disk, they should be copied there before processing. This, of course, requires sufficient disk storage to contain the entire study group in one file. If this requirement creates a problem, the data may be read directly from magnetic tape. This approach is not recommended, unless necessary, due to the penalty extracted in MOX processing time.

USING MOX

VARIABLE DEFINITIONS

Using MOX requires an understanding of the use of several input variables which are defined either in a specification session (see Step 4, page 37) or in the SELECT routine (see Step 2, page 31). Generally those variables that are fixed for a particular run, i.e. do not vary from worker to worker, are defined in the specification session, while those that must be defined for each worker are determined in the SELECT routine.

The following fixed variables are defined in the specification session:

ISTDYS, a four digit calendar year indicating the first year for which exposure data is to be considered.

ISTDYE, a four digit calendar year indicating the final year to be included in the study.

PRIMDESC, choice of primary control variable.

SECDESC, choice of secondary control variable.

STRATCYR, option for controlling by calendar year.

STRATLEN, option for controlling by length of employment.

STRATFUE, option for controlling by follow-up time.

STRATJOB, option for controlling by job category.

STRATUSE, option for controlling by non-time dependent user defined variables.

LATENT, the number of years by which exposures are to be lagged.

The following variables are defined for each worker in the SELECT routine:

IBYR, a four digit calendar year of birth.

ICAUSE, an Eighth Revision ICD three digit code for cause of death (or a missing value code for workers still alive).

IDYR, a four digit calendar year of death (or a missing value code for workers still alive).

- IHYR, a four digit calendar year indicating initial employment date.
- IFYR, a four digit calendar year indicating final year of employment (last date included in the study for workers still employed).

The dates IHYR and IFYR are used for the calculation of length of employment which may be used as a criterion for selecting cases, and/or may be selected as a time dependent control variable.

IUSEV1 thru IUSEV5,

These variables are needed only if stratification by non-time dependent user defined control variables is desired. Common choices for these variables would include sex, race, a code for plant or company, initial employment year, a code for smoking habits, etc.

IYEMP, a four digit calendar year designating the first year to enter into the analysis for the subject being processed. A worker should not enter the analysis until the specified LATENT period has passed, and, since all person-years begin on January 1, a worker should not enter the analysis until the year following $IHYR + LATENT$. Thus the minimum permissible value for IYEMP is $IHYR + LATENT + 1$. Also, if the study is limited to workers who have been employed for at least M years, IYEMP should be no smaller than $IHYR + M + 1$.

IYTERM, a four digit calendar year designating the last year to enter into the analysis for the case being processed. For many applications, this will be the year of death (IDYR) or a fixed final year (ISTDYE), whichever occurs first. (When available, the year lost to follow-up could be substituted for ISTDYE).

NOTE: A proportional mortality analysis can be performed by specifying LATENT as zero, setting IYEMP equal to $IDYR - 1$ and IYTERM equal to IDYR.

JOBCODE, an integer job code, usually read in directly from the data file. Needed only if job category is to serve as a potential control variable or is to be used in the definition of the exposure vector.

JOB CAT, an integer job category. Each value of JOBCAT will include one or more, not necessarily consecutive, values of JOB CODE. The value of JOBCAT is determined by calling the subroutine JOBCATG that uses the job category specifications you will enter in step 4 (see page 42). Record (20) on page 32 illustrates how JOBCATG is called after JOB CODE has been read in for a case. JOBCAT is not referenced in the call statement because it is contained in COMMON.MOX included by record (2). (see Appendix C).

EXPOSURE, This is an array which must be filled with the exposure values associated with each year of the study from 1 (for calendar year ISTDYS) to ISTDYE - ISTDYS + 1 (for calendar year ISTDYE). In the sample SELECT routine in Figure 2 (pages 32,33), MOX reads in an exposure vector YEXP where YEXP(I) denotes the annual exposure received by the worker being processed in year I (indexed as noted). Values for years before and after the worker's period of employment may be designated as zero or as a negative missing value code (both are treated as zero). Note that the indexing for this vector does not depend on the particular employment years of the worker.

In the sample SELECT routine on page 32, MOX calculates the cumulative exposure associated with each calendar year as

$$\text{EXPOSURE}(I) = \sum_{K=1}^{I-1} \text{YEXP}(K) \quad [\text{See records (9) and (10) of the SELECT routine}]$$

For some applications it may be more straightforward to read in the cumulative EXPOSURE vector directly and omit this step [records (9) and (10)] of the SELECT routine. See example 4 (page 30).

As noted on page 27, the user also defines the fixed variable LATENT (constant for all workers in a particular run) which designates a value by which exposures are to be lagged. In carrying out analyses, MOX takes LATENT into account by using EXPOSURE(I - LATENT) as the exposure value to be associated with year I. This provision for the latent period is done outside the SELECT routine and is not shown.

For the examples presented in this manual, quantitative measurements of radiation exposure for each worker for each year of employment were available. These measurements could then be used directly in defining the array YEXP of annual exposures. In other studies, exposure data may not be in this form and recoding may be necessary. The following are a few examples of such recoding.

Example 1: Exposure data is available only as an estimate of the cumulative exposure X over the entire employment period of K years. In this case, it would be necessary to distribute this total over the relevant period based on available knowledge of the probable timing of exposures. In the absence of such knowledge, the simplest way of distributing exposure would be to assign X/K as the YEXP value for each year of employment.

Example 2: Years of employment are used as a surrogate for exposure. In this case, the YEXP value for each year that an individual is employed in the industry or job is assigned a value of 1, and each year he is not employed in the industry or job is assigned a value of zero.

Example 3: For each worker, the period of time worked in each of jobs 1,2,...L is known. If the annual exposure associated with each of the jobs can be quantified, these exposures could then be assigned to the relevant years in defining the array YEXP.

Example 4: Each worker can be assigned to a single job category designated by JOBCAT (defined by calling JOBCATG) , but it is not possible to quantify the exposure associated with each category in a meaningful way. In this case, the EXPOSURE array could be filled directly with the value of JOBCAT and the steps given in records (9) and (10) of the SELECT routine (page 32) omitted. A test for trend could be obtained if the job categories could be even roughly ordered with respect to exposure, but other tests provided by MOX might be more meaningful. Note that an analysis of initial year of employment, or other fixed variables, could be accomplished in a similar manner.

We will now describe the steps to follow to run MOX:

Step 1. IMPLEMENTING MOX

Follow the instructions in Appendix A to implement MOX on your computer system. The modules that make up MOX are listed in Appendix B.

Step 2. MODIFYING THE SELECT SUBROUTINE

You must modify the SELECT subroutine for your own use. The purpose of this routine is to read in the relevant variables for each case, select cases that you wish MOX to analyze and use the data read in to define the basic variables needed for analysis.

An example of a SELECT subroutine is shown in figure 2 on the next page. We will examine each of these FORTRAN instructions and describe their purpose. This particular subroutine has been designed to analyze the cases in the sample study group illustrated in Figure 1 (page 20).

```

SUBROUTINE SELECT                                     ( 1)

  INCLUDE 'COMMON.MOX/NOLIST'                         ( 2)

C*****
C  Variables that must be defined                      *
C  (or given a negative missing value code):          *
C                                                    *
C  EXPOSURE values,IBYR,ICAUSE,IDYR,IFYR,             *
C  IHYR,IYEMP,IYTERM                                  *
C                                                    *
C  Variables that may need to be defined:             *
C                                                    *
C  IUSEV1,IUSEV2,IUSEV3,IUSEV4,IUSEV5,               *
C  JOBCAT,JOBCODE                                     *
C*****

      REAL*4 YEXP(6)                                  ( 3)

C-----Set end of file indicator
      EOF=.FALSE.                                     ( 4)

C-----Zero exposure vector
100  CALL SETRV4 (0.0,EXPOSURE,YRS)                   ( 5)

C-----Formatted input file?
      IF (BINARY) GO TO 300                           ( 6)

C-----Yes...read a case
      READ (INP,800,END=700) IRESN,IBYR,IHYR,IFYR,IDYR,ISEX,IRACE,
      +                               JOBCODE,ICAUSE,(YEXP(I),I=1,6)
                                                                ( 7)
                                                                ( 8)

C-----Transform yearly exposures into cumulative exposures
      DO 200 I=2,6                                     ( 9)
200  EXPOSURE(I)=MAX(YEXP(I-1),0.0)+EXPOSURE(I-1)      (10)

C-----If creating subfile write case
      IF (SUBSET) WRITE (ISF)                          (11)
      +                               IRESN,IBYR,IHYR,IFYR,IDYR,ISEX,IRACE,
      +                               JOBCODE,ICAUSE,(EXPOSURE(I),I=1,6)
                                                                (12)
                                                                (13)
      GO TO 400                                         (14)

C-----No....read a binary case
300  READ (INP,END=700) IRESN,IBYR,IHYR,IFYR,IDYR,ISEX,IRACE,
      +                               JOBCODE,ICAUSE,(EXPOSURE(I),I=1,6)
                                                                (15)
                                                                (16)

C-----Increment # of records read
400  NRR = NRR+1                                       (17)

C-----Male worker?
      IF (ISEX.NE.1) GO TO 100                         (18)

C-----Yes...white?
      IF (IRACE.NE.1) GO TO 100                       (19)

```

FIGURE 2. SAMPLE SELECT SUBROUTINE


```

C-----Yes...worker in a desired job category?
      IF (STRATJOB) CALL JOBCATG (*100)                                (20)

C-----Yes...define user control variable 1 (e.g. year hired)
      IF (STRATUSE1) IUSEV1 = IHYR                                    (21)

C-----Worker alive?
      IF (IDYR.GE.ISTDYS.AND.IDYR.LE.ISTDYE) GO TO 500                (22)

C-----Yes...employed 2 or more years?
      IF (IFYR-IHYR.LT.2) GO TO 100                                    (23)

C-----Yes...define first & last years to consider
      IYEMP=IHYR+LATENT+1                                             (24)
      IYTERM=ISTDYE                                                  (25)

C-----Process case?
      IF (IYEMP.GT.IYTERM) GO TO 100                                  (26)

C-----Yes
      GO TO 600                                                        (27)

C-----No...Employed 2 or more years?
C----- (Do not count year of death if same as final year of employment)
500   LEMP=IFYR - IHYR                                                (28)
      IF (IDYR.EQ.IFYR) LEMP=LEMP - 1                                (29)
      IF (LEMP.LT.2) GO TO 100                                        (30)

C-----Yes...define first & last years to consider
      IYEMP=IHYR+LATENT+1                                             (31)
      IYTERM=IDYR                                                    (32)

C-----Process case?
      IF (IYEMP.GT.IYTERM) GO TO 100                                  (33)

C-----Yes...write data for death summary on temporary file
      WRITE (IS4) CASE                                                (34)

C-----If input file is binary & creating subfile write selected case
C-----Process case
600   IF (BINARY.AND.SUBSET) WRITE (ISF)                              (35)
      + IRESN,IBYR,IHYR,IFYR,IDYR,ISEX,IRACE,                        (36)
      + JOBCODE,ICAUSE,(EXPOSURE(1),I=2,7)                          (37)
      RETURN                                                          (38)

C-----End of file...set indicator
700   EOF=.TRUE.                                                      (39)
      RETURN                                                          (40)

800   FORMAT(19,5X,11,8X,I4,6X,I4,2(10X,I4)/                        (41)
      +      14X,11,9X,11,8X,11,13X,I3/                             (42)
      +      31X,F5.3,2(9X,F5.3)/                                    (43)
      +      31X,F5.3,2(9X,F5.3))                                    (44)
      END                                                            (45)

```

The following explains the purpose of each instruction in Figure 2:

- Record (1)
Identifies subroutine.
- Record (2)
Includes the statements in COMMON.MOX but does not list them.
The variables in these statements may then be used in the
subroutine. COMMON.MOX is listed in Appendix C.
- *
- Record (3)
Dimensions the vector to use for reading in fractional
exposure values.
- Record (4)
Turns the end of file indicator off.
- Record (5)
Fills the exposure vector used by MOX with zeros. The size of
this vector is YRS (YRS=50 in include statements).
- Record (6)
If a binary (rather than formatted) input mode was specified,
transfers control to record (15).
- * *
- Record (7), (8)
Reads a case according to the format statement defined in
records (41) thru (44). If end of file encountered, transfers
control to record (39).
- * *
- Record (9), (10)
Takes the annual exposure values read in and transforms them
into cumulative exposure values for analysis. Other
transformations of exposure values could be performed at this
point (see pages 29-30).
- * * *
- Record (11), (12), (13), (14)
If specified, the variables read in and the cumulative
exposure values are written to a binary subfile. Then,
transfers control to record (17).
- * *
- Record (15), (16)
Reads a case from a subfile in the binary mode. If end of
file encountered, transfers control to record (39).
- Record (17)
Counts the number of sets of records (cases) read.

* Indicates instructions likely to require user modification.

- *
Record (18)
If the worker is female, rejects the case by transferring control to record (5).
- *
Record (19)
If the worker is non-white, rejects the case by transferring control to record (5).
- Record (20)
This provides for a definition of job category which can possibly be used as a stratification variable. The job code read in is used to determine the job category of the case. If the job code does not fall into a specified job category, the case is rejected by transferring control to record (5).
- *
Record (21)
Provides for a user-defined control variable. In this example the variable is defined as year hired. (User control variables 2 thru 5 could be defined in a like manner.)
- Record (22)
If the worker died during the study period to be used in the analysis, transfers control to record (28).
- *
Record (23)
If the worker was employed less than two years, rejects the case by transferring control to record (5).
- Record (24), (25)
Equates the first year to consider with the year hired + LATENT + 1. (It is not appropriate to include person-years before the specified latent period has passed.) Equates the last year to consider with the end of the study period. For other studies, the year the worker was lost to follow-up might be used here.
- Record (26)
If the first year to consider is later than the last year to consider, rejects the case by transferring control to record (5).
- Record (27)
Transfers control to record (35).
- *
Record (28), (29), (30)
If the deceased worker was employed less than two years, rejects the case by transferring control to record (5).

* Indicates instructions likely to require user modification.

Record (31), (32)

Equates the first year to consider with the year hired + LATENT + 1. (It is not appropriate to include person-years before the specified latent period has passed.) Equates the last year to consider with the year of death.

Record (33)

If the first year to consider is later than the last year to consider, rejects the case by transferring control to record (5).

Record (34)

Writes the variables in common block CASE (see Appendix C) on a temporary binary file for use in the specified death analyses.

* * * *

Record (35), (36), (37), (38)

If specified, the values read in from a binary subfile are written on a new binary subfile containing just the cases selected for processing. Control is returned to MOX so the case can be processed.

Record (39), (40)

Turns the end of file indicator on and returns control to MOX. At this point, all selected cases have been processed.

* * * * *

Record (41), (42), (43), (44), (45)

Specifies the format used for reading cases in the formatted mode. Ends subroutine.

You could, of course, develop a SELECT subroutine in many ways. However, because there are variables that either must be or may need to be defined, it is easier to use the routine provided as a model and make only the changes necessary to perform your own MOX analysis. To illustrate this, we modified the sample SELECT routine in Figure 2 so it could be used to analyze a new study group in a different manner. The format of the new study group is in Appendix D. The modified SELECT routine is listed in Appendix E.

* Indicates instructions likely to require user modification.

Step 3. LINKING MOX

Each time the SELECT subroutine is modified, you must rebuild the MOX executable image to substitute the new object module. To do this, after compiling the modified subroutine (in the subdirectory created in step 1), enter:

```
@linkmox
```

Step 4. ENTERING YOUR SPECIFICATIONS

Users may wish to perform a variety of MOX analyses. Changes such as transformation of exposure measurements (log, square root, etc.), definition of user control variables and selection of different subsets of the study group population take place in the SELECT subroutine, as discussed in step 2. However, the selection of control variables, the exposure categories and the latent period are all specified in an interactive specification session. This allows the user to conduct many different analyses without modifying the SELECT subroutine. An interactive specification session is initiated by entering:

```
run mox
```

```
online
```

The first prompt is then sent to your terminal. To receive help for a prompt, simply press the return key. To receive help for prompts that may require a multiple value response, press the control and Z keys simultaneously. Each succeeding prompt is sent when a suitable response is entered for the present one; otherwise help is automatically given and the prompt is re-issued. Although upper case responses are acceptable, enter your responses in lower case (if possible). Because all prompts are issued in upper case, this helps to distinguish user input when analysis results are printed.

After entering the specifications you will be asked for a command file name. The file created by MOX will consist of prompts, helps and responses. Finally, you will have a choice of performing an interactive analysis based on your specifications or ending the interactive specification session. If you choose not to perform an interactive analysis, you may then submit the command file (that was just created) to perform a batch MOX analysis. (This procedure is discussed in the next step on page 46.) Appendix F illustrates a sample specification session for the study group described in Appendix D.

The following is a list of all possible prompts and the rules for each response. Note that the cutpoints (lower category boundaries) referred to in this list divide a variable into specific categories or levels the number of which is one more than the number of cutpoints. For example,

if the number of cutpoints specified is 3
and the cutpoints given are 2,5,15
the 4 categories or levels would be <2, 2 up to 5, 5 up to 15, 15 or more.

Note also, when you are entering values separated by commas, the end of a record acts as a separator. For example,

2,5
15

would be one correct way of entering the above cutpoints; however,

2,5,
15

would not be a correct way.

PROMPT: (UPPER CASE)
response: (lower case)

VARIABLE OR ARRAY NAME:
action:

REPORT FILE NAME?
any valid file name up to 80 characters

RPTNAME
names file to contain analysis results

TASKNAME?
1 to 80 characters

TASKNAME
identifies analysis results

STARTING YEAR OF STUDY?
any 4 digit integer

ISTDYS
specifies first calendar year for which exposure data is to be considered

ENDING YEAR OF STUDY?
4 digit integer < or = starting year of study + 50

ISTDYE
specifies final calendar year to be included in the study

BINARY INPUT FILE?
yes OR no

BINARY
specifies input form

INPUT FILE NAME?
any valid file name up to 80 characters

INPNAME
names study group data file

CREATING A SUBFILE?
yes OR no

SUBSET
if response is yes, creates a binary subfile of study group data

(if response is yes then:)
SUBFILE NAME?
any valid file name up to 80 characters

SUBFILE
names subfile to create

PRIMARY CONTROL VARIABLE?
SPECIFY age , calendar year , OR follow-up time

PRIMDESC
specifies primary tabling variable (rows)

OF PRIMARY CUTPOINTS?
an integer between 2 & 49 inclusive

NPRIM
divides primary variable into NPRIM + 1 categories (rows)

EQUAL PRIMARY CUTPOINT INTERVALS?
yes OR no

EQPCI
if response is yes, divides primary variable into equal sized categories

PROMPT: (UPPER CASE)
response: (lower case)

VARIABLE OR ARRAY NAME:
action:

(if response is yes then:)
FIRST PRIMARY CUTPOINT,
LAST PRIMARY CUTPOINT?
(last-first integer values)/
(# primary cutpoints-1) must
= an integer

IPRIM
determines primary categories
using NPRIM & these cutpoints

(if response is no then:)
PRIMARY CUTPOINTS?
ascending integer values
separated by commas

IPRIM
defines primary categories

SECONDARY CONTROL VARIABLE?
SPECIFY age , calendar year , OR
follow-up time

SECDESC
specifies secondary tabling
variable (columns)

OF SECONDARY CUTPOINTS?
an integer between 2 & 15 inclusive

NSEC
divides secondary variable into
NSEC + 1 categories (columns)

EQUAL SECONDARY CUTPOINT INTERVALS?
yes OR no

EQSCI
if response is yes,
divides secondary variable into
equal sized categories

(if response is yes then:)
FIRST SECONDARY CUTPOINT,
LAST SECONDARY CUTPOINT?
(last-first integer values)/
(# secondary cutpoints-1) must
= an integer

ISEC
determines secondary categories
using NSEC & these cutpoints

(if response is no then:)
SECONDARY CUTPOINTS?
ascending integer values
separated by commas

ISEC
defines secondary categories

(prompt not issued if calendar year
has been selected as the primary or
secondary control variable)
STRATIFY BY CALENDAR YEAR?
yes OR no

STRATCYR
if response is yes,
stratifies workers by calendar
year

(if response is yes then:)
OF CALENDAR YEAR CUTPOINTS?
an integer between 1 & 14
inclusive

NCYR
stratifies workers into NCYR + 1
levels

PROMPT: (UPPER CASE)
response: (lower case)

VARIABLE OR ARRAY NAME:
action:

CALENDAR YEAR CUTOPOINTS?
ascending integer values
separated by commas

ICYR
defines calendar year levels

CALENDAR YEAR DESCRIPTION FOR
FOR GROUP XX?
1 to 24 characters

CYRDESC
identifies calendar year levels

STRATIFY BY LENGTH OF EMPLOYMENT?
yes OR no

STRATLEN
if response is yes,
stratifies workers by length of
employment

(if response is yes then:)
OF LENGTH OF EMPLOYMENT
CUTOPOINTS?
an integer between 1 & 14
inclusive

NLEN
stratifies workers into NLEN + 1
levels

LENGTH OF EMPLOYMENT
CUTOPOINT(S)?
ascending integer values
separated by commas

ILEN
defines length of employment
levels

LENGTH OF EMPLOYMENT
DESCRIPTION FOR GROUP XX?
1 to 24 characters

LENDESC
identifies length of employment
levels

(prompt not issued if follow-up time
has been selected as the primary or
secondary control variable)

STRATIFY BY FOLLOW-UP SINCE YEAR OF
EMPLOYMENT?
yes OR no

STRATFUE
if response is yes,
stratifies workers by follow-up

(if response is yes then:)
OF FOLLOW-UP CUTOPOINTS?
an integer between 1 & 14
inclusive

NFUE
stratifies workers into NFUE + 1
levels

FOLLOW-UP CUTOPOINTS?
ascending integer values
separated by commas

IFUE
defines follow-up levels

FOLLOW-UP DESCRIPTION FOR
GROUP XX?
1 to 24 characters

FUEDESC
identifies follow-up levels

PROMPT: (UPPER CASE)
response: (lower case)

VARIABLE OR ARRAY NAME:
action:

STRATIFY BY JOB CATEGORY?
yes OR no

STRATJOB
if response is yes,
stratifies workers by job
category

(if response is yes then:)
OF JOB CATEGORIES?
an integer between 1 & 15
inclusive

NOCC
stratifies workers into NOCC
levels

OF CODES IN JOB
CATEGORY XX?
an integer between 1 & 15
inclusive

NCODES
specifies # of codes for each
of NOCC levels

CODES IN JOB CATEGORY XX?
integer values separated by
commas

IOCC
defines codes for each of NOCC
levels

DESCRIPTION FOR JOB CATEGORY
XX?
1 to 24 characters

OCCDESC
identifies job category levels

STRATIFY BY USER-DEFINED CONTROL
VARIABLE(S)?
yes OR no

STRATUSE
if response is yes,
stratifies workers by these
control variables

(if response is yes then:)
OF USER-DEFINED CONTROL
VARIABLES?
an integer between 1 & 5
inclusive

NUSE
specifies # of these control
variables to stratify by

OF CONTROL VARIABLE X
CUTPOINTS?
an integer between 1 & 14
inclusive

NUSEX
stratifies workers into NUSEX
+ 1 levels

CONTROL VARIABLE X
CUTPOINT(S)?
ascending integer values
separated by commas

IUSEX
defines control variable X
levels

CONTROL VARIABLE X
DESCRIPTION FOR GROUP XX?
1 to 24 characters

USEXDESC
identifies control variable X
levels

PROMPT: (UPPER CASE)
response: (lower case)

VARIABLE OR ARRAY NAME:
action:

OF EXPOSURE CUTPOINTS?
an integer between 1 & 14 inclusive

NEXP
stratifies workers into NEXP + 1
exposure categories

EXPOSURE CUTPOINT(S)?
ascending real values separated by
commas

REXP
defines exposure categories

DESCRIPTION OF EXPOSURE UNITS?
1 to 24 characters

EXPDESC
identifies exposure units

LATENCY PERIOD FOR EXPOSURE?
0 or a positive integer by which
exposures are to be lagged

LATENT
specifies # of years to lag
exposure

(prompt not issued if controlling
only for primary & secondary
variables)

PRINT TABLES BY PRIMARY &
SECONDARY CATEGORIES ONLY?
yes OR no

TABSTRAT
if response is yes,
tables are not printed for each
level of specified
stratification
(this does not affect death
analyses results)

PRINT TABLES OF DEATHS FROM
ALL CAUSES?
yes OR no

TABDTH
if response is yes,
prints deaths from ICD coded
causes 0 - 999 inclusive

PRINT TABLES OF DEATHS FROM
ALL MALIGNANT NEOPLASMS?
yes OR no

TABDTHMN
if response is yes,
prints deaths from ICD coded
causes 140 - 209 inclusive

PRINT TABLES FOR OTHER SPECIFIED
CAUSES OF DEATH?
yes OR no

TABDTHSPC
prints deaths from specified
ICD coded causes

PROMPT: (UPPER CASE)
response: (lower case)

VARIABLE OR ARRAY NAME:
action:

(if response is yes then:)

OF OTHER DEATH TABLES?
1 or 2 or 3

NDTHGRPS
specifies # of other death
tables to print

OF ICD CODE RANGES IN
DEATH TABLE X?
an integer between 1 & 15
inclusive

NICDS
specifies # of ICD code ranges
for each of NDTHGRPS tables

LOWER,UPPER RANGE OF CODES
IN DEATH TABLE X?
non-descending integers
between 0 & 999
inclusive

IRANGES
defines ICD code ranges for each
of NDTHGRPS tables

DEATH TABULATION DESCRIPTION
FOR TABLE X?
1 to 80 characters

DTNDESC
identifies each of NDTHGRPS
tables

PRINT POWER TOTALS?
yes OR no

TABPOW
if response is yes,
prints tables of exposure to the
1st, 2nd, 3rd & 4th powers by
primary & secondary categories
only

PRINT UNGROUPED EXPOSURE ANALYSIS
RESULTS?
yes OR no

INDIV
if response is yes,
prints analyses of ungrouped
exposures

PRINT GROUPED EXPOSURE ANALYSIS
RESULTS?
yes OR no

GROUPED
if response is yes,
prints analyses of grouped
exposures

(if response is yes then:)
ASSIGN SCORES TO THE
EXPOSURE CATEGORIES?
yes OR no

ASSIGNSCR
if response is yes,
specified scores will be
substituted for exposure
category means in the grouped
exposure analysis

PROMPT: (UPPER CASE)
response: (lower case)

VARIABLE OR ARRAY NAME:
action:

(if response is yes then:)
EXPOSURE CATEGORY SCORES?
(# of exposure cutpoints + 1)
real values separated by commas

SCORES
defines exposure category scores

COMMAND FILE NAME?
any valid file name up to 80 characters

COMNAME
names command file & creates it

PERFORM INTERACTIVE ANALYSIS PER
SPECIFICATIONS?
yes OR no

ABORT
the specification phase is now
complete, if response is yes an
interactive analysis begins

Step 5. USING THE COMMAND FILE

As noted in the last step, a command file is created at the conclusion of each interactive specification session. This file contains all possible prompts and helps, not just the actual prompts and any helps issued during the session. This allows you to use a system editor to easily modify the responses in the command file so that a variety of batch analyses can be performed, without going thru the interactive specification phase again. The command file created from the specification session in Appendix F is listed in Appendix G. This listing is followed by a discussion of ways in which the command file may be modified. Appendix H is a listing of the output generated by submitting the command file in Appendix G as a batch job.

APPLICATION TO WORKERS AT A NUCLEAR FACILITY

The MOX approach is illustrated in this manual by using data from a study of mortality at the Hanford nuclear facility. The Hanford plant, located in southeastern Washington State, has employed many workers in jobs involving some exposure to radiation. The initial purpose of this plant was the manufacture, chemical separation and purification of plutonium. In addition, research of a diverse nature and, more recently, power generation have been conducted at the facility. Employment records, which include data on age, sex, race, dates of employment and termination, and job classification, have been kept on 28,683 male workers and 11,190 female workers employed between 1944 and 1979.

Relatively good quantitative measurements of radiation exposure, obtained from personal dosimeter readings, are available for each Hanford worker for each year of employment at Hanford. Although these data include annual measurements of exposure to several types of ionizing radiation, only whole body penetrating radiation is considered here. Such exposure is measured in rem, a normalized sum of several radiation types.

The study population for the sample analysis in Appendix H consists of 13,462 white males with at least three dosimeter readings. (This criterion is slightly different from that used in earlier analyses of this population [15,16]). The analyses include the experience of workers until death or the study cutoff date (January 1, 1979), whichever occurred first. In many instances, the follow-up period includes many years after termination of employment at Hanford. A more complete description of the Hanford data as well as interpretation of results of analyses are given in [15] and [16].

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APPENDIX A. IMPLEMENTING MOX

Follow these steps to implement MOX on your VAX computer system:

Step 1. MOUNT THE MOX SOURCE TAPE

mount mt?: mox tape (? is your tape drive designator, e.g. 0 or 1)

Step 2. CREATE A SUBDIRECTORY

create/directory [?.mox] (? is your directory name)

Step 3. COPY MOX TO SUBDIRECTORY

set default [?.mox] (? is your directory name)

copy tape:*. * *

dismount tape

Step 4. COMPILE MOX

@compmox

Your subdirectory should now contain:

(43) *.FOR (43) *.OBJ COMMON.MOX

COMPMOX.COM LINKMOX.COM LINKMOX.OPT

BANNER.DAT (This file is used to display a banner on the MOX output.
 The file may be deleted, or moved to a different directory
 if a banner is not desired.)

MOX.DOC (This file contains the document you are reading.)

The number of words of memory required to perform a particular task is printed for each MOX analysis. If this Figure should exceed the preset value of five hundred thousand (see Appendix C), do the following:

- 1) Set the SPACE parameter in COMMON.MOX to a value greater than the number of words required.

- 2) Re-compile MOX by entering:

@compnox

- 3) Re-link MOX by entering:

@linknox

Allocating memory in this fashion allows MOX to divide all specified control variables into many more categories than would otherwise be possible, even on a VAX (when configured in the usual fashion).

APPENDIX B. MOX MODULES

The following is an alphabetical listing of the software modules in MOX. The function of each module is briefly described and its entry points and external references are noted.

MODULE: AGEPRIM

Alternate Entry Points: CYPRIM, FUPRIM

Purpose: Determines primary group for age, calendar year or follow-up time

Called From: PRIMSEC

Calls To:

MODULE: AGESEC

Alternate Entry Points: CYSEC, FUSEC

Purpose: Determines secondary group for age, calendar year or follow-up time

Called From: PRIMSEC

Calls To:

MODULE: ALPHAP

Purpose: Prompts for a character message of a specified length

Called From: PROMPT

References To: NOFCHAR

MODULE:

BATCH

Purpose:

Reads processing specifications from a command file created by MOX. Because the file may be edited by the user, it is screened for gross errors.

Called From:

MOX

Calls To:

PRIMCV,SECCV

References To:

NOFCHAR

MODULE:

CAUSES

Purpose:

Defines titles for cause of death categories

Called From:

MOX

Calls To:

MODULE:

COMMAND

Purpose:

Creates a command file from processing specifications

Called From:

PROMPT

Calls To:

NUMBER

References To:

NOFCHAR

MODULE:

DEATHGRP

Purpose:

Generates a summary based on grouped exposure

Called From:

MOX

Calls To:

GINDEX,INVERSE,LEVELS,PRIMSEC,SETIV2,SETRV4

References To:

NOFCHAR,NORMAL

MODULE: DEATHIND

Purpose: Generates a summary based on ungrouped exposure

Called From: MOX

Calls To: AINDEX, LEVELS, PRIMSEC, SETIV2, SETRV4

References To: NOFCHAR, NORMAL

MODULE: DIALOGUE

Purpose: Defines prompts & helps

Called From: PROMPT

Calls To:

MODULE: DIGITS

Purpose: Determines # of digits to allow for printing a real number

Called From: STRATTAB, TABLES

Calls To:

MODULE: GINDEX

Alternate Entry Point: AINDEX

Purpose: Determines control level index

Called From: DEATHGRP, DEATHIND, PROCESS, STRATTAB, TABLES

Calls To:

MODULE: INTEGERP

Purpose: Prompts for an integer value within a specified range

Referenced From: PROMPT

References To: NOFCHAR

MODULE: INTFREEP

Purpose: Prompts for a series of integer values separated by commas

Called From: PROMPT

References To: NOFCHAR

MODULE: INTGTAB

Purpose: Prints integer table plus simple totals

Called From: STRATTAB, TABLES

Calls To: SETIV4

MODULE: INVERSE

Purpose: Inverts n-th order matrix by the Jordan elimination method

Called From: DEATHGRP

Calls To:

MODULE: JOBCATG

Purpose: Determines job category for a specified job code

Called From: SELECT

Calls to:

MODULE: LEVELS

Purpose: Determines control variable levels

Called From: DEATHGRP, DEATHIND, PROCESS

Calls To:

MODULE: MOX

Purpose: Serves as the control point for all processing of a study group. Storage is allocated & supporting modules are referenced.

Calls To: BATCH, CAUSES, DEATHGRP, DEATHIND, PROCESS, PROMPT, SELECT, SETIV4, SETRV4, STRATTAB, TABLES

References To: SECOND

MODULE: NOFCHAR

Purpose: Determines the # of characters in a message

Referenced From: ALPHAP, BATCH, COMMAND, DEATHGRP, DEATHIND, INTEGERP, INTFREEP, PROMPT, REALFREEP, STRATTAB, TABLES, YESNOF

References To:

MODULE: NORMAL

Purpose: Determines p-value of a normal test statistic

Referenced From: DEATHGRP, DEATHIND

References To:

MODULE: NUMBER

 Purpose: Numbers group description prompts
 Called From: COMMAND,PROMPT
 Calls To:

MODULE: PRIMCV

 Alternate Entry Point: SECCV
 Purpose: Determines primary & secondary control
 variables
 Called From: BATCH,PROMPT
 Calls To:

MODULE: PRIMSEC

 Purpose: Determines primary & secondary group
 Called From: DEATHGRP,DEATHIND,PROCESS
 Calls To: AGEPRIM,AGESEC,CYPRIM,CYSEC,FUPRIM,
 FUSEC

MODULE: PROCESS

 Purpose: Allocates person-years & exposures by
 category to generate risk strata
 Called From: MOX
 Calls To: AINDEX,GINDEX,LEVELS,PRIMSEC

MODULE: PROMPT

Purpose: Prompts user for processing specifications
& screens them for errors
Called From: MOX
Calls To: ALPHAP, COMMAND, DIALOGUE, INTFREEP, NUMBER,
PRIMCV, REALFREEP, SECCV
References To: INTEGERP, NOFCHAR, YESNOP

MODULE: REALFREEP

Purpose: Prompts for a series of real values
separated by commas
Called From: PROMPT
References To: NOFCHAR

MODULE: REALTAB

Purpose: Prints real table & mean totals
Called From: STRATTAB, TABLES
Calls To: SETRV4

MODULE: REALWTAB

Purpose: Prints real table & weighted mean totals
Called From: STRATTAB
Calls To: SETRV4

MODULE: SECOND

Purpose: Dummy function to compensate for lack of
cpu library routine

Referenced from: MOX

References to:

MODULE: SELECT

Purpose: Selects cases & creates subfiles per user
specifications

Called From: MOX

Calls To: JOBCATG,SETRV4

MODULE: SETIV2

Purpose: Initializes an integer*2 vector

Called From: DEATHGRP,DEATHIND

Calls To:

MODULE: SETIV4

Purpose: Initializes an integer*4 vector

Called From: MOX,RISKTAB,TRISKTAB

Calls To:

MODULE: SETRV4

Purpose: Initializes a real*4 vector

Called From: DEATHGRP,DEATHIND,MOX,PRIMTAB,
SELECT, TABLES,TPRIMTAB,TRISKTAB

Calls To:

MODULE: STRATTAB

Purpose: Prints tables stratified by all specified control variables

Called From: MOX

Calls To: AINDEX, DIGITS, GINDEX, INTGTAB, REALTAB, REALWTAB, STRATTOT, VARTAB

References To: NOFCHAR

MODULE: STRATTOT

Purpose: Prints tables of totals for output stratified by all specified control variables

Called From: STRATTAB

Calls To: TINTGTAB, TREALTAB

MODULE: TABLES

Purpose: Prints tables stratified by primary & secondary variables only

Called From: MOX

Calls To: AINDEX, DIGITS, GINDEX, INTGTAB, REALTAB, SETRV4, TOTALS

References To: NOFCHAR

MODULE: TINTGTAB

Purpose: Prints total integer table plus simple totals

Called From: STRATTOT, TOTALS

Calls To: SETIV4

MODULE: TOTALS

Purpose: Prints tables of totals for output stratified
by primary & secondary variables only
Called From: TABLES
Calls To: TREALTAB

MODULE: TREALTAB

Purpose: Prints real total table plus simple totals
Called From: STRATTOT, TOTALS
Calls To: SETRV4

MODULE: VARTAB

Purpose: Prints exposure variance table
Called From: STRATTAB
Calls To:

MODULE: YESNOF

Purpose: Prompts for response of yes or no
Referenced From: PROMPT
References To: NOFCHAR

APPENDIX C. MOX INCLUDE STATEMENTS

```

+ INTEGER*2 CYR,DTHG,FUE,LEN,NCOD,NCODOCC,NDC,NDL,NICR,
+   NICR2DTHG,NQH,NRL,OCC,PRIM,SEC,STA,USE,XPO

+ INTEGER*4 SPACE,YRS

+ PARAMETER (CYR=15,DTHG=5,FUE=15,LEN=15,NCOD=15,NDC=86,
+   NDL=24,NICR=15,NQH=77,NRL=80,OCC=15,PRIM=50,
+   *
+   SEC=16,SPACE=500000,STA=15,USE=15,XPO=15,
+   YRS=50)

+ PARAMETER (NCODOCC=NCOD*OCC,NICR2DTHG=NICR*2*DTHG)

+ COMMON /CASE / EXPOSURE(YRS),IBYR,ICAUSE,IDYR,IFYR,
+   ** **
+   IHYR,IRACE,ISEX,IUSEV1,IUSEV2,IUSEV3,
+   IUSEV4,IUSEV5,IYEMP,IYTERM,JOBCAT,
+   JOBCODE

+ COMMON /CENTER/ NCCYR(CYR),NCFUE(FUE),NCLLEN(LEN),
+   NCOCC(OCC),NCPRIM,NCSEC,NCSTA(STA),
+   NCUSE1(USE),NCUSE2(USE),NCUSE3(USE),
+   NCUSE4(USE),NCUSE5(USE),NSECPR,
+   PRIMPR(PRIM*2),SECPR(SEC*2)

+ COMMON /DEATHS/ AMU2(NDC),EXSUM(NDC),IRANGES(NICR,2,DTHG),
+   ND(NDC),NICDS(DTHG),OSUM(NDC),SCORES(XPO)

+ COMMON /GOVERN/ ABORT,ASCEND,ASSIGNSCR,BINARY,EOF,EQPCI,
+   EQSCI,GROUPED,INDIV,INTACT,ISTDYE,ISTDYS,
+   LAG,LATENT,MOMENTS,NDTHGRPS,NPRIMC,PNL,PRIMAGE,
+   PRIMCY,PRIMFU,PRIMOWN,SECAGE,SECCY,SECFU,SECOWN,
+   SENSITIVE,STRAT,STRATCYR,STRATFUE,STRATJOB,
+   STRATLEN,STRATSTA,STRATUSE,STRATUSE1,STRATUSE2,
+   STRATUSE3,STRATUSE4,STRATUSE5,SUBSET,TAB,TABDTH,
+   TABDTHMN,TABDTHSPC,TABPOW,TABSTRAT

+ COMMON /IDENTS/ BLANK,DASH,DASHES(NRL),CYRDESC(CYR),
+   DTHCTGS(NDC),DTHDESC(DTHG),EXPDESC,
+   FUEDESC(FUE),LENDESC(LEN),OCCDESC(OCC),
+   PRIMDESC,SECDESC,STADDESC(STA),USE1DESC(USE),
+   USE2DESC(USE),USE3DESC(USE),USE4DESC(USE),
+   USE5DESC(USE)

+ COMMON /INDEX / IAGE,ICYEAR,ICYRX,IFUEX,IFUP,IGRPX,ILENX,INDEXA,
+   INDEXG,IOCCX,ISTAX,IUSE1X,IUSE2X,IUSE3X,IUSE4X,
+   IUSE5X,LENGTH,NPRIMG,NSECG

+ COMMON /LIMIT / EGMN(XPO),ICYR(CYR),IFUE(FUE),ILEN(LEN),
+   IOCC(NCOD,OCC),IPRIM(PRIM),ISEC(SEC),ISTA(STA),
+   IUL,IUSE1(USE),IUSE2(USE),IUSE3(USE),IUSE4(USE),
+   IUSE5(USE),NCODES(OCC),NOING(XPO),REXP(XPO)

```

* The SPACE parameter may be increased (see Appendix A).

**IRACE and ISEX are included for a special purpose and do not need to be defined by the user

```

COMMON /NAMES / COMNAME,INPNAME,RPTNAME,SUBNAME,TASKNAME

COMMON /SHARE / IMAX,IMIN,INTEGERS(PRIM-1),IQH,ISUM(PRIM),
+               ITOTAL(SEC+1),IVECTOR(PRIM,SEC),LMSG,NCH,NCQ,
+               NCR,NOV,NRR,NRS(OCC),REALS(XPO-1),SUM(PRIM),
+               TOTAL(SEC+1),TOTWT(SEC)

COMMON /SIZE / INC3D,NCYR,NEXP,NFUE,NGEXP,NLEN,NOCC,NPRIM,
+              NSEC,NSTA,NUSE,NUSE1,NUSE2,NUSE3,NUSE4,NUSE5

COMMON /SPACE / BUFR(SPACE)

COMMON /TALK / AGE(2),AID,AIDS(NQH),C1,C2,CUE,CUES(NQH),CY(2),
+             FU(2),OWN(2),RESPOND(NRL),SPEAK(NRL),TYPE

COMMON /TIME / CPU,ELAPSED

COMMON /UNITS / COM,INP,IPR,ISF,IS4,ITY,IWF

COMMON /WHEN / DDMMYY,HHMMSS

REAL*4          CASE(YRS+17),NORMAL

EQUIVALENCE (CASE,EXPOSURE),(RESPOND,RESPONSE)

INTEGER*2 COM,IAGE,IBYR,ICYEAR,ICYR,ICYRX,IDYR,IFUE,IFUEX,
+         IFUP,IFYR,IGRPX,IHYR,ILEN,ILENX,IMAX,IMIN,INP,
+         INTEGERS,IOCC,IOCCX,IPR,IPRIM,IQH,IRACE,IRANGES,
+         ISEC,ISEX,ISF,ISTA,ISTAX,ISTDYE,ISTDYS,IS4,ITY,
+         IUEGP,IUL,IUSE1,IUSE2,IUSE3,IUSE4,IUSE5,IYEMP,
+         IYTERM,JOBCAT,LAG,LATENT,LENGTH,LMSG,NCCYR,NCFUE,
+         NCH,NCLN,NCOCC,NCODES,NCPRIM,NCQ,NCR,NCSEC,NCSTA,
+         NCUSE1,NCUSE2,NCUSE3,NCUSE4,NCUSE5,NCYR,ND,NFUE,
+         NGEXP,NICDS,NLEN,NOCC,NOFCHAR,NOV,NPRIM,NSECG,
+         NSECPR,NSTA,PRIMPR,SECPR

LOGICAL*1 ABORT,ASCEND,ASSIGNSCR,BANNER,BINARY,EOF,EQPCI,
+         EQSCI,GROUPED,INDIV,INTACT,MOMENTS,PNL,PRIMAGE,
+         PRIMCY,PRIMFU,PRIMOWN,SECAGE,SECCY,SECFU,SECOWN,
+         SENSITIVE,STRAT,STRATCYR,STRATFUE,STRATJOB,
+         STRATLEN,STRATSTA,STRATUSE,STRATUSE1,STRATUSE2,
+         STRATUSE3,STRATUSE4,STRATUSE5,SUBSET,TAB,TABDTH,
+         TABDTHMN,TABDTHSPC,TABPOW,TABSTRAT,YESNOP

CHARACTER AGE*3,AID*(NRL),AIDS*(NRL),BLANK,C1,C2,
+         COMNAME*(NRL),CUE*(NRL),CUES*(NRL),CY*13,
+         CYRDESC*(NDL),DASH,DASHES,DDMMYY*9,DTHCTGS*(NRL),
+         DTHDESC*(NRL),EXPDESC*(NDL),FU*14,FUEDESC*(NDL),
+         HHMMSS*8,INPNAME*(NRL),LENDESC*(NDL),LINE*132,
+         OCCDESC*(NDL),OWN*3,PRIMDESC*(NDL),RESPOND,
+         RESPONSE*(NRL),RPTNAME*(NRL),SECDESC*(NDL),SPEAK,
+         STADDESC*(NDL),SUBNAME*(NRL),TASKNAME*(NRL),TYPE*8,
+         USE1DESC*(NDL),USE2DESC*(NDL),USE3DESC*(NDL),
+         USE4DESC*(NDL),USE5DESC*(NDL)

```


APPENDIX D. STUDY GROUP FORMAT

Record #	Length	Specification	Columns	Field Identification
1	9	I9	1 - 9	Research #
1	7	F7.3	10 - 16	exact Birth Date - 1900
1	1	I1	17	Sex
1	1	I1	18	Race
1	7	F7.3	19 - 25	exact Employment Date - 1900
1	7	F7.3	26 - 32	exact Termination " "
1	1	I1	34	Job Category code
1	5	F5.0	43 - 47	1944 Exposure in centirems
1	5	" "	48 - 52	1945 " "
1	5	" "	53 - 57	1946 " "
1	5	" "	58 - 62	1947 " "
1	5	" "	63 - 67	1948 " "
1	5	" "	68 - 72	1949 " "
1	5	" "	73 - 77	1950 " "

Record #	Length	Specification	Columns	Field Identification
2	5	F5.0	1 - 5	1951 Exposure in centirems
2	5	" "	6 - 10	1952 " "
2	5	" "	11 - 15	1953 " "
2	5	" "	16 - 20	1954 " "
2	5	" "	21 - 25	1955 " "
2	5	" "	26 - 30	1956 " "
2	5	" "	31 - 35	1957 " "
2	5	" "	36 - 40	1958 " "
2	5	" "	41 - 45	1959 " "
2	5	" "	46 - 50	1960 " "
2	5	" "	51 - 55	1961 " "
2	5	" "	56 - 60	1962 " "
2	5	" "	61 - 65	1963 " "
2	5	" "	66 - 70	1964 " "
2	5	" "	71 - 75	1965 " "
2	5	" "	76 - 80	1966 " "

Record #	Length	Specification	Columns	Field Identification
3	5	F5.0	1 - 5	1967 Exposure in centimeters
3	5	" "	6 - 10	1968 " "
3	5	" "	11 - 15	1969 " "
3	5	" "	16 - 20	1970 " "
3	5	" "	21 - 25	1971 " "
3	5	" "	26 - 30	1972 " "
3	5	" "	31 - 35	1973 " "
3	5	" "	36 - 40	1974 " "
3	5	" "	41 - 45	1975 " "
3	5	" "	46 - 50	1976 " "
3	5	" "	51 - 55	1977 " "
3	5	" "	56 - 60	1978 " "
3	2	I2	61 - 62	# of Exposure Readings
3	2	I2	63 - 64	1st Year Of Exposure - 1900
3	2	I2	66 - 67	2nd " "
3	2	I2	68 - 69	3rd " "
3	2	I2	70 - 71	Last " "

Record #	Length	Specification	Columns	Field Identification
4	7	F7.3	28 - 34	exact Death Date - 1900
4	4	I3	42 - 44	ICD Cause Of Death code

APPENDIX E. MODIFIED SELECT MODULE

SUBROUTINE SELECT

```

C*****
C    Process only white males with at least 3 dosimetry readings      *
C                                                                    *
C    Start yr = max (yr 3rd Reading + 1 , yr 1st Reading + LATENT + 1) *
C*****

```

```

INCLUDE 'COMMON.MOX/NOLIST'

```

```

C*****
C    Variables that must be defined      *
C    (or given a negative missing value code): *
C                                        *
C    EXPOSURE values, IBYR, ICAUSE, IDYR, IFYR, *
C    IHYR, IYEMP, IYTERM                *
C                                        *
C    Variables that may need to be defined: *
C                                        *
C    IUSEV1, IUSEV2, IUSEV3, IUSEV4, IUSEV5, *
C    JOBCAT, JOBCODE                    *
C*****

```

```

REAL*4 YEXP(35)

```

```

C-----Set end of file indicator
      EOF=.FALSE.

```

```

C-----Zero exposure vector
100  CALL SETRV4 (0.0, EXPOSURE, YRS)

```

```

C-----Formatted input file?
      IF (BINARY) GO TO 300

```

```

C-----Yes...read a case
      READ (INP,800,END=700) IRESN,YOB,ISEX,IRACE,YOH,YOF,JOBCODE,
      +(YEXP(1),I=1,35),NONR,IFSTDS,ISCNDS,ITHRDS,ILSTDS,YOD,IDCODE

```

```

C-----Transform yearly exposures into cumulative exposures
      DO 200 I=2,35
200  EXPOSURE(I)=MAX(YEXP(I-1),0.0)+EXPOSURE(I-1)

```

```

C-----Define dates & cause of death
      IFSTDS=1900 + IFSTDS
      ISCND=1900 + ISCND
      ITHRDS=1900 + ITHRDS
      ILSTDS=1900 + ILSTDS
      YOB=1900.0 + YOB
      YOH=1900.0 + YOH
      YOF=1900.0 + YOF
      YOD=1900.0 + YOD
      IBYR=YOB
      IHYR=YOH
      IFYR=YOF
      IDYR=YOD
      ICAUSE=IDCODE

C-----If creating subfile write case
      IF (SUBSET) WRITE (ISF)
      +      IRESN,IBYR,ISEX,IRACE,IHYR,IFYR,JOBCODE,
      +      (EXPOSURE(I),I=1,35),NONR,IFSTDS,ISCND,ITHRDS,ILSTDS,
      +      IDYR,ICAUSE
      GO TO 400

C-----No...read a binary case
300  READ(INF,END=700)IRESN,IBYR,ISEX,IRACE,IHYR,IFYR,JOBCODE,
      +      (EXPOSURE(I),I=1,35),NONR,IFSTDS,ISCND,ITHRDS,ILSTDS,
      +      IDYR,ICAUSE

C-----Increment # of records read
400  NRR = NRR + 1

C-----Male worker?
      IF (ISEX.NE.1) GO TO 100

C-----Yes...white?
      IF (IRACE.NE.1) GO TO 100

C*****
      IF (NONR.LT.3) GO TO 100
      IHYR = MAX(ITHRDS + 1 , IFSTDS + LATENT + 1)
      IF (IHYR.LT.1947.OR.IHYR.GT.ISTDYE) GO TO 100
      IFYR = MIN(ILSTDS,ISTDYE)
C*****

C-----Yes...worker in a desired job category?
      IF (STRATJOB) CALL JOBCATG (*100)

C-----Worker alive?
      IF (IDYR.GE.ISTDYS.AND.IDYR.LE.ISTDYE) GO TO 500

C-----Yes...define first & last years to consider
      IYEMP = IHYR
      IYTERM = ISTDYE

C-----Process case?
      IF (IYEMP.GT.IYTERM) GO TO 100

```

```

C-----Yes
      GO TO 600

C-----no...Define first & last years to consider
500      IYEMP = IHYR
      IYTERM= IDYR

C-----Process case?
      IF (IYEMP.GT.IYTERM) GO TO 100

C-----Yes...write data for death summary on temporary file
      WRITE (IS4) CASE

C-----If input file is binary & creating subfile write selected case
C-----Process case
600      IF (BINARY.AND.SUBSET) WRITE (ISF)
          +      IRESN,IBYR,ISEX,IRACE,IHYR,IFYR,JOBCODE,
          +      (EXPOSURE(I),I=1,35),NONR,IFSTDS,ISCNDS,ITHRDS,ILSTDS,
          +      IDYR,ICAUSE
          RETURN

C-----End of file...set indicator
700      EOF=.TRUE.
          RETURN

800      FORMAT(I9,F7.3,2I1,2F7.3,1X,I1,8X,7F5.2/
          +      16F5.2/12F5.2,2I2,1X,3I2/
          +      27X,F7.3,7X,I3)

      END

```


APPENDIX F. MOX SPECIFICATION SESSION

(MOX PROMPTS ARE PRINTED IN UPPER CASE)

```

$ run mox
online
REPORT FILE NAME?
sample.rpt
TASK NAME?
white males  start year=max(#1 reading + latent + 1,#3 reading + 1)
STARTING YEAR OF STUDY?
1944
ENDING YEAR OF STUDY?
1978
BINARY INPUT FILE?
no
INPUT FILE NAME?
sample.dat
CREATING A SUBFILE?
yes
SUBFILE NAME?
sample.sub
PRIMARY CONTROL VARIABLE?
age
# OF PRIMARY CUTPOINTS?
48
EQUAL PRIMARY CUTPOINT INTERVALS?
no
PRIMARY CUTPOINTS?
25,30,35,36,37,38,39,40,41
42,43,44,45,46,47,48,49,50
51,52,53,54,55,56,57,58,59
60,61,62,63,64,65,66,67,68
69,70,71,72,73,74,75,76,77
78,79,80
SECONDARY CONTROL VARIABLE?
calendar year
# OF SECONDARY CUTPOINTS?
3
EQUAL SECONDARY CUTPOINT INTERVALS?
yes
FIRST SECONDARY CUTPOINT, LAST SECONDARY CUTPOINT?
1960,1970
STRATIFY BY LENGTH OF EMPLOYMENT?
no
STRATIFY BY FOLLOW-UP SINCE YEAR OF EMPLOYMENT?
no
STRATIFY BY JOB CATEGORY?
no
STRATIFY BY USER-DEFINED CONTROL VARIABLE(S)?
no

```

OF EXPOSURE CUTPOINTS?
3
EXPOSURE CUTPOINT(S)?
2.,5.,15.
DESCRIPTION OF EXPOSURE UNITS?
rema
LATENCY PERIOD FOR EXPOSURE?
10
PRINT TABLES OF DEATHS FROM ALL CAUSES?
yes
PRINT TABLES OF DEATHS FROM ALL MALIGNANT NEOPLASMS?
yes
PRINT TABLES FOR OTHER SPECIFIED CAUSES OF DEATH?
yes
OF OTHER DEATH TABLES?
1
OF ICD CODE RANGES IN DEATH TABLE 1?
1
LOWER,UPPER RANGE OF CODES IN DEATH TABLE 1?
162,162
DEATH TABULATION DESCRIPTION FOR TABLE 1?
lung cancer (162)
PRINT POWER TOTALS?
yes
PRINT UNGROUPED EXPOSURE ANALYSIS RESULTS?
yes
PRINT GROUPED EXPOSURE ANALYSIS RESULTS?
yes
ASSIGN SCORES TO THE EXPOSURE CATEGORIES?
no
COMMAND FILE NAME?
sample.com

INPUT SPECIFICATIONS HAVE BEEN RECORDED ON sample.com

PERFORM INTERACTIVE ANALYSIS PER SPECIFICATIONS?
no

MOX FINISHED

APPENDIX G. MOX COMMAND FILE

(The name of this file is sample.com)

\$ SD .MOX

\$ RUN MOX

batch

REPORT FILE NAME?

any valid file name up to 80 characters

sample.rpt

TASK NAME?

1 to 80 characters

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

STARTING YEAR OF STUDY?

any 4 digit integer

1944

ENDING YEAR OF STUDY?

4 digit integer < OR = starting year of study + 50

1978

BINARY INPUT FILE?

yes OR no

no

INPUT FILE NAME?

any valid file name up to 80 characters

sample.dat

CREATING A SUBFILE?

yes OR no

yes

SUBFILE NAME?

any valid file name up to 80 characters

sample.sub

PRIMARY CONTROL VARIABLE?

SPECIFY age , calendar year , OR follow-up time

age

OF PRIMARY CUTPOINTS?

an integer between 2 & 49 inclusive

48

EQUAL PRIMARY CUTPOINT INTERVALS?

yes OR no

no

FIRST PRIMARY CUTPOINT, LAST PRIMARY CUTPOINT?

(last-first integer values)/(# primary cutpoints-1) must = an integer

0025,0080

PRIMARY CUTPOINTS?

ascending integer values separated by commas

0025,0030,0035,0036,0037,0038,0039,0040,0041,0042,0043,0044,0045,0046,0047
 0048,0049,0050,0051,0052,0053,0054,0055,0056,0057,0058,0059,0060,0061,0062
 0063,0064,0065,0066,0067,0068,0069,0070,0071,0072,0073,0074,0075,0076,0077
 0078,0079,0080

SECONDARY CONTROL VARIABLE?

SPECIFY age , calendar year , OR follow-up time
 calendar year

OF SECONDARY CUTPOINTS?

an integer between 2 & 15 inclusive

03

EQUAL SECONDARY CUTPOINT INTERVALS?

yes OR no

yes

FIRST SECONDARY CUTPOINT, LAST SECONDARY CUTPOINT?

(last-first integer values)/(# secondary cutpoints-1) must = an integer
 1960,1970

SECONDARY CUTPOINTS?

ascending integer values separated by commas

9999

STRATIFY BY CALENDAR YEAR?

yes OR no

no

OF CALENDAR YEAR CUTPOINTS?

an integer between 1 & 14 inclusive

01

CALENDAR YEAR CUTPOINT(S)?

ascending integer values separated by commas

9999

CALENDAR YEAR DESCRIPTION FOR GROUP 1?

1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 2?

1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 3?

1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 4?

1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 5?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 6?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 7?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 8?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 9?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 10?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 11?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 12?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 13?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 14?
1 to 24 characters

CALENDAR YEAR DESCRIPTION FOR GROUP 15?
1 to 24 characters

STRATIFY BY LENGTH OF EMPLOYMENT?
yes OR no
no

OF LENGTH OF EMPLOYMENT CUTPOINTS?
an integer between 1 & 14 inclusive
01

LENGTH OF EMPLOYMENT CUTPOINT(S)?
ascending integer values separated by commas
9999

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 1?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 2?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 3?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 4?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 5?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 6?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 7?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 8?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 9?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 10?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 11?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 12?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 13?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 14?
1 to 24 characters

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 15?
1 to 24 characters

STRATIFY BY FOLLOW-UP SINCE YEAR OF EMPLOYMENT?
yes OR no
no

OF FOLLOW-UP CUTPOINTS?
an integer between 1 & 14 inclusive
01

FOLLOW-UP CUTPOINT(S)?
ascending integer values separated by commas
9999

FOLLOW-UP DESCRIPTION FOR GROUP 1?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 2?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 3?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 4?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 5?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 6?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 7?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 8?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 9?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 10?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 11?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 12?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 13?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 14?
1 to 24 characters

FOLLOW-UP DESCRIPTION FOR GROUP 15?
1 to 24 characters

STRATIFY BY JOB CATEGORY?
yes OR no
no

OF JOB CATEGORIES?
an integer between 2 & 15 inclusive
02

OF CODES IN JOB CATEGORY 1?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 1?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 1?
1 to 24 characters

OF CODES IN JOB CATEGORY 2?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 2?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 2?
1 to 24 characters

OF CODES IN JOB CATEGORY 3?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 3?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 3?
1 to 24 characters

OF CODES IN JOB CATEGORY 4?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 4?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 4?
1 to 24 characters

OF CODES IN JOB CATEGORY 5?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 5?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 5?
1 to 24 characters

OF CODES IN JOB CATEGORY 6?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 6?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 6?
1 to 24 characters

OF CODES IN JOB CATEGORY 7?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 7?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 7?

1 to 24 characters

OF CODES IN JOB CATEGORY 8?

an integer between 1 & 15 inclusive

01

CODES IN JOB CATEGORY 8?

integer values separated by commas

9999

DESCRIPTION FOR JOB CATEGORY 8?

1 to 24 characters

OF CODES IN JOB CATEGORY 9?

an integer between 1 & 15 inclusive

01

CODES IN JOB CATEGORY 9?

integer values separated by commas

9999

DESCRIPTION FOR JOB CATEGORY 9?

1 to 24 characters

OF CODES IN JOB CATEGORY 10?

an integer between 1 & 15 inclusive

01

CODES IN JOB CATEGORY 10?

integer values separated by commas

9999

DESCRIPTION FOR JOB CATEGORY 10?

1 to 24 characters

OF CODES IN JOB CATEGORY 11?

an integer between 1 & 15 inclusive

01

CODES IN JOB CATEGORY 11?

integer values separated by commas

9999

DESCRIPTION FOR JOB CATEGORY 11?

1 to 24 characters

OF CODES IN JOB CATEGORY 12?

an integer between 1 & 15 inclusive

01

CODES IN JOB CATEGORY 12?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 12?
1 to 24 characters

OF CODES IN JOB CATEGORY 13?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 13?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 13?
1 to 24 characters

OF CODES IN JOB CATEGORY 14?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 14?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 14?
1 to 24 characters

OF CODES IN JOB CATEGORY 15?
an integer between 1 & 15 inclusive
01

CODES IN JOB CATEGORY 15?
integer values separated by commas
9999

DESCRIPTION FOR JOB CATEGORY 15?
1 to 24 characters

STRATIFY BY USER-DEFINED CONTROL VARIABLE(S)?
yes OR no
no

OF USER-DEFINED CONTROL VARIABLES?
an integer between 1 & 5 inclusive
01

OF CONTROL VARIABLE 1 CUTPOINTS?
an integer between 1 & 14 inclusive
01

CONTROL VARIABLE 1 CUTPOINT(S)?
ascending integer values separated by commas
9999

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 1?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 2?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 3?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 4?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 5?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 6?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 7?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 8?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 9?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 10?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 11?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 12?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 13?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 14?
1 to 24 characters

CONTROL VARIABLE 1 DESCRIPTION FOR GROUP 15?
1 to 24 characters

OF CONTROL VARIABLE 2 CUTPOINTS?
an integer between 1 & 14 inclusive
01

CONTROL VARIABLE 2 CUTPOINT(S)?
ascending integer values separated by commas
9999

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 1?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 2?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 3?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 4?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 5?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 6?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 7?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 8?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 9?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 10?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 11?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 12?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 13?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 14?
1 to 24 characters

CONTROL VARIABLE 2 DESCRIPTION FOR GROUP 15?
1 to 24 characters

OF CONTROL VARIABLE 3 CUTPOINTS?
an integer between 1 & 14 inclusive
01

CONTROL VARIABLE 3 CUTPOINT(S)?
ascending integer values separated by commas
9999

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 1?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 2?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 3?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 4?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 5?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 6?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 7?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 8?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 9?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 10?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 11?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 12?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 13?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 14?
1 to 24 characters

CONTROL VARIABLE 3 DESCRIPTION FOR GROUP 15?
1 to 24 characters

OF CONTROL VARIABLE 4 CUTPOINTS?
an integer between 1 & 14 inclusive
01

CONTROL VARIABLE 4 CUTPOINT(S)?
ascending integer values separated by commas
9999

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 1?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 2?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 3?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 4?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 5?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 6?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 7?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 8?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 9?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 10?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 11?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 12?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 13?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 14?
1 to 24 characters

CONTROL VARIABLE 4 DESCRIPTION FOR GROUP 15?
1 to 24 characters

OF CONTROL VARIABLE 5 CUTPOINTS?
an integer between 1 & 14 inclusive
01

CONTROL VARIABLE 5 CUTPOINT(S)?
ascending integer values separated by commas
9999

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 1?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 2?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 3?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 4?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 5?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 6?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 7?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 8?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 9?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 10?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 11?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 12?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 13?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 14?
1 to 24 characters

CONTROL VARIABLE 5 DESCRIPTION FOR GROUP 15?
1 to 24 characters

OF EXPOSURE CUTPOINTS?

an integer between 1 & 14 inclusive

03

EXPOSURE CUTPOINT(S)?

ascending real values separated by commas

2.000, 5.000, 15.000

DESCRIPTION OF EXPOSURE UNITS?

1 to 24 characters

remms

LATENCY PERIOD FOR EXPOSURE?

0 or a positive integer by which exposures are to be lagged

10

PRINT TABLES BY PRIMARY & SECONDARY CATEGORIES ONLY?

yes OR no

no

PRINT TABLES OF DEATHS FROM ALL CAUSES?

yes OR no

yes

PRINT TABLES OF DEATHS FROM ALL MALIGNANT NEOPLASMS?

yes OR no

yes

PRINT TABLES FOR OTHER SPECIFIED CAUSES OF DEATH?

yes OR no

yes

OF OTHER DEATH TABLES?

1 OR 2 OR 3

01

OF ICD CODE RANGES IN DEATH TABLE 1?

an integer between 1 & 15 inclusive

01

LOWER,UPPER RANGE OF CODES IN DEATH TABLE 1?

non-descending integers between 1 & 999 inclusive separated by commas

0162,0162

DEATH TABULATION DESCRIPTION FOR TABLE 1?

1 to 80 characters

lung cancer (162)

OF ICD CODE RANGES IN DEATH TABLE 2?

an integer between 1 & 15 inclusive

01

LOWER,UPPER RANGE OF CODES IN DEATH TABLE 2?

non-descending integers between 1 & 999 inclusive separated by commas
9999,9999

DEATH TABULATION DESCRIPTION FOR TABLE 2?

1 to 80 characters

OF ICD CODE RANGES IN DEATH TABLE 3?

an integer between 1 & 15 inclusive

01

LOWER,UPPER RANGE OF CODES IN DEATH TABLE 3?

non-descending integers between 1 & 999 inclusive separated by commas
9999,9999

DEATH TABULATION DESCRIPTION FOR TABLE 3?

1 to 80 characters

PRINT POWER TOTALS?

yes OR no

yes

PRINT UNGROUPED EXPOSURE ANALYSIS RESULTS?

yes OR no

yes

PRINT GROUPED EXPOSURE ANALYSIS RESULTS?

yes OR no

yes

ASSIGN SCORES TO THE EXPOSURE CATEGORIES?

yes OR no

no

EXPOSURE CATEGORY SCORES?

(# of exposure cutpoints + 1) real values separated by commas

9.999000E+03, 9.999000E+03, 9.999000E+03, 9.999000E+03

This command file could easily be modified to perform a variety of batch analyses. A few examples of changes that could be made are (altered records are indicated by an *):

EX1. Specify single-year intervals for the secondary control variable.

```
.
.
.
.
.
# OF SECONDARY CUTPOINTS?
an integer between 2 & 15 inclusive
* 11
.
.
.
.
.
```

EX2. Stratify by length of employment. Divide workers into two categories: employed less than 10 years and employed 10 or more years.

```
.
.
.
.
.
STRATIFY BY LENGTH OF EMPLOYMENT?
yes OR no
* yes
.
.
.
LENGTH OF EMPLOYMENT CUTPOINT(S)?
ascending integer values separated by commas
* 10

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 1?
1 to 24 characters
* employed <10 years

LENGTH OF EMPLOYMENT DESCRIPTION FOR GROUP 2?
1 to 24 characters
* employed 10 or > years
.
.
.
.
.
```

EX3. Stratify by job category. Divide workers into two categories:
non-nuclear (job codes of 1 & 4) and nuclear (codes of 2 & 3).

```

.
.
.
.
.
STRATIFY BY JOB CATEGORY?
yes OR no
* yes
.
.
.
# OF CODES IN JOB CATEGORY 1?
an integer between 1 & 15 inclusive
* 02

CODES IN JOB CATEGORY 1?
1 to 24 characters
* 1,4

DESCRIPTION FOR JOB CATEGORY 1?
1 to 24 characters
* non-nuclear workers

# OF CODES IN JOB CATEGORY 2?
an integer between 1 & 15 inclusive
* 02

CODES IN JOB CATEGORY 2?
1 to 24 characters
* 2,3

DESCRIPTION FOR JOB CATEGORY 2?
1 to 24 characters
* nuclear workers
.
.
.
.
.

```

Keep the following thoughts in mind when modifying a MOX command file:

1. Never add or delete a record (except a multiple record list of cutpoints or ICD codes). This includes all blank records.
2. As in our examples, responses are normally the only records changed. However, prompts may be reworded if so desired.
3. To nullify the action a positive response invokes, change only that response. For instance, in example 3 we chose to stratify by job category. In a subsequent analysis (using this command file) we might decide not to control for job category. To nullify the control, all we have to do is change the first response in the example. Thus, once the particulars for each control variable are specified, they can simply be turned off and on to perform different analyses.
4. Follow the help or rule preceding each response you change. The responses are screened for gross errors, but a strange analysis could occur if the rules are violated.

You may feel more comfortable having MOX interactively prompt you for the specifications necessary to perform each analysis. In this mode, an incorrect response will not be accepted and you can take immediate action. You also have the option of performing an interactive analysis. The principal disadvantage of operating in this mode is that you must re-enter all of your specifications each time you perform an analysis.

APPENDIX H. MOX OUTPUT FILE

This output* was created by submitting the command file in Appendix G as a batch job. The command used was:

submit sample

(The name of this file is SAMPLE.RPT)

MOX STARTED AT 12:01:04 ON 4-NOV-83

REPORT FILE NAME: sample.rpt

TASK NAME: white males start year=max(#1 reading + latent + 1,#3 reading + 1)

STARTING YEAR OF STUDY: 1944

ENDING YEAR OF STUDY: 1978

BINARY INPUT FILE: no

INPUT FILE NAME: sample.dat

CREATING A SUBFILE: yes

SUBFILE NAME: sample.sub

PRIMARY CONTROL VARIABLE: age

OF PRIMARY CUTPOINTS: 48

EQUAL PRIMARY CUTPOINT INTERVALS: no

PRIMARY CUTPOINTS:	25	30	35	36	37	38	39	40	41
	42	43	44	45	46	47	48	49	50
	51	52	53	54	55	56	57	58	59
	60	61	62	63	64	65	66	67	68
	69	70	71	72	73	74	75	76	77
	78	79	80						

* The tables in this appendix have calendar year grouped into four categories (-1959, 1960-64, 1965-69, 1970-) to limit the width of the output for this manual. The death analyses results presented, however, are actually based on calendar year being grouped into eleven categories (-1944, 1945-49, 1950-54, 1955-59, 1960-64, 1965-69, 1970-74, 1975-75, 1976-76, 1977-77, 1978-).

SECONDARY CONTROL VARIABLE: calendar year
OF SECONDARY CUTPOINTS: 03
EQUAL SECONDARY CUTPOINT INTERVALS: yes
FIRST SECONDARY CUTPOINT, LAST SECONDARY CUTPOINT: 1960 1970
STRATIFY BY LENGTH OF EMPLOYMENT: no
STRATIFY BY FOLLOW-UP SINCE YEAR OF EMPLOYMENT: no
STRATIFY BY JOB CATEGORY: no
STRATIFY BY USER-DEFINED CONTROL VARIABLE(S): no
OF EXPOSURE CUTPOINTS: 03
EXPOSURE CUTPOINT(S): 2.000 5.000 15.000
DESCRIPTION OF EXPOSURE UNITS: rems
LATENCY PERIOD FOR EXPOSURE: 10
PRINT TABLES BY PRIMARY & SECONDARY CATEGORIES ONLY: no
PRINT TABLES OF DEATHS FROM ALL CAUSES: yes
PRINT TABLES OF DEATHS FROM ALL MALIGNANT NEOPLASMS: yes
PRINT TABLES FOR OTHER SPECIFIED CAUSES OF DEATH: yes
OF OTHER DEATH TABLES: 01
OF ICD CODE RANGES IN DEATH TABLE 1: 01
LOWER, UPPER RANGE OF CODES IN DEATH TABLE 1: 162 162
DEATH TABULATION DESCRIPTION FOR TABLE 1: lung cancer (162)
PRINT POWER TOTALS: yes
PRINT UNGROUPED EXPOSURE ANALYSIS RESULTS: yes
PRINT GROUPED EXPOSURE ANALYSIS RESULTS: yes
ASSIGN SCORES TO THE EXPOSURE CATEGORIES: no
SPACE AVAILABLE IS 500000 WORDS
11225 WORDS REQUIRED FOR THIS RUN
ELAPSED TIME IS 5.50 BEGIN PROCESSING WORKERS
ELAPSED TIME IS 1215.94 END PROCESSING WORKERS
RECORDS FOR 44502 WORKERS WERE READ
13462 WORKERS WERE PROCESSED

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

PERSON-YEARS AT RISK

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	66	92	130	66	354
0030-0034	1146	2636	1856	2904	8542
0035-0035	484	1048	927	1238	3697
0036-0036	594	1156	1157	1412	4319
0037-0037	645	1309	1347	1602	4903
0038-0038	732	1339	1492	1774	5337
0039-0039	796	1383	1593	1893	5665
0040-0040	853	1406	1658	2068	5985
0041-0041	850	1433	1684	2257	6224
0042-0042	852	1428	1752	2400	6432
0043-0043	854	1407	1776	2579	6616
0044-0044	874	1419	1769	2764	6826
0045-0045	861	1447	1730	2971	7009
0046-0046	796	1403	1744	3146	7089
0047-0047	720	1399	1713	3216	7048
0048-0048	671	1345	1663	3308	6987
0049-0049	629	1294	1651	3311	6885
0050-0050	584	1237	1635	3286	6742
0051-0051	546	1143	1589	3317	6595
0052-0052	476	1057	1561	3277	6371
0053-0053	445	973	1492	3237	6147
0054-0054	402	887	1445	3159	5893
0055-0055	334	835	1370	3097	5636
0056-0056	299	775	1271	3022	5367
0057-0057	292	685	1173	2905	5055
0058-0058	307	613	1074	2817	4811
0059-0059	308	557	976	2719	4560
0060-0060	297	485	916	2551	4249
0061-0061	274	452	844	2410	3980
0062-0062	249	428	748	2258	3683
0063-0063	223	432	664	2106	3425
0064-0064	186	408	597	1950	3141
0065-0065	172	385	524	1777	2858
0066-0066	138	353	477	1600	2568
0067-0067	122	319	443	1448	2332
0068-0068	122	278	422	1258	2080
0069-0069	113	237	379	1134	1863
0070-0070	95	200	354	995	1644
0071-0071	91	166	309	870	1436
0072-0072	67	136	284	766	1253
0073-0073	63	121	236	666	1086
0074-0074	41	114	187	589	931
0075-0075	32	88	145	523	788
0076-0076	17	83	110	463	673
0077-0077	9	57	99	399	564
0078-0078	4	48	81	334	467
0079-0079	0	30	78	273	381
0080-	0	43	215	999	1257
	18731	36569	47340	95114	197754

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

DEATHS FROM ALL CAUSES

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	1	1	2	4	8
0035-0035	1	1	0	1	3
0036-0036	1	1	3	0	5
0037-0037	3	2	4	2	11
0038-0038	0	4	5	4	13
0039-0039	2	1	3	2	8
0040-0040	3	5	7	2	17
0041-0041	1	4	3	4	12
0042-0042	1	5	5	7	18
0043-0043	1	4	6	2	13
0044-0044	5	6	7	8	26
0045-0045	7	6	5	6	24
0046-0046	5	10	6	13	34
0047-0047	6	12	6	11	35
0048-0048	5	10	4	12	31
0049-0049	3	7	12	19	41
0050-0050	7	7	8	19	41
0051-0051	2	5	7	17	31
0052-0052	4	6	12	26	48
0053-0053	1	9	18	26	54
0054-0054	2	12	15	19	48
0055-0055	7	17	14	26	64
0056-0056	3	10	17	34	64
0057-0057	2	8	10	26	46
0058-0058	5	7	13	36	61
0059-0059	3	7	14	45	69
0060-0060	6	7	15	41	69
0061-0061	10	10	12	51	83
0062-0062	7	13	12	37	69
0063-0063	7	7	15	47	76
0064-0064	5	8	23	51	87
0065-0065	8	10	16	46	80
0066-0066	2	17	18	39	76
0067-0067	4	13	18	46	81
0068-0068	4	11	20	45	80
0069-0069	4	10	16	45	75
0070-0070	2	9	11	48	70
0071-0071	5	10	16	41	72
0072-0072	5	5	18	32	60
0073-0073	3	8	14	34	59
0074-0074	1	5	17	34	57
0075-0075	1	5	11	40	57
0076-0076	2	6	9	48	65
0077-0077	0	6	7	28	41
0078-0078	0	5	6	35	46
0079-0079	0	0	8	19	27
0080-	0	6	22	130	158
	157	338	510	1308	2313

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

DEATHS FROM ALL CANCERS

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	1	1	1	3
0035-0035	0	1	0	0	1
0036-0036	0	0	1	0	1
0037-0037	0	1	1	0	2
0038-0038	0	0	0	1	1
0039-0039	0	0	1	1	2
0040-0040	2	2	0	0	4
0041-0041	0	1	2	0	3
0042-0042	0	0	0	0	0
0043-0043	0	2	0	0	2
0044-0044	0	0	1	2	3
0045-0045	2	2	2	0	6
0046-0046	1	3	1	2	7
0047-0047	3	2	3	0	8
0048-0048	2	1	0	3	6
0049-0049	0	2	4	5	11
0050-0050	1	1	1	6	9
0051-0051	0	2	3	2	7
0052-0052	1	0	1	2	4
0053-0053	0	0	1	9	10
0054-0054	1	1	6	6	14
0055-0055	2	5	2	8	17
0056-0056	0	3	2	11	16
0057-0057	0	1	4	6	11
0058-0058	1	2	6	5	14
0059-0059	1	2	2	13	18
0060-0060	0	1	7	11	19
0061-0061	1	3	3	10	17
0062-0062	0	3	3	16	22
0063-0063	2	2	3	11	18
0064-0064	2	1	3	14	20
0065-0065	2	2	2	8	14
0066-0066	0	4	5	12	21
0067-0067	1	4	6	11	22
0068-0068	2	3	3	13	21
0069-0069	2	4	0	6	12
0070-0070	0	2	4	12	18
0071-0071	1	2	4	4	11
0072-0072	2	1	2	6	11
0073-0073	0	1	3	9	13
0074-0074	1	0	3	6	10
0075-0075	1	0	2	8	11
0076-0076	1	0	0	5	6
0077-0077	0	1	0	4	5
0078-0078	0	1	3	9	13
0079-0079	0	0	2	1	3
0080-	0	0	0	14	14
	35	70	103	273	481

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

DEATHS FROM lung cancer (162)

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	1	0	1
0038-0038	0	0	0	0	0
0039-0039	0	0	0	0	0
0040-0040	0	1	0	0	1
0041-0041	0	0	0	0	0
0042-0042	0	0	0	0	0
0043-0043	0	0	0	0	0
0044-0044	0	0	0	1	1
0045-0045	0	1	0	0	1
0046-0046	0	0	1	1	2
0047-0047	0	0	1	0	1
0048-0048	1	0	0	0	1
0049-0049	0	2	0	2	4
0050-0050	0	0	0	2	2
0051-0051	0	1	1	0	2
0052-0052	1	0	0	0	1
0053-0053	0	0	0	4	4
0054-0054	1	0	1	4	6
0055-0055	0	3	0	2	5
0056-0056	0	0	1	4	5
0057-0057	0	1	1	2	4
0058-0058	0	1	2	4	7
0059-0059	1	0	0	6	7
0060-0060	0	0	2	5	7
0061-0061	1	3	0	4	8
0062-0062	0	0	2	8	10
0063-0063	0	0	0	3	3
0064-0064	0	0	2	3	5
0065-0065	1	0	1	1	3
0066-0066	0	1	3	7	11
0067-0067	0	0	2	3	5
0068-0068	0	1	0	5	6
0069-0069	0	1	0	2	3
0070-0070	0	1	3	5	9
0071-0071	0	0	2	1	3
0072-0072	1	0	0	3	4
0073-0073	0	0	2	3	5
0074-0074	0	0	1	2	3
0075-0075	0	0	1	2	3
0076-0076	0	0	0	1	1
0077-0077	0	0	0	1	1
0078-0078	0	0	0	2	2
0079-0079	0	0	1	1	2
0080-	0	0	0	3	3
	7	17	31	97	152

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

EXPOSURE MEANS

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0025-0029	2.8030E-02	8.0978E-02	1.0469E-01	1.8197E-01	9.8644E-02
0030-0034	9.9939E-02	2.2656E-01	4.1685E-01	6.9121E-01	4.0888E-01
0035-0035	2.0415E-01	3.2006E-01	7.1876E-01	1.1726E+00	6.9036E-01
0036-0036	3.0027E-01	3.3624E-01	8.5815E-01	1.3880E+00	8.1497E-01
0037-0037	3.7874E-01	3.5068E-01	9.4845E-01	1.6002E+00	9.2687E-01
0038-0038	3.8004E-01	3.8726E-01	1.0065E+00	1.8175E+00	1.0348E+00
0039-0039	3.6569E-01	4.5526E-01	1.1118E+00	1.9701E+00	1.1335E+00
0040-0040	3.1537E-01	5.1791E-01	1.1568E+00	2.0689E+00	1.2020E+00
0041-0041	3.2067E-01	5.4138E-01	1.1931E+00	2.2232E+00	1.2975E+00
0042-0042	3.2754E-01	5.6153E-01	1.2337E+00	2.3535E+00	1.3823E+00
0043-0043	3.2707E-01	5.5863E-01	1.2386E+00	2.4671E+00	1.4553E+00
0044-0044	3.2900E-01	5.5746E-01	1.2386E+00	2.6624E+00	1.5571E+00
0045-0045	3.3268E-01	5.4782E-01	1.2547E+00	2.7812E+00	1.6425E+00
0046-0046	3.3702E-01	5.5984E-01	1.1999E+00	2.8670E+00	1.7162E+00
0047-0047	3.5324E-01	5.7457E-01	1.2016E+00	2.9280E+00	1.7783E+00
0048-0048	3.4283E-01	5.7959E-01	1.2081E+00	3.0366E+00	1.8697E+00
0049-0049	3.1830E-01	6.0390E-01	1.1940E+00	3.0757E+00	1.9080E+00
0050-0050	3.0767E-01	6.3447E-01	1.1508E+00	3.1203E+00	1.9429E+00
0051-0051	2.9896E-01	6.5050E-01	1.1590E+00	3.1006E+00	1.9762E+00
0052-0052	3.0113E-01	6.4335E-01	1.2272E+00	3.0827E+00	2.0156E+00
0053-0053	3.1380E-01	6.3017E-01	1.2340E+00	3.0382E+00	2.0219E+00
0054-0054	3.0684E-01	5.7785E-01	1.2938E+00	2.9834E+00	2.0244E+00
0055-0055	2.8090E-01	5.7968E-01	1.3125E+00	2.9250E+00	2.0289E+00
0056-0056	2.2268E-01	6.0494E-01	1.3209E+00	2.9568E+00	2.0775E+00
0057-0057	2.1664E-01	5.6234E-01	1.3102E+00	2.9950E+00	2.1139E+00
0058-0058	2.1570E-01	5.6843E-01	1.3256E+00	2.9979E+00	2.1375E+00
0059-0059	2.2136E-01	5.2887E-01	1.1880E+00	3.0155E+00	2.1319E+00
0060-0060	2.3111E-01	5.0433E-01	1.1903E+00	3.0584E+00	2.1665E+00
0061-0061	2.1894E-01	4.4343E-01	1.2186E+00	3.1614E+00	2.2382E+00
0062-0062	2.0972E-01	4.4423E-01	1.1768E+00	3.2344E+00	2.2878E+00
0063-0063	2.0726E-01	4.8729E-01	1.1158E+00	3.3258E+00	2.3363E+00
0064-0064	1.9737E-01	5.0542E-01	1.1030E+00	3.3696E+00	2.3789E+00
0065-0065	1.8581E-01	4.8665E-01	1.0434E+00	3.3810E+00	2.3702E+00
0066-0066	2.2290E-01	4.4201E-01	9.8765E-01	3.2253E+00	2.2657E+00
0067-0067	2.2918E-01	4.1266E-01	9.9255E-01	3.1280E+00	2.1992E+00
0068-0068	2.1451E-01	4.2025E-01	1.0666E+00	3.0209E+00	2.1122E+00
0069-0069	2.1407E-01	3.8000E-01	1.0385E+00	3.0781E+00	2.1462E+00
0070-0070	2.0263E-01	3.9865E-01	8.7186E-01	3.2313E+00	2.2036E+00
0071-0071	1.8703E-01	4.2681E-01	8.1861E-01	3.0125E+00	2.0625E+00
0072-0072	2.0284E-01	4.5816E-01	7.5504E-01	2.6407E+00	1.8460E+00
0073-0073	2.2603E-01	4.3942E-01	8.3631E-01	2.5501E+00	1.8077E+00
0074-0074	2.3073E-01	4.8868E-01	7.4513E-01	2.2446E+00	1.6397E+00
0075-0075	3.3406E-01	3.8375E-01	7.7834E-01	1.9963E+00	1.5246E+00
0076-0076	4.9235E-01	3.4735E-01	6.6873E-01	1.7759E+00	1.3864E+00
0077-0077	6.4778E-01	3.3263E-01	6.4960E-01	1.7048E+00	1.3640E+00
0078-0078	3.3750E-01	4.3229E-01	5.8284E-01	1.4718E+00	1.2010E+00
0079-0079	0.0000E+00	3.8200E-01	5.7346E-01	1.1060E+00	9.3997E-01
0080-	0.0000E+00	6.0093E-01	3.8777E-01	6.5318E-01	6.0600E-01
	2.9074E-01	4.9967E-01	1.1188E+00	2.7119E+00	1.6921E+00

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

EXPOSURE VARIANCES

age	calendar year			
	-1959	1960-1964	1965-1969	1970-
-0024	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0025-0029	3.2613E-03	3.6322E-02	3.2894E-02	1.5538E-01
0030-0034	4.1805E-02	1.5133E-01	5.3235E-01	1.4320E+00
0035-0035	1.6728E-01	2.6822E-01	1.3093E+00	3.2005E+00
0036-0036	3.2966E-01	2.9878E-01	1.6610E+00	4.5364E+00
0037-0037	4.2755E-01	3.1708E-01	1.9473E+00	5.6971E+00
0038-0038	4.5798E-01	3.6087E-01	2.3626E+00	7.4639E+00
0039-0039	4.1030E-01	4.8041E-01	3.0663E+00	9.2005E+00
0040-0040	2.8865E-01	6.2601E-01	3.5032E+00	1.0810E+01
0041-0041	3.0700E-01	6.1114E-01	3.9099E+00	1.2741E+01
0042-0042	3.0180E-01	6.6570E-01	4.3264E+00	1.4819E+01
0043-0043	2.7844E-01	6.0741E-01	4.4958E+00	1.6860E+01
0044-0044	2.8422E-01	6.1421E-01	4.1933E+00	2.0292E+01
0045-0045	2.7495E-01	5.8259E-01	3.9994E+00	2.2563E+01
0046-0046	2.8001E-01	5.5212E-01	3.6943E+00	2.4377E+01
0047-0047	2.9711E-01	6.1713E-01	3.6675E+00	2.5660E+01
0048-0048	2.6811E-01	5.8264E-01	3.7097E+00	2.8313E+01
0049-0049	2.4248E-01	6.1167E-01	3.7281E+00	2.9033E+01
0050-0050	2.3588E-01	7.1600E-01	3.2548E+00	3.1456E+01
0051-0051	2.0466E-01	8.3740E-01	3.2416E+00	3.1680E+01
0052-0052	2.1492E-01	8.0135E-01	3.7177E+00	3.2608E+01
0053-0053	2.4065E-01	7.6779E-01	3.5132E+00	3.1654E+01
0054-0054	2.2596E-01	5.3871E-01	4.0803E+00	3.0128E+01
0055-0055	2.0934E-01	5.6263E-01	4.6281E+00	2.9096E+01
0056-0056	1.3133E-01	6.7968E-01	5.0374E+00	2.8741E+01
0057-0057	1.1971E-01	5.6602E-01	4.8088E+00	3.0246E+01
0058-0058	1.2195E-01	6.5640E-01	5.2696E+00	3.0460E+01
0059-0059	1.6165E-01	5.5352E-01	3.5052E+00	2.9606E+01
0060-0060	1.7631E-01	5.4590E-01	3.3951E+00	3.0571E+01
0061-0061	1.2339E-01	3.5769E-01	3.6630E+00	3.3674E+01
0062-0062	1.3154E-01	3.6191E-01	3.5616E+00	3.4422E+01
0063-0063	1.2470E-01	4.6343E-01	3.5901E+00	3.6564E+01
0064-0064	1.0474E-01	5.6687E-01	3.8302E+00	3.8696E+01
0065-0065	1.1231E-01	5.3654E-01	3.4158E+00	4.0105E+01
0066-0066	1.4315E-01	4.6772E-01	3.1744E+00	3.6421E+01
0067-0067	1.2855E-01	3.1026E-01	3.4413E+00	3.5156E+01
0068-0068	1.1619E-01	4.1718E-01	4.3574E+00	3.3080E+01
0069-0069	1.2481E-01	2.5522E-01	4.1960E+00	3.4044E+01
0070-0070	1.7050E-01	2.4563E-01	2.7214E+00	3.8467E+01
0071-0071	1.8142E-01	2.9185E-01	2.1922E+00	3.5813E+01
0072-0072	1.8590E-01	4.1503E-01	1.6031E+00	2.9739E+01
0073-0073	2.5228E-01	5.2528E-01	2.3400E+00	2.9052E+01
0074-0074	1.6942E-01	8.5030E-01	1.7157E+00	2.1544E+01
0075-0075	2.3682E-01	3.4308E-01	1.5884E+00	1.9692E+01
0076-0076	4.1071E-01	3.5499E-01	1.1876E+00	1.5645E+01
0077-0077	6.4131E-01	3.1267E-01	1.2887E+00	1.5333E+01
0078-0078	1.1242E-01	5.8256E-01	1.3068E+00	1.2431E+01
0079-0079	0.0000E+00	6.3350E-01	1.4212E+00	6.5211E+00
0080-	0.0000E+00	1.5022E+00	6.7622E-01	1.8405E+00

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

PERSON-YEARS IN EXPOSURE CATEGORY 1 <2.0 rems

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	66	92	130	65	353
0030-0034	1145	2611	1769	2616	8141
0035-0039	479	1028	841	1018	3366
0036-0036	580	1130	1020	1115	3845
0037-0037	621	1284	1159	1227	4291
0038-0038	703	1304	1274	1302	4583
0039-0039	768	1320	1335	1372	4795
0040-0040	834	1325	1385	1497	5041
0041-0041	834	1347	1409	1612	5202
0042-0042	837	1341	1461	1693	5332
0043-0043	836	1330	1486	1801	5453
0044-0044	854	1344	1470	1905	5573
0045-0045	847	1375	1418	2048	5688
0046-0046	777	1330	1454	2138	5699
0047-0047	701	1324	1417	2192	5634
0048-0048	661	1267	1384	2252	5564
0049-0049	619	1220	1387	2243	5469
0050-0050	575	1156	1381	2246	5358
0051-0051	539	1063	1343	2283	5228
0052-0052	470	990	1300	2268	5028
0053-0053	435	913	1251	2253	4852
0054-0054	395	839	1188	2207	4629
0055-0055	329	784	1130	2189	4432
0056-0056	298	725	1056	2119	4198
0057-0057	291	652	969	2031	3943
0058-0058	305	580	897	1973	3755
0059-0059	306	534	821	1903	3564
0060-0060	294	467	762	1797	3320
0061-0061	271	440	704	1690	3105
0062-0062	247	415	636	1569	2867
0063-0063	222	417	577	1454	2670
0064-0064	185	389	524	1342	2440
0065-0065	170	371	464	1231	2236
0066-0066	136	344	432	1109	2021
0067-0067	121	310	401	1025	1857
0068-0068	122	269	376	893	1660
0069-0069	113	233	340	796	1482
0070-0070	94	196	323	701	1314
0071-0071	90	162	285	628	1165
0072-0072	66	131	263	578	1038
0073-0073	61	118	214	507	900
0074-0074	40	108	173	464	785
0075-0075	31	85	132	429	677
0076-0076	16	80	103	391	590
0077-0077	8	55	91	339	493
0078-0078	4	45	76	292	417
0079-0079	0	29	73	246	348
0080-	0	40	206	949	1195
	18396	34912	40290	67998	161596

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

DEATHS FROM ALL CAUSES IN EXPOSURE CATEGORY 1

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	1	1	1	3	6
0035-0035	1	1	0	1	3
0036-0036	1	1	3	0	5
0037-0037	3	2	3	2	10
0038-0038	0	4	4	4	12
0039-0039	2	1	3	1	7
0040-0040	3	4	5	1	13
0041-0041	1	4	3	3	11
0042-0042	1	5	4	3	13
0043-0043	1	4	6	2	13
0044-0044	5	6	7	4	22
0045-0045	7	5	3	4	19
0046-0046	5	10	6	12	33
0047-0047	6	11	6	8	31
0048-0048	5	9	3	9	26
0049-0049	3	7	12	13	35
0050-0050	7	6	7	14	34
0051-0051	2	5	7	16	30
0052-0052	4	5	11	20	40
0053-0053	1	9	13	19	42
0054-0054	2	11	13	16	42
0055-0055	7	17	13	19	56
0056-0056	3	10	16	18	47
0057-0057	2	8	7	12	29
0058-0058	5	5	9	27	46
0059-0059	3	7	13	28	51
0060-0060	6	6	9	29	50
0061-0061	10	10	12	42	74
0062-0062	7	13	11	27	58
0063-0063	7	7	13	37	64
0064-0064	5	8	20	34	67
0065-0065	8	9	15	32	64
0066-0066	2	17	18	27	64
0067-0067	4	13	14	35	66
0068-0068	4	11	19	33	67
0069-0069	4	10	15	29	58
0070-0070	2	9	11	33	55
0071-0071	5	10	14	31	60
0072-0072	5	5	17	24	51
0073-0073	3	8	12	25	48
0074-0074	1	4	17	26	48
0075-0075	1	5	10	34	50
0076-0076	2	6	9	41	58
0077-0077	0	6	7	21	34
0078-0078	0	4	6	27	37
0079-0079	0	0	7	17	24
0080-	0	6	20	123	149
	157	325	454	986	1922

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

DEATHS FROM ALL CANCERS IN EXPOSURE CATEGORY 1

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	1	0	1	2
0035-0035	0	1	0	0	1
0036-0036	0	0	1	0	1
0037-0037	0	1	1	0	2
0038-0038	0	0	0	1	1
0039-0039	0	0	1	1	2
0040-0040	2	1	0	0	3
0041-0041	0	1	2	0	3
0042-0042	0	0	0	0	0
0043-0043	0	2	0	0	2
0044-0044	0	0	1	1	2
0045-0045	2	2	1	0	5
0046-0046	1	3	1	2	7
0047-0047	3	2	3	0	8
0048-0048	2	1	0	1	4
0049-0049	0	2	4	3	9
0050-0050	1	1	1	4	7
0051-0051	0	2	3	1	6
0052-0052	1	0	0	2	3
0053-0053	0	0	1	5	6
0054-0054	1	1	6	6	14
0055-0055	2	5	2	4	13
0056-0056	0	3	1	4	8
0057-0057	0	1	2	2	5
0058-0058	1	2	4	3	10
0059-0059	1	2	2	7	12
0060-0060	0	1	5	9	15
0061-0061	1	3	3	9	16
0062-0062	0	3	2	10	15
0063-0063	2	2	3	8	15
0064-0064	2	1	3	11	17
0065-0065	2	2	2	6	12
0066-0066	0	4	5	8	17
0067-0067	1	4	5	8	18
0068-0068	2	3	3	11	19
0069-0069	2	4	0	4	10
0070-0070	0	2	4	9	15
0071-0071	1	2	3	4	10
0072-0072	2	1	2	4	9
0073-0073	0	1	2	5	8
0074-0074	1	0	3	5	9
0075-0075	1	0	2	8	11
0076-0076	1	0	0	4	5
0077-0077	0	1	0	3	4
0078-0078	0	1	3	6	10
0079-0079	0	0	2	1	3
0080-	0	0	0	14	14
	35	69	89	195	388

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

DEATHS FROM lung cancer (162) IN EXPOSURE CATEGORY 1

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0039	0	0	0	0	0
0040-0044	0	0	0	0	0
0045-0049	0	1	0	0	1
0050-0054	0	0	1	1	2
0055-0059	0	0	1	0	1
0060-0064	1	0	0	0	1
0065-0069	0	2	0	1	3
0070-0074	0	0	0	1	1
0075-0079	0	1	1	0	2
0080-	1	0	0	4	6
	0	3	0	1	4
	0	0	1	0	1
	0	1	1	1	3
	0	1	1	2	4
	1	0	0	3	4
	0	0	1	4	5
	1	3	0	4	8
	0	0	2	5	7
	0	0	0	2	2
	0	0	2	2	4
	1	0	1	1	3
	0	1	3	3	7
	0	0	2	1	3
	0	1	0	4	5
	0	1	0	1	2
	0	1	3	5	9
	0	0	1	1	2
	1	0	0	2	3
	0	0	2	1	3
	0	0	1	1	2
	0	0	1	2	3
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	1	1
	0	0	1	1	2
	0	0	0	3	3
	7	16	28	59	110

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

PERSON-YEARS IN EXPOSURE CATEGORY 2 2.0 UP TO 5.0 rems

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	1	1
0030-0034	1	24	82	231	338
0035-0035	5	19	74	158	256
0036-0036	14	24	113	195	346
0037-0037	24	22	148	223	417
0038-0038	29	33	172	259	493
0039-0039	28	61	182	290	561
0040-0040	19	78	191	306	594
0041-0041	15	83	179	329	606
0042-0042	14	82	185	371	652
0043-0043	18	74	183	410	685
0044-0044	20	71	206	441	738
0045-0045	14	67	219	445	745
0046-0046	19	69	199	495	782
0047-0047	19	69	208	483	779
0048-0048	10	76	193	487	766
0049-0049	10	72	184	486	752
0050-0050	9	76	181	464	730
0051-0051	7	76	169	480	732
0052-0052	6	62	180	477	725
0053-0053	10	51	157	465	683
0054-0054	7	47	162	450	666
0055-0055	5	51	151	435	642
0056-0056	1	46	129	437	613
0057-0057	1	30	128	427	586
0058-0058	2	29	115	402	548
0059-0059	2	21	109	383	515
0060-0060	3	15	108	337	463
0061-0061	3	12	93	324	432
0062-0062	2	13	73	310	398
0063-0063	1	14	56	285	356
0064-0064	1	18	45	267	331
0065-0065	2	14	37	247	300
0066-0066	2	7	27	242	278
0067-0067	1	9	22	209	241
0068-0068	0	8	24	190	222
0069-0069	0	4	21	183	208
0070-0070	1	4	20	156	181
0071-0071	1	4	15	127	147
0072-0072	1	4	14	104	123
0073-0073	2	2	15	87	106
0074-0074	1	5	9	66	81
0075-0075	1	3	9	54	67
0076-0076	1	3	6	36	46
0077-0077	1	2	7	30	40
0078-0078	0	3	4	21	28
0079-0079	0	1	4	16	21
0080-	0	3	9	37	49
	333	1561	4817	13358	20069

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

DEATHS FROM ALL CAUSES IN EXPOSURE CATEGORY 2

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	1	1	2
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	1	0	1
0038-0038	0	0	1	0	1
0039-0039	0	0	0	1	1
0040-0040	0	1	1	1	3
0041-0041	0	0	0	0	0
0042-0042	0	0	1	3	4
0043-0043	0	0	0	0	0
0044-0044	0	0	0	3	3
0045-0045	0	1	1	1	3
0046-0046	0	0	0	1	1
0047-0047	0	1	0	0	1
0048-0048	0	1	1	1	3
0049-0049	0	0	0	4	4
0050-0050	0	1	1	2	4
0051-0051	0	0	0	0	0
0052-0052	0	1	1	4	6
0053-0053	0	0	3	3	6
0054-0054	0	1	2	3	6
0055-0055	0	0	1	2	3
0056-0056	0	0	1	10	11
0057-0057	0	0	0	4	4
0058-0058	0	1	1	2	4
0059-0059	0	0	1	4	5
0060-0060	0	1	4	6	11
0061-0061	0	0	0	6	6
0062-0062	0	0	0	5	5
0063-0063	0	0	2	6	8
0064-0064	0	0	1	9	10
0065-0065	0	1	1	6	8
0066-0066	0	0	0	5	5
0067-0067	0	0	3	6	9
0068-0068	0	0	0	7	7
0069-0069	0	0	0	10	10
0070-0070	0	0	0	6	6
0071-0071	0	0	1	4	5
0072-0072	0	0	1	4	5
0073-0073	0	0	2	7	9
0074-0074	0	1	0	4	5
0075-0075	0	0	1	4	5
0076-0076	0	0	0	3	3
0077-0077	0	0	0	5	5
0078-0078	0	1	0	3	4
0079-0079	0	0	1	1	2
0080-	0	0	2	5	7
	0	12	37	162	211

white males start year = max(#1 reading + latent + 1, #3 reading + 1)

DEATHS FROM ALL CANCERS IN EXPOSURE CATEGORY 2

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	1	0	1
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	0	0	0
0038-0038	0	0	0	0	0
0039-0039	0	0	0	0	0
0040-0040	0	1	0	0	1
0041-0041	0	0	0	0	0
0042-0042	0	0	0	0	0
0043-0043	0	0	0	0	0
0044-0044	0	0	0	1	1
0045-0045	0	0	1	0	1
0046-0046	0	0	0	0	0
0047-0047	0	0	0	0	0
0048-0048	0	0	0	1	1
0049-0049	0	0	0	1	1
0050-0050	0	0	0	1	1
0051-0051	0	0	0	0	0
0052-0052	0	0	1	0	1
0053-0053	0	0	0	2	2
0054-0054	0	0	0	0	0
0055-0055	0	0	0	1	1
0056-0056	0	0	1	5	6
0057-0057	0	0	0	1	1
0058-0058	0	0	0	1	1
0059-0059	0	0	0	3	3
0060-0060	0	0	1	1	2
0061-0061	0	0	0	1	1
0062-0062	0	0	0	4	4
0063-0063	0	0	0	2	2
0064-0064	0	0	0	2	2
0065-0065	0	0	0	1	1
0066-0066	0	0	0	2	2
0067-0067	0	0	1	2	3
0068-0068	0	0	0	2	2
0069-0069	0	0	0	1	1
0070-0070	0	0	0	0	0
0071-0071	0	0	0	0	0
0072-0072	0	0	0	2	2
0073-0073	0	0	1	3	4
0074-0074	0	0	0	0	0
0075-0075	0	0	0	0	0
0076-0076	0	0	0	1	1
0077-0077	0	0	0	0	0
0078-0078	0	0	0	2	2
0079-0079	0	0	0	0	0
0080-	0	0	0	0	0
	0	1	7	43	51

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

DEATHS FROM lung cancer (162) IN EXPOSURE CATEGORY 2

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	0	0	0
0038-0038	0	0	0	0	0
0039-0039	0	0	0	0	0
0040-0040	0	1	0	0	1
0041-0041	0	0	0	0	0
0042-0042	0	0	0	0	0
0043-0043	0	0	0	0	0
0044-0044	0	0	0	1	1
0045-0045	0	0	0	0	0
0046-0046	0	0	0	0	0
0047-0047	0	0	0	0	0
0048-0048	0	0	0	0	0
0049-0049	0	0	0	1	1
0050-0050	0	0	0	1	1
0051-0051	0	0	0	0	0
0052-0052	0	0	0	0	0
0053-0053	0	0	0	1	1
0054-0054	0	0	0	0	0
0055-0055	0	0	0	0	0
0056-0056	0	0	0	2	2
0057-0057	0	0	0	0	0
0058-0058	0	0	0	1	1
0059-0059	0	0	0	1	1
0060-0060	0	0	1	0	1
0061-0061	0	0	0	0	0
0062-0062	0	0	0	2	2
0063-0063	0	0	0	0	0
0064-0064	0	0	0	1	1
0065-0065	0	0	0	0	0
0066-0066	0	0	0	2	2
0067-0067	0	0	0	2	2
0068-0068	0	0	0	1	1
0069-0069	0	0	0	0	0
0070-0070	0	0	0	0	0
0071-0071	0	0	0	0	0
0072-0072	0	0	0	1	1
0073-0073	0	0	0	2	2
0074-0074	0	0	0	0	0
0075-0075	0	0	0	0	0
0076-0076	0	0	0	1	1
0077-0077	0	0	0	0	0
0078-0078	0	0	0	1	1
0079-0079	0	0	0	0	0
0080-	0	0	0	0	0
	0	1	1	21	23

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

PERSON-YEARS IN EXPOSURE CATEGORY 3 5.0 UP TO 15.0 rems

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	1	5	57	63
0035-0035	0	1	12	62	75
0036-0036	0	2	24	102	128
0037-0037	0	3	40	151	194
0038-0038	0	2	45	207	254
0039-0039	0	2	75	218	295
0040-0040	0	3	82	239	324
0041-0041	1	3	95	275	374
0042-0042	1	5	105	282	393
0043-0043	0	3	104	295	402
0044-0044	0	4	91	314	409
0045-0045	0	5	92	348	445
0046-0046	0	4	90	371	465
0047-0047	0	6	86	382	474
0048-0048	0	2	83	389	474
0049-0049	0	2	76	405	483
0050-0050	0	5	72	397	474
0051-0051	0	4	75	373	452
0052-0052	0	5	80	349	434
0053-0053	0	9	84	341	434
0054-0054	0	1	93	340	434
0055-0055	0	0	88	322	410
0056-0056	0	4	84	315	403
0057-0057	0	3	73	294	370
0058-0058	0	4	58	287	349
0059-0059	0	2	45	280	327
0060-0060	0	3	46	265	314
0061-0061	0	0	47	247	294
0062-0062	0	0	39	233	272
0063-0063	0	1	31	228	260
0064-0064	0	1	28	214	243
0065-0065	0	0	22	179	201
0066-0066	0	2	18	144	164
0067-0067	0	0	19	126	145
0068-0068	0	1	20	99	120
0069-0069	0	0	17	85	102
0070-0070	0	0	11	71	82
0071-0071	0	0	9	63	72
0072-0072	0	1	7	47	55
0073-0073	0	1	7	39	47
0074-0074	0	1	5	34	40
0075-0075	0	0	4	22	26
0076-0076	0	0	1	22	23
0077-0077	0	0	1	18	19
0078-0078	0	0	1	14	15
	2	96	2191	9563	11852

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

DEATHS FROM ALL CAUSES IN EXPOSURE CATEGORY 3

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	0	0	0
0038-0038	0	0	0	0	0
0039-0039	0	0	0	0	0
0040-0040	0	0	1	0	1
0041-0041	0	0	0	1	1
0042-0042	0	0	0	1	1
0043-0043	0	0	0	0	0
0044-0044	0	0	0	1	1
0045-0045	0	0	1	1	2
0046-0046	0	0	0	0	0
0047-0047	0	0	0	3	3
0048-0048	0	0	0	2	2
0049-0049	0	0	0	1	1
0050-0050	0	0	0	1	1
0051-0051	0	0	0	0	0
0052-0052	0	0	0	2	2
0053-0053	0	0	2	1	3
0054-0054	0	0	0	0	0
0055-0055	0	0	0	3	3
0056-0056	0	0	0	5	5
0057-0057	0	0	3	9	12
0058-0058	0	1	2	4	7
0059-0059	0	0	0	9	9
0060-0060	0	0	2	4	6
0061-0061	0	0	0	2	2
0062-0062	0	0	1	4	5
0063-0063	0	0	0	4	4
0064-0064	0	0	2	3	5
0065-0065	0	0	0	6	6
0066-0066	0	0	0	3	3
0067-0067	0	0	1	4	5
0068-0068	0	0	1	2	3
0069-0069	0	0	1	6	7
0070-0070	0	0	0	5	5
0071-0071	0	0	1	3	4
0072-0072	0	0	0	2	2
0073-0073	0	0	0	2	2
0074-0074	0	0	0	2	2
0075-0075	0	0	0	2	2
0076-0076	0	0	0	2	2
0077-0077	0	0	0	1	1
0078-0078	0	0	0	3	3
0079-0079	0	0	0	1	1
0080-	0	0	0	2	2
	0	1	18	107	126

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

DEATHS FROM ALL CANCERS IN EXPOSURE CATEGORY 3

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	0	0	0
0038-0038	0	0	0	0	0
0039-0039	0	0	0	0	0
0040-0040	0	0	0	0	0
0041-0041	0	0	0	0	0
0042-0042	0	0	0	0	0
0043-0043	0	0	0	0	0
0044-0044	0	0	0	0	0
0045-0045	0	0	0	0	0
0046-0046	0	0	0	0	0
0047-0047	0	0	0	0	0
0048-0048	0	0	0	1	1
0049-0049	0	0	0	0	0
0050-0050	0	0	0	0	0
0051-0051	0	0	0	0	0
0052-0052	0	0	0	0	0
0053-0053	0	0	0	1	1
0054-0054	0	0	0	0	0
0055-0055	0	0	0	2	2
0056-0056	0	0	0	2	2
0057-0057	0	0	2	2	4
0058-0058	0	0	2	0	2
0059-0059	0	0	0	2	2
0060-0060	0	0	1	1	2
0061-0061	0	0	0	0	0
0062-0062	0	0	1	1	2
0063-0063	0	0	0	1	1
0064-0064	0	0	0	1	1
0065-0065	0	0	0	1	1
0066-0066	0	0	0	0	0
0067-0067	0	0	0	1	1
0068-0068	0	0	0	0	0
0069-0069	0	0	0	1	1
0070-0070	0	0	0	2	2
0071-0071	0	0	1	0	1
0072-0072	0	0	0	0	0
0073-0073	0	0	0	1	1
0074-0074	0	0	0	1	1
0075-0075	0	0	0	0	0
0076-0076	0	0	0	0	0
0077-0077	0	0	0	1	1
0078-0078	0	0	0	1	1
0079-0079	0	0	0	0	0
0080-	0	0	0	0	0
	0	0	7	23	30

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

DEATHS FROM lung cancer (162) IN EXPOSURE CATEGORY 3

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	0	0	0
0038-0038	0	0	0	0	0
0039-0039	0	0	0	0	0
0040-0040	0	0	0	0	0
0041-0041	0	0	0	0	0
0042-0042	0	0	0	0	0
0043-0043	0	0	0	0	0
0044-0044	0	0	0	0	0
0045-0045	0	0	0	0	0
0046-0046	0	0	0	0	0
0047-0047	0	0	0	0	0
0048-0048	0	0	0	0	0
0049-0049	0	0	0	0	0
0050-0050	0	0	0	0	0
0051-0051	0	0	0	0	0
0052-0052	0	0	0	0	0
0053-0053	0	0	0	1	1
0054-0054	0	0	0	0	0
0055-0055	0	0	0	1	1
0056-0056	0	0	0	2	2
0057-0057	0	0	0	1	1
0058-0058	0	0	1	0	1
0059-0059	0	0	0	1	1
0060-0060	0	0	0	1	1
0061-0061	0	0	0	0	0
0062-0062	0	0	0	1	1
0063-0063	0	0	0	1	1
0064-0064	0	0	0	0	0
0065-0065	0	0	0	0	0
0066-0066	0	0	0	0	0
0067-0067	0	0	0	0	0
0068-0068	0	0	0	0	0
0069-0069	0	0	0	1	1
0070-0070	0	0	0	0	0
0071-0071	0	0	1	0	1
0072-0072	0	0	0	0	0
0073-0073	0	0	0	0	0
0074-0074	0	0	0	1	1
0075-0075	0	0	0	0	0
0076-0076	0	0	0	0	0
0077-0077	0	0	0	1	1
0078-0078	0	0	0	0	0
0079-0079	0	0	0	0	0
0080-	0	0	0	0	0
	0	0	2	12	14

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

PERSON-YEARS IN EXPOSURE CATEGORY 4 = OR >15.0 rems

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	0	1	1
0038-0038	0	0	1	6	7
0039-0039	0	0	1	13	14
0040-0040	0	0	0	26	26
0041-0041	0	0	1	41	42
0042-0042	0	0	1	54	55
0043-0043	0	0	3	73	76
0044-0044	0	0	2	104	106
0045-0045	0	0	1	130	131
0046-0046	0	0	1	142	143
0047-0047	0	0	2	159	161
0048-0048	0	0	3	180	183
0049-0049	0	0	4	177	181
0050-0050	0	0	1	179	180
0051-0051	0	0	2	181	183
0052-0052	0	0	1	183	184
0053-0053	0	0	0	178	178
0054-0054	0	0	2	162	164
0055-0055	0	0	1	151	152
0056-0056	0	0	2	151	153
0057-0057	0	0	3	153	156
0058-0058	0	0	4	155	159
0059-0059	0	0	1	153	154
0060-0060	0	0	0	152	152
0061-0061	0	0	0	149	149
0062-0062	0	0	0	146	146
0063-0063	0	0	0	139	139
0064-0064	0	0	0	127	127
0065-0065	0	0	1	120	121
0066-0066	0	0	0	105	105
0067-0067	0	0	1	88	89
0068-0068	0	0	2	76	78
0069-0069	0	0	1	70	71
0070-0070	0	0	0	67	67
0071-0071	0	0	0	52	52
0072-0072	0	0	0	37	37
0073-0073	0	0	0	33	33
0074-0074	0	0	0	25	25
0075-0075	0	0	0	18	18
0076-0076	0	0	0	14	14
0077-0077	0	0	0	12	12
0078-0078	0	0	0	7	7
0079-0079	0	0	0	3	3
0080-	0	0	0	3	3
	0	0	42	4195	4237

white males start year=max(#1 reading + latent + 1, #3 reading + 1)

DEATHS FROM ALL CAUSES IN EXPOSURE CATEGORY 4

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	0	0	0
0038-0038	0	0	0	0	0
0039-0039	0	0	0	0	0
0040-0040	0	0	0	0	0
0041-0041	0	0	0	0	0
0042-0042	0	0	0	0	0
0043-0043	0	0	0	0	0
0044-0044	0	0	0	0	0
0045-0045	0	0	0	0	0
0046-0046	0	0	0	0	0
0047-0047	0	0	0	0	0
0048-0048	0	0	0	0	0
0049-0049	0	0	0	1	1
0050-0050	0	0	0	2	2
0051-0051	0	0	0	1	1
0052-0052	0	0	0	0	0
0053-0053	0	0	0	3	3
0054-0054	0	0	0	0	0
0055-0055	0	0	0	2	2
0056-0056	0	0	0	1	1
0057-0057	0	0	0	1	1
0058-0058	0	0	1	3	4
0059-0059	0	0	0	4	4
0060-0060	0	0	0	2	2
0061-0061	0	0	0	1	1
0062-0062	0	0	0	1	1
0063-0063	0	0	0	0	0
0064-0064	0	0	0	5	5
0065-0065	0	0	0	2	2
0066-0066	0	0	0	4	4
0067-0067	0	0	0	1	1
0068-0068	0	0	0	3	3
0069-0069	0	0	0	0	0
0070-0070	0	0	0	4	4
0071-0071	0	0	0	3	3
0072-0072	0	0	0	2	2
0073-0073	0	0	0	0	0
0074-0074	0	0	0	2	2
0075-0075	0	0	0	0	0
0076-0076	0	0	0	2	2
0077-0077	0	0	0	1	1
0078-0078	0	0	0	2	2
0079-0079	0	0	0	0	0
0080-	0	0	0	0	0
	0	0	1	53	54

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

DEATHS FROM ALL CANCERS IN EXPOSURE CATEGORY 4

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	0	0	0
0038-0038	0	0	0	0	0
0039-0039	0	0	0	0	0
0040-0040	0	0	0	0	0
0041-0041	0	0	0	0	0
0042-0042	0	0	0	0	0
0043-0043	0	0	0	0	0
0044-0044	0	0	0	0	0
0045-0045	0	0	0	0	0
0046-0046	0	0	0	0	0
0047-0047	0	0	0	0	0
0048-0048	0	0	0	0	0
0049-0049	0	0	0	1	1
0050-0050	0	0	0	1	1
0051-0051	0	0	0	1	1
0052-0052	0	0	0	0	0
0053-0053	0	0	0	1	1
0054-0054	0	0	0	0	0
0055-0055	0	0	0	1	1
0056-0056	0	0	0	0	0
0057-0057	0	0	0	1	1
0058-0058	0	0	0	1	1
0059-0059	0	0	0	1	1
0060-0060	0	0	0	0	0
0061-0061	0	0	0	0	0
0062-0062	0	0	0	1	1
0063-0063	0	0	0	0	0
0064-0064	0	0	0	0	0
0065-0065	0	0	0	0	0
0066-0066	0	0	0	2	2
0067-0067	0	0	0	0	0
0068-0068	0	0	0	0	0
0069-0069	0	0	0	0	0
0070-0070	0	0	0	1	1
0071-0071	0	0	0	0	0
0072-0072	0	0	0	0	0
0073-0073	0	0	0	0	0
0074-0074	0	0	0	0	0
0075-0075	0	0	0	0	0
0076-0076	0	0	0	0	0
0077-0077	0	0	0	0	0
0078-0078	0	0	0	0	0
0079-0079	0	0	0	0	0
0080-	0	0	0	0	0
	0	0	0	12	12

white males start year=max(#1 reading + latent + 1,#3 reading + 1)

DEATHS FROM lung cancer (162) IN EXPOSURE CATEGORY 4

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	0	0	0	0	0
0030-0034	0	0	0	0	0
0035-0035	0	0	0	0	0
0036-0036	0	0	0	0	0
0037-0037	0	0	0	0	0
0038-0038	0	0	0	0	0
0039-0039	0	0	0	0	0
0040-0040	0	0	0	0	0
0041-0041	0	0	0	0	0
0042-0042	0	0	0	0	0
0043-0043	0	0	0	0	0
0044-0044	0	0	0	0	0
0045-0045	0	0	0	0	0
0046-0046	0	0	0	0	0
0047-0047	0	0	0	0	0
0048-0048	0	0	0	0	0
0049-0049	0	0	0	0	0
0050-0050	0	0	0	0	0
0051-0051	0	0	0	0	0
0052-0052	0	0	0	0	0
0053-0053	0	0	0	1	1
0054-0054	0	0	0	0	0
0055-0055	0	0	0	0	0
0056-0056	0	0	0	0	0
0057-0057	0	0	0	0	0
0058-0058	0	0	0	1	1
0059-0059	0	0	0	1	1
0060-0060	0	0	0	0	0
0061-0061	0	0	0	0	0
0062-0062	0	0	0	0	0
0063-0063	0	0	0	0	0
0064-0064	0	0	0	0	0
0065-0065	0	0	0	0	0
0066-0066	0	0	0	2	2
0067-0067	0	0	0	0	0
0068-0068	0	0	0	0	0
0069-0069	0	0	0	0	0
0070-0070	0	0	0	0	0
0071-0071	0	0	0	0	0
0072-0072	0	0	0	0	0
0073-0073	0	0	0	0	0
0074-0074	0	0	0	0	0
0075-0075	0	0	0	0	0
0076-0076	0	0	0	0	0
0077-0077	0	0	0	0	0
0078-0078	0	0	0	0	0
0079-0079	0	0	0	0	0
0080-	0	0	0	0	0
	0	0	0	5	5

TOTAL PERSON-YEARS AT RISK

age	calendar year				TOTAL
	-1959	1960-1964	1965-1969	1970-	
-0024	0	0	0	0	0
0025-0029	66	92	130	66	354
0030-0034	1146	2636	1856	2904	8542
0035-0039	484	1048	927	1238	3697
0036-0039	594	1156	1157	1412	4319
0037-0039	645	1309	1347	1602	4903
0038-0039	732	1339	1492	1774	5337
0039-0039	796	1383	1593	1893	5665
0040-0040	853	1406	1658	2068	5985
0041-0041	850	1433	1684	2257	6224
0042-0042	852	1428	1752	2400	6432
0043-0043	854	1407	1776	2579	6616
0044-0044	874	1419	1769	2764	6826
0045-0045	861	1447	1730	2971	7009
0046-0046	796	1403	1744	3146	7089
0047-0047	720	1399	1713	3216	7048
0048-0048	671	1345	1663	3308	6987
0049-0049	629	1294	1651	3311	6885
0050-0050	584	1237	1635	3286	6742
0051-0051	546	1143	1589	3317	6595
0052-0052	476	1057	1561	3277	6371
0053-0053	445	973	1492	3237	6147
0054-0054	402	887	1445	3159	5893
0055-0055	334	835	1370	3097	5636
0056-0056	299	775	1271	3022	5367
0057-0057	292	685	1173	2905	5055
0058-0058	307	613	1074	2817	4811
0059-0059	308	557	976	2719	4560
0060-0060	297	485	916	2551	4249
0061-0061	274	452	844	2410	3980
0062-0062	249	428	748	2258	3683
0063-0063	223	432	664	2106	3425
0064-0064	186	408	597	1950	3141
0065-0065	172	385	524	1777	2858
0066-0066	138	353	477	1600	2568
0067-0067	122	319	443	1448	2332
0068-0068	122	278	422	1258	2080
0069-0069	113	237	379	1134	1863
0070-0070	95	200	354	995	1644
0071-0071	91	166	309	870	1436
0072-0072	67	136	284	766	1253
0073-0073	63	121	236	666	1086
0074-0074	41	114	187	589	931
0075-0075	32	88	145	523	788
0076-0076	17	83	110	463	673
0077-0077	9	57	99	399	564
0078-0078	4	48	81	334	467
0079-0079	0	30	78	273	381
0080-	0	43	215	999	1257
	18731	36569	47340	95114	197754

TOTAL EXPOSURE

age	calendar year				
	-1959	1960-1964	1965-1969	1970-	
-0024	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0025-0029	1.8500E+00	7.4500E+00	1.3610E+01	1.2010E+01	3.4920E+01
0030-0034	1.1453E+02	5.9721E+02	7.7367E+02	2.0073E+03	3.4927E+03
0035-0035	9.8810E+01	3.3542E+02	6.6629E+02	1.4517E+03	2.5523E+03
0036-0036	1.7836E+02	3.8869E+02	9.9288E+02	1.9599E+03	3.5198E+03
0037-0037	2.4429E+02	4.5904E+02	1.2776E+03	2.5635E+03	4.5444E+03
0038-0038	2.7819E+02	5.1854E+02	1.5016E+03	3.2243E+03	5.5226E+03
0039-0039	2.9109E+02	6.2962E+02	1.7710E+03	3.7294E+03	6.4211E+03
0040-0040	2.6901E+02	7.2818E+02	1.9180E+03	4.2785E+03	7.1937E+03
0041-0041	2.7257E+02	7.7580E+02	2.0092E+03	5.0179E+03	8.0755E+03
0042-0042	2.7906E+02	8.0187E+02	2.1615E+03	5.6483E+03	8.8908E+03
0043-0043	2.7932E+02	7.8628E+02	2.1997E+03	6.3627E+03	9.6280E+03
0044-0044	2.8755E+02	7.9103E+02	2.1910E+03	7.3590E+03	1.0629E+04
0045-0045	2.8644E+02	7.9270E+02	2.1706E+03	8.2628E+03	1.1513E+04
0046-0046	2.6827E+02	7.8546E+02	2.0927E+03	9.0195E+03	1.2166E+04
0047-0047	2.5433E+02	8.0382E+02	2.0584E+03	9.4165E+03	1.2533E+04
0048-0048	2.3004E+02	7.7955E+02	2.0090E+03	1.0045E+04	1.3064E+04
0049-0049	2.0021E+02	7.8144E+02	1.9714E+03	1.0184E+04	1.3137E+04
0050-0050	1.7968E+02	7.8484E+02	1.8816E+03	1.0253E+04	1.3099E+04
0051-0051	1.6323E+02	7.4352E+02	1.8417E+03	1.0285E+04	1.3033E+04
0052-0052	1.4334E+02	6.8002E+02	1.9157E+03	1.0102E+04	1.2841E+04
0053-0053	1.3964E+02	6.1316E+02	1.8411E+03	9.8348E+03	1.2429E+04
0054-0054	1.2335E+02	5.1255E+02	1.8695E+03	9.4244E+03	1.1930E+04
0055-0055	9.3820E+01	4.8403E+02	1.7982E+03	9.0588E+03	1.1435E+04
0056-0056	6.6580E+01	4.6883E+02	1.6788E+03	8.9356E+03	1.1150E+04
0057-0057	6.3260E+01	3.8520E+02	1.5369E+03	8.7005E+03	1.0686E+04
0058-0058	6.6220E+01	3.4845E+02	1.4237E+03	8.4451E+03	1.0283E+04
0059-0059	6.8180E+01	2.9458E+02	1.1595E+03	8.1993E+03	9.7215E+03
0060-0060	6.8640E+01	2.4460E+02	1.0903E+03	7.8019E+03	9.2054E+03
0061-0061	5.9990E+01	2.0043E+02	1.0285E+03	7.6190E+03	8.9079E+03
0062-0062	5.2220E+01	1.9013E+02	8.8028E+02	7.3033E+03	8.4259E+03
0063-0063	4.6220E+01	2.1051E+02	7.4092E+02	7.0041E+03	8.0017E+03
0064-0064	3.6710E+01	2.0621E+02	6.5848E+02	6.5706E+03	7.4720E+03
0065-0065	3.1960E+01	1.8736E+02	5.4672E+02	6.0080E+03	6.7740E+03
0066-0066	3.0760E+01	1.5603E+02	4.7111E+02	5.1604E+03	5.8183E+03
0067-0067	2.7960E+01	1.3164E+02	4.3970E+02	4.5293E+03	5.1286E+03
0068-0068	2.6170E+01	1.1683E+02	4.5009E+02	3.8003E+03	4.3934E+03
0069-0069	2.4190E+01	9.0060E+01	3.9361E+02	3.4905E+03	3.9984E+03
0070-0070	1.9250E+01	7.9730E+01	3.0864E+02	3.2152E+03	3.6228E+03
0071-0071	1.7020E+01	7.0850E+01	2.5295E+02	2.6209E+03	2.9617E+03
0072-0072	1.3590E+01	6.2310E+01	2.1443E+02	2.0228E+03	2.3131E+03
0073-0073	1.4240E+01	5.3170E+01	1.9737E+02	1.6984E+03	1.9632E+03
0074-0074	9.4600E+00	5.5710E+01	1.3934E+02	1.3221E+03	1.5266E+03
0075-0075	1.0690E+01	3.3770E+01	1.1286E+02	1.0441E+03	1.2014E+03
0076-0076	8.3700E+00	2.8830E+01	7.3560E+01	8.2226E+02	9.3302E+02
0077-0077	5.8300E+00	1.8960E+01	6.4310E+01	6.8021E+02	7.6931E+02
0078-0078	1.3500E+00	2.0750E+01	4.7210E+01	4.9157E+02	5.6088E+02
0079-0079	0.0000E+00	1.1460E+01	4.4730E+01	3.0194E+02	3.5813E+02
0080-	0.0000E+00	2.5840E+01	8.3370E+01	6.5253E+02	7.6174E+02
	5.4458E+03	1.8272E+04	5.2963E+04	2.5794E+05	3.3462E+05

TOTAL EXPOSURE**2

age	calendar year				1970-
	-1959	1960-1964	1965-1969		
-0024	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0025-0029	2.6710E-01	3.9449E+00	5.7011E+00	1.2441E+01	2.2354E+01
0030-0034	5.9355E+01	5.3420E+02	1.3106E+03	5.5461E+03	7.4502E+03
0035-0039	1.0114E+02	3.8844E+02	1.6926E+03	5.6646E+03	7.8468E+03
0036-0036	2.4938E+02	4.7608E+02	2.7738E+03	9.1258E+03	1.2625E+04
0037-0037	3.6829E+02	5.7603E+02	3.8348E+03	1.3229E+04	1.8008E+04
0038-0038	4.4097E+02	6.8402E+02	5.0363E+03	1.9101E+04	2.5262E+04
0039-0039	4.3305E+02	9.5105E+02	6.8535E+03	2.4764E+04	3.3001E+04
0040-0040	3.3105E+02	1.2573E+03	8.0270E+03	3.1208E+04	4.0823E+04
0041-0041	3.4836E+02	1.2958E+03	8.9816E+03	3.9913E+04	5.0538E+04
0042-0042	3.4853E+02	1.4009E+03	1.0247E+04	4.8859E+04	6.0855E+04
0043-0043	3.2915E+02	1.2940E+03	1.0709E+04	5.9181E+04	7.1513E+04
0044-0044	3.4301E+02	1.3125E+03	1.0132E+04	7.5680E+04	8.7467E+04
0045-0045	3.3202E+02	1.2773E+03	9.6424E+03	9.0015E+04	1.0127E+05
0046-0046	3.1330E+02	1.2144E+03	8.9540E+03	1.0255E+05	1.1303E+05
0047-0047	3.0376E+02	1.3252E+03	8.7559E+03	1.1009E+05	1.2048E+05
0048-0048	2.5877E+02	1.2355E+03	8.5961E+03	1.2416E+05	1.3425E+05
0049-0049	2.1624E+02	1.2634E+03	8.5090E+03	1.2745E+05	1.3744E+05
0050-0050	1.9304E+02	1.3836E+03	7.4870E+03	1.3536E+05	1.4442E+05
0051-0051	1.6054E+02	1.4408E+03	7.2855E+03	1.3697E+05	1.4586E+05
0052-0052	1.4547E+02	1.2845E+03	8.1544E+03	1.3800E+05	1.4758E+05
0053-0053	1.5091E+02	1.1335E+03	7.5137E+03	1.3234E+05	1.4114E+05
0054-0054	1.2868E+02	7.7401E+02	8.3147E+03	1.2329E+05	1.3251E+05
0055-0055	9.6273E+01	7.5038E+02	8.7006E+03	1.1661E+05	1.2616E+05
0056-0056	5.4093E+01	8.1037E+02	8.6201E+03	1.1328E+05	1.2276E+05
0057-0057	4.8659E+01	6.0434E+02	7.6543E+03	1.1392E+05	1.2223E+05
0058-0058	5.1724E+01	6.0045E+02	7.5466E+03	1.1112E+05	1.1932E+05
0059-0059	6.4880E+01	4.6411E+02	4.7985E+03	1.0522E+05	1.1055E+05
0060-0060	6.8227E+01	3.8812E+02	4.4077E+03	1.0185E+05	1.0671E+05
0061-0061	4.6943E+01	2.5055E+02	4.3449E+03	1.0524E+05	1.0988E+05
0062-0062	4.3706E+01	2.3936E+02	3.7000E+03	1.0135E+05	1.0533E+05
0063-0063	3.7388E+01	3.0278E+02	3.2106E+03	1.0030E+05	1.0385E+05
0064-0064	2.6727E+01	3.3551E+02	3.0129E+03	9.7596E+04	1.0097E+05
0065-0065	2.5255E+01	2.9775E+02	2.3603E+03	9.1580E+04	9.4263E+04
0066-0066	2.6611E+01	2.3407E+02	1.9795E+03	7.4917E+04	7.7157E+04
0067-0067	2.2091E+01	1.5329E+02	1.9609E+03	6.5073E+04	6.7209E+04
0068-0068	1.9789E+01	1.6507E+02	2.3189E+03	5.3094E+04	5.5598E+04
0069-0069	1.9282E+01	9.4710E+01	1.9991E+03	4.9350E+04	5.1463E+04
0070-0070	2.0098E+01	8.0910E+01	1.2325E+03	4.8664E+04	4.9997E+04
0071-0071	1.9692E+01	7.8687E+01	8.8447E+02	3.9052E+04	4.0035E+04
0072-0072	1.5212E+01	8.4991E+01	6.1717E+02	2.8121E+04	2.8839E+04
0073-0073	1.9112E+01	8.6923E+01	7.1730E+02	2.3680E+04	2.4503E+04
0074-0074	9.1290E+00	1.2416E+02	4.2466E+02	1.5657E+04	1.6215E+04
0075-0075	1.1149E+01	4.3151E+01	3.1817E+02	1.2383E+04	1.2756E+04
0076-0076	1.1103E+01	3.9479E+01	1.7983E+02	8.7040E+03	8.9344E+03
0077-0077	9.5483E+00	2.4129E+01	1.6936E+02	7.2775E+03	7.4806E+03
0078-0078	9.0530E+00	3.6933E+01	1.3336E+02	4.8755E+03	5.0467E+03
0079-0079	0.0000E+00	2.3383E+01	1.3651E+02	2.1142E+03	2.2741E+03
0080-	0.0000E+00	8.0121E+01	1.7771E+02	2.2649E+03	2.5227E+03
	6.3229E+03	2.8900E+04	2.2442E+05	3.1458E+06	3.4054E+06

TOTAL EXPOSURE**3

age	calendar year				
	-1959	1960-1964	1965-1969	1970-	
-0024	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0025-0029	5.6453E-02	4.3628E+00	3.3719E+00	2.0575E+01	2.8366E+01
0030-0034	6.1864E+01	9.6642E+02	3.7663E+03	2.5674E+04	3.0468E+04
0035-0035	1.7310E+02	9.0327E+02	7.2774E+03	3.4783E+04	4.3136E+04
0036-0036	5.5021E+02	1.1838E+03	1.3245E+04	6.6079E+04	8.1058E+04
0037-0037	8.4690E+02	1.4790E+03	1.9308E+04	1.0244E+05	1.2407E+05
0038-0038	1.0710E+03	1.7302E+03	3.0769E+04	1.7061E+05	2.0418E+05
0039-0039	1.0065E+03	2.5217E+03	4.5914E+04	2.4940E+05	2.9885E+05
0040-0040	6.7638E+02	3.7315E+03	5.7101E+04	3.5215E+05	4.1366E+05
0041-0041	8.2859E+02	3.4940E+03	6.8214E+04	4.9475E+05	5.6729E+05
0042-0042	8.2123E+02	4.0757E+03	8.2213E+04	6.6332E+05	7.5043E+05
0043-0043	6.0283E+02	3.5324E+03	9.0245E+04	8.6324E+05	9.5762E+05
0044-0044	6.4013E+02	3.8687E+03	8.0589E+04	1.2107E+06	1.2958E+06
0045-0045	6.1607E+02	3.8733E+03	7.2585E+04	1.5065E+06	1.5835E+06
0046-0046	6.0732E+02	3.1717E+03	6.6714E+04	1.7997E+06	1.8701E+06
0047-0047	5.6918E+02	3.9314E+03	6.7404E+04	1.9798E+06	2.0517E+06
0048-0048	4.6662E+02	3.1436E+03	6.8021E+04	2.3555E+06	2.4271E+06
0049-0049	3.7637E+02	3.2521E+03	6.9762E+04	2.4483E+06	2.5217E+06
0050-0050	3.3891E+02	4.1077E+03	5.5183E+04	2.8106E+06	2.8702E+06
0051-0051	2.4881E+02	5.1703E+03	5.1203E+04	2.8964E+06	2.9530E+06
0052-0052	2.3071E+02	4.4833E+03	6.1314E+04	3.0095E+06	3.0755E+06
0053-0053	2.6321E+02	3.9575E+03	5.0226E+04	2.8594E+06	2.9138E+06
0054-0054	2.1227E+02	1.9540E+03	6.1860E+04	2.6245E+06	2.6885E+06
0055-0055	1.5414E+02	1.8747E+03	7.2470E+04	2.4349E+06	2.5094E+06
0056-0056	6.7457E+01	2.3916E+03	7.8189E+04	2.2861E+06	2.3667E+06
0057-0057	5.8777E+01	1.6171E+03	6.6871E+04	2.3608E+06	2.4293E+06
0058-0058	7.0956E+01	1.8833E+03	7.3098E+04	2.3255E+06	2.4006E+06
0059-0059	1.3609E+02	1.3502E+03	3.6242E+04	2.1090E+06	2.1468E+06
0060-0060	1.5638E+02	1.2334E+03	3.1292E+04	2.0586E+06	2.0913E+06
0061-0061	6.5683E+01	5.7390E+02	3.2311E+04	2.2798E+06	2.3127E+06
0062-0062	8.0776E+01	5.6343E+02	2.7232E+04	2.1868E+06	2.2147E+06
0063-0063	6.9919E+01	7.9191E+02	2.4735E+04	2.2456E+06	2.2712E+06
0064-0064	3.9220E+01	1.0190E+03	2.6190E+04	2.2814E+06	2.3086E+06
0065-0065	4.3572E+01	8.7480E+02	2.0070E+04	2.2053E+06	2.2263E+06
0066-0066	4.5542E+01	7.2625E+02	1.5713E+04	1.7383E+06	1.7548E+06
0067-0067	2.8746E+01	3.3949E+02	1.6302E+04	1.4836E+06	1.5003E+06
0068-0068	2.4137E+01	4.7691E+02	2.2814E+04	1.1904E+06	1.2137E+06
0069-0069	2.4870E+01	1.9050E+02	1.8587E+04	1.1097E+06	1.1285E+06
0070-0070	4.3214E+01	1.2688E+02	9.8679E+03	1.1476E+06	1.1576E+06
0071-0071	4.7057E+01	1.4457E+02	6.7996E+03	9.3612E+05	9.4311E+05
0072-0072	3.9919E+01	2.2035E+02	3.5026E+03	6.6249E+05	6.6626E+05
0073-0073	4.8584E+01	3.5819E+02	5.4460E+03	5.7132E+05	5.7717E+05
0074-0074	1.4936E+01	6.7650E+02	2.9516E+03	3.2699E+05	3.3063E+05
0075-0075	1.7565E+01	9.6891E+01	1.7421E+03	2.6104E+05	2.6290E+05
0076-0076	1.9611E+01	9.3501E+01	1.0566E+03	1.6035E+05	1.6152E+05
0077-0077	2.0979E+01	5.7002E+01	1.0277E+03	1.3542E+05	1.3653E+05
0078-0078	6.6208E-01	1.0564E+02	9.2092E+02	8.8177E+04	8.9205E+04
0079-0079	0.0000E+00	8.3762E+01	9.4374E+02	2.8955E+04	2.9983E+04
0080-	0.0000E+00	3.6426E+02	7.0238E+02	2.2372E+04	2.3438E+04
	1.2527E+04	8.2770E+04	1.7200E+06	6.3160E+07	6.4975E+07

TOTAL EXPOSURE**4

age	calendar year				
	~1959	1960-1964	1965-1969	1970-	
~0024	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
0025-0029	1.3336E-02	6.2634E+00	2.2942E+00	3.8914E+01	4.7485E+01
0030-0034	8.7711E+01	2.5701E+03	1.4332E+04	1.5209E+05	1.6908E+05
0035-0039	3.6399E+02	3.1756E+03	4.1000E+04	2.6444E+05	3.0898E+05
0036-0036	1.5196E+03	4.1584E+03	8.4710E+04	5.9086E+05	6.8124E+05
0037-0037	2.4203E+03	5.4070E+03	1.3037E+05	9.5801E+05	1.0962E+06
0038-0038	3.2359E+03	6.0549E+03	2.6627E+05	1.8646E+06	2.1401E+06
0039-0039	2.9518E+03	8.8191E+03	4.1118E+05	3.0320E+06	3.4549E+06
0040-0040	1.8193E+03	1.4894E+04	5.1834E+05	4.8314E+06	5.3665E+06
0041-0041	2.9863E+03	1.1946E+04	6.5724E+05	7.4737E+06	8.1459E+06
0042-0042	3.0281E+03	1.5494E+04	8.2459E+05	1.1031E+07	1.1874E+07
0043-0043	1.3947E+03	1.2655E+04	9.5823E+05	1.5307E+07	1.6279E+07
0044-0044	1.4878E+03	1.5984E+04	8.1063E+05	2.3405E+07	2.4233E+07
0045-0045	1.5041E+03	1.8726E+04	6.9281E+05	2.9994E+07	3.0707E+07
0046-0046	1.5701E+03	1.1403E+04	6.3719E+05	3.7579E+07	3.8230E+07
0047-0047	1.3803E+03	1.6745E+04	6.8031E+05	4.2409E+07	4.3108E+07
0048-0048	1.0884E+03	1.0448E+04	7.1910E+05	5.3199E+07	5.3930E+07
0049-0049	8.2709E+02	1.0857E+04	7.7580E+05	5.5783E+07	5.6571E+07
0050-0050	7.7000E+02	1.6908E+04	5.5107E+05	7.0943E+07	7.1511E+07
0051-0051	4.8932E+02	2.8103E+04	4.7488E+05	7.4487E+07	7.4991E+07
0052-0052	4.6405E+02	2.3172E+04	6.0970E+05	7.9276E+07	7.9910E+07
0053-0053	5.7543E+02	1.9883E+04	4.1635E+05	7.4673E+07	7.5110E+07
0054-0054	4.2986E+02	7.0992E+03	5.8527E+05	6.8465E+07	6.9058E+07
0055-0055	3.0643E+02	5.9779E+03	7.6906E+05	6.2227E+07	6.3003E+07
0056-0056	1.0177E+02	9.3671E+03	9.3245E+05	5.5586E+07	5.6528E+07
0057-0057	8.6353E+01	5.8043E+03	7.3569E+05	5.8718E+07	5.9459E+07
0058-0058	1.2834E+02	8.1196E+03	8.9185E+05	5.8266E+07	5.9166E+07
0059-0059	4.4369E+02	5.6078E+03	3.6612E+05	5.0343E+07	5.0715E+07
0060-0060	5.4970E+02	5.7286E+03	2.8124E+05	4.9344E+07	4.9632E+07
0061-0061	1.2135E+02	1.8378E+03	3.0621E+05	5.9456E+07	5.9764E+07
0062-0062	2.2212E+02	1.8616E+03	2.5111E+05	5.6302E+07	5.6555E+07
0063-0063	2.0154E+02	2.7903E+03	2.3171E+05	6.0005E+07	6.0239E+07
0064-0064	8.0108E+01	4.1458E+03	2.8231E+05	6.3519E+07	6.3805E+07
0065-0065	1.0221E+02	3.3203E+03	2.2357E+05	6.3116E+07	6.3343E+07
0066-0066	1.0447E+02	3.0673E+03	1.5372E+05	4.8093E+07	4.8250E+07
0067-0067	4.6420E+01	1.0424E+03	1.6991E+05	3.9179E+07	3.9350E+07
0068-0068	3.5492E+01	1.8562E+03	2.8248E+05	3.0877E+07	3.1162E+07
0069-0069	3.7686E+01	5.6887E+02	2.0877E+05	2.8827E+07	2.9036E+07
0070-0070	1.1861E+02	2.5032E+02	1.0011E+05	3.0815E+07	3.0915E+07
0071-0071	1.3923E+02	3.4303E+02	7.2300E+04	2.5753E+07	2.5825E+07
0072-0072	1.2761E+02	8.0377E+02	2.5746E+04	1.7941E+07	1.7968E+07
0073-0073	1.4535E+02	2.0864E+03	5.4618E+04	1.6060E+07	1.6117E+07
0074-0074	2.8903E+01	4.9359E+03	2.8758E+04	8.1845E+06	8.2182E+06
0075-0075	3.2316E+01	2.6362E+02	1.2321E+04	6.3951E+06	6.4077E+06
0076-0076	3.8198E+01	2.5978E+02	8.5721E+03	3.4286E+06	3.4375E+06
0077-0077	5.1741E+01	1.6440E+02	8.4440E+03	2.9113E+06	2.9200E+06
0078-0078	5.0521E+01	3.4337E+02	8.0685E+03	1.8574E+06	1.8658E+06
0079-0079	0.0000E+00	3.4209E+02	8.1647E+03	4.6674E+05	4.7524E+05
0080-	0.0000E+00	1.7655E+03	3.1815E+03	2.9979E+05	3.0473E+05
	3.3645E+04	3.3716E+05	1.7276E+07	1.5537E+09	1.5713E+09

RESULTS OF ANALYSES BASED ON UNGROUPED EXPOSURE DATA

ALL CAUSES (0-999)

NUMBER OF DEATHS	=	2313
OBSERVED MEAN	=	1.667768E+00
EXPECTED MEAN	=	1.726937E+00
TREND TEST STATISTIC	=	-7.497727E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.732343E-01
ADJUSTED ONE-TAILED P-VALUE	=	7.712489E-01
TOTAL VARIANCE	=	3.331789E+04

NO CERTIFICATE (0)

NUMBER OF DEATHS	=	65
OBSERVED MEAN	=	2.180308E+00
EXPECTED MEAN	=	2.579965E+00
TREND TEST STATISTIC	=	-6.311903E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.359831E-01
ADJUSTED ONE-TAILED P-VALUE	=	7.201983E-01
TOTAL VARIANCE	=	1.693872E+03

ALL NON-CANCERS (1-139,210-999)

NUMBER OF DEATHS	=	1767
OBSERVED MEAN	=	1.626284E+00
EXPECTED MEAN	=	1.663149E+00
TREND TEST STATISTIC	=	-4.209799E-01
UNADJUSTED ONE-TAILED P-VALUE	=	6.631017E-01
ADJUSTED ONE-TAILED P-VALUE	=	6.578649E-01
TOTAL VARIANCE	=	2.394278E+04

ALL CANCERS (140-209)

NUMBER OF DEATHS	=	481
OBSERVED MEAN	=	1.750895E+00
EXPECTED MEAN	=	1.846005E+00
TREND TEST STATISTIC	=	-5.219822E-01
UNADJUSTED ONE-TAILED P-VALUE	=	6.991196E-01
ADJUSTED ONE-TAILED P-VALUE	=	6.909091E-01
TOTAL VARIANCE	=	7.681221E+03

RESULTS OF ANALYSES BASED ON UNGROUPED EXPOSURE DATA

BUCCAL (140-9)

NUMBER OF DEATHS	=	17
OBSERVED MEAN	=	1.591177E+00
EXPECTED MEAN	=	1.775149E+00
TREND TEST STATISTIC	=	-1.953360E-01
UNADJUSTED ONE-TAILED P-VALUE	=	5.774792E-01
ADJUSTED ONE-TAILED P-VALUE	=	5.039840E-01
TOTAL VARIANCE	=	2.563544E+02

OTHER DIGESTIVE (150,152,154-6,158-9)

NUMBER OF DEATHS	=	18
OBSERVED MEAN	=	1.601667E+00
EXPECTED MEAN	=	1.450781E+00
TREND TEST STATISTIC	=	1.959583E-01
UNADJUSTED ONE-TAILED P-VALUE	=	4.222773E-01
ADJUSTED ONE-TAILED P-VALUE	=	3.601517E-01
TOTAL VARIANCE	=	1.920936E+02

STOMACH (151)

NUMBER OF DEATHS	=	23
OBSERVED MEAN	=	2.533478E+00
EXPECTED MEAN	=	1.822402E+00
TREND TEST STATISTIC	=	8.800369E-01
UNADJUSTED ONE-TAILED P-VALUE	=	1.894907E-01
ADJUSTED ONE-TAILED P-VALUE	=	1.829692E-01
TOTAL VARIANCE	=	3.453717E+02

LARGE INTESTINE (153)

NUMBER OF DEATHS	=	51
OBSERVED MEAN	=	1.046863E+00
EXPECTED MEAN	=	1.567490E+00
TREND TEST STATISTIC	=	-1.026820E+00
UNADJUSTED ONE-TAILED P-VALUE	=	8.476844E-01
ADJUSTED ONE-TAILED P-VALUE	=	8.499640E-01
TOTAL VARIANCE	=	6.686595E+02

RESULTS OF ANALYSES BASED ON UNGROUPED EXPOSURE DATA

RECTUM (154)

NUMBER OF DEATHS	=	16
OBSERVED MEAN	=	1.135000E+00
EXPECTED MEAN	=	1.685225E+00
TREND TEST STATISTIC	=	-5.686434E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.151523E-01
ADJUSTED ONE-TAILED P-VALUE	=	6.605814E-01
TOTAL VARIANCE	=	2.396849E+02

PANCREAS (157)

NUMBER OF DEATHS	=	34
OBSERVED MEAN	=	2.053824E+00
EXPECTED MEAN	=	1.547341E+00
TREND TEST STATISTIC	=	8.640711E-01
UNADJUSTED ONE-TAILED P-VALUE	=	1.938459E-01
ADJUSTED ONE-TAILED P-VALUE	=	1.864136E-01
TOTAL VARIANCE	=	3.971810E+02

ALL OTHER CANCERS (160-1,163,170-3,186-7,190,193-9)

NUMBER OF DEATHS	=	52
OBSERVED MEAN	=	1.487308E+00
EXPECTED MEAN	=	1.861886E+00
TREND TEST STATISTIC	=	-6.813782E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.521191E-01
ADJUSTED ONE-TAILED P-VALUE	=	7.339159E-01
TOTAL VARIANCE	=	8.171771E+02

LUNG (162)

NUMBER OF DEATHS	=	152
OBSERVED MEAN	=	2.222500E+00
EXPECTED MEAN	=	2.164148E+00
TREND TEST STATISTIC	=	1.595358E-01
UNADJUSTED ONE-TAILED P-VALUE	=	4.365759E-01
ADJUSTED ONE-TAILED P-VALUE	=	4.174632E-01
TOTAL VARIANCE	=	3.090926E+03

RESULTS OF ANALYSES BASED ON UNGROUPED EXPOSURE DATA

BREAST (174)

NUMBER OF DEATHS	=	1
OBSERVED MEAN	=	0.000000E+00
EXPECTED MEAN	=	9.876519E-01
TREND TEST STATISTIC	=	-5.543386E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.102805E-01
ADJUSTED ONE-TAILED P-VALUE	=	4.353584E-01
TOTAL VARIANCE	=	3.174370E+00

PROSTATE (185)

NUMBER OF DEATHS	=	39
OBSERVED MEAN	=	1.269487E+00
EXPECTED MEAN	=	1.904819E+00
TREND TEST STATISTIC	=	-9.310567E-01
UNADJUSTED ONE-TAILED P-VALUE	=	8.240188E-01
ADJUSTED ONE-TAILED P-VALUE	=	8.191673E-01
TOTAL VARIANCE	=	7.082361E+02

BLADDER & URINARY (188-9)

NUMBER OF DEATHS	=	17
OBSERVED MEAN	=	1.262941E+00
EXPECTED MEAN	=	1.362512E+00
TREND TEST STATISTIC	=	-1.314525E-01
UNADJUSTED ONE-TAILED P-VALUE	=	5.523389E-01
ADJUSTED ONE-TAILED P-VALUE	=	4.727300E-01
TOTAL VARIANCE	=	1.658139E+02

BRAIN (191-2)

NUMBER OF DEATHS	=	15
OBSERVED MEAN	=	9.253334E-01
EXPECTED MEAN	=	1.740089E+00
TREND TEST STATISTIC	=	-9.152961E-01
UNADJUSTED ONE-TAILED P-VALUE	=	8.199121E-01
ADJUSTED ONE-TAILED P-VALUE	=	8.126065E-01
TOTAL VARIANCE	=	1.782848E+02

RESULTS OF ANALYSES BASED ON UNGROUPED EXPOSURE DATA

LYMPHOSARCOMA (200)

NUMBER OF DEATHS	=	13
OBSERVED MEAN	=	1.143846E+00
EXPECTED MEAN	=	1.694187E+00
TREND TEST STATISTIC	=	-5.482950E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.082106E-01
ADJUSTED ONE-TAILED P-VALUE	=	6.469836E-01
TOTAL VARIANCE	=	1.702638E+02

HODGKIN'S DISEASE (201)

NUMBER OF DEATHS	=	6
OBSERVED MEAN	=	4.433334E-01
EXPECTED MEAN	=	1.365158E+00
TREND TEST STATISTIC	=	-8.030005E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.889411E-01
ADJUSTED ONE-TAILED P-VALUE	=	7.690995E-01
TOTAL VARIANCE	=	4.744251E+01

OTHER LYMPHATIC NEOPLASMS (202,208-9)

NUMBER OF DEATHS	=	6
OBSERVED MEAN	=	2.683333E-01
EXPECTED MEAN	=	1.772424E+00
TREND TEST STATISTIC	=	-9.822353E-01
UNADJUSTED ONE-TAILED P-VALUE	=	8.369419E-01
ADJUSTED ONE-TAILED P-VALUE	=	8.381217E-01
TOTAL VARIANCE	=	8.441493E+01

MULTIPLE MYELOMA (203)

NUMBER OF DEATHS	=	7
OBSERVED MEAN	=	6.345715E+00
EXPECTED MEAN	=	1.247989E+00
TREND TEST STATISTIC	=	5.183619E+00
UNADJUSTED ONE-TAILED P-VALUE	=	1.192093E-07
ADJUSTED ONE-TAILED P-VALUE	=	8.542836E-05
TOTAL VARIANCE	=	4.738958E+01

RESULTS OF ANALYSES BASED ON UNGROUPED EXPOSURE DATA

OTHER LEUKEMIA (204,206-7)

NUMBER OF DEATHS	=	6
OBSERVED MEAN	=	1.866667E-01
EXPECTED MEAN	=	1.391125E+00
TREND TEST STATISTIC	=	-9.589486E-01
UNADJUSTED ONE-TAILED P-VALUE	=	8.311401E-01
ADJUSTED ONE-TAILED P-VALUE	=	8.293951E-01
TOTAL VARIANCE	=	5.679305E+01

MYELOID LEUKEMIA (205)

NUMBER OF DEATHS	=	8
OBSERVED MEAN	=	2.743750E+00
EXPECTED MEAN	=	2.745691E+00
TREND TEST STATISTIC	=	-1.066683E-03
UNADJUSTED ONE-TAILED P-VALUE	=	5.004264E-01
ADJUSTED ONE-TAILED P-VALUE	=	4.267560E-01
TOTAL VARIANCE	=	2.119588E+02

INFECTIOUS (1-136)

NUMBER OF DEATHS	=	6
OBSERVED MEAN	=	8.583333E-01
EXPECTED MEAN	=	2.580796E+00
TREND TEST STATISTIC	=	-8.119862E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.915285E-01
ADJUSTED ONE-TAILED P-VALUE	=	7.596475E-01
TOTAL VARIANCE	=	1.619962E+02

ENDOCRINE (240-79)

NUMBER OF DEATHS	=	41
OBSERVED MEAN	=	2.404146E+00
EXPECTED MEAN	=	1.713531E+00
TREND TEST STATISTIC	=	1.193667E+00
UNADJUSTED ONE-TAILED P-VALUE	=	1.163518E-01
ADJUSTED ONE-TAILED P-VALUE	=	1.219739E-01
TOTAL VARIANCE	=	5.626968E+02

RESULTS OF ANALYSES BASED ON UNGROUPED EXPOSURE DATA

BLOOD (280-9)

NUMBER OF DEATHS	=	3
OBSERVED MEAN	=	5.253334E+00
EXPECTED MEAN	=	2.196561E+00
TREND TEST STATISTIC	=	1.168814E+00
UNADJUSTED ONE-TAILED P-VALUE	=	1.212894E-01
ADJUSTED ONE-TAILED P-VALUE	=	1.211008E-01
TOTAL VARIANCE	=	6.155709E+01

MENTAL (290-315)

NUMBER OF DEATHS	=	12
OBSERVED MEAN	=	3.934167E+00
EXPECTED MEAN	=	2.027063E+00
TREND TEST STATISTIC	=	1.505560E+00
UNADJUSTED ONE-TAILED P-VALUE	=	6.610996E-02
ADJUSTED ONE-TAILED P-VALUE	=	8.026239E-02
TOTAL VARIANCE	=	2.310549E+02

NERVOUS & SENSORY (320-89)

NUMBER OF DEATHS	=	17
OBSERVED MEAN	=	3.829412E+00
EXPECTED MEAN	=	2.009433E+00
TREND TEST STATISTIC	=	1.747004E+00
UNADJUSTED ONE-TAILED P-VALUE	=	4.032487E-02
ADJUSTED ONE-TAILED P-VALUE	=	5.719397E-02
TOTAL VARIANCE	=	3.136483E+02

CIRCULATORY (390-458)

NUMBER OF DEATHS	=	1263
OBSERVED MEAN	=	1.600990E+00
EXPECTED MEAN	=	1.668530E+00
TREND TEST STATISTIC	=	-6.481745E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.415028E-01
ADJUSTED ONE-TAILED P-VALUE	=	7.375623E-01
TOTAL VARIANCE	=	1.731962E+04

RESULTS OF ANALYSES BASED ON UNGROUPED EXPOSURE DATA

RESPIRATORY(460-519)

NUMBER OF DEATHS	=	122
OBSERVED MEAN	=	1.727459E+00
EXPECTED MEAN	=	1.548601E+00
TREND TEST STATISTIC	=	5.602764E-01
UNADJUSTED ONE-TAILED P-VALUE	=	2.876925E-01
ADJUSTED ONE-TAILED P-VALUE	=	2.735422E-01
TOTAL VARIANCE	=	1.516820E+03

DIGESTIVE (520-77)

NUMBER OF DEATHS	=	95
OBSERVED MEAN	=	1.648948E+00
EXPECTED MEAN	=	1.797532E+00
TREND TEST STATISTIC	=	-3.799962E-01
UNADJUSTED ONE-TAILED P-VALUE	=	6.480243E-01
ADJUSTED ONE-TAILED P-VALUE	=	6.253619E-01
TOTAL VARIANCE	=	1.379861E+03

RESIDUAL (210-39,580-799)

NUMBER OF DEATHS	=	43
OBSERVED MEAN	=	9.639536E-01
EXPECTED MEAN	=	1.514855E+00
TREND TEST STATISTIC	=	-1.039032E+00
UNADJUSTED ONE-TAILED P-VALUE	=	8.505431E-01
ADJUSTED ONE-TAILED P-VALUE	=	8.532564E-01
TOTAL VARIANCE	=	5.197897E+02

EXTERNAL (800-999)

NUMBER OF DEATHS	=	165
OBSERVED MEAN	=	1.278485E+00
EXPECTED MEAN	=	1.550225E+00
TREND TEST STATISTIC	=	-1.035265E+00
UNADJUSTED ONE-TAILED P-VALUE	=	8.496652E-01
ADJUSTED ONE-TAILED P-VALUE	=	8.509423E-01
TOTAL VARIANCE	=	1.875744E+03

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

EXPOSURE CATEGORY MEANS 4.896379E-01 3.073205E+00 8.500353E+00 2.196740E+01

ALL CAUSES (0-999)

NUMBER OF DEATHS = 2313
 OBSERVED MEAN SCORE = 1.663160E+00
 EXPECTED MEAN SCORE = 1.701086E+00
 TREND TEST STATISTIC = -5.032380E-01
 UNADJUSTED ONE-TAILED P-VALUE = 6.925668E-01
 ADJUSTED ONE-TAILED P-VALUE = 6.889838E-01
 TOTAL VARIANCE = 3.038588E+04
 CHI-SQUARE TEST FOR HOMOGENEITY = 5.077718E-01

OBSERVED FREQUENCIES	1.922000E+03	2.110000E+02	1.260000E+02	5.400000E+01
EXPECTED FREQUENCIES	1.916978E+03	2.139498E+02	1.233539E+02	5.872012E+01
RELATIVE RISKS	1.017156E+00	9.843234E-01	1.023573E+00	9.144483E-01
RELATIVE RISKS LBND	9.073025E-01	8.524367E-01	8.522941E-01	6.943008E-01
RELATIVE RISKS UBND	1.140310E+00	1.136615E+00	1.229272E+00	1.204400E+00
NORMAL TEST STATISTIC	2.917196E-01	-2.152814E-01	2.493766E-01	-6.364610E-01

NO CERTIFICATE (0)

NUMBER OF DEATHS = 65
 OBSERVED MEAN SCORE = 2.256118E+00
 EXPECTED MEAN SCORE = 2.415033E+00
 TREND TEST STATISTIC = -2.757545E-01
 UNADJUSTED ONE-TAILED P-VALUE = 6.086594E-01
 ADJUSTED ONE-TAILED P-VALUE = 5.856334E-01
 TOTAL VARIANCE = 1.403183E+03
 CHI-SQUARE TEST FOR HOMOGENEITY = 2.282084E+00

OBSERVED FREQUENCIES	5.300000E+01	4.000000E+00	5.000000E+00	3.000000E+00
EXPECTED FREQUENCIES	4.903926E+01	7.780671E+00	5.245467E+00	2.934611E+00
RELATIVE RISKS	1.461451E+00	4.692206E-01	9.483109E-01	1.023983E+00
RELATIVE RISKS LBND	7.862435E-01	1.708529E-01	3.800814E-01	3.173085E-01
RELATIVE RISKS UBND	2.716512E+00	1.288641E+00	2.366055E+00	3.304484E+00
NORMAL TEST STATISTIC	1.199646E+00	-1.468020E+00	-1.137736E-01	3.964869E-02

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

ALL NON-CANCERS (1-139,210-999)

NUMBER OF DEATHS = 1767
 OBSERVED MEAN SCORE = 1.604339E+00
 EXPECTED MEAN SCORE = 1.647659E+00
 TREND TEST STATISTIC = -5.146660E-01
 UNADJUSTED ONE-TAILED P-VALUE = 6.965694E-01
 ADJUSTED ONE-TAILED P-VALUE = 6.924339E-01
 TOTAL VARIANCE = 2.212082E+04
 CHI-SQUARE TEST FOR HOMOGENEITY = 4.098170E-01

OBSERVED FREQUENCIES	1.481000E+03	1.560000E+02	9.100000E+01	3.900000E+01
EXPECTED FREQUENCIES	1.474792E+03	1.595242E+02	9.027031E+01	4.241373E+01
RELATIVE RISKS	1.028758E+00	9.750050E-01	1.008855E+00	9.142454E-01
RELATIVE RISKS LBND	9.007121E-01	8.252521E-01	8.135059E-01	6.608160E-01
RELATIVE RISKS UBND	1.175006E+00	1.151933E+00	1.251114E+00	1.264867E+00
NORMAL TEST STATISTIC	4.180633E-01	-2.975212E-01	8.028879E-02	-5.413230E-01

ALL CANCERS (140-209)

NUMBER OF DEATHS = 481
 OBSERVED MEAN SCORE = 1.799020E+00
 EXPECTED MEAN SCORE = 1.800885E+00
 TREND TEST STATISTIC = -1.082968E-02
 UNADJUSTED ONE-TAILED P-VALUE = 5.043283E-01
 ADJUSTED ONE-TAILED P-VALUE = 4.931481E-01
 TOTAL VARIANCE = 6.861916E+03
 CHI-SQUARE TEST FOR HOMOGENEITY = 8.083690E-01

OBSERVED FREQUENCIES	3.880000E+02	5.100000E+01	3.000000E+01	1.200000E+01
EXPECTED FREQUENCIES	3.931454E+02	4.664467E+01	2.783813E+01	1.337183E+01
RELATIVE RISKS	9.246684E-01	1.108752E+00	1.086135E+00	8.914539E-01
RELATIVE RISKS LBND	7.269503E-01	8.240340E-01	7.449636E-01	4.987886E-01
RELATIVE RISKS UBND	1.176162E+00	1.491846E+00	1.583554E+00	1.593240E+00
NORMAL TEST STATISTIC	-6.380805E-01	6.817921E-01	4.295148E-01	-3.878392E-01

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

BUCCAL (140-9)

NUMBER OF DEATHS = 17
 OBSERVED MEAN SCORE = 1.584050E+00
 EXPECTED MEAN SCORE = 1.698320E+00
 TREND TEST STATISTIC = -1.307275E-01
 UNADJUSTED ONE-TAILED P-VALUE = 5.520521E-01
 ADJUSTED ONE-TAILED P-VALUE = 4.870790E-01
 TOTAL VARIANCE = 2.208169E+02
 CHI-SQUARE TEST FOR HOMOGENEITY = 1.941499E+00

OBSERVED FREQUENCIES	1.400000E+01	1.000000E+00	2.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	1.405674E+01	1.604907E+00	9.165787E-01	4.217739E-01
RELATIVE RISKS	9.729527E-01	5.889165E-01	2.500902E+00	0.000000E+00
RELATIVE RISKS LBND	2.381258E-01	7.673796E-02	5.487171E-01	0.000000E+00
RELATIVE RISKS UBND	3.975365E+00	4.519571E+00	1.139842E+01	0.000000E+00
NORMAL TEST STATISTIC	-3.818225E-02	-5.092345E-01	1.184473E+00	-6.697607E-01

OTHER DIGESTIVE (150,152,154-6,158-9)

NUMBER OF DEATHS = 18
 OBSERVED MEAN SCORE = 1.682847E+00
 EXPECTED MEAN SCORE = 1.473972E+00
 TREND TEST STATISTIC = 2.776402E-01
 UNADJUSTED ONE-TAILED P-VALUE = 3.906171E-01
 ADJUSTED ONE-TAILED P-VALUE = 3.383525E-01
 TOTAL VARIANCE = 1.833808E+02
 CHI-SQUARE TEST FOR HOMOGENEITY = 3.993554E+00

OBSERVED FREQUENCIES	1.700000E+01	0.000000E+00	0.000000E+00	1.000000E+00
EXPECTED FREQUENCIES	1.534520E+01	1.460949E+00	8.686132E-01	3.252356E-01
RELATIVE RISKS	3.211786E+00	0.000000E+00	0.000000E+00	3.270506E+00
RELATIVE RISKS LBND	4.440510E-01	0.000000E+00	0.000000E+00	4.819858E-01
RELATIVE RISKS UBND	2.323059E+01	0.000000E+00	0.000000E+00	2.219196E+01
NORMAL TEST STATISTIC	1.155833E+00	-1.283141E+00	-9.719334E-01	1.212925E+00

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

STOMACH (151)

NUMBER OF DEATHS = 23
 OBSERVED MEAN SCORE = 2.930220E+00
 EXPECTED MEAN SCORE = 1.841094E+00
 TREND TEST STATISTIC = 1.346813E+00
 UNADJUSTED ONE-TAILED P-VALUE = 8.905315E-02
 ADJUSTED ONE-TAILED P-VALUE = 1.002516E-01
 TOTAL VARIANCE = 3.459373E+02
 CHI-SQUARE TEST FOR HOMOGENEITY = 2.802896E+00

OBSERVED FREQUENCIES	1.800000E+01	2.000000E+00	1.000000E+00	2.000000E+00
EXPECTED FREQUENCIES	1.867924E+01	2.330823E+00	1.312676E+00	6.772664E-01
RELATIVE RISKS	8.179418E-01	8.427520E-01	7.430485E-01	3.410635E+00
RELATIVE RISKS LBND	2.883590E-01	1.984750E-01	9.616202E-02	8.018890E-01
RELATIVE RISKS UBND	2.320125E+00	3.578440E+00	5.741572E+00	1.450629E+01
NORMAL TEST STATISTIC	-3.778009E-01	-2.318946E-01	-2.846875E-01	1.661082E+00

LARGE INTESTINE (153)

NUMBER OF DEATHS = 51
 OBSERVED MEAN SCORE = 9.506602E-01
 EXPECTED MEAN SCORE = 1.541093E+00
 TREND TEST STATISTIC = -1.246213E+00
 UNADJUSTED ONE-TAILED P-VALUE = 8.936144E-01
 ADJUSTED ONE-TAILED P-VALUE = 9.058013E-01
 TOTAL VARIANCE = 5.838442E+02
 CHI-SQUARE TEST FOR HOMOGENEITY = 2.749744E+00

OBSERVED FREQUENCIES	4.400000E+01	6.000000E+00	1.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	4.335670E+01	4.189567E+00	2.330012E+00	1.123726E+00
RELATIVE RISKS	1.117573E+00	1.508963E+00	4.166086E-01	0.000000E+00
RELATIVE RISKS LBND	4.928006E-01	6.388952E-01	6.309628E-02	0.000000E+00
RELATIVE RISKS UBND	2.534433E+00	3.563916E+00	2.750760E+00	0.000000E+00
NORMAL TEST STATISTIC	2.660846E-01	9.382745E-01	-9.092478E-01	-1.095101E+00

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

RECTUM (154)

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NUMBER OF DEATHS           =           16
OBSERVED MEAN SCORE        =  1.151781E+00
EXPECTED MEAN SCORE        =  1.667137E+00
TREND TEST STATISTIC       = -5.733816E-01
UNADJUSTED ONE-TAILED P-VALUE =  7.167573E-01
ADJUSTED ONE-TAILED P-VALUE =  6.689884E-01
TOTAL VARIANCE             =  2.068080E+02
CHI-SQUARE TEST FOR HOMOGENEITY =  5.741913E-01

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OBSERVED FREQUENCIES  1.400000E+01  1.000000E+00  1.000000E+00  0.000000E+00
EXPECTED FREQUENCIES  1.345812E+01  1.306875E+00  8.213877E-01  4.136222E-01
RELATIVE RISKS        1.375096E+00  7.399993E-01  1.268534E+00  0.000000E+00
RELATIVE RISKS LBND   2.860805E-01  9.444101E-02  1.345363E-01  0.000000E+00
RELATIVE RISKS UBND   6.609636E+00  5.798316E+00  1.196093E+01  0.000000E+00
NORMAL TEST STATISTIC  3.976455E-01 -2.866738E-01  2.077785E-01 -6.669164E-01

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PANCREAS (157)

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NUMBER OF DEATHS           =           34
OBSERVED MEAN SCORE        =  1.820518E+00
EXPECTED MEAN SCORE        =  1.555683E+00
TREND TEST STATISTIC       =  4.647399E-01
UNADJUSTED ONE-TAILED P-VALUE =  3.210841E-01
ADJUSTED ONE-TAILED P-VALUE =  2.931875E-01
TOTAL VARIANCE             =  3.753933E+02
CHI-SQUARE TEST FOR HOMOGENEITY =  2.236319E-01

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OBSERVED FREQUENCIES  2.800000E+01  3.000000E+00  2.000000E+00  1.000000E+00
EXPECTED FREQUENCIES  2.856905E+01  3.052424E+00  1.687518E+00  6.910019E-01
RELATIVE RISKS        8.720492E-01  9.797587E-01  1.201093E+00  1.470180E+00
RELATIVE RISKS LBND   3.364735E-01  2.808199E-01  2.883347E-01  2.034209E-01
RELATIVE RISKS UBND   2.260118E+00  3.418302E+00  5.003300E+00  1.062540E+01
NORMAL TEST STATISTIC -2.817757E-01 -3.207435E-02  2.516951E-01  3.819040E-01

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RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

ALL OTHER CANCERS (160-1,163,170-3,186-7,190,193-9)

NUMBER OF DEATHS	=	52
OBSERVED MEAN SCORE	=	1.613249E+00
EXPECTED MEAN SCORE	=	1.823216E+00
TREND TEST STATISTIC	=	-4.015524E-01
UNADJUSTED ONE-TAILED P-VALUE	=	6.559854E-01
ADJUSTED ONE-TAILED P-VALUE	=	6.270502E-01
TOTAL VARIANCE	=	7.393069E+02
CHI-SQUARE TEST FOR HOMOGENEITY	=	1.635214E-01

OBSERVED FREQUENCIES	4.300000E+01	5.000000E+00	3.000000E+00	1.000000E+00
EXPECTED FREQUENCIES	4.221653E+01	5.146604E+00	3.233085E+00	1.403783E+00
RELATIVE RISKS	1.120721E+00	9.674321E-01	9.209498E-01	6.935410E-01
RELATIVE RISKS LBND	5.185478E-01	3.767332E-01	2.812768E-01	9.024372E-02
RELATIVE RISKS UBND	2.422181E+00	2.484317E+00	3.015351E+00	5.330001E+00
NORMAL TEST STATISTIC	2.898500E-01	-6.881048E-02	-1.360847E-01	-3.517154E-01

LUNG (162)

NUMBER OF DEATHS	=	152
OBSERVED MEAN SCORE	=	2.324907E+00
EXPECTED MEAN SCORE	=	2.065086E+00
TREND TEST STATISTIC	=	7.663189E-01
UNADJUSTED ONE-TAILED P-VALUE	=	2.218139E-01
ADJUSTED ONE-TAILED P-VALUE	=	2.169881E-01
TOTAL VARIANCE	=	2.655935E+03
CHI-SQUARE TEST FOR HOMOGENEITY	=	5.027552E+00

OBSERVED FREQUENCIES	1.100000E+02	2.300000E+01	1.400000E+01	5.000000E+00
EXPECTED FREQUENCIES	1.198385E+02	1.666103E+01	1.013538E+01	5.365156E+00
RELATIVE RISKS	6.737381E-01	1.471953E+00	1.439758E+00	9.272803E-01
RELATIVE RISKS LBND	4.617318E-01	9.355650E-01	8.225660E-01	3.748990E-01
RELATIVE RISKS UBND	9.830882E-01	2.315867E+00	2.520045E+00	2.293548E+00
NORMAL TEST STATISTIC	-2.048474E+00	1.671945E+00	1.276115E+00	-1.634043E-01

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

BREAST (174)

NUMBER OF DEATHS	=	1
OBSERVED MEAN SCORE	=	4.896379E-01
EXPECTED MEAN SCORE	=	9.381688E-01
TREND TEST STATISTIC	=	-2.782629E-01
UNADJUSTED ONE-TAILED P-VALUE	=	6.096218E-01
ADJUSTED ONE-TAILED P-VALUE	=	2.349172E-01
TOTAL VARIANCE	=	2.598208E+00
CHI-SQUARE TEST FOR HOMOGENEITY	=	7.812500E-02

OBSERVED FREQUENCIES	1.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	9.056604E-01	5.660377E-02	3.773585E-02	0.000000E+00
NORMAL TEST STATISTIC	3.227486E-01	-2.449490E-01	-1.980295E-01	0.000000E+00

PROSTATE (185)

NUMBER OF DEATHS	=	39
OBSERVED MEAN SCORE	=	1.099180E+00
EXPECTED MEAN SCORE	=	1.830778E+00
TREND TEST STATISTIC	=	-1.149063E+00
UNADJUSTED ONE-TAILED P-VALUE	=	8.746830E-01
ADJUSTED ONE-TAILED P-VALUE	=	8.822471E-01
TOTAL VARIANCE	=	6.165760E+02
CHI-SQUARE TEST FOR HOMOGENEITY	=	1.439122E+00

OBSERVED FREQUENCIES	3.400000E+01	3.000000E+00	2.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	3.234089E+01	3.276388E+00	2.139568E+00	1.243157E+00
RELATIVE RISKS	1.506223E+00	9.027211E-01	9.263952E-01	0.000000E+00
RELATIVE RISKS LBND	5.078298E-01	2.609028E-01	2.062975E-01	0.000000E+00
RELATIVE RISKS UBND	4.467459E+00	3.123406E+00	4.160051E+00	0.000000E+00
NORMAL TEST STATISTIC	7.384254E-01	-1.616008E-01	-9.976850E-02	-1.152990E+00

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

BLADDER & URINARY (188-9)

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NUMBER OF DEATHS           =           17
OBSERVED MEAN SCORE        =  1.112831E+00
EXPECTED MEAN SCORE        =  1.395479E+00
TREND TEST STATISTIC       = -3.768041E-01
UNADJUSTED ONE-TAILED P-VALUE =  6.468397E-01
ADJUSTED ONE-TAILED P-VALUE =  5.754958E-01
TOTAL VARIANCE             =  1.626135E+02
CHI-SQUARE TEST FOR HOMOGENEITY =  5.352263E-01

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OBSERVED FREQUENCIES	1.500000E+01	1.000000E+00	1.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	1.467892E+01	1.329416E+00	6.931067E-01	2.985588E-01
RELATIVE RISKS	1.211519E+00	7.225786E-01	1.480194E+00	0.000000E+00
RELATIVE RISKS LBND	2.513332E-01	8.835857E-02	1.990417E-01	0.000000E+00
RELATIVE RISKS UBND	5.839973E+00	5.909102E+00	1.100761E+01	0.000000E+00
NORMAL TEST STATISTIC	2.391044E-01	-3.030618E-01	3.831010E-01	-5.617968E-01

BRAIN (191-2)

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NUMBER OF DEATHS           =           15
OBSERVED MEAN SCORE        =  1.006352E+00
EXPECTED MEAN SCORE        =  1.759978E+00
TREND TEST STATISTIC       = -8.162230E-01
UNADJUSTED ONE-TAILED P-VALUE =  7.927420E-01
ADJUSTED ONE-TAILED P-VALUE =  7.722049E-01
TOTAL VARIANCE             =  1.918125E+02
CHI-SQUARE TEST FOR HOMOGENEITY =  2.776671E+00

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OBSERVED FREQUENCIES	1.200000E+01	3.000000E+00	0.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	1.212535E+01	1.527101E+00	1.027148E+00	3.204029E-01
RELATIVE RISKS	9.505571E-01	2.175247E+00	0.000000E+00	0.000000E+00
RELATIVE RISKS LBND	2.930262E-01	6.546801E-01	0.000000E+00	0.000000E+00
RELATIVE RISKS UBND	3.083542E+00	7.227498E+00	0.000000E+00	0.000000E+00
NORMAL TEST STATISTIC	-8.445526E-02	1.268539E+00	-1.061561E+00	-5.763569E-01

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

LYMPHOSARCOMA (200)

NUMBER OF DEATHS = 13
 OBSERVED MEAN SCORE = 1.503319E+00
 EXPECTED MEAN SCORE = 1.693167E+00
 TREND TEST STATISTIC = -2.007466E-01
 UNADJUSTED ONE-TAILED P-VALUE = 5.795950E-01
 ADJUSTED ONE-TAILED P-VALUE = 5.082139E-01
 TOTAL VARIANCE = 1.511486E+02
 CHI-SQUARE TEST FOR HOMOGENEITY = 7.103999E-01

OBSERVED FREQUENCIES	1.000000E+01	2.000000E+00	1.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	1.058341E+01	1.420938E+00	6.987175E-01	2.969379E-01
RELATIVE RISKS	7.614824E-01	1.490017E+00	1.473354E+00	0.000000E+00
RELATIVE RISKS LBND	2.308635E-01	3.391553E-01	1.972836E-01	0.000000E+00
RELATIVE RISKS UBND	2.511681E+00	6.546120E+00	1.100331E+01	0.000000E+00
NORMAL TEST STATISTIC	-4.475102E-01	5.280941E-01	3.777783E-01	-5.723923E-01

HODGKIN'S DISEASE (201)

NUMBER OF DEATHS = 6
 OBSERVED MEAN SCORE = 4.896379E-01
 EXPECTED MEAN SCORE = 1.385803E+00
 TREND TEST STATISTIC = -7.751489E-01
 UNADJUSTED ONE-TAILED P-VALUE = 7.808033E-01
 ADJUSTED ONE-TAILED P-VALUE = 7.293989E-01
 TOTAL VARIANCE = 4.811806E+01
 CHI-SQUARE TEST FOR HOMOGENEITY = 1.157359E+00

OBSERVED FREQUENCIES	6.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	5.082157E+00	5.412361E-01	3.051906E-01	7.141691E-02
RELATIVE RISKS	3.849715E+06	0.000000E+00	0.000000E+00	0.000000E+00
RELATIVE RISKS LBND	3.828108E-06	0.000000E+00	0.000000E+00	0.000000E+00
RELATIVE RISKS UBND	3.871445E+18	0.000000E+00	0.000000E+00	0.000000E+00
NORMAL TEST STATISTIC	1.075401E+00	-7.772295E-01	-5.786070E-01	-2.712275E-01

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

OTHER LYMPHATIC NEOPLASMS (202,208-9)

NUMBER OF DEATHS	=	6
OBSERVED MEAN SCORE	=	4.896379E-01
EXPECTED MEAN SCORE	=	1.793769E+00
TREND TEST STATISTIC	=	-8.401386E-01
UNADJUSTED ONE-TAILED P-VALUE	=	7.995129E-01
ADJUSTED ONE-TAILED P-VALUE	=	7.625324E-01
TOTAL VARIANCE	=	8.674473E+01
CHI-SQUARE TEST FOR HOMOGENEITY	=	1.456770E+00

OBSERVED FREQUENCIES	6.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	4.888952E+00	6.171119E-01	3.251053E-01	1.688308E-01
RELATIVE RISKS	4.660073E+06	0.000000E+00	0.000000E+00	0.000000E+00
RELATIVE RISKS LBND	6.849656E-05	0.000000E+00	0.000000E+00	0.000000E+00
RELATIVE RISKS UBND	3.170429E+17	0.000000E+00	0.000000E+00	0.000000E+00
NORMAL TEST STATISTIC	1.206534E+00	-8.355736E-01	-5.941058E-01	-4.238072E-01

MULTIPLE MYELOMA (203)

NUMBER OF DEATHS	=	7
OBSERVED MEAN SCORE	=	5.846665E+00
EXPECTED MEAN SCORE	=	1.262257E+00
TREND TEST STATISTIC	=	4.519057E+00
UNADJUSTED ONE-TAILED P-VALUE	=	3.099442E-06
ADJUSTED ONE-TAILED P-VALUE	=	1.103023E-03
TOTAL VARIANCE	=	5.042746E+01
CHI-SQUARE TEST FOR HOMOGENEITY	=	2.413103E+01

OBSERVED FREQUENCIES	4.000000E+00	0.000000E+00	2.000000E+00	1.000000E+00
EXPECTED FREQUENCIES	6.032353E+00	6.185393E-01	2.738355E-01	7.527228E-02
RELATIVE RISKS	1.667236E-01	0.000000E+00	1.204375E+01	2.371498E+01
RELATIVE RISKS LBND	3.540778E-02	0.000000E+00	2.857560E+00	3.875204E+00
RELATIVE RISKS UBND	7.850466E-01	0.000000E+00	5.076071E+01	1.451280E+02
NORMAL TEST STATISTIC	-2.266146E+00	-8.298516E-01	3.390537E+00	3.425636E+00

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

OTHER LEUKEMIA (204,206-7)

 NUMBER OF DEATHS = 6
 OBSERVED MEAN SCORE = 4.896379E-01
 EXPECTED MEAN SCORE = 1.431833E+00
 TREND TEST STATISTIC = -7.832540E-01
 UNADJUSTED ONE-TAILED P-VALUE = 7.831898E-01
 ADJUSTED ONE-TAILED P-VALUE = 7.306461E-01
 TOTAL VARIANCE = 5.209299E+01
 CHI-SQUARE TEST FOR HOMOGENEITY = 1.214306E+00

OBSERVED FREQUENCIES	6.000000E+00	0.000000E+00	0.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	5.091252E+00	5.183588E-01	3.022739E-01	8.811566E-02
RELATIVE RISKS	5.082089E+06	0.000000E+00	0.000000E+00	0.000000E+00
RELATIVE RISKS LBND	5.852285E-06	0.000000E+00	0.000000E+00	0.000000E+00
RELATIVE RISKS UBND	4.413257E+18	0.000000E+00	0.000000E+00	0.000000E+00
NORMAL TEST STATISTIC	1.100943E+00	-7.654911E-01	-5.823293E-01	-3.040275E-01

MYELOID LEUKEMIA (205)

 NUMBER OF DEATHS = 8
 OBSERVED MEAN SCORE = 3.497303E+00
 EXPECTED MEAN SCORE = 2.579688E+00
 TREND TEST STATISTIC = 5.348846E-01
 UNADJUSTED ONE-TAILED P-VALUE = 2.964067E-01
 ADJUSTED ONE-TAILED P-VALUE = 2.688186E-01
 TOTAL VARIANCE = 1.883568E+02
 CHI-SQUARE TEST FOR HOMOGENEITY = 1.708801E+00

OBSERVED FREQUENCIES	6.000000E+00	1.000000E+00	0.000000E+00	1.000000E+00
EXPECTED FREQUENCIES	5.896417E+00	9.858208E-01	7.301970E-01	3.875666E-01
RELATIVE RISKS	1.068924E+00	1.015146E+00	0.000000E+00	2.982952E+00
RELATIVE RISKS LBND	2.302877E-01	1.485441E-01	0.000000E+00	3.669863E-01
RELATIVE RISKS UBND	4.961615E+00	6.937483E+00	0.000000E+00	2.424614E+01
NORMAL TEST STATISTIC	8.510255E-02	1.533054E-02	-9.030613E-01	1.022319E+00

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

INFECTIOUS (1-136)

 NUMBER OF DEATHS = 6
 OBSERVED MEAN SCORE = 9.202325E-01
 EXPECTED MEAN SCORE = 2.481569E+00
 TREND TEST STATISTIC = -7.936050E-01
 UNADJUSTED ONE-TAILED P-VALUE = 7.862158E-01
 ADJUSTED ONE-TAILED P-VALUE = 7.510999E-01
 TOTAL VARIANCE = 1.393435E+02
 CHI-SQUARE TEST FOR HOMOGENEITY = 9.097429E-01

OBSERVED FREQUENCIES	5.000000E+00	1.000000E+00	0.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	4.490551E+00	7.682626E-01	4.419899E-01	2.991966E-01
RELATIVE RISKS	1.688721E+00	1.358989E+00	0.000000E+00	0.000000E+00
RELATIVE RISKS LBND	2.185054E-01	1.684281E-01	0.000000E+00	0.000000E+00
RELATIVE RISKS UBND	1.305129E+01	1.096522E+01	0.000000E+00	0.000000E+00
NORMAL TEST STATISTIC	5.022131E-01	2.879388E-01	-7.041661E-01	-5.679103E-01

ENDOCRINE (240-79)

 NUMBER OF DEATHS = 41
 OBSERVED MEAN SCORE = 1.984061E+00
 EXPECTED MEAN SCORE = 1.725576E+00
 TREND TEST STATISTIC = 4.474491E-01
 UNADJUSTED ONE-TAILED P-VALUE = 3.272961E-01
 ADJUSTED ONE-TAILED P-VALUE = 3.021213E-01
 TOTAL VARIANCE = 5.609840E+02
 CHI-SQUARE TEST FOR HOMOGENEITY = 1.385228E+00

OBSERVED FREQUENCIES	3.300000E+01	3.000000E+00	4.000000E+00	1.000000E+00
EXPECTED FREQUENCIES	3.399444E+01	3.627538E+00	2.320543E+00	1.057479E+00
RELATIVE RISKS	8.376199E-01	8.101261E-01	1.837582E+00	9.431806E-01
RELATIVE RISKS LBND	3.738810E-01	2.488525E-01	6.540661E-01	1.278957E-01
RELATIVE RISKS UBND	1.876552E+00	2.637323E+00	5.162639E+00	6.955587E+00
NORMAL TEST STATISTIC	-4.305510E-01	-3.496549E-01	1.154469E+00	-5.738375E-02

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

BLOOD (280-9)

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NUMBER OF DEATHS           =           3
OBSERVED MEAN SCORE        =  7.648891E+00
EXPECTED MEAN SCORE        =  2.111725E+00
TREND TEST STATISTIC       =  2.244198E+00
UNADJUSTED ONE-TAILED P-VALUE =  1.240826E-02
ADJUSTED ONE-TAILED P-VALUE =  3.705363E-02
TOTAL VARIANCE             =  5.478923E+01
CHI-SQUARE TEST FOR HOMOGENEITY =  7.894232E+00

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```

OBSERVED FREQUENCIES      2.000000E+00  0.000000E+00  0.000000E+00  1.000000E+00
EXPECTED FREQUENCIES      2.367005E+00  3.113987E-01  2.112880E-01  1.103082E-01
RELATIVE RISKS            5.135173E-01  0.000000E+00  0.000000E+00  1.235247E+01
RELATIVE RISKS LBND      4.542609E-02  0.000000E+00  0.000000E+00  2.085968E+00
RELATIVE RISKS UBND      5.805034E+00  0.000000E+00  0.000000E+00  7.314751E+01
NORMAL TEST STATISTIC     -5.386302E-01 -5.926172E-01 -4.853650E-01  2.770210E+00

```

MENTAL (290-315)

```

NUMBER OF DEATHS           =           12
OBSERVED MEAN SCORE        =  2.947011E+00
EXPECTED MEAN SCORE        =  1.999072E+00
TREND TEST STATISTIC       =  7.863119E-01
UNADJUSTED ONE-TAILED P-VALUE =  2.159137E-01
ADJUSTED ONE-TAILED P-VALUE =  2.066495E-01
TOTAL VARIANCE             =  2.092828E+02
CHI-SQUARE TEST FOR HOMOGENEITY =  1.994913E+00

```

```

OBSERVED FREQUENCIES      1.000000E+01  0.000000E+00  1.000000E+00  1.000000E+00
EXPECTED FREQUENCIES      9.702197E+00  1.125439E+00  7.406365E-01  4.317271E-01
RELATIVE RISKS            1.207856E+00  0.000000E+00  1.393468E+00  2.695889E+00
RELATIVE RISKS LBND      2.439196E-01  0.000000E+00  1.799059E-01  3.087624E-01
RELATIVE RISKS UBND      5.981134E+00  0.000000E+00  1.079317E+01  2.353855E+01
NORMAL TEST STATISTIC     2.313715E-01 -1.134626E+00  3.176759E-01  8.970312E-01

```

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

NERVOUS & SENSORY (320-89)

```

NUMBER OF DEATHS           =           17
OBSERVED MEAN SCORE        =  2.847448E+00
EXPECTED MEAN SCORE        =  1.925955E+00
TREND TEST STATISTIC       =  9.478530E-01
UNADJUSTED ONE-TAILED P-VALUE =  1.716704E-01
ADJUSTED ONE-TAILED P-VALUE =  1.701998E-01
TOTAL VARIANCE             =  2.731490E+02
CHI-SQUARE TEST FOR HOMOGENEITY =  1.766550E+00

```

```

OBSERVED FREQUENCIES  1.300000E+01  1.000000E+00  2.000000E+00  1.000000E+00
EXPECTED FREQUENCIES  1.360439E+01  1.836966E+00  1.025074E+00  5.335699E-01
RELATIVE RISKS        7.919396E-01  4.844627E-01  2.113961E+00  2.002754E+00
RELATIVE RISKS LBND  2.394663E-01  5.735486E-02  4.901460E-01  2.528638E-01
RELATIVE RISKS UBND  2.619026E+00  4.092139E+00  9.117343E+00  1.586240E+01
NORMAL TEST STATISTIC -3.822590E-01 -6.656916E-01  1.003810E+00  6.577982E-01

```

CIRCULATORY (390-458)

```

NUMBER OF DEATHS           =           1263
OBSERVED MEAN SCORE        =  1.586263E+00
EXPECTED MEAN SCORE        =  1.647070E+00
TREND TEST STATISTIC       = -6.099998E-01
UNADJUSTED ONE-TAILED P-VALUE =  7.290133E-01
ADJUSTED ONE-TAILED P-VALUE =  7.250146E-01
TOTAL VARIANCE             =  1.585095E+04
CHI-SQUARE TEST FOR HOMOGENEITY =  1.059897E+00

```

```

OBSERVED FREQUENCIES  1.063000E+03  1.070000E+02  6.600000E+01  2.700000E+01
EXPECTED FREQUENCIES  1.054703E+03  1.140282E+02  6.367231E+01  3.059799E+01
RELATIVE RISKS        1.054730E+00  9.308625E-01  1.040135E+00  8.748019E-01
RELATIVE RISKS LBND  9.009355E-01  7.621803E-01  8.076839E-01  5.922639E-01
RELATIVE RISKS UBND  1.234778E+00  1.136877E+00  1.339484E+00  1.292124E+00
NORMAL TEST STATISTIC  6.626517E-01 -7.023589E-01  3.049262E-01 -6.721411E-01

```

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

RESPIRATORY(460-519)

 NUMBER OF DEATHS = 122
 OBSERVED MEAN SCORE = 1.731772E+00
 EXPECTED MEAN SCORE = 1.556239E+00
 TREND TEST STATISTIC = 5.584219E-01
 UNADJUSTED ONE-TAILED P-VALUE = 2.883249E-01
 ADJUSTED ONE-TAILED P-VALUE = 2.751925E-01
 TOTAL VARIANCE = 1.470664E+03
 CHI-SQUARE TEST FOR HOMOGENEITY = 2.072628E+00

OBSERVED FREQUENCIES	1.010000E+02	1.300000E+01	4.000000E+00	4.000000E+00
EXPECTED FREQUENCIES	1.038885E+02	9.791576E+00	5.484817E+00	2.835062E+00
RELATIVE RISKS	8.191175E-01	1.385334E+00	7.091138E-01	1.456851E+00
RELATIVE RISKS LBND	4.928353E-01	7.689337E-01	2.551398E-01	5.179315E-01
RELATIVE RISKS UBND	1.361415E+00	2.495858E+00	1.970850E+00	4.097870E+00
NORMAL TEST STATISTIC	-7.697516E-01	1.085194E+00	-6.590941E-01	7.131224E-01

DIGESTIVE (520-77)

 NUMBER OF DEATHS = 95
 OBSERVED MEAN SCORE = 1.720004E+00
 EXPECTED MEAN SCORE = 1.778967E+00
 TREND TEST STATISTIC = -1.536891E-01
 UNADJUSTED ONE-TAILED P-VALUE = 5.611203E-01
 ADJUSTED ONE-TAILED P-VALUE = 5.355694E-01
 TOTAL VARIANCE = 1.328359E+03
 CHI-SQUARE TEST FOR HOMOGENEITY = 1.850110E+00

OBSERVED FREQUENCIES	7.800000E+01	1.100000E+01	3.000000E+00	3.000000E+00
EXPECTED FREQUENCIES	7.776900E+01	9.021192E+00	5.728725E+00	2.481088E+00
RELATIVE RISKS	1.017590E+00	1.254897E+00	4.962852E-01	1.221172E+00
RELATIVE RISKS LBND	5.953414E-01	6.646061E-01	1.569895E-01	3.847862E-01
RELATIVE RISKS UBND	1.739321E+00	2.369473E+00	1.568889E+00	3.875558E+00
NORMAL TEST STATISTIC	6.375664E-02	7.001492E-01	-1.193065E+00	3.391091E-01

RESULTS OF ANALYSES BASED ON GROUPED EXPOSURE DATA

RESIDUAL (210-39,580-799)

```

NUMBER OF DEATHS           =           43
OBSERVED MEAN SCORE        =  1.162644E+00
EXPECTED MEAN SCORE        =  1.525464E+00
TREND TEST STATISTIC       = -7.130120E-01
UNADJUSTED ONE-TAILED P-VALUE =  7.620133E-01
ADJUSTED ONE-TAILED P-VALUE =  7.421056E-01
TOTAL VARIANCE             =  4.787684E+02
CHI-SQUARE TEST FOR HOMOGENEITY =  1.672708E+00

```

OBSERVED FREQUENCIES	3.600000E+01	5.000000E+00	2.000000E+00	0.000000E+00
EXPECTED FREQUENCIES	3.668418E+01	3.450305E+00	1.924580E+00	9.409350E-01
RELATIVE RISKS	8.640640E-01	1.567987E+00	1.042591E+00	0.000000E+00
RELATIVE RISKS LBND	3.456057E-01	5.781956E-01	2.476843E-01	0.000000E+00
RELATIVE RISKS UBND	2.160285E+00	4.252163E+00	4.388638E+00	0.000000E+00
NORMAL TEST STATISTIC	-3.125150E-01	8.836826E-01	5.687739E-02	-1.008087E+00

EXTERNAL (800-999)

```

NUMBER OF DEATHS           =           165
OBSERVED MEAN SCORE        =  1.291625E+00
EXPECTED MEAN SCORE        =  1.563660E+00
TREND TEST STATISTIC       = -1.071584E+00
UNADJUSTED ONE-TAILED P-VALUE =  8.579873E-01
ADJUSTED ONE-TAILED P-VALUE =  8.599494E-01
TOTAL VARIANCE             =  1.754546E+03
CHI-SQUARE TEST FOR HOMOGENEITY =  1.595055E+00

```

OBSERVED FREQUENCIES	1.400000E+02	1.500000E+01	9.000000E+00	1.000000E+00
EXPECTED FREQUENCIES	1.375899E+02	1.556326E+01	8.720366E+00	3.126421E+00
RELATIVE RISKS	1.132640E+00	9.583126E-01	1.035303E+00	3.012903E-01
RELATIVE RISKS LBND	7.142925E-01	5.541807E-01	5.215160E-01	4.517477E-02
RELATIVE RISKS UBND	1.796006E+00	1.657154E+00	2.055264E+00	2.009437E+00
NORMAL TEST STATISTIC	5.295296E-01	-1.523861E-01	9.916934E-02	-1.239173E+00

MOX FINISHED AT 12:21:46 ON 4-NOV-83

ELAPSED TIME IS 1241.83

APPENDIX I. CAUSES OF DEATH

Cause	* order in Summary	Eighth Revision ICD Code(s)
All Causes	1	0-999
None (No Death Certificate)	2	0
All Non-Cancers	3	<140 , >209
All Malignant Neoplasms	4	140-209
Buccal	5	140-149
Other Digestive	6	150, 152, 154-6, 158-9
Stomach	7	151
Large Intestine	8	153
Pancreas	9	157
All Other Cancers	10	160-1, 163, 170-3, 186-7, 190, 193-9
Lung	11	162
Breast	12	174
Cervix	13	180
Uterus	14	181-2
Other Female	15	183-4
Prostate	16	185
Bladder and Urinary	17	188-9
Brain	18	191-2
Lymphosarcoma	19	200
Hodgkin's	20	201
Other Lymphatic Neoplasms	21	202, 208-9

* If there are not any deaths occurring from a particular cause, the cause is omitted from the summaries.

Cause	* order in Summary	Eighth Revision ICD Code(s)
Multiple Myeloma	22	203
Other Leukemia	23	204, 206-7
Myeloid Leukemia	24	205
Infectious	25	1-136
Endocrine	26	240-79
Blood	27	280-9
Mental	28	290-315
Nervous and Sense	29	320-89
Circulatory	30	390-458
Respiratory	31	460-519
Digestive	32	520-577
Residual	33	210-39, 580-799
External	34	800-999

* If there are not any deaths occurring from a particular cause, the cause is omitted from the summaries.

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