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MORTALITY ANALYSIS USING MONSON'S COMPUTER PROGRAM

by

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This document was prepared as part of a contract with Statistics Canada. The aim of the project is to make the Monson's computer routine compatible to work with Canadian Mortality data. The purpose of this document is to describe how the routine works and to advise potential users of its availability. The following persons were associated in the preparation of this document: M. Smith, P. Lalonde and G. Quesnel. The author wishes to thank referees from within Statistics Canada and outside whose comments have significantly enhanced this report.

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Mortality Analysis Using Monson's Computer Program

Introduction:

In a study of mortality of a well defined group (e.g. workers in a particular industry over a specified period), the investigator is concerned with the total number of deaths or deaths from specific cause (e.g. lung cancer) in relation to what might have occurred in the same group if it was similar to the general population or another well defined comparison group.

The method of analysis is known as Stardardised Mortality Analysis. Monson(1)* developed a computer program for performing the analysis based on U.S. general mortality and causes of death consolidated into a grouping of 61 codes. Monson's computer program has been modified and updated to be used with Canadian mortality data and the cause-specific analysis has been expanded in accordance with the 174 codes of death developed by the LCDC, Health and Welfare Canada. This manual is written to introduce the use of the modified Monson's Computer Program for performing Standardised Mortality Analysis.

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Though the revised program can be used independently, it is particularly useful for studies using mortality linkage with the Canadian Mortality Data Base [CMDB]. Typically in such studies the user has a clearly defined study population spanning a specified time period which is computer linked with the (CMDB) to identify the deaths that have occurred along with the causes of death. The age-sex distribution of the study population is compared with the

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* The numbers refer to the References.

age-sex-time specific mortality rates of the Canadian population to derive the expected number of deaths, both total and specified causes, that should have occurred in the study population under normal circumstances. Statistical tests are used to evaluate the significance of the divergence among the observed and expected deaths.

An annotated example of the use of the computer program to investigate the mortality among Canadian Veterans exposed to low dose radiation is considered. The example is designed to illustrate the use of the program to explain the different options in the analysis and the setting up of the control cards needed.

The computer program operational at present performs the estimation of relative survival as described by Monson. The segment relating to Proportional Mortality Analysis will be made available some time in the future. Consequently, the current user should have sufficient information on his data files to calculate the time-specific person years of exposure. This implies that information should be available for the participants on the date of entry into the study and the date of exit from the study (if applicable). To ensure the compatibility of the data for this analysis, the user is encouraged to discuss the design of the data collection scheme with Statistics Canada before embarking on his study.

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Object

The object of standardised mortality analysis is to investigate the mortality experience of a "Study" population in comparison with a "Control" population.

Definitions

The "Study" population refers to the population of interest whose mortality is to be investigated. It must be a well defined group of persons sharing a common characteristic. For example, it could be a group of persons belonging to a specified occupational category. Or it could be a group exposed to a substance that is a determinant of the mortality outcome of interest. It is possible for the exposure to have taken place at one point in time or over a period of time. Such groups are referred to as an exposed cohort or "exposed" for short. The term "cohort" is broadly used to denote a group of persons who are followed up over a period of time.

The "Control" population refers to a well-defined group of persons suitably chosen with whom the mortality experience of the study population is to be compared. Ideally the control population should be similar to the study population in respect of all characteristics that influence mortality, other than exposure or the characteristic that was used to distinguish between the two groups. Since this is not always feasible, the control population is usually chosen to be the general population of the country or parts of it. For Canadian mortality studies the natural choice of control population could be the total Canadian population referring to the same time period as the study population. If the study population was confined to a particular

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province of Canada, then it is advisable to choose the contemporary population of the same province as the control population.

Since mortality is strongly affected by both age and sex, it is necessary for the control group to be similar to the study group in age and sex composition. It is not necessary for the study and control populations to be of the same size. Since the general population will not in general have the same age and sex composition as the study population, the mortality analysis should adjust for the difference in those factors. The computer program described herein performs the mortality analysis with the Canadian general population as the control group using the technique called 'indirect adjustment'.

If the user had selected a control population other than the Canadian general population or parts thereof; for example, in an occupational mortality study by choosing the control as the persons working in a related occupational category; the analysis is performed by using the technique of 'direct adjustment'. The term direct adjustment should however not be confused with the method of direct standardisation of mortality used in epidemiology. The only difference between indirect and direct adjustment is in the choice of the control population; the former using the national population and the latter using a selected population determined by the researcher. Monson's computer program can be used to perform direct adjustment as shown in Appendix 1. It is easy to use this program to calculate the expected number of deaths or SMR by direct standardisation. This is done by interchanging the exposed and control groups so that the first set of option cards belong to the exposed and the next to the control. The implications are discussed in Appendix 1 and the card set up is shown in Appendix 2.

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Even in cases where a separate control population has been selected by the investigator, it is useful to compare the mortality in the study population with the Canadian general mortality which often provides useful clues to the nature of differences in risks for both general mortality and cause-specific mortality. The emphasis in this manual is on the technique of indirect adjustment and its use in conjunction with mortality linkage using CMDB.

Rationale

Risk of mortality in a study population depends on its age and sex distribution, place of residence and the calendar years under consideration in addition to other special characteristics such as occupation, ethnic composition, etc. If the control population is similar to the study population on general demographic characteristics but differs on the factor of exposure under consideration, then the mortality experience of the study population due to exposure can be evaluated by comparing the mortality experiences of the two populations. To enable the comparison, the age-sex-calendar time specific mortality rates derived from the control population are applied to the corresponding category of the study population to calculate the expected number of deaths for each category. The expected number of deaths

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are cumulated to calculate the total expected number of deaths in the study population. The ratio of the observed number of deaths in the study population to the calculated expected number of deaths is called the Standardized Mortality Ratio (SMR). This method of computing the SMR is called the indirect method of standardisation. This method forms the basis for the calculations produced from this computer program.

Description of Data Base

The current version of the control data set is made up of the Canadian Mortality rates separated by sex from 1951 to 1982. For example, the five year calendar and age specific male mortality rates are shown in Table 1. For use on data prior to 1950 it is assumed that the mortality rates are frozen at the 1950-54 level. Since mortality has been steadily declining in each age group from the beginning of the century, this assumption will generate an under-estimate in the calculation of the expected deaths prior to 1950. Also beyond 1980-84, the mortality has been assumed to be frozen at the 1980-84 level. This will produce an over-estimate in the calculation of the expected deaths. It is safe to use the data set for follow-up studies from 1951 to 1982. For values beyond this range the interpretation of the results should be done with caution.

The Canadian mortality data set will be updated from time to time. Also other provincial data sets will be made available. Users should check with Statistics Canada to choose the appropriate data set for their analysis.

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How to use the Computer Program

The use of the computer program is simple. There are two stages. The first is the preparation of a computer routine called subroutine READIT. This routine is used to describe the layout of the variables in the user data set to select the cases which would be used in the analysis and to check for errors. If the user is not familiar with Fortran computer programming he should seek the assistance of a knowledgeable person in the preparation of subroutine READIT. The second stage is the preparation of the option cards to specify the types of analyses. Several examples of setting up the option cards are shown in Appendix 2.

The writing of the subroutine READIT and the preparation of the options can best be understood by examining the following fully annotated example.

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Annotated Example

The example is based on the mortality study of Canadian military personnel exposed to radiation during Chalk River nuclear reactor clean-ups and the observation of atomic bomb tests during the 1950's. The full report of the study has been published by Raman et al.(2).

Briefly, the exposed population consists of 957 Canadian Veterans who participated in one or more of the following operations: the two major clean-up operations following accidents at the Chalk River Nuclear Laboratories (1953 and 1958) and the observation of atomic bomb tests in Nevada (1955 and 1957) and Australia (1956 and 1957). The data set with the

needed identifiers was linked to the Canadian Mortality Data Base to obtain the mortality status of each individual. This linked data set has been used in the following analysis.

As a first step, the user-written subroutine READIT was prepared. It is shown in Appendix 3. This routine reads the data and provides the variables needed by the main program for further computations. Since this subroutine is user-written it has the flexibility wherein the user can edit the data, check for errors, choose cases that should be used in the analyses, exclude cases based on certain characteristics and perform analyses for a selected cause of mortality, e.g. cancer. The description of the routine using the Internal Statement Numbers (ISN) is shown below.

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Note: Some of the statements and variables used in the subroutine READIT and the option cards are used by other segments of the Monson's Computer Program (e.g. proportional mortality analysis) which are not currently operational. These variables and statements are left in the default state as described herein and the user should not try to modify them.

ISN 1 to 5 — These are always required by the program and should not be changed.

ISN 6 to 7 — Describe the VARIABLES to be read in and the FORMAT of the data. See the listing of the subroutine and the comments in it for a description of the variables.

ISN 8 The variable IEXPCD is used to select the exposed group for the analysis. It should be noted that any subset of the exposed group could have been selected by using IEXPCD in conjunction with the variable IGROUP. It was also possible to select the control group for analysis at this stage. In that case ISN 8 would be:

```
IF(IEXPCD .EQ. 2 .OR. IEXPCD .EQ. 3) GO TO 150
```

ISN 11 NN is a counter variable. If the user wanted to read only 100 cases, he should put in a card after this card as follows:

```
IF (NN .GT. 100) GO TO 900
```

ISN 12 to 15 The Status variable is checked for valid codes. The codes are:

STATUS	3	alive
	6	dead
	9	lost

If these codes were not as stated at this point the user could transform the data appropriately. Also the variable MSGNO can be used by the user to write an appropriate error message. If MSGNO=1, then the case did not have a valid status code and as shown in ISN 37, if MSGNO=2, then the case had died after the study termination date. A listing of these cases may be made for purposes of verification.

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ISN 16 to 82 This segment of the routine defines the variables needed by the program. The user should make sure for his study that he has the information in his data set to generate these required variables. There are two types of variables viz, Descriptive and Analytic.

1. Descriptive

   a. YOB Year of birth. (Calculated in ISN 16)

   b. YIN Year started working or the year the exposure started. (Calculated in ISN 19)

   c. YOUT Year stopped working or the year the exposure ended. It is the date of termination of the follow-up if the person continued alive without being lost until that date. (Calculated in ISN 20)

2. Analytic

   a. YRIN Year the person entered the follow-up. This will be the starting date of the follow-up if the person was exposed before the study started. For this study the starting date has been set at 53 in ISN 39.

   b. AGE Calculated as YRIN-YOB = Age at the time person entered the follow-up. (See ISN 41)

   c. YROUT Year the person left the follow-up. A person leaves the follow-up by death (STATUS=6) or by loss (STATUS=9) or by continuing alive until

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the termination date (STATUS=3). (Calculated in ISN 26). If the official year of death was unknown from Statistics Canada, but was known unofficially from other records, the unofficial values are used. (See ISN 23 to 25)

d. SURV Calculated as YROUT-YRIN = Years followed. (See ISN 51)

e. YRIX Must be set equal to YIN = Year started working or the year the exposure started. (See ISN 44)

f. AGX Calculated as YRIX-YOB = Age started working or the age at the time the exposure started. (See ISN 45)

g. YRS Calculated as YOUT-YIN = Years worked or the duration of exposure. (See ISN 54)

h. SURX Calculated as YROUT-YIN = Years from start of work or exposure until the person left the follow-up. (See ISN 53)

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The variable DEAD either read-in or created in the routine denotes the death status as follows:

DEAD	1	Dead of cause being evaluated. For example, if the person died of cancer and all circulatory causes of death are being evaluated, then DEAD = 0 and STATUS = 6.
	0	If person is alive or is dead of cause other than the one being evaluated.

Note: For all calculations, months and days are converted to fraction of years.

Explanation

Only the analytic variables are passed on to the main program. The user should study carefully the coding for this particular study and modify them to suit his study. The calculated analytic variables will be coded the same way for all studies. The computer coding of the other variables will depend on the nature of the study and should be done in accordance with their definitions.

For the example considered, YIN was taken to be the date of first exposure at Chalk River, Nevada or Australia, as the case may be. YOUT was computed taking the date of termination of the study, (i.e.) January 1, 1982.

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ISN 55 to 76 Are used to generate error conditions specific for this study. Various logical errors in the data set are checked by using these error conditions. For example, ISN 62 checks whether the age is less than 5 years or greater then 99.9 years which are inadmissible values from the point of view of this study. The user may code his own logical checks for his data set and have them printed.

In statement 72, a variable KSEL is checked for a valid code (1 in this case which represents the exposed cases). The variable KSEL is read in columns 7 and 8 of the second option card. (For description, please see under option card 2). Thus the case selection and error checking segment of subroutine READIT can get complex by using information directly read in the subroutine and also provided externally in the option cards. If the user is assured of the accuracy of his data set he need not concern himself with complex programming for error checks and case selection.

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ISN 77 Completes the loop in case selection to read the data set until the end of file (EOF) is reached.

ISN 78 to 84 Required by the program and should not be changed unless the user has introduced his own output statements. Subroutine READIT produces one line of output as follows:

READIT - EOF, NO AND NN = 0 AND #

NO is always zero but is used later on by the program and # will be the number of cases read. (It is 957 for this example.)

The Option Control Cards

The next step is to prepare the option cards required by the Program. There are three option cards that are required. Detailed descriptions follow:

1. Option card

Column	Variable	Description
1- 2	KCAUSE	If KCAUSE = 99, then Tables 1 to 18 are calculated for all causes of death. The frequency distribution of the specific causes of death is printed as Table 19 and the screen for each cause of death (according to LCDC 174 causes) is printed as Table 20. If more than one cause of death is to be investigated, then KCAUSE = # causes. The LCDC code corresponding to the lowest three digits of the ICD codes must be in cols 8 to 10. Subsequent LCDC codes must be included in the first three columns of each card in ascending order of the ICD codes as 4th, 5th... cards. (See Appendix 2 for examples of card set-up.)
3- 4	KGR	KGR = 11 for Male mortality = 12 for Female mortality
5	KSURV	Not used by this program

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Column	Variable	Description
6	KSTRIP	= 0 or blank then all 18 tables are printed = 1 then Tables 2 to 8 are printed = 2 then Table 8 only is printed
7	KTYPE	= 0 or blank
8-10	KCOD	= 000 for all causes of death = the lowest three digit LCOC 174 code for other causes of death. (See also the description under KCAUSE and Appendix 2 for card set-up)
11	KRATE	= 0 or blank for indirect adjustment. For direct adjustment using two groups, KRATE=1 for the first group which must be the control group and KRATE=2 for the second group which is the exposed group. (See Appendix 1)
12-13	KIN	This is the starting year of the follow-up with a default value of 25. By leaving this blank or putting zero, YRIN which is evaluated by the subroutine READIT is used as the starting year.
14	KAGE	Not used by this program
15	KYR	Must be = 6 for this program
16	KPYRS	Must be = 0 for this program

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Column	Variable	Description
17	KSTRIX	Another table selection variable = 0 for all Tables 1 to 18 = 1 for Tables 2 to 6, 9 to 11 and 14 to 16
18-19	KPROV	= 00 for using all Canadian rates (for specific codes for provinces consult Statistics Canada)
20	Blank	
21-38	KT	Any 1 in a column will suppress the printing of the corresponding table, e.g. a '1' in col. 21 will suppress Table 1; a '1' in col. 22, Table 2 etc.

2. Option Card

Column	Variable	Description
1- 2	KSTUDY	# of study group (must be = 01 for this program)
3- 4	YRCCD	Year of study termination date
5	KYR5CD	Date of termination: = 0 or blank if termination date is January 1 = 5 if termination date is July 1

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Column	Variable	Description
6	KSTAT	= 0 if losts are withdrawn as alive at the time of loss = 1 if losts are treated as dead at the time of loss = 2 if losts are treated as alive until the termination of the study
7- 8	KSEL	An all purpose selection variable. It may indicate a code which may be compared directly to a variable for purposes of case selection.
9-10	Blank	
11	KTAB	This variable relates to latency and the associated Tables 14 to 18. Latency refers to the duration from start of work or exposure until death. It is related to the analytic variable SURX described in the READIT routine. Tables 14 to 18 are of use primarily in occupational studies. = 0 then Tables 14 to 18 are calculated by years worked or the duration of exposure (YRS) by latency. = 1 then Tables 14 to 18 are calculated by the age started working or the age at the time the exposure started (AGX) by latency.

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Column	Variable	Description
		= 2 then Tables 14 to 18 are calculated by the year started working or the year of exposure (YRIX) by latency. (For description of the variables see the write-up of the READIT subroutine.)

3. Option Card

This is the title card which is printed on each page of the output.

Other option cards as required. (See the description of KCAUSE under option card 1 and Appendix 2).

For the example considered the option cards are:

```
9911000000000006000000000000000000000000
01820201000
U of O RADIATION STUDY ..... (ALL EXPOSED   GROUPS - CODE = 1)
```

Option card 1 indicates that all causes are to be evaluated and the data set to be used is male Canadian mortality. All tables are requested.

Option card 2 indicates that the study termination date is Jan. 1, 1982, the losses to follow-up are to be treated as alive until the termination date and that case selection should check that the exposed (KSEL=01) is selected for

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analysis. By setting KTAB = 0 (column 11) Tables 14 to 18 are requested to tabulate latency by the duration of exposure.

Option card 3 provides the title of the study to be printed on every page.

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Standard Life Table with Complete Output and Screen for All Causes of Death

At the beginning of the output (Attachment 1) the three option cards are printed for the user to verify the requested options. This is followed by a line of output from the READIT subroutine showing the number of cases accepted for analysis. In this example 957 cases were read by the program.

Table 1 shows the annual male mortality rates from all causes for Canada in five year age and calendar groupings. Actual rates are used only for 1951 to 1982. The rates for 1925 to 1945 are assumed to be those for the 1950 grouping and for 1985 are assumed to be those for the 1980 grouping. Since mortality rates are steadily declining, the user should be aware that the above assumption will produce an under-estimate of expected deaths for 1925 to 1945 and an over-estimate for 1985. Also the rates for ages 85 and beyond are assumed to be constant since these are based on small numbers.

Table 2 shows the distribution of the study population at entry into the follow-up. For this example, there are two entry groups: those entering the cohort during 1950 to 1954 and those entering during 1955 to 1959. The age distribution of the entry cohorts are shown in each column.

Table 3C shows the total person years by age and calendar year. For this example, those lost to follow-up were assumed alive until the end of the study (KSTAT=2 in option card 2). After entry into the study at the point of their age at the time of entry, the individuals move diagonally as they age and hence their contribution to the person-years accumulate diagonally. In

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other words, individuals from the time of entry contribute to the person years diagonally since the increase in age is always equal to the increase in calendar time.

Table 4 shows the distribution of the observed deaths by age and year of occurrence. For this example these are deaths from all causes. If instead a particular cause of death had been chosen, then Table 4 would be the distribution by age and year of occurrence of the selected cause of death.

Table 5 shows the distribution of the expected deaths by age and year of occurrence. Each value in the cell is obtained by multiplying the value of the person-years in the corresponding cell of the person-years table, (i.e. Table 3C) by the corresponding cell value of the mortality rate from Table 1. These expected values can be compared with the corresponding observed values in Table 4. When the expected values are larger than 5, they can be tested using the chi square test:

$$C = (|O - E| - 0.5)^2/E$$

where O is the observed number of deaths and E is the corresponding expected number of deaths. The chi square test will be statistically significant at 5% if the value of C exceeds 3.84. For the given example, the total observed number of deaths is 143 and the expected number of deaths on the basis of the Canadian male mortality is 172.6. The value of chi square by the above formula is 4.9 which is statistically significant at the 5% level, indicating that the observed number of deaths are significantly lower than what might be expected under general Canadian mortality experience.

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Table 6 shows the ratio of the observed to expected deaths by age and year. This is computed by taking the ratio of corresponding cells from Tables 5 and 4. These values, usually expressed as a percentage, represent the Standardized Mortality Ratio (SMR). If the SMR's are close to unity, it suggests that the mortality experience of the study population is similar to that of the general Canadian population for the time period under consideration. Statistical significance of the SMR should be evaluated using the Poisson distribution. Using the approximation suggested by D. Byar of NCI, the 95% confidence limits can be estimated as follows:

$$LL = [O(1 - 1/90 - 0.653\ /1/O)^3]/E$$

$$UL = [(O+1)(1 - 1/9(O+1) + 0.653\ /1/(O+1))^3]/E$$

O is the observed and E the expected number of deaths, while LL and UL form the lower and upper limits of the 95% confidence interval for the SMR. For the example considered, the overall SMR is 82.9% and the 95% confidence interval is (0.70-0.98), showing thereby that the overall mortality experience of the study population is better than the Canadian general population. In this particular case, this result is not surprising since the veterans will tend to be healthier than the general population and hence will have a lower mortality.

Table 7 shows the excess mortality in the study population. It is 1000 times the difference of the corresponding cells in Table 4 and Table 5 divided by Table 3. For the example considered most of the values are negative,indicating that in most of the cells the expected deaths exceed the observed deaths.

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Table 8 shows the life table follow-up of the study population:

LX = Number alive at the start of the year, which is successively calculated as

$LX(i + 1) = LX(i) - WX(i) - UX(i) - DX(i)$

WX = Number of live withdrawals during the year

UX = Lost to follow-up during the year

OBS(DX) = Observed deaths during the year

EXP(DX) = Expected number of deaths during the year on the basis of general Canadian mortality

OBS/EXP = OBS(DX)/EXP(DX) for each year

SURV = Crude survival for the year

= 1 - mortality risk for the year

= 1 - OBS(DX)/(LX - 0.5(WX + UX))

RSR = Relative survival for the year

= SURV . (LX/(LX - EXP(DX))

SERSR = Standard error of RSR

$= \sqrt{[SURV(1-SURV)/(LX-EXP(DX))]}$

(Greenwood's formula)

CSURV = Cumulative crude survival from 0 to i^{th} year

Eg: CSURV(i) = SURV(0).SURV(1) ..... SURV(i)

CRSR = Cumulative relative survival from 0 to i^{th} year

Eg: CRSR(i) = RSR(0).RSR(1) ..... RSR(i)

SECRSR = Standard error of cumulative relative survival

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The results of survival by 5 year periods are calculated similar to those done by single years (except for the fact that the time interval chosen is five years). These values will be more stable.

M-H CHI SQUARE is the modified Mantel-Haenzel chi square with one degree of freedom calculated for each of the OBS/EXP ratios using the Poisson approximation for the variance. It is an overall test of the agreement between the observed and expected deaths for each year. Since OBS/EXP is the SMR, the M-H chi square test is the overall test of whether the SMR is equal to unity. For the example considered, the value is 4.90 which is statistically significant at the 5% level. Hence the hypothesis that the study population and the general Canadian population have a similar mortality experience is statistically untenable.

Table 9 shows the distribution of the observed deaths by calendar year and the age at the time of entry to the study. This table taken in conjunction with Table 2 shows the distribution of the deaths among the entry population. By considering corresponding cells, any unusual occurrence of deaths among the entry cohort can be detected.

Table 10 shows the distribution of the expected deaths by calendar year and age at the time of entry to the study. This table corresponds to Table 9. The observed and expected deaths in Tables 9 and 10 can be tested for statistical significance using the chi square test as before.

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Table 11 shows the ratio of the observed and expected deaths in Tables 9 and 10. These SMR's can be analysed similar to the way they were analysed under Table 6. Significant SMR values in the cells help to identify age specific cohort groups that are at a high risk in comparison with the general population.

Table 12 shows the distribution of the person-years of exposure by calendar year and the age at the time of entry to the study. Each cell in this table shows the total person-years contributed by the persons entering the study listed in the corresponding cell of Table 2. Division of the cell values in Table 12 by the corresponding cell values in Table 2 provide the average number of person years survived by that particular age calendar specific cohort. These numbers are useful in identifying cohort subgroups with unusual survival patterns.

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Table 13 is the excess mortality corresponding to Tables 9 and 10 and is equal to (Table 9 - Table 10)/Table 12 calculated for each cell.

Tables 14 to 18 are of use primarily in occupational studies. For the options available in generating different kinds of tables, see the description of variable KTAB under option card 2.

For this example, KTAB = 0 and hence Tables 14 to 18 are calculated by duration of exposure, which is the equivalent of the years worked (YRS) by latency. Latency in this case is the duration from the start of exposure until death.

Table 14 shows the distribution of the observed deaths by years worked (duration of exposure) and latency. Since the study cohort enters only at two specific periods, viz. 1950 to 1954 and 1955 to 1959, the observations are distributed along the two rows: 20 to 24 years and 25 to 29 years of exposure.

Table 15 shows the distribution of the expected deaths by years worked (duration of exposure) and latency. In computing the expected deaths (and person-years) all persons move first through the (0,00) cell. Each individual or subject moves diagonally until he stops working or his exposure ceases and then for the remaining period he moves horizontally. For this example the exposure persists throughout the study period and hence the group moves diagonally all the time.

Table 16 shows the ratio of observed to expected deaths (SMR) by the years worked (duration of exposure) and latency. For the example, the meaningful numbers are the SMR's at the end of the columns (corresponding to the row entitled SUM). The SMR values except one are less than unity, as is expected.

Table 17 shows the person-years by years worked (duration of exposure) and latency (which corresponds to Table 15).

Table 18 shows the excess risk and is equal to (Table 14 - Table 15)/Table17, calculated for each cell.

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Table 19 shows the frequency distribution of the observed causes of deaths by ICD numbers. If the cause of death is unknown it is listed as 9999. The screen which is shown in Table 20 is made up of the appropriate grouping of these frequencies into the LCDC 174 causes of death.

Table 20 is the screen of observed and expected deaths for each cause of death grouped under the LCDC 174 codes. For each cause the following are tabulated: the observed number of deaths, the expected number of deaths, the ratio of observed to expected deaths (SMR), the lower and upper 95% confidence limits of the SMR, the chi squared value and the Poisson probability. The confidence limits are calculated using the formula discussed under Table 6, and the chi square by the formula stated under Table 5. The chi squared values are meaningless when expected numbers are small. When the expected numbers are large (at least 5) the chi square is significant at 5% level when it exceeds 3.84. On the other hand the Poisson probability is useful when the expected numbers are small. These are calculated as the tail sum of equal to or exceeding the observed number of deaths on the basis of a Poisson distribution with the parameter equal to the expected number of deaths. When the observed or expected number of deaths are equal to or larger than 40, the Poisson probabilities are not calculated. Also, the Poisson probability has been arbitrarily set equal to zero when the expected death is zero, and to one when the observed death is equal to zero. Very small values of Poisson probability along with a small expected number of deaths is indicative of the occurrence of a very rare event among the cases. In occupational studies it is useful to examine these cases carefully. SMR's which are larger than unity indicate a higher risk in comparison with the general population, provided the SMR is outside the 95% confidence interval. For interpreting the LCDC 174 causes one should consult the detailed manual (Appendix 4) showing the ICD conversions to the LCDC 174

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codes. It should be noted that for some causes of death, data were not available for some of the intervening years and for these causes the calculation of the expected deaths would be in error. Hence the interpretation of the results should be done with caution. For occupational health studies, interest will be centered on cancer and cardiovascular causes of death. Each of these categories should be carefully examined. For rare causes of cancer the number of deaths will usually be small and hence the SMR will not attain statistical significance. A SMR of 2 or higher, though not statistically significant should be carefully evaluated. It is also useful to do a statistical power calculation based on the Poisson distribution. (See Appendix 5). Finally, a word of caution about multiple statistical testing. At a level of significance of 5%, while examining the 174 causes, one could expect by chance alone to observe about 8 (174 x .05) instances to be statistically significant.

For the example under consideration, causes of death relating to radiation are of particular interest. These are especially Leukemia, Thyroid Cancer and Breast Cancer (since the cohort is all males, Breast Cancer is very rare). None of these categories appear suspicious. Also one would examine all cancers, other specific cancers and finally other causes of death. Cancer of the Esophagus is significantly elevated with a relative risk of about 4 which should be further investigated. Again, Malignant Melanoma with a relative risk of 4.6, though not statistically significant, should be studied further. Very low Poisson probability suggests further investigation of Cancer of the Pleura. Among other causes of death, Suicide (which is unrelated to radiation exposure) is significantly elevated with a relative risk of 2.

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PROGRAM DOCUMENTATION

The MAIN program controls the logic of computation of the routine. After initializing the variables to zero, subroutine USDR1 is called to read the option cards and the rates. The user written subroutine READIT is called next to obtain the data and to select cases. Subroutine USDR2 is next called to calculate the person-years lived by age and the observed and expected deaths. The program goes in a loop alternating between calling Readit-USDR2 until the EOF of the input file is reached. Subroutine USDR3 is then called which performs the additional calculations, in turn calling subroutine USDR4 to complete the calculations of the cause specific deaths and to print the results.

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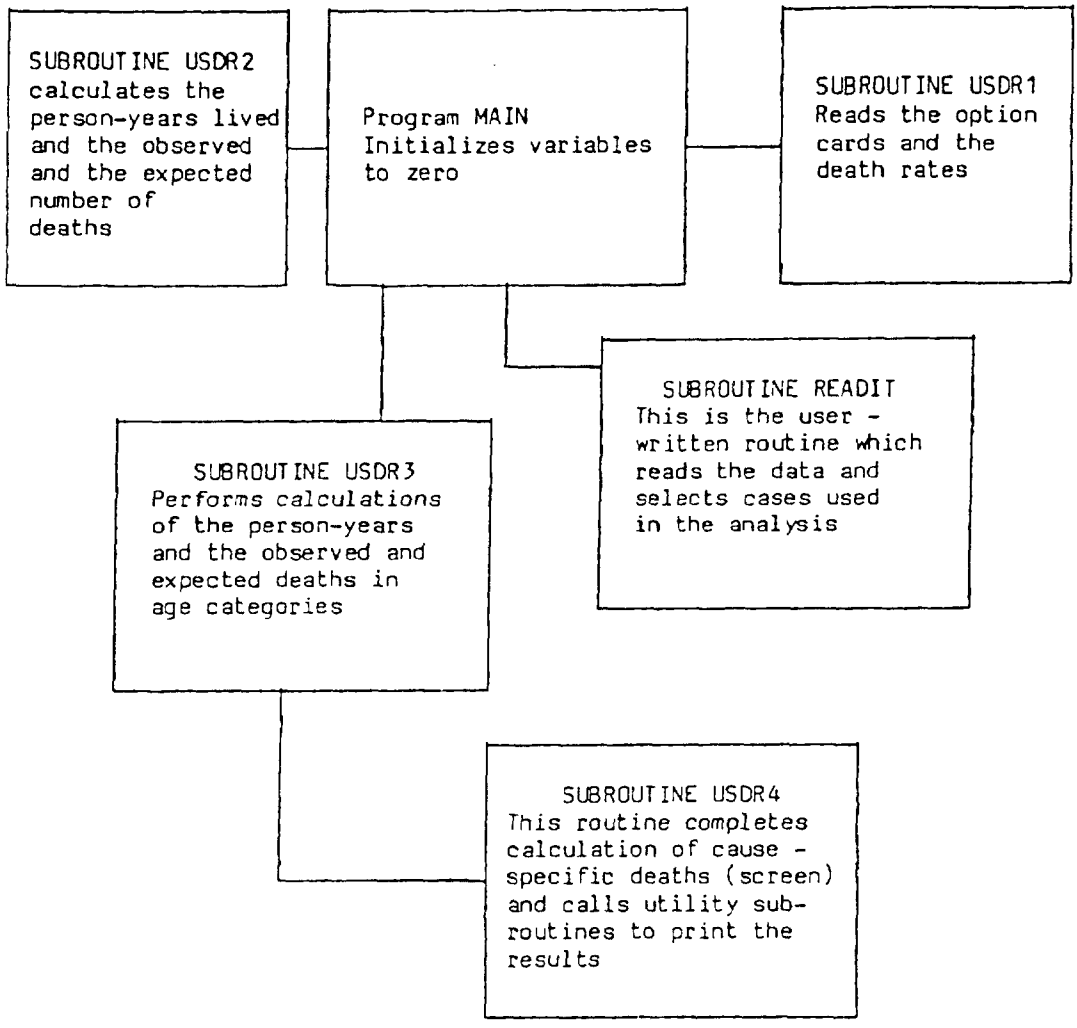
General Program Flow Chart



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Other utility Subroutines Called

SUBROUTINE ANIT - Called to initialize arrays to zero
SUBROUTINE ADDUP - Called to calculate the marginal totals
SUBROUTINE SEXP - Called to calculate person-years
SUBROUTINE PRINTB - Called to format the printing of results
SUBROUTINE ADD - Called by US Version of program to group 3 digit ICD codes to 61 Monson codes - the cause - specific deaths (Screen)- Table 20
SUBROUTINE V9LCDC /V8LCDC - Called by Canadian Version of program to calculate the cause - specific deaths (Screen). It groups 4 digit ICDA 8th or 9th Rev. to LCDC codes - Table 20

References

1. Monson, R.R. Analysis of Relative Survival and Proportional Mortality. Computers in Biomedical Research, 7: 325-332, 1974.

2. Raman, S., Dulberg, C.S. and Spasoff, R.A. Mortality Study of Canadian Military Personnel Exposed to Radiation. Atomic Test Blasts and Chalk River Nuclear Reactor Clean-Ups, 1950's. Final report on the contract between Canadian Pension Commission and University of Ottawa, 1984.

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APPENDIX 1 DIRECT ADJUSTMENT

For using the computer program for direct adjustment, the control and the study groups should be defined. User must provide subroutine READIT so that the descriptive and analytic variables are available to the program for the analysis. User should also provide two sets of option cards; the first set for the control group and the second set for the exposed group. The variables in the option cards are the same as described in the example in the text except for the fact that in option card 1, KRATE=1 for the control set and KRATE=2 for the exposed set.

The mortality rates in five year age and calendar groups are calculated for the control group and are applied to the corresponding person years accumulated for the exposed group (to calculate the expected number of deaths within each five year age and calendar grouping). Since this has to be done once for each cause of death, to generate Table 19 and Table 20 which is the screen, the program has to perform these calculations 174 times which is a tremendous amount of computer time and paper output. Consequently for economy, the user should use this computer program for direct adjustment only for a specific cause at one time.

The illustration of the program, for circulatory causes of death for the Canadian veterans, is shown in the following pages.

Listing of the subroutine READIT is almost similar to the one in the main text. Note that in ISN 8 the control group is selected and in ISN 10 the

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exposed group is selected. The variable KSEL in option card 2 has been set to 1 for the control set of option cards and to 2 for the exposed set of control cards. This information also is used in case selection.

In ISN 44, the circulatory causes of death (ICD numbers 3900 to 4589) are selected and deaths from all other causes are ignored. These ICD numbers constitute code 8 of the LCDC 174 list. Hence the variable KCOD in the first option card has been set to 8 in both the control and exposed set of option cards.

The listing of the option cards are as follows:

```
0111000008100060000000000000000000000000
01820201000
U OF O RADIATION STUDY _____ (CNTRL.GRPS 2 & 3)
```

Control Set

```
0111000008100060000000000000000000000000
01820202000
U OF O RADIATION STUDY _____ (EXPOSED GRP -1-)
```

Exposed Set

The option card 1 for both sets indicate that one cause will be evaluated (KCAUSE=1) for males only (KGR=11). The selected cause, LCDC Code 8 (circulatory diseases), is specified by setting KCOD=008. In the first set KRATE=1 for the control group and KRATE=2 for the exposed group. Hence the rates will be calculated for the controls, which will be applied to the person years of the exposed, for the direct adjustment method of calculating SMR. One may note that if the two sets are reversed (i.e. if the first set is the

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option cards for exposed group and the second set the cards for the control group) then the expected number of deaths are calculated by applying the rates from the exposed to the person years of the control group. This will produce estimate of SMR by the direct method of standardisation. No changes are needed in the write-up for the subroutine READIT. Finally, all tables (1 to 18) are requested for both the groups.

The option card 2 in both groups indicate that the study termination date is January 1, 1982 and the losses to follow-up are to be treated as alive until the termination date (KSTAT=2). The case selection variable has been set at 1 and 2. (KSEL=01 for controls and KSEL=02 for the exposed).

The output produced by the computer program consists of two sets of tables. The first set of 19 tables (Table 0 to Table 18) relate to the control group. Table 0 is the observed circulatory disease mortality rate in 5 year age and calendar groupings. Table 1 is the circulatory disease mortality rate for Canada in 5 year age and calendar groupings. The remaining tables (Table 2 to 18) are similar to the ones described in the text with the expected deaths calculated by applying the Canadian circulatory disease mortality rates to the person-years accumulated for the persons in the control group. The second set of 18 tables (Table 1 to 18) are produced for the exposed group. Table 1 is the circulatory disease mortality for the control group in 5 year age and calendar groupings (i.e. same as Table 0 of the first set). The remaining 17 tables (Tables 2 to 18) are similar to the ones described in the text, but the expected deaths are calculated by applying the rates for the control group to the accumulated person years of the exposed group (i.e. the method of direct adjustment).

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APPENDIX 2 CARD SET-UP: DIRECT AND INDIRECT ADJUSTMENT

We list the option card set-up for different kinds of analyses. For a description of the variables, the reader should refer to the text. All examples shown are for the Canadian Veteran's study.

1. Indirect Adjustment using Canadian Male Mortality for
   All Causes:

   991100000000006
   01820201000
   (Title of the study)

   This is the same as what is considered in the text and the outputs are listed in Attachment 4.

2. Indirect Adjustment using Canadian Male Mortality for
   Circulatory Diseases:

   011100000800006
   01820201000
   (Title of the study)
   Note: KCAUSE=01 and KCOD=008 (according to LCDC code). Subroutine READIT must have been written to select all deaths from circulatory diseases (i.e. ICD 3900 to 4589). The variable DEAD=1, if death had occurred with ICD 3900 to 4589; otherwise DEAD=0.

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3. Indirect Adjustment using Canadian Male Mortality for Circulatory Diseases and Cancer (two causes):

021100000300006

01820201000

(Title of the study)

008

Note: KCAUSE=02 and in the first card KCOD=003 (according to LCDC 174). Cancer should be stated first since the ICD codes for cancer are lower than the ICD codes for circulatory diseases. The ICD codes for cancer are 1400 to 2399 and for circulatory diseases, 3900 to 4589. The fourth card specifies the LCDC code for circulatory diseases viz., 008.

Subroutine READIT must have been written to select these deaths in two passes. It may be as follows:

```
DEAD=0.
IF (KCOD .EQ. 033 .AND. ICOD .GE. 1400 .AND.
    ICOD .LE. 2399) DEAD=1.
IF (KCOD .EQ. 008 .AND. ICOD .GE. 3900 .AND.
    ICOD .LE. 4589) DEAD=1.
```

If there are more than two causes to be studied, the LCDC codes corresponding to them follow as 5th, 6th ---. The number of causes should be specified in the first two columns (KCAUSE = # causes) of the first card. Subroutine READIT should be modified accordingly. Care should be taken to stack the causes in ascending order of the ICD codes.

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4. Direct Adjustment using a Control Group for Circulatory Diseases:

011100000810006

01820201000

(Title for the control group)

011100000810006

01820202000

(Title for the exposed group)

This is the same as what is discussed in Appendix 1.

5. Direct Standardised SMR for Circulatory Diseases using a Control Group:

011100000810006

01820201000

(Title for the exposed group)

011100000810006

01820202000

(Title for the control group)

See also discussion in Appendix 1.

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APPENDIX 3

```
*LEVEL 2.2.1 (DEC 77)                    OS/360  FORTRAN H EXTENDED          DATE 85.206/17.22.31      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) OPTIMIZE(2) LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM FLAG(I)

                C*********************************************************
                C
                C     UNIVERSITY OF OTTAWA RADIATION STUDY
                C
                C*********************************************************
                C     **********     CARD INPUT FOR USDR **************
                C
                C     ESSENTAIL VARIABLES ARE:
                C     ID=STUDY ID; ICOD=CAUSE OF DEATH; YRIN=YR ENTERED FOLLOW-UP
                C     YROUT=YEAR LEFT FOLLOW-UP(DEATH, LOST)
                C     STATUS(3=ALIVE,6=DEAD,9=UNKNOWN)
                C
                C     ***************************************************
  ISN 0002            SUBROUTINE READIT
                C     ***************************************************
                C     THIS SUBROUTINE IS FOR DATA ENTRY TO MONSON'S USDR27
  ISN 0003            COMMON/MAM2/ID,AGE,YRIN,YROUT,STATUS,SURV,DEAD,COD,NUMB,KEND,NN,NO
                     1,AGX,YRIX,YRS,SURX
  ISN 0004            COMMON/MAM123/ICOD,KCOD,KSTAT,JSTUDY,KSTUDY,KSURV,KTYPE,KSTRIP,
                     1KSEL,XXXX,KGR,KDUM1,YRCCD,KYRSCD,JCAUSE,KCAUSE,SAGE,KIN,KAGE,KYR
  ISN 0005            COMMON/MAM3/NT
                C*********************************************************
                C      DEFINE STATUS 3. - LIVE, 6. - DEAD, 9. - LOST
                C      DEFINE DEAD 0. - LIVE OR DEAD OF OTHER CAUSE.
                C                  1. - DEAD OF SPECIFIC CAUSE OF INTEREST
                C      DEFINE AGE,YRIN,YROUT,SURV,ICCD
                C      FOR PM DEFINE AGE,YROUT,ICOD
                C      OPTIONAL VARIABLES - AGX,YRIX,SURX,YRS
                C*********************************************************
                C
  ISN 0006        100 READ(8,1000,END=900)ID,IEXPCD,ISITE,AYOB,AMOB,ADOB,AYOD1,AMOD1,
                     1ADOD1,AYIN,AMIN,ADIN,AYOUT,AMOUT,ADOUT,STATUS,ISEX,
                     2AYOD,AMOD,ADOD,IPROV,ICCD,IGROUP
  ISN 0007       1000 FORMAT(I4,I1,106X,I2,3F2.0,6X,3F2.0,5X,6F2.0,F1.0,I1,2X,
                     13F2.0,7X,I2,13X,I4,24X,I1)
                C*********************************************************
                C---> SELECT SUB-GROUP TO BE ANALYZED
                C
                C     IEXPCD = 1 = EXPOSED GROUP
                C            = 2,3 = TWO CONTROL GROUPS
                C            = 6,7,8,= OTHER CONTROL GROUPS
                C
                C     IGROUP = 1 = EXPOSURE AT CHALK RIVER ONLY
                C            = 2 = EXPOSURE AT NEVADA/AUSTRALIA ONLY
                C            = 3 = EXPOSURE AT CHALK RIVER AND NEVADA/AUSTRALIA
                C*********************************************************
  ISN 0008            IF(IEXPCD.EQ.1) GOTO 150
  ISN 0010            GO TO 100
                C
  ISN 0011        150   NN = NN + 1
                C---> CHECK VALIDITY OF 'STATUS' CODE
  ISN 0012            IF (((STATUS.EQ.3.).OR.(STATUS.EQ.6.).OR.(STATUS.EQ.9.)))
                     *GOTO 8
```

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```
                C     STATUS CODE IS NOT 3,6,9.  MSGNO=1                                00009049
   ISN 0014           MSGNO = 1                                                         00009050
   ISN 0015     8     CONTINUE                                                          00009051
                C*****************************************************************    00009052
                C                                                                      00009053
                C     YOB   = DATE OF BIRTH                                            00009054
                C     YIN   = DATE STARTED WORKING                                     00009055
                C     YRIN  = DATE ENTERED FOLLOWUP                                    00009056
                C     YOUT  = DATE STOPPED WORKING                                     00009057
                C     YROUT = DATE LEFT FOLLOWUP                                       00009058
                C                                                                      00009059
                C*****************************************************************    00009060
   ISN 0016           YOB=(AYOB+(AMOB-1.)/12.+(ADOB-1.)/365.)                           00009061
   ISN 0017           IF (AMOB.EQ.0.) YOB = YOB + .5                                    00009062
   ISN 0019           YIN=AYIN+(AMIN-1.)/12.+(ADIN-1.)/365.                             00009063
   ISN 0020           YOUT=AYOUT+(AMOUT-1.)/12.+(ADOUT-1.)/365.                         00009064
                C                                                                      00009065
                C---> AYOD = OFFICIAL DEATH DATE    AYOD1 = STUDY KNOWN DEATH DATE     00009066
   ISN 0021           IF(AYOD.GT.0.) GOTO 200                                           00009067
   ISN 0023           AYOD = AYOD1                                                      00009068
   ISN 0024           AMOD = AMOD1                                                      00009069
   ISN 0025           ADOD = ADOD1                                                      00009070
                C---> SET YROUT FOR THOSE DEAD AT END OF FOLLOW-UP                     00009071
   ISN 0026     200   YROUT=AYOD+(AMOD-1.)/12.+(ADOD-1.)/365.                           00009072
                C---> SET YROUT FOR THOSE ALIVE AT END OF FOLLOW-UP                    00009073
   ISN 0027           IF(STATUS.EQ.3)YROUT=YRCCD                                        00009074
                C---> SET YROUT FOR LOST TO FOLLOW-UP                                  00009075
   ISN 0029           IF(STATUS.EQ.9)YROUT=YOUT                                         00009076
                C---> ADJUST ENDING DATE TO PARAMETER CARD YRCCD+KYR5CD/10              00009077
                C---> IF DIED OR LEFT FOLLOWUP AFTER STUDY CLOSING DATE, MAKE ADJUSTMNT 00009078
   ISN 0031           IF(YROUT.GT.YRCCD) YROUT = YRCCD                                  00009079
   ISN 0033           IF(YROUT.EQ.YRCCD)STATUS=3.                                       00009080
   ISN 0035           IF (AYOD.LT.YRCCD) GOTO 300                                       00009081
   ISN 0037           MSGNO = 2                                                         00009082
                C     MSGNO = 2 = DIED  AFTER STUDY CLOSING DATE                       00009083
                C---> SET AGE AND YEAR ENTERED FOLLOW-UP, EARLIEST IS 1953             00009084
   ISN 0038     300   YRIN=YIN                                                          00009085
   ISN 0039           IF(YRIN.LT.53.)YRIN=53.                                           00009086
   ISN 0041           AGE=YRIN-YOB                                                      00009087
   ISN 0042           IF(AGE.LE.0.)AGE=AGE+100.                                         00009088
                C---> SET AGE AND YEAR ENTERED EXPOSURE (ENTERED STUDY GROUP)          00009089
   ISN 0044           YRIX=YIN                                                          00009090
   ISN 0045           AGX=YRIX-YOB                                                      00009091
   ISN 0046           IF(AGX.LE.0.)AGX=AGX+100.                                         00009092
                C---> SET VARIABLE 'DEAD' FOR THIS RUN                                 00009093
   ISN 0048           DEAD=0.                                                           00009094
   ISN 0049           IF(STATUS.EQ.6.) DEAD = 1.                                        00009095
                C---> SET THE LATENCY VARIABLES.                                       00009096
   ISN 0051           SURV=YROUT-YRIN                                                   00009097
   ISN 0052           TOT = AGE + SURV                                                  00009098
   ISN 0053           SURX = YROUT-YRIX                                                 00009099
   ISN 0054           YRS=YOUT-YIN                                                      00009100
                C                                                                      00009101
                C*****************************************************************    00009102
                C---> EDIT THE USDR VARIABLES                                          00009103
   ISN 0055           IERR = 0                                                          00009104
   ISN 0056           IF (YRIN.LT.25. .OR. YRIN.GT.89.9) IERR=IERR*10+1                 00009105
   ISN 0058           IF (YROUT.LE.YRIN .OR. YROUT.GT.89.9) IERR=IERR*10+2              00009106
```

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```
   ISN 0060           IF (YRIX.LT.25. .OR. YRIX.GT.YRIN) IERR=IERR*10+3                00009107
   ISN 0062           IF (AGE.LT.5 .OR. AGE.GT.99.9) IERR=IERR*10+4                    00009108
   ISN 0064           IF (AGX.GT.AGE .OR. AGX.LT.5) IERR=IERR*10+5                     00009109
   ISN 0066           IF (YRS.LT.0 .OR. YRS.GT.99.9) IERR=IERR*10+6                    00009110
   ISN 0068           IF (TOT.GE.100) IERR=IERR*10+7                                   00009111
   ISN 0070           IF (IERR.GT.0) GOTO 3000                                         00009112
                     C**************************************************              00009113
                     C---> PRINT SELECTED RECORDS                                     00009114
   ISN 0072           IF (DEAD.EQ.0.0 .OR. KSEL .NE. 1)GO TO 99                        00009115
   ISN 0074         3000 IYOB=1900.+YRIN-AGE                                           00009116
   ISN 0075           ISTAT = STATUS                                                   00009117
   ISN 0076           IDEAD = DEAD                                                     00009118
                     C     * * * * * * * * * * * * * * * * * * * * * * * * * * * *    00009119
   ISN 0077           GO TO 99                                                         00009120
   ISN 0078          900 KEND=1                                                        00009121
   ISN 0079           REWIND 8                                                         00009122
   ISN 0080           REWIND 12                                                        00009123
   ISN 0081           WRITE(4,1080)NO,NN                                               00009124
   ISN 0082         1080 FORMAT('///' READIT __ EOF, NO AND NN =',2I8/1H1)             00009125
   ISN 0083           99 RETURN                                                        00009126
   ISN 0084           END                                                              00009127

*OPTIONS IN EFFECT*NAME(MAIN) OPTIMIZE(2) LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)

*OPTIONS IN EFFECT*SOURCE EBCDIC NOLIST NODECK OBJECT NOMAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM FLAG(I)

*STATISTICS*     SOURCE STATEMENTS =      83, PROGRAM SIZE =     1622, SUBPROGRAM NAME =READIT

*STATISTICS*  NO  DIAGNOSTICS GENERATED

******* END OF COMPILATION *******                                  884K BYTES OF CORE NOT USED

*STATISTICS*  NO  DIAGNOSTICS THIS STEP
```

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Statistics Canada Statistique Canada

RECORD LAYOUT – CLICHE D'ARTICLE

Page ____ of / de ____

Data Set Name – *Nom de l'ensemble de données*: R E A D I T . I N P U T . F I L E

JOB Name – *Nom du travail*:

Field – Zone	Size – Longueur	Position – Poste	Type	Title – Titre
	4		N	Record Identity
	1		N	Exposure Code
	106			Filler
	2		N	Exposure Site
	6		N	Birth Year, Month, Day
	6			Filler
	6		N	Death, Year, Month, Day
	5			Filler
	6		N	Entry into Study Year, Month, Day
	6		N	Exist from Study Year, Month, Day
	1		N	Status
	1		N	Sex Code
	6		N	Death Year, Month, Day – From Mortality
	7			Filler
	2		N	Province of Death
	13			Filler
	4		N	Cause of Death 8th Revision Code
	24			Filler
	1		N	Exposure Site Group

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9-8000-21: 9-12-82

ICD TO LCDC CODE CONVERSION

APPENDIX 4

	LCDC Code	ICD CODES ON TAPE 9th 1979-1988	8th 1969-1978	7th 1958-1968	6th 1951-1957
All Causes	1	001-999	000-999	001-999	
Infective and Parasitic Diseases	2	001-139	000-136	001-138,571,696,697,764,767,768,785.6	
Neoplasms	3	140-239	140-239	140-219,222-239,292.3,294	
Endocrine/Nutritional/Metabolic Diseases	4	240-279	240-279	250-289,772	
Blood Diseases	5	280-289	280-289	290-291,292.0,.1,.2,.4,.5,.6,.7,295-297,298.1,299,468.0,.1,.2	
Mental Disorders	6	290-319	290-315	300-324,325.0,.1,.2,.3,.5,326,688.1,781.5	
Nervous System/Sense Organ Disease	7	320-389	320-389	340-364,366-398,744.1,765,780.3	
Circulatory Disease	8	390-459	390-458	330-334,400-467,468.3,570.2	
Respiratory Disease	9	460-519	460-519	240,241,470-527,763	
Digestive Disease	10	520-579	520-577	530-561,570.0,.1,.3,.4,.5,572-587,784.6	
Genitourinary Disease	11	580-629	580-629	590-637,789.1	
Complications of Pregnancy	12	630-676	630-678	640-687,688.0,.2,.3,689	
Skin/Subcutaneous Tissue Disease	13	680-709	680-709	221,690-695,698-709,710.1,.3,.4,.5,711-716,766	
Musculoskeletal Disease	14	710-739	710-738	710.0,720-743,744.0,.2,745-747,749	
Congenital Anomalies	15	740-759	740-759	220,325.4,710.2,748,750-759	
Perinatal Mortality	16	760-779	760-779	760-762,769-771,773-776	
Symptoms/Ill-Defined	17	780-799	780-796	780.0,.1,.2,.4,.5,.6,.7,.8,.9,781.0,.1,.2,.3,.4,.6,.7,.8,.9,782-783,784.0,.1,.2,.3,.4,.5,.7,.8,785.0,.1,.2,.3,.4,.5,.7,.8,.9,786-788,789.0,.2,.3,.4,.5,.6,.7,.8,790-795	
Accidents/Poisonings/Violence	18	800-999	800-999	365,800-999	
Cancer	19	140-208	140-209	140-207,292.3,294	
Lip	20	140	140	140	
Tongue	21	141	141	141	

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	IC0C Code	1979-1988	1969-1978	1958-1968	1951-1957
Salivary Gland	22	142	142	142	
Mouth	23	143-145	143-145	143-144	
Oropharynx	24	146	146	145	
Nasopharynx	25	147	147	146	
Hypopharynx	26	148	148	147	
Pharynx	27	149.0	149	148	
Pharynx	28	146-148, 149.0	146-149	145-148	
Buccal Cavity and Pharynx	29	140-149	140-149	140-148	
Tongue Mouth and Pharynx	30	141,143-149	141,143-149	141,143-148	
Esophagus	31	150	150	150	
Stomach	32	151	151	151	
Small Intestine	33	152	152	152	
Large Intestine Except Rectum	34	153	153	153	
Rectum and Rectosigmoid Junction	35	154	154	154	
Large Intestine and Rectum	36	153,154	153,154	153,154	
Liver	37	155.0,155.1	155	155.0	NE
Gallbladder	38	156	156	155.1	NE
Liver and Gallbladder	39	155,156	155,156	155	
Pancreas	40	157	157	157	
Peritoneum	41	158	158	158	
Digestive NS	42	159	159	159	
Digestive	43	150-159	150-159	150-159	
Nose/Sinuses	44	160	160	160	
Larynx	45	161	161	161	
Bronchus and Lung	46	162.2,.3,.4,.5,.8,.9	162.1	162.1	NE
Pleura	47	163	163.0	162.2	NE
Trachea/Bronchus/Lung and Other	48	162-163, 164.2,.3,.8,.9,165	162,163	162-164	
Respiratory	49	160-163, 164.2,.3,.8,.9,165	160-163	160-162,164	

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	ICCC Code	1979-1988	1969-1978	1958-1968	1951-1957
Bone	50	170	170	196	
Connective Tissue	51	164.1,171	171	197	
Malignant Melanoma	52	172	172	190	
Mel.Lip	53	172.0	172.0	190.0	NE
Mel Eyelid	54	172.1	172.1	190.1	NE
Mel Ear	55	172.2	172.2	190.2	NE
Mel Other Face	56	172.3	172.3	190.3	NE
Mel Scalp and Neck	57	172.4	172.4	190.4	NE
Mel Scrotum	58	187.7	172.5	179.1	NE
Mel Trunk	59	172.5	172.6	190.5	NE
Mel Upper Limb	60	172.6	172.7	190.6	NE
Mel Lower Limb	61	172.7	172.8	190.7	NE
Mel Site NS	62	172.8,.9	172.9	190.9	NE
Other Skin	63	173	173	191	
Breast	64	174,175	174	170	
Cervix Uteri	65	180	180	171	
Chorionepithelioma	66	181	181	NE.	NE
Corpus Uteri	67	182	182.0	172	
Chorio. and Uterus NS	68	179,181	181,182.9	173,174	
Other Uterus	69	179,182	182	NE.	NE
Chorio and Other Uterus	70	179,181, 182	181,182	172-174	
Uterus Incl. Cervix	71	179-182	180-182	171-174	
Ovary	72	183.0	183.0	175.0	NE
Ovary/Fallopian Tube/Broad Lig	73	183	183	175	
Female Genital	74	180-184	180-184	171-176	
Prostate	75	185	185	177	
Testis	76	186	186	178	
Male Genital	77	185,186, 187.1,.2, .3,.4,.5, .6,.8,.9	185-187	177-179	
Kidney	78	189.0,.1, .2	189.0,189.1, 189.2	180	

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	SEER Code	1979-1988	1969-1978	1958-1968	1951-1957
Bladder	79	188	188	181.0	NE
Bladder and Other Urinary	80	188,189.3, .4,.8,.9	188,189.9	181	
Urinary	81	188,189	188,189	180,181	
Eye	82	190	190	192	
Brain	83	191	191	193.0	NE
Brain and Other Nervous System	84	191,192	191,192	193	
Nervous System,Benign and Malignant	85	191,192, 225,237.5, 237.6, 239.6	191,192,225, 238	193,223,237	
Thyroid	86	193	193	194	
Other Endocrine	87	164.0,194	194	195	
Ill-Defined Cancer	88	195-199	195-199	156,163,165,198,199	
Lymphosarcoma and Retic.Cell Sarcoma	89	200.0, 200.1	200	200.0,200.1	
Reticulum Cell Sarc	90	200.0	200.0	200.0	
Lymphosarcoma	91	200.1	200.1	200.1	
Hodgkins Disease	92	201	201	201	
Other Lymphoid	93	200.2, 200.8,202	202	200.2,202,205	
Non-Hodgkins Lymphomas	94	200,202	200,202	200,202,205	
Multiple Myeloma	95	203	203	203	
Lymphoid	96	200-203	200-203	200-203,205	
Lymphatic Leukemia	97	204	204	NE	NE
Myeloid Leukemia	98	205	205	NE	NE
Monocytic Leukemia	99	206	206	204.2	
Lymphatic and Myeloid Leukemia	100	204,205	204,205	204.0,204.1,204.3	
Other and Unspecified Leukemia	101	207.0,.2, .8,208	207	204.4	
Leukemias	102	204-206, 207.0,.2, .8,208	204-207	204	
Polycythemia Vera	103	207.1, 238.4	208	294	
Myelofibrosis	104	NE	209	292.3	

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	LCDC Code	1979-1988	1969-1978	1958-1968	1951-1957
Neoplasms of Lymphatic and Hematopoietic Tissue	105	NE	200-209	200-205,202.3,204	
Benign Neoplasms	106	210-229	210-223	210-219,222-229	
Neoplasm of Unspecified Nature	107	239.1, 235-238	230-239	230-239	
Neoplasms, Secondary, Ill-Defined and Benign	108	195-199, 210-229, 239.1, 235-238	195-199, 210-239	156,163,165,198,199, 210-219,222-239	
Diabetes Mellitus	109	250	250	260	
Cystic Fibrosis	110	277.0	277.0	NE	NE
Aplastic Anemia	111	284	284	292.4	
Alcoholic Psychosis, Alcoholism and Alcohol Poisoning	112	291, 303, 305.0, 860	291, 303, 969	307, 322, 880	
Multiple Sclerosis	113	340	340	345	
Paralysis Agitans	114	332.0	342	350	
Motor Neurone Disease	115	335.2	348	356.0, .1, .3	
Major Cardio-Vascular Diseases	116	390-448	390-448	330-334, 400-456, 467.1, 570.2	
Ischemic Heart Disease	117	410-414	410-413	420	
Cerebrovascular Disease	118	430-438	430-438	430-434	
Heart Disease	119	NE	391, 392.0, 393-398, 402, 404, 410-429	401, 402.1, 410-443	NE
Rheumatic Fever and Chronic Rheumatic Heart Disease	120	390-398	390-398	400-402, 410-416	
Hypertensive Disease	121	401-405	400-404	NE	NE
Active Rheumatic Fever	122	390-392	390-392	400-402	
Chronic Rheumatic Heart Disease	123	393-398	393-398	410-416	
Acute Myocardial Infarction	124	410	410	NE	NE
Other Forms of Heart Disease	125	415.0, 416-429	420-429	NE	NE
Diseases of Arteries, Arterioles and Capillaries	126	440-448	440-448	450-456, 467.1, 570.2	
Aortic Aneurysm	127	441.0, .1, .2, .3, .4, .5, .6	441	451	
Diseases of Veins, Lymphatics and Other Dis. of Circ. Syst.	128	415.1, 451-459	450-458	460-467, 468.3	
Acute Respiratory Infections, Except Influenza	129	460-466	460-466	470-475, 500	
Influenza	130	487	470-474	480-483	

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	LCDC Code	1979-1988	1969-1978	1958-1968	1951-1957
Pneumonia	131	480-486	480-486	490-493,763	
Chronic Bronchitis, Emphysema and Asthma	132	490-493 496	490-493,519.3	241,501,502, 527.1	
Other Diseases of Upper Respiratory Tract	133	470-478	500-508	240,510-517	
Other Diseases of Respiratory System	134	494,495, 497-519	510-518,519.0, .1,.2,.9	518-526,527.0, 527.2	
Viral Pneumonia	135	480	480	NE	NE
Pneumococcal Pneumonia	136	481	481	NE	NE
Other Bacterial Pneumonia	137	482	482	NE	NE
Pneumonia due to Other Specified Organism	138	483	483	NE	NE
Other Pneumonia	139	484-486	484-486	NE	NE
Pneumoconioses	140	011.4,495, 500-508	010,515,516	001,523,524	
Silicosis and Anthracosilicosis	141	500,502	515.0,515.1	523.0,523.1	
Asbestosis	142	501	515.2	523.2	
Other Pneumoconioses	143	495,503-508	515.9,516	523.3,524	
Silicotuberculosis	144	011.4	010	001	
Ulcer of Stomach	145	531	531	540	
Ulcer of Duodenum	146	532	532	541	
Ulcers	147	531-534	531-534	540-542	
Cirrhosis of Liver	148	571	571	298.0,581	
Gallbladder Diseases	149	574-576	574-576	584-586	
Diseases of Pancreas	150	577	577	587	
Nephritis and Nephrosis	151	580-583, 587	580-584	590-594	
Kidney Infections	152	590	590	600	
Kidney Diseases	153	580-593	580-593	590-603,789.1	
Prostate Diseases	154	222.2,600-602	600-602	610-612	
Congenital Anomalies of Nervous System	155	740-742	740-743	750-753	
Congenital Anomalies of Circulatory System	156	745-747	746-747	754	
Motor Vehicle Traffic Accidents	157	810-819	810-819	810-825	
MVTA Involving Pedestrian	158	814	814	812	
Accidental Falls	159	880-888	880-887	900-904	
Accidents Caused by Fires and Flames	160	890-899	890-899	916	

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	LCDC Code	1979-1988	1969-1978	1958-1968	1951-1957
Accidents Caused by Fire in Private Dwelling	161	890	890	NE	NE
Accidental Drownings	162	910	910	929	
Suicide	163	950-959	950-959	970-979	
Homicide	164	960-969	960-969	980-983	
Chronic Respiratory Disease	165	490-508, 515-517	490-493,515-518, 519.2,519.3	241,501,502, 523-526,527.1	
Cirrhosis and Other Liver Disease	166	570-573	570-573	290.0,580-583	
Prostatis Neoplasia and Hyperplasia	167	185,222.2, 233.4,236.5, 600	185,600	177,610	
Prostatitis and Other Diseases of Prostate	168	601,602	601,602	611,612	
All Natural Causes of Death	169	001-799	000-796	001-795	
Appendicitis	170	540-543	540-543	550-553	
Renal Calculi	171	592,594	592,594	602-604	
Accidental Poisoning	172	E850-869	E850-895	E870-985	E870-895
Asthma	173	493	493	241	241
Chronic Obstructive Pulmonary Disease	174	490-496	NE	NE	NE

Note: ICD codes for 1951-57 are the same as those for 1958-68 unless otherwise indicated.

ST0164863

APPENDIX 5 SMR USING POISSON DISTRIBUTION

The following in an outline of the method of calculating statistical power for SMR using the Poisson distribution.

Let E be the expected number of deaths, A the level of significance (Type I Error). We are interested in evaluating the statistical power of detecting an SMR = R, (>1)

Solve for X in the equation:

$$1 - A = \sum_{i=0}^{X-1} \exp(-E) \times E^i/(i!) \quad ...(1)$$

(It may not be possible to set an exact solution for every value of A. Get the closest solution).

Then the Power of detecting an SMR=R is given by:

$$P = 1 - \sum_{i=0}^{X-1} \exp(-R.E) \times (R.E)^i/(i!) \quad ...(2)$$

Example: Let E = 2 and A = 0.05.

Say we are interested in calculating the power of detecting an SMR = R = 3.

Solving equation(1) gives X=5 approximately.

Hence from equation(2) the power is P = 0.73.

ST0164864

ATTACHMENT 1

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9911100  00 00600 0 0000000000000000000

VALUE OF PARAMETERS FROM FIRST INPUT CARD:
          KCAUSE =  99 KGR    =  11 KSURV  =

          KSTRIP =   0 KTYPE =   0 KCOD   =   0

          KRATE  =   0 KIN   =  25 KAGE   =   0

          KYR    =   6 KPYRS =   0 KSTRIX =   0

          KFPOV  =   0

 18202 1 008

VALUE OF PARAMETERS FROM SECOND INPUT CARD:
          KSTUDY =   1 IRCCO =  82 KYR5CO =   0

          KSTAT  =   2 KSEL  =   1 KSAGE  =   0

          KTAB   =   0 KVERSION  8

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1)          00009134


READIT __ EOF, NO AND IRI =       0     957
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S10161865

TABLE 1. ANNUAL RATE IN FIVE-YEAR PERIOD X 1000

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

AGE	YEAR 1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	10.678	10.678	10.678	10.678	10.678	10.678	8.837	7.162	5.229	4.447	3.431	2.742	2.742	0.0
5-	0.948	0.948	0.948	0.948	0.948	0.948	0.737	0.644	0.602	0.545	0.460	0.345	0.345	0.0
10-	0.760	0.760	0.760	0.760	0.760	0.760	0.622	0.539	0.523	0.508	0.439	0.390	0.390	0.0
15-	1.329	1.329	1.329	1.329	1.329	1.329	1.231	1.166	1.271	1.561	1.476	1.294	1.294	0.0
20-	1.857	1.857	1.857	1.857	1.857	1.857	1.681	1.705	1.826	1.951	1.860	1.571	1.571	0.0
25-	1.709	1.709	1.709	1.709	1.709	1.709	1.614	1.496	1.528	1.505	1.489	1.384	1.384	0.0
30-	1.983	1.983	1.983	1.983	1.983	1.983	1.774	1.628	1.634	1.620	1.527	1.368	1.368	0.0
35-	2.489	2.489	2.489	2.489	2.489	2.489	2.265	2.263	2.232	2.250	2.078	1.763	1.763	0.0
40-	3.833	3.833	3.833	3.833	3.833	3.833	3.531	3.454	3.493	3.559	3.253	2.739	2.739	0.0
45-	6.104	6.104	6.104	6.104	6.104	6.104	5.861	5.776	5.735	5.729	5.362	4.662	4.662	0.0
50-	10.315	10.315	10.315	10.315	10.315	10.315	9.712	9.476	9.511	9.238	8.877	7.765	7.765	0.0
55-	15.787	15.787	15.787	15.787	15.787	15.787	15.617	15.339	15.202	14.763	13.967	12.565	12.565	0.0
60-	24.291	24.291	24.291	24.291	24.291	24.291	24.276	24.213	23.709	23.026	21.810	19.691	19.691	0.0
65-	35.227	35.227	35.227	35.227	35.227	35.227	36.196	35.268	36.293	35.321	32.982	30.940	30.940	0.0
70-	52.975	52.975	52.975	52.975	52.975	52.975	53.549	53.897	52.911	52.741	50.111	47.122	47.122	0.0
75-	83.411	83.411	83.411	83.411	83.411	83.411	83.174	82.035	80.436	78.889	75.097	71.870	71.870	0.0
80-	130.691	130.691	130.691	130.691	130.691	130.691	131.981	124.362	123.003	119.465	114.552	108.527	108.527	0.0
85-	225.528	225.528	225.528	225.528	225.528	225.528	221.396	209.567	209.574	199.081	191.098	190.827	190.827	0.0
90-	225.528	225.528	225.528	225.528	225.528	225.528	221.396	209.567	209.574	199.081	191.098	190.827	190.827	0.0
95-	225.528	225.528	225.528	225.528	225.528	225.528	221.396	209.567	209.574	199.081	191.098	190.827	190.827	0.0
SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

S10164866

TABLE 2. TOTAL PERSONS BY AGE AND YEAR OF ENTRY INTO FOLLOW-UP

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

AGE	YEAR 1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15-	0.	0.	0.	0.	0.	2.	73.	0.	0.	0.	0.	0.	0.	75.
20-	0.	0.	0.	0.	0.	9.	116.	0.	0.	0.	0.	0.	0.	125.
25-	0.	0.	0.	0.	0.	35.	103.	0.	0.	0.	0.	0.	0.	138.
30-	0.	0.	0.	0.	0.	67.	124.	0.	0.	0.	0.	0.	0.	191.
35-	0.	0.	0.	0.	0.	42.	153.	0.	0.	0.	0.	0.	0.	195.
40-	0.	0.	0.	0.	0.	18.	140.	0.	0.	0.	0.	0.	0.	158.
45-	0.	0.	0.	0.	0.	3.	58.	0.	0.	0.	0.	0.	0.	61.
50-	0.	0.	0.	0.	0.	2.	12.	0.	0.	0.	0.	0.	0.	14.
55-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
65-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
75-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
80-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
85-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
90-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
95-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUM	0.	0.	0.	0.	0.	178.	779.	0.	0.	0.	0.	0.	0.	957.

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TABLE 3C. TOTAL PERSON-YEARS BY AGE AND YEAR - LOST TO FOLLOW-UP PATIENTS ASSUMED ALIVE TO THE END OF THE STUDY

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

	YEAR													
AGE	1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-	0.0	0.0	0.0	0.0	0.0	2.5	81.0	19.8	0.0	0.0	0.0	0.0	0.0	103.3
20-	0.0	0.0	0.0	0.0	0.0	11.7	223.5	450.6	19.8	0.0	0.0	0.0	0.0	705.6
25-	0.0	0.0	0.0	0.0	0.0	46.4	293.5	513.3	447.6	19.8	0.0	0.0	0.0	1320.5
30-	0.0	0.0	0.0	0.0	0.0	92.3	505.5	568.7	510.1	443.6	19.1	0.0	0.0	2139.2
35-	0.0	0.0	0.0	0.0	0.0	75.6	696.9	794.1	562.9	505.2	431.4	19.1	0.0	3085.2
40-	0.0	0.0	0.0	0.0	0.0	26.0	582.3	1069.8	780.1	547.8	493.1	237.9	0.0	3737.1
45-	0.0	0.0	0.0	0.0	0.0	9.5	274.2	830.3	1045.3	758.6	530.8	166.7	0.0	3615.4
50-	0.0	0.0	0.0	0.0	0.0	3.0	70.2	373.5	802.4	1014.3	722.3	228.5	0.0	3214.2
55-	0.0	0.0	0.0	0.0	0.0	0.0	13.0	83.5	357.2	769.9	987.5	318.3	0.0	2529.3
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.0	82.4	318.9	724.6	372.1	0.0	1511.0
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	67.2	296.9	224.2	0.0	595.9
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	62.2	73.7	0.0	141.5
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	11.0	0.0	14.0
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.0	0.0	0.0	0.0	0.0	267.0	2740.0	4716.4	4615.6	4450.9	4270.8	1651.4	0.0	22712.1

TOTAL YEARS OF SURVIVAL = 22712.5

TOTAL NUMBER OF PEOPLE = 957.

AVERAGE SURVIVAL = 23.73

AVERAGE AGE OF ENTRY = 33.23

AVERAGE YEAR OF ENTRY = 1956.84

AVERAGE AGE OF DEATH = 52.96

AVERAGE YEAR OF DEATH = 1972.48

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TABLE 4. OBSERVED EVENTS BY AGE AND YEAR OF EVENT

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

AGE	YEAR 1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
20-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
25-	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	0.	0.	0.	1.
30-	0.	0.	0.	0.	0.	0.	1.	2.	0.	1.	0.	0.	0.	4.
35-	0.	0.	0.	0.	0.	0.	1.	1.	2.	3.	2.	0.	0.	9.
40-	0.	0.	0.	0.	0.	0.	2.	6.	3.	3.	1.	2.	0.	17.
45-	0.	0.	0.	0.	0.	0.	2.	4.	7.	5.	8.	0.	0.	26.
50-	0.	0.	0.	0.	0.	0.	0.	2.	6.	9.	4.	2.	0.	23.
55-	0.	0.	0.	0.	0.	0.	0.	0.	3.	13.	3.	8.	0.	27.
60-	0.	0.	0.	0.	0.	0.	0.	0.	2.	3.	10.	1.	0.	16.
65-	0.	0.	0.	0.	0.	0.	0.	0.	2.	2.	8.	4.	0.	16.
70-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	2.	0.	3.
75-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	1.	0.	1.
80-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
85-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
90-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
95-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUM	0.	0.	0.	0.	0.	0.	6.	15.	26.	39.	37.	20.	0.	143.

ST0161869

TABLE 5. EXPECTED EVENTS BY AGE AND YEAR OF EVENT

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

YEAR

AGE	1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-	0.0	0.0	0.0	0.0	0.0	0.003	0.100	0.023	0.0	0.0	0.0	0.0	0.0	0.126
20-	0.0	0.0	0.0	0.0	0.0	0.022	0.376	0.768	0.036	0.0	0.0	0.0	0.0	1.202
25-	0.0	0.0	0.0	0.0	0.0	0.079	0.474	0.768	0.684	0.030	0.0	0.0	0.0	2.034
30-	0.0	0.0	0.0	0.0	0.0	0.183	0.897	0.926	0.834	0.719	0.029	0.0	0.0	3.587
35-	0.0	0.0	0.0	0.0	0.0	0.188	1.578	1.797	1.257	1.137	0.897	0.034	0.0	6.887
40-	0.0	0.0	0.0	0.0	0.0	0.099	2.056	3.696	2.725	1.950	1.604	0.652	0.0	12.782
45-	0.0	0.0	0.0	0.0	0.0	0.058	1.607	4.795	5.995	4.346	2.846	0.777	0.0	20.426
50-	0.0	0.0	0.0	0.0	0.0	0.031	0.682	3.539	7.632	9.371	6.412	1.774	0.0	29.440
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.203	1.280	5.431	11.366	13.792	3.999	0.0	36.070
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.314	1.954	7.344	15.804	7.327	0.0	32.742
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.277	2.374	9.792	6.935	0.0	19.378
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.293	3.119	3.471	0.0	6.883
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.223	0.791	0.0	1.015
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.0	0.0	0.0	0.0	0.0	0.664	7.971	17.906	26.825	38.929	54.518	25.760	0.0	172.573

ST0164870

TABLE 6. OBSERVED/EXPECTED EVENTS BY AGE AND YEAR

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

YEAR

AGE	1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.462	0.0	0.0	0.0	0.0	0.492
30-	0.0	0.0	0.0	0.0	0.0	0.0	1.115	2.160	0.0	1.391	0.0	0.0	0.0	1.115
35-	0.0	0.0	0.0	0.0	0.0	0.0	0.634	0.556	1.592	2.639	2.231	0.0	0.0	1.307
40-	0.0	0.0	0.0	0.0	0.0	0.0	0.973	1.623	1.101	1.539	0.623	3.069	0.0	1.330
45-	0.0	0.0	0.0	0.0	0.0	0.0	1.245	0.834	1.168	1.150	2.811	0.0	0.0	1.273
50-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.565	0.786	0.960	0.624	1.127	0.0	0.781
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.552	1.144	0.218	2.000	0.0	0.749
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.023	0.409	0.633	0.136	0.0	0.489
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.225	0.842	0.817	0.577	0.0	0.826
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.321	0.576	0.0	0.436
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.264	0.0	0.986
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.0	0.0	0.0	0.0	0.0	0.0	0.753	0.838	0.969	1.002	0.679	0.776	0.0	0.829

ST0164871

TABLE 7. 1000 X (OBS-EXP)/PYRS BY AGE AND YEAR OF EVENT

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

YEAR

AGE	1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-	0.0	0.0	0.0	0.0	0.0	-1.329	-1.231	-1.166	0.0	0.0	0.0	0.0	0.0	-1.221
20-	0.0	0.0	0.0	0.0	0.0	-1.857	-1.681	-1.705	-1.826	0.0	0.0	0.0	0.0	-1.703
25-	0.0	0.0	0.0	0.0	0.0	-1.709	-1.614	-1.496	0.706	-1.505	0.0	0.0	0.0	-0.783
30-	0.0	0.0	0.0	0.0	0.0	-1.983	0.205	1.889	-1.634	0.634	-1.527	0.0	0.0	0.193
35-	0.0	0.0	0.0	0.0	0.0	-2.489	-0.830	-1.004	1.321	3.688	2.557	-1.763	0.0	0.605
40-	0.0	0.0	0.0	0.0	0.0	-3.833	-0.096	2.154	0.352	1.917	-1.225	5.667	0.0	1.129
45-	0.0	0.0	0.0	0.0	0.0	-6.104	1.433	-0.958	0.961	0.862	9.711	-4.662	0.0	1.542
50-	0.0	0.0	0.0	0.0	0.0	-10.315	-9.712	-4.121	-2.034	-0.366	-3.339	0.908	0.0	-2.004
55-	0.0	0.0	0.0	0.0	0.0	0.0	-15.617	-15.339	-6.804	2.123	-10.929	12.571	0.0	-3.586
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-24.213	0.552	-13.620	-8.009	-17.004	0.0	-11.080
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	225.907	-5.564	-6.036	-13.095	0.0	-5.669
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-52.741	-34.046	-19.971	0.0	-27.451
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-75.097	18.975	0.0	-1.039
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.0	0.0	0.0	0.0	0.0	-2.488	-0.719	-0.616	-0.179	0.016	-4.102	-3.488	0.0	-1.302

STOI6487Z

TABLE 8. OBSERVED AND EXPECTED EVENTS BY YEAR AFTER ENTRY INTO FOLLOW-UP - VERSION 48, 2/01/82

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 0000CANADA

1 ALL CAUSES CANADA

YEAR	LX	WX	UX	OBS(DX)	EXP(DX)	OBS/EXP	SURV	RSR	SERSR	CSURV	CRSR	SECRSR
0-	957.	0.	0.	0.	2.47	0.0	1.0000	1.0026	0.0	1.0000	1.0026	0.0
1-	957.	0.	0.	3.	2.63	1.14	0.9969	0.9996	0.00181	0.9969	1.0022	0.00182
2-	954.	0.	0.	2.	2.78	0.72	0.9979	1.0008	0.00149	0.9948	1.0030	0.00235
3-	952.	0.	0.	0.	2.97	0.0	1.0000	1.0031	0.0	0.9948	1.0062	0.00236
4-	952.	0.	0.	2.	3.19	0.63	0.9979	1.0013	0.00149	0.9927	1.0074	0.00280
5-	950.	0.	0.	2.	3.46	0.58	0.9979	1.0015	0.00149	0.9906	1.0090	0.00318
6-	948.	0.	0.	6.	3.76	1.60	0.9937	0.9976	0.00259	0.9843	1.0066	0.00411
7-	942.	0.	0.	4.	4.05	0.99	0.9958	1.0000	0.00213	0.9801	1.0066	0.00463
8-	938.	0.	0.	4.	4.40	0.91	0.9957	1.0004	0.00214	0.9760	1.0071	0.00511
9-	934.	0.	0.	4.	4.78	0.84	0.9957	1.0008	0.00215	0.9718	1.0079	0.00555
10-	930.	0.	0.	8.	5.19	1.54	0.9914	0.9970	0.00305	0.9634	1.0049	0.00633
11-	922.	0.	0.	4.	5.67	0.71	0.9957	1.0018	0.00218	0.9592	1.0067	0.00671
12-	918.	0.	0.	9.	6.04	1.49	0.9902	0.9968	0.00327	0.9498	1.0034	0.00745
13-	909.	0.	0.	8.	6.39	1.25	0.9912	0.9982	0.00312	0.9415	1.0016	0.00807
14-	901.	0.	0.	8.	6.91	1.16	0.9911	0.9988	0.00315	0.9331	1.0004	0.00866
15-	893.	0.	0.	4.	7.55	0.53	0.9955	1.0040	0.00225	0.9289	1.0044	0.00898
16-	889.	0.	0.	7.	8.20	0.85	0.9921	1.0014	0.00299	0.9216	1.0058	0.00948
17-	882.	0.	0.	8.	8.64	0.93	0.9909	1.0007	0.00322	0.9133	1.0065	0.01003
18-	874.	0.	0.	6.	9.17	0.65	0.9931	1.0037	0.00282	0.9070	1.0102	0.01046
19-	868.	0.	0.	5.	9.93	0.50	0.9942	1.0057	0.00260	0.9018	1.0160	0.01084
20-	863.	0.	0.	8.	10.81	0.74	0.9907	1.0033	0.00330	0.8934	1.0194	0.01138
21-	855.	0.	0.	10.	11.52	0.87	0.9883	1.0018	0.00373	0.8830	1.0212	0.01202
22-	845.	0.	0.	5.	11.05	0.42	0.9941	1.0082	0.00268	0.8777	1.0296	0.01242
23-	840.	207.	0.	9.	11.76	0.77	0.9878	1.0018	0.00384	0.8670	1.0315	0.01314
24-	624.	391.	0.	12.	7.71	1.56	0.9720	0.9842	0.00669	0.8427	1.0151	0.01538
25-	221.	30.	0.	1.	3.65	0.27	0.9951	1.0119	0.00475	0.8306	1.0272	0.01635
26-	190.	45.	0.	2.	3.07	0.65	0.9881	1.0043	0.00801	0.8286	1.0315	0.01861
27-	143.	0.	0.	2.	2.63	0.76	0.9860	1.0045	0.01000	0.8170	1.0361	0.02135
28-	141.	141.	0.	0.	1.37	0.0	1.0000	1.0198	0.0	0.8170	1.0566	0.02177
SUM-	957.	814.	0.	143.	172.56	0.83						

M-H CHI SQUARE = 4.90

SURVIVAL BY 5-YEAR PERIODS

LX5	957.	950.	930.	893.	863.	221.	0.	0.	0.	0.	0.	0.	0.
SURV5	0.9927	0.9789	0.9602	0.9664	0.9345	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RSR5	1.0074	1.0005	0.9926	1.0156	0.9991	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SERSR	0.0028	0.0048	0.0066	0.0063	0.0107	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OBS5	7.0	20.0	37.0	30.0	44.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
EXP5	14.05	20.45	30.20	43.49	53.65	10.71	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O/E5	0.50	0.98	1.23	0.69	0.82	0.47	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ST0164873

CUMULATIVE SURVIVAL BY 5-YEAR PERIODS

CSURV	0.9927	0.9718	0.9331	0.9018	0.8427	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CRSR	1.0074	1.0079	1.0004	1.0160	1.0151	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SECRS	0.0028	0.0056	0.0087	0.0108	0.0154	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
COBS5	7.0	27.0	64.0	94.0	138.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0	143.0
CEXP5	14.05	34.50	64.70	108.20	161.85	172.56	172.56	172.56	172.56	172.56	172.56	172.56	172.56
CO/E5	0.50	0.78	0.99	0.87	0.85	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83

S10164874

TABLE 9. OBSERVED EVENTS BY AGE AND YEAR AT ENTRANCE INTO COHORT

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

AGE	YEAR 1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15-	0.	0.	0.	0.	0.	0.	3.	0.	0.	0.	0.	0.	0.	3.
20-	0.	0.	0.	0.	0.	1.	8.	0.	0.	0.	0.	0.	0.	9.
25-	0.	0.	0.	0.	0.	5.	12.	0.	0.	0.	0.	0.	0.	17.
30-	0.	0.	0.	0.	0.	9.	15.	0.	0.	0.	0.	0.	0.	24.
35-	0.	0.	0.	0.	0.	15.	21.	0.	0.	0.	0.	0.	0.	36.
40-	0.	0.	0.	0.	0.	3.	26.	0.	0.	0.	0.	0.	0.	29.
45-	0.	0.	0.	0.	0.	2.	16.	0.	0.	0.	0.	0.	0.	18.
50-	0.	0.	0.	0.	0.	2.	5.	0.	0.	0.	0.	0.	0.	7.
55-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
65-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
75-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
80-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
85-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
90-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
95-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUM	0.	0.	0.	0.	0.	37.	106.	0.	0.	0.	0.	0.	0.	143.

ST0164875

TABLE 10. EXPECTED EVENTS BY AGE AND YEAR AT ENTRANCE INTO COHORT

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

YEAR

AGE	1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-	0.0	0.0	0.0	0.0	0.0	0.126	3.075	0.0	0.0	0.0	0.0	0.0	0.0	3.200
20-	0.0	0.0	0.0	0.0	0.0	0.703	6.080	0.0	0.0	0.0	0.0	0.0	0.0	6.783
25-	0.0	0.0	0.0	0.0	0.0	4.184	8.029	0.0	0.0	0.0	0.0	0.0	0.0	12.214
30-	0.0	0.0	0.0	0.0	0.0	12.231	16.290	0.0	0.0	0.0	0.0	0.0	0.0	28.521
35-	0.0	0.0	0.0	0.0	0.0	9.545	29.806	0.0	0.0	0.0	0.0	0.0	0.0	39.351
40-	0.0	0.0	0.0	0.0	0.0	7.815	41.332	0.0	0.0	0.0	0.0	0.0	0.0	49.147
45-	0.0	0.0	0.0	0.0	0.0	1.075	23.971	0.0	0.0	0.0	0.0	0.0	0.0	25.046
50-	0.0	0.0	0.0	0.0	0.0	0.847	7.411	0.0	0.0	0.0	0.0	0.0	0.0	8.259
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.0	0.0	0.0	0.0	0.0	36.526	135.996	0.0	0.0	0.0	0.0	0.0	0.0	172.522

S1016876

TABLE 11. OBSERVED/EXPECTED EVENTS BY AGE AND YEAR AT ENTRANCE INTO COHORT

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

AGE	YEAR 1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-	0.0	0.0	0.0	0.0	0.0	0.0	0.976	0.0	0.0	0.0	0.0	0.0	0.0	0.937
20-	0.0	0.0	0.0	0.0	0.0	1.423	1.316	0.0	0.0	0.0	0.0	0.0	0.0	1.327
25-	0.0	0.0	0.0	0.0	0.0	1.195	1.494	0.0	0.0	0.0	0.0	0.0	0.0	1.392
30-	0.0	0.0	0.0	0.0	0.0	0.736	0.921	0.0	0.0	0.0	0.0	0.0	0.0	0.841
35-	0.0	0.0	0.0	0.0	0.0	1.572	0.705	0.0	0.0	0.0	0.0	0.0	0.0	0.915
40-	0.0	0.0	0.0	0.0	0.0	0.304	0.629	0.0	0.0	0.0	0.0	0.0	0.0	0.590
45-	0.0	0.0	0.0	0.0	0.0	1.860	0.667	0.0	0.0	0.0	0.0	0.0	0.0	0.719
50-	0.0	0.0	0.0	0.0	0.0	2.361	0.675	0.0	0.0	0.0	0.0	0.0	0.0	0.848
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.0	0.0	0.0	0.0	0.0	1.013	0.779	0.0	0.0	0.0	0.0	0.0	0.0	0.829

STO164877

TABLE 12. PERSON-YEARS BY AGE AND YEAR AT ENTRANCE INTO COHORT

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

YEAR

AGE	1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-	0.0	0.0	0.0	0.0	0.0	57.0	1698.9	0.0	0.0	0.0	0.0	0.0	0.0	1755.9
20-	0.0	0.0	0.0	0.0	0.0	235.1	2727.9	0.0	0.0	0.0	0.0	0.0	0.0	2963.0
25-	0.0	0.0	0.0	0.0	0.0	952.5	2393.5	0.0	0.0	0.0	0.0	0.0	0.0	3346.0
30-	0.0	0.0	0.0	0.0	0.0	1808.3	2992.3	0.0	0.0	0.0	0.0	0.0	0.0	4800.6
35-	0.0	0.0	0.0	0.0	0.0	990.3	3549.7	0.0	0.0	0.0	0.0	0.0	0.0	4540.1
40-	0.0	0.0	0.0	0.0	0.0	478.6	3217.1	0.0	0.0	0.0	0.0	0.0	0.0	3695.7
45-	0.0	0.0	0.0	0.0	0.0	48.3	1264.8	0.0	0.0	0.0	0.0	0.0	0.0	1313.1
50-	0.0	0.0	0.0	0.0	0.0	35.2	262.2	0.0	0.0	0.0	0.0	0.0	0.0	297.4
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.0	0.0	0.0	0.0	0.0	4605.3	18106.5	0.0	0.0	0.0	0.0	0.0	0.0	22711.8

STO164878

TABLE 13. 1000 X (OBS-EXP)/PYRS BY AGE AND YEAR AT ENTRANCE INTO COHORT

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

	YEAR													
AGE	1925-	1930-	1935-	1940-	1945-	1950-	1955-	1960-	1965-	1970-	1975-	1980-	1985-	SUM
0-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-	0.0	0.0	0.0	0.0	0.0	-2.206	-0.044	0.0	0.0	0.0	0.0	0.0	0.0	-0.114
20-	0.0	0.0	0.0	0.0	0.0	1.264	0.704	0.0	0.0	0.0	0.0	0.0	0.0	0.748
25-	0.0	0.0	0.0	0.0	0.0	0.856	1.659	0.0	0.0	0.0	0.0	0.0	0.0	1.430
30-	0.0	0.0	0.0	0.0	0.0	-1.787	-0.431	0.0	0.0	0.0	0.0	0.0	0.0	-0.942
35-	0.0	0.0	0.0	0.0	0.0	5.509	-2.481	0.0	0.0	0.0	0.0	0.0	0.0	-0.738
40-	0.0	0.0	0.0	0.0	0.0	-10.062	-4.766	0.0	0.0	0.0	0.0	0.0	0.0	-5.452
45-	0.0	0.0	0.0	0.0	0.0	19.153	-6.302	0.0	0.0	0.0	0.0	0.0	0.0	-5.366
50-	0.0	0.0	0.0	0.0	0.0	32.750	-9.198	0.0	0.0	0.0	0.0	0.0	0.0	-4.232
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.0	0.0	0.0	0.0	0.0	0.103	-1.657	0.0	0.0	0.0	0.0	0.0	0.0	-1.300

ST0164879

TABLE 14. OBSERVED EVENTS BY YEARS WORKED AND LATENCY

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

	LATENCY													
YRS	00-	05-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	SUM
0-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
20-	4.	13.	27.	20.	27.	0.	0.	0.	0.	0.	0.	0.	0.	91.
25-	3.	7.	10.	10.	17.	5.	0.	0.	0.	0.	0.	0.	0.	52.
30-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
35-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
40-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
45-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
50-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
55-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
60-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
65-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
70-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
75-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
80-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
85-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
90-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
95-	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
SUM	7.	20.	37.	30.	44.	5.	0.	0.	0.	0.	0.	0.	0.	143.

ST0164880

TABLE 15. EXPECTED EVENTS BY YEARS WORKED AND LATENCY

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

	LATENCY													
YRS	00-	05-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	SUM
0-	14.048	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.048
5-	0.0	20.443	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.443
10-	0.0	0.0	30.181	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.181
15-	0.0	0.0	0.0	43.471	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.471
20-	0.0	0.0	0.0	0.0	53.625	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.625
25-	0.0	0.0	0.0	0.0	0.0	10.709	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.709
30-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	14.048	20.443	30.181	43.471	53.625	10.709	0.0	0.0	0.0	0.0	0.0	0.0	0.0	172.478

S10164881

TABLE 16.OBSERVED/EXPECTED EVENTS BY YEARS WORKED AND LATENCY

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES

CANADA

LATENCY

YRS	00-	05-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	SUM
0-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20-	0.0	0.0	0.0	0.0	0.503	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.697
25-	0.0	0.0	0.0	0.0	0.0	0.467	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.656
30-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	0.498	0.978	1.226	0.690	0.821	0.467	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.829

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TABLE 17. PERSON-YEARS BY YEARS WORKED AND LATENCY

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

	LATENCY													
YRS	00-	05-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	SUM
0-	4767.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4767.5
5-	0.0	4702.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4702.5
10-	0.0	0.0	4558.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4558.7
15-	0.0	0.0	0.0	4390.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4390.9
20-	0.0	0.0	0.0	0.0	3707.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3707.1
25-	0.0	0.0	0.0	0.0	0.0	583.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	583.6
30-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	4767.5	4702.5	4558.7	4390.9	3707.1	583.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22710.2

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TABLE 18. 1000 X (OBS-EXP)/PYRS BY YEARS WORKED AND LATENCY

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00009134

1 ALL CAUSES CANADA

LATENCY

YRS	00-	05-	10-	15-	20-	25-	30-	35-	40-	45-	50-	55-	60-	SUM
0-	-2.947	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-2.947
5-	0.0	-4.347	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-4.347
10-	0.0	0.0	-6.621	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-6.621
15-	0.0	0.0	0.0	-9.900	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-9.900
20-	0.0	0.0	0.0	0.0	-7.182	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.082
25-	0.0	0.0	0.0	0.0	0.0	-9.783	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.754
30-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
95-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUM	-1.478	-0.094	1.496	-3.068	-2.596	-9.783	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.298

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TABLE 19. FREQUENCY DISTRIBUTION OF CAUSE OF DEATH BY ICD NUMBER

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00017530

TOTAL OBSERVED = 143 FOR CANADA

1090 -	1	1500 -	4	1538 -	2	1579 -	3	1619 -	1	1621 -	8	1630 -	2
1729 -	2	1850 -	1	1860 -	1	1880 -	1	1910 -	4	1978 -	1	2030 -	1
2060 -	1	2509 -	1	2869 -	1	3032 -	1	3039 -	1	3400 -	1	3950 -	1
3969 -	1	3979 -	1	4020 -	1	4100 -	3	4109 -	34	4119 -	2	4123 -	10
4270 -	1	4309 -	3	4310 -	3	4420 -	1	4442 -	1	4710 -	1	4910 -	1
5304 -	1	5329 -	1	5532 -	1	5699 -	1	5710 -	2	5718 -	1	5719 -	3
5920 -	1	8120 -	1	8121 -	1	8150 -	1	8169 -	1	8191 -	1	8199 -	1
8300 -	1	8411 -	1	8413 -	1	8730 -	1	8900 -	1	9110 -	1	9238 -	1
9503 -	1	9520 -	1	9521 -	1	9550 -	8	9650 -	1	9840 -	1	9850 -	1
9880 -	1	9999 -	2	0 -	0	0 -	0	0 -	0	0 -	0	0 -	0

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TABLE 20. SCREEN OF OBSERVED AND EXPECTED NUMBERS FOR EACH CAUSE OF DEATH

U OF O RADIATION STUDY ----> (ALL EXPOSED GROUPS - CODE = 1) 00001590

TOTAL PERSONS = 957. EXPECTED NUMBERS BASED ON MORTALITY RATES FOR WM FROM CANADA

	OBSERVED	EXPECTED	OBS/EXP	LL	UL	POISS
1 ALL CAUSES	143	172.57	0.83	0.70	0.98	1.000*
2 INFECTIVE AND PARASITIC DISEASES	1	1.61	0.62	0.01	3.45	0.800
3 NEOPLASMS	32	40.56	0.79	0.54	1.11	1.000*
4 ENDOCRINE/NUTRITIONAL/METABOLIC DISEASES	1	2.87	0.35	0.00	1.94	0.943
5 BLOOD DISEASES	1	0.31	3.26	0.04	18.15	0.264
6 MENTAL DISORDERS	2	1.57	1.27	0.14	4.60	0.466
7 NERVOUS SYSTEM/SENSE ORGAN DISEASE	1	2.04	0.49	0.01	2.73	0.869
8 CIRCULATORY DISEASE	62	78.29	0.79	0.61	1.02	1.000*
9 RESPIRATORY DISEASE	2	8.37	0.24	0.03	0.86	0.998
10 DIGESTIVE DISEASE	10	9.01	1.11	0.53	2.04	0.414
11 GENITOURINARY DISEASE	1	1.74	0.57	0.01	3.19	0.825
12 COMPLICATIONS OF PREGNANCY	0	0.0	0.0	0.0	0.0	0.0
13 SKIN/SUBCUTANEOUS TISSUE DISEASE	0	0.08	0.0	0.0	0.0	1.000
14 MUSKULOSKELETAL DISEASE	0	0.36	0.0	0.0	0.0	1.000
15 CONGENITAL ANOMALIES	0	0.46	0.0	0.0	0.0	1.000
16 PERINATAL MORTALITY	0	0.00	0.0	0.0	0.0	1.000
17 SYMPTOMS/ILL-DEFINED	0	1.22	0.0	0.0	0.0	1.000
18 ACCIDENTS/POISONINGS/VIOLENCE	28	24.06	1.16	0.77	1.68	0.236
19 CANCER	32	40.16	0.80	0.54	1.12	1.000*
20 LIP	0	0.04	0.0	0.0	0.0	1.000
21 TONGUE	0	0.28	0.0	0.0	0.0	1.000
22 SALIVARY GLAND	0	0.07	0.0	0.0	0.0	1.000
23 MOUTH	0	0.25	0.0	0.0	0.0	1.000
24 OROPHARYNX	0	0.16	0.0	0.0	0.0	1.000
25 NASOPHARYNX	0	0.13	0.0	0.0	0.0	1.000
26 HYPOPHARYNX	0	0.10	0.0	0.0	0.0	1.000

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27 PHARYNX	0	0.21	0.0	0.0	0.0	0.38	1.000
28 PHARYNX	0	0.60	0.0	0.0	0.0	0.02	1.000
29 BUCCAL CAVITY AND PHARYNX	0	1.24	0.0	0.0	0.0	0.44	1.000
30 TONGUE MOUTH AND PHARYNX	0	1.13	0.0	0.0	0.0	0.35	1.000
31 ESOPHAGUS	4	0.96	4.19	1.13	10.72	6.78	0.016
32 STOMACH	0	3.16	0.0	0.0	0.0	2.24	1.000
33 SMALL INTESTINE	0	0.11	0.0	0.0	0.0	1.36	1.000
34 LARGE INTESTINE EXCEPT RECTUM	2	3.29	0.61	0.07	2.19	0.19	0.840
35 RECTUM AND RECTOSIGMOID JUNCTION	0	1.53	0.0	0.0	0.0	0.69	1.000
36 LARGE INTESTINE AND RECTUM	2	4.82	0.42	0.05	1.50	1.12	0.953
37 LIVER	0	0.37	0.0	0.0	0.0	0.04	1.000
38 GALLBLADDER	0	0.34	0.0	0.0	0.0	0.08	1.000
39 LIVER AND GALLBLADDER	0	0.77	0.0	0.0	0.0	0.09	1.000
40 PANCREAS	3	2.35	1.28	0.26	3.73	0.01	0.417
41 PERITONEUM	0	0.13	0.0	0.0	0.0	1.08	1.000
42 DIGESTIVE NS	0	0.23	0.0	0.0	0.0	0.33	1.000
43 DIGESTIVE	9	12.59	0.72	0.33	1.36	0.76	0.680
44 NOSE/SINUSES	0	0.10	0.0	0.0	0.0	1.64	1.000
45 LARYNX	1	0.68	1.47	0.02	8.17	0.05	0.494
46 BRONCHUS AND LUNG	8	13.18	0.61	0.26	1.20	1.66	0.951
47 PLEURA	2	0.06	34.47	3.87	124.44	35.83	0.002+
48 TRACHEA/BRONCHUS/LUNG AND OTHER	10	13.42	0.75	0.36	1.37	0.63	0.860
49 RESPIRATORY	11	14.20	0.77	0.39	1.39	0.51	0.837
50 BONE	0	0.21	0.0	0.0	0.0	0.39	1.000
51 CONNECTIVE TISSUE	0	0.17	0.0	0.0	0.0	0.67	1.000
52 MALIGNANT MELANOMA	2	0.43	4.62	0.52	16.69	2.63	0.071
53 MEL.LIP	0	0.00	0.0	0.0	0.0	184.67	1.000
54 MEL.EYELID	0	0.00	0.0	0.0	0.0	278.80	1.000
55 MEL.EAR	0	0.01	0.0	0.0	0.0	39.06	1.000
56 MEL.OTHER FACE	0	0.01	0.0	0.0	0.0	15.89	1.000

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57 MEL.SCALP AND NECK	0	0.02	0.0	0.0	0.0	9.52	1.000
58 MEL.SCROTUM	0	0.00	0.0	0.0	0.0	168.99	1.000
59 MEL.TRUNK	0	0.11	0.0	0.0	0.0	1.40	1.000
60 MEL.UPPER LIMB	0	0.03	0.0	0.0	0.0	6.35	1.000
61 MEL.LOWER LIMB	0	0.05	0.0	0.0	0.0	4.48	1.000
62 MEL.SITE NS	2	0.18	11.01	1.24	39.73	9.56	0.015
63 OTHER SKIN	0	0.11	0.0	0.0	0.0	1.44	1.000
64 BREAST	0	0.06	0.0	0.0	0.0	3.42	1.000
65 CERVIX UTERI	0	0.0	0.0	0.0	0.0	3.42	0.0
66 CHORIONEPITHELIOMA	0	0.0	0.0	0.0	0.0	3.42	0.0
67 CORPUS UTERI	0	0.0	0.0	0.0	0.0	3.42	0.0
68 CHORIO. AND UTERUS NS	0	0.0	0.0	0.0	0.0	3.42	0.0
69 OTHER UTERUS	0	0.0	0.0	0.0	0.0	3.42	0.0
70 CHORIO AND OTHER UTERUS	0	0.0	0.0	0.0	0.0	3.42	0.0
71 UTERUS INCL. CERVIX	0	0.0	0.0	0.0	0.0	3.42	0.0
72 OVARY	0	0.0	0.0	0.0	0.0	3.42	0.0
73 OVARY/FALLOPIAN TUBE/BROAD LIB	0	0.0	0.0	0.0	0.0	3.42	0.0
74 FEMALE GENITAL	0	0.0	0.0	0.0	0.0	3.42	0.0
75 PROSTATE	1	1.46	0.68	0.01	3.80	0.00	0.769
76 TESTIS	1	0.20	4.98	0.07	27.72	0.45	0.182
77 MALE GENITAL	2	1.71	1.17	0.13	4.22	0.03	0.511
78 KIDNEY	0	1.09	0.0	0.0	0.0	0.32	1.000
79 BLADDER	1	0.88	1.14	0.01	6.32	0.16	0.585
80 BLADDER AND OTHER URINARY	1	0.91	1.10	0.01	6.13	0.18	0.597
81 URINARY	1	2.00	0.50	0.01	2.78	0.12	0.865
82 EYE	0	0.05	0.0	0.0	0.0	3.70	1.000
83 BRAIN	4	1.52	2.63	0.71	6.74	2.58	0.068
84 BRAIN AND OTHER NERVOUS SYTEM	4	1.76	2.27	0.61	5.81	1.71	0.103
85 NERVOUS SYSTEM.BENIGN AND MALIGNANT	4	2.01	1.99	0.53	5.08	1.10	0.145
86 THYROID	0	0.09	0.0	0.0	0.0	1.97	1.000

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87 OTHER ENDOCRINE	0	0.08	0.0	0.0	0.0	2.13	1.000
88 ILL-DEFINED CANCER	1	1.62	0.62	0.01	3.43	0.01	0.802
89 LYMPHOSARCOMA AND RETIC.CELL SARCOMA	0	0.74	0.0	0.0	0.0	0.08	1.000
90 RETICULUM CELL SARC	0	0.30	0.0	0.0	0.0	0.13	1.000
91 LYMPHOSARCOMA	0	0.44	0.0	0.0	0.0	0.01	1.000
92 HODGKINS DISEASE	0	0.54	0.0	0.0	0.0	0.00	1.000
93 OTHER LYMPHOID	0	0.53	0.0	0.0	0.0	0.00	1.000
94 NON-HODGKINS LYMPHOMAS	0	1.27	0.0	0.0	0.0	0.47	1.000
95 MULTIPLE MYELOMA	1	0.54	1.86	0.02	10.34	0.00	0.416
96 LYMPHOID	1	2.35	0.43	0.01	2.37	0.31	0.904
97 LYMPHATIC LEUKEMIA	0	0.26	0.0	0.0	0.0	0.23	1.000
98 MYELOID LEUKEMIA	0	0.43	0.0	0.0	0.0	0.01	1.000
99 MONOCYTIC LEUKEMIA	1	0.05	20.45	0.27	113.79	4.16	0.048
100 LYMPHATIC AND MYELOID LEUKEMIA	0	1.06	0.0	0.0	0.0	0.29	1.000
101 OTHER AND UNSPECIFIED LEUKEMIA	0	0.36	0.0	0.0	0.0	0.05	1.000
102 LEUKEMIAS	1	1.47	0.68	0.01	3.78	0.00	0.770
103 POLYCYTHEMIA VERA	0	0.05	0.0	0.0	0.0	3.88	1.000
104 MYELOFIBROSIS	0	0.05	0.0	0.0	0.0	3.90	1.000
105 NEOPLASMS OF LYMPHATIC AND HEMATOPOIETIC TISSUE	2	3.09	0.65	0.07	2.34	0.11	0.813
106 BENIGN NEOPLASMS	0	0.21	0.0	0.0	0.0	0.40	1.000
107 NEOPLASM OF UNSPECIFIED NATURE	0	0.16	0.0	0.0	0.0	0.71	1.000
108 NEOPLASMS,SECONDARY,ILL-DEFINED AND BENIGN	1	1.99	0.50	0.01	2.79	0.12	0.864
109 DIABETES MELLITUS	1	2.24	0.45	0.01	2.48	0.25	0.894
110 CYSTIC FIBROSIS	0	0.00	0.0	0.0	0.0	256.36	1.000
111 APLASTIC ANEMIA	0	0.08	0.0	0.0	0.0	2.40	1.000
112 ALCOHOLIC PSYCHOSIS,ALCOHOLISM AND ALCOHOL POISONING	2	1.66	1.21	0.14	4.36	0.01	0.493
113 MULTIPLE SCLEROSIS	1	0.35	2.88	0.04	16.02	0.07	0.293
114 PARALYSIS AGITANS	0	0.16	0.0	0.0	0.0	0.74	1.000
115 MOTOR NEURONE DISEASE	0	0.35	0.0	0.0	0.0	0.06	1.000
116 MAJOR CARDIO-VASCULAR DISEASES	0	77.45	0.0	0.0	0.0	76.45	1.000*

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117 ISCHEMIC HEART DISEASE	49	59.34	0.83	0.61	1.09	1.63	1.000*
118 CEREBROVASCULAR DISEASE	6	8.15	0.74	0.27	1.60	0.34	0.823
119 HEART DISEASE	54	51.92	1.04	0.78	1.36	0.05	1.000*
120 RHEUMATIC FEVER AND CHRONIC RHEUMATIC HEART DISEASE	3	1.90	1.58	0.32	4.61	0.19	0.296
121 HYPERTENSIVE DISEASE	1	0.71	1.41	0.02	7.83	0.06	0.509
122 ACTIVE RHEUMATIC FEVER	0	0.06	0.0	0.0	0.0	3.20	1.000
123 CHRONIC RHEUMATIC HEART DISEASE	3	1.84	1.63	0.33	4.76	0.24	0.280
124 ACUTE MYOCARDIAL INFARCTION	37	33.55	1.10	0.78	1.52	0.26	0.298
125 OTHER FORMS OF HEART DISEASE	1	2.05	0.35	0.00	1.95	0.64	0.942
126 DISEASE OF ARTERIES, ARTERIOLES AND CAPILLARIES	2	2.78	0.72	0.08	2.60	0.03	0.765
127 AORTIC ANEURYSM	0	1.46	0.0	0.0	0.0	0.63	1.000
128 DISEASES OF VEINS, LYMPHATICS AND OTHER DIS. OF CIRC. SYST.	0	1.00	0.0	0.0	0.0	0.25	1.000
129 ACUTE RESPIRATORY INFECTIONS, EXCEPT INFLUENZA	0	0.09	0.0	0.0	0.0	1.92	1.000
130 INFULENZA	1	0.21	4.73	0.06	26.33	0.39	0.190
131 PNEUMONIA	0	2.47	0.0	0.0	0.0	1.58	1.000
132 CHRONIC BRONCHITIS, EMPHYSEMA AND ASTHMA	1	4.45	0.22	0.00	1.25	1.95	0.908
133 OTHER DISEASES OF UPPER RESPIRATORY TRACK	0	0.04	0.0	0.0	0.0	6.02	1.000
134 OTHER DISEASES OF RESPIRATORY SYSTEM	0	1.11	0.0	0.0	0.0	0.34	1.000
135 VIRAL PNEUMONIA	0	0.03	0.0	0.0	0.0	7.10	1.000
136 PNEUMOCOCCAL PNEUMONIA	0	0.21	0.0	0.0	0.0	0.41	1.000
137 OTHER BACTERIAL PNEUMONIA	0	0.03	0.0	0.0	0.0	6.68	1.000
138 PNEUMONIA DUE TO OTHER SPECIFIED ORGANISM	0	0.00	0.0	0.0	0.0	51.19	1.000
139 OTHER PNEUMONIA	0	1.51	0.0	0.0	0.0	0.67	1.000
140 PNEUMOCONIOSES	0	0.16	0.0	0.0	0.0	0.75	1.000
141 SILICOSIS AND ANTHRACOSILICOSIS	0	0.00	0.0	0.0	0.0	2.32	1.000
142 ASCESTOSIS	0	0.02	0.0	0.0	0.0	14.56	1.000
143 OTHER PNEUMOCONIOSES	0	0.04	0.0	0.0	0.0	4.63	1.000
144 SILICOTUBERCULOSIS	0	0.02	0.0	0.0	0.0	12.24	1.000
145 ULCER OF STOMACH	0	0.49	0.0	0.0	0.0	0.00	1.000
146 ULCER OF DUODENUM	1	0.56	1.79	0.02	9.98	0.01	0.427

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147 ULCERS	1	1.15	0.87	0.01	4.84	0.683
148 CIRRHOSIS OF LIVER	6	5.32	1.13	0.41	2.46	0.439
149 GALLBLADDER DISEASES	0	0.31	0.0	0.0	0.0	1.000
150 DISEASES OF PANCREAS	0	0.45	0.0	0.0	0.0	1.000
151 NEPHRITIS AND NEPHROSIS	0	0.89	0.0	0.0	0.0	1.000
152 KIDNEY INFECTIONS	0	0.26	0.0	0.0	0.0	1.000
153 KIDNEY DISEASES	1	1.58	0.63	0.01	3.53	0.793
154 PROSTATE DISEASES	0	0.06	0.0	0.0	0.0	1.000
155 CONGENITAL ANOMALIES OF NERVOUS SYSTEM	0	0.03	0.0	0.0	0.0	1.000
156 CONGENITAL ANOMALIES OF CIRCULATORY SYSTEM	0	0.24	0.0	0.0	0.0	1.000
157 MOTOR VEHICLE TRAFFIC ACCIDENTS	6	7.54	0.80	0.29	1.73	0.762
158 MVTA INVOLVING PEDESTRIAN	0	1.24	0.0	0.0	0.0	1.000
159 ACCIDENTAL FALLS	0	1.62	0.0	0.0	0.0	1.000
160 ACCIDENTS CAUSED BY FIRES AND FLAMES	1	0.89	1.13	0.01	6.28	0.587
161 ACCIDENTS CAUSED BY FIRE IN PRIVATE DWELLING	1	0.35	2.89	0.04	16.09	0.292
162 ACCIDENTAL DROWNING	0	1.18	0.0	0.0	0.0	1.000
163 SUICIDE	11	5.29	2.08	1.04	3.72	0.020
164 HOMICIDE	1	0.67	1.50	0.02	8.36	0.486
165 CHRONIC RESPIRATORY DISEASE	1	5.08	0.20	0.00	1.10	0.994
166 CIRRHOSIS AND OTHER LIVER DISEASE	6	5.62	1.07	0.39	2.33	0.491
167 PROSTATIS NEOPLASIA AND HYPERPLASIA	1	1.52	0.66	0.01	3.67	0.781
168 PROSTATITIS AND OTHER DISEASES OF PROSTATE	0	0.01	0.0	0.0	0.0	1.000
169 ALL NATURAL CAUSES OF DEATH	113	148.51	0.76	0.63	0.91	1.000*
170 APPENDICITIS	0	0.14	0.0	0.0	0.0	1.000
171 RENAL CALCULI	1	0.06	16.42	0.21	91.34	0.059
172 ACCIDENTAL POISONING	2	1.00	2.00	0.22	7.23	0.264
173 ASTHMA	0	0.45	0.0	0.0	0.0	1.000
174 CHRONIC OBSTRUCTIVE PULMONARY DISEASE	0	1.29	0.0	0.0	0.0	1.000
TOTAL RESIDUAL	2					

* POISSON PROBABILITY NOT CALCULATED: OBS,EXP > 40

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