NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30, and subsequent amendments.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30, et ses amendements subséquents.

NATIVE MORTALITY IN CANADA:

AN EPIDEMIOLOGICAL STUDY USING COMPUTERIZED RECORD LINKAGE OF NATIVE ADMINISTRATIVE FILES WITH THE CANADA MORTALITY DATA BASE AND TWO SOURCES OF ROUTINELY COLLECTED MORTALITY STATISTICS

by

PAUL HASSELBACK

Thesis submitted to
the School of Graduate Studies and Research
in partial fulfillment of the requirements for the
M.Sc. degree in Epidemiology

UNIVERSITY OF OTTAWA

ISBN 0-315-60040-3

UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

ABSTRACT

The Problem:

Natives in Canada suffer from high rates of morbidity and mortality in comparison to the Canadian population. Investigation of this inequity has been hampered by a lack of valid health statistics on native populations. This thesis assesses native mortality through a study of three potential sources of native mortality statistics using routinely collected data.

Purpose: Assess native mortality in Canada

Objectives:

- Measure mortality indicators using a computerized record linkage of government Indian administrative records with the Canada Mortality Database.
- Compare native mortality indicators based on the linked files, on-reserve deaths, and Medical Services Branch native client files.
- Relate mortality amongst natives with respect to the Canadian population.
- Determine if there is a contribution of "rural" living to native mortality.

Background Information:

This thesis provides extensive background information on approaches to studying native mortality and the results of previous studies of the health and mortality risk by disease for natives. A methodological review of the process of record linkage is also provided.

Data sources:

Three sources of data are used to assess native mortality: i) a generated computerized record linkage of the Department of Indian Affairs and Northern Development (DIAND) native "Event" file with the CMDB, ii) CMDB records of deaths occurring on reserves, and iii) records of native clients of the Medical Services Branch (MSB) of Health and Welfare Canada. The MSB files provide death information aggregated to the ICD chapter level, whereas more specific information is available from the other two native files. Comparison populations are derived from the seven provinces with reserve coding of deaths and a subset of "rural" census divisions which include a reserve in these provinces.

Period of Study:

The record linkage includes deaths recorded with DIAND as occurring in 1981. The average annual mortality rate for the two other native files and comparison populations are derived from 1979-1983 records:

Methods of Analysis:

Analysis are based on age-sex specific; mortality rates, life expectancy, and survival; age-standardized cause-specific mortality rates, standardized mortality ratios; potential years of life lost to age 75 (PYLL) and rates of PYLL; crude and age-standardized proportional mortality ratios; and mortality rankings based on age-standardized mortality rates, potential years of life lost, proportional mortality ratios, and standardized mortality ratios. Age group sex and cause specific rates are appended for 6 age categories, namely: 0-1, 1-4, 5-14, 15-34, 35-64, and over 65.

Results:

Natives are subject to higher mortality rates at all ages below 55 in males and 65 in females. In older age groups an apparently lower mortality rate is noted in natives than in the comparison populations. This elderly reduction has a substantial effect on the measurement of life expectancy at birth but does not effect the measurement of survival probabilities to all ages below 75 which are lower in natives.

Natives are noted to have higher mortality from: all causes; ICD chapters; infective and parasitic disorders, mental disorders, symptoms and ill-defined disorders, accidents, poisoning and violence; and disease categories of; alcoholic psychosis/alcoholism, motor vehicle traffic accidents, pneumonia, fires, drowning, suicide, homicide and accidental poisoning.

Female natives are at higher risk for cancer of the uterus (including cervix) and cirrhosis of the liver. Natives also appear to be at higher risk for several other ICD chapters and some disease aggregates.

Native populations are at lower risk from: ICD chapters; neoplasms, and circulatory disorders; and disease aggregations of; digestive tract cancers, colorectal cancers, lung cancer, and coronary heart disease. Native males have a lower risk for cancers of the bladder and brain. Female natives have a lower risk for cancer of the breast

Comparison of Data Sources:

Differences in the absolute measurement of rates between the three native data sources are identified. The MSB file is approximately 20% greater than DIAND-linked files and 30% greater than the on-reserve deaths. The relative contribution of various causes of death appears to be consistent.

Despite a potential underestimate by using the on-reserve deaths, this measure of native mortality has a significantly elevated mortality

experience from the "rural" comparison population in many of the potentially lifestyle associated diseases.

Sources of Error in this Study:

In the development of the linked records from the DIAND event file and the CMDB the potential exists for an error of up to 11% from unmatched records and an additional 9% from the late reporting of deaths to DIAND. The on-reserve deaths may be effected by: inaccurate coding of on-reserve residence in determining the population at risk, inaccurate coding of on-reserve residence on death certificates, and non-status persons coded as dying with a residence on-reserve. A potential underestimation of true mortality by 30% may exist through using this method of mortality ascertainment. The MSB files have not been fully examined by this thesis.

Conclusion:

Natives in Canada carry the burden of increased mortality in comparison to the general Canadian population.

The potential exists for three separate data sources to be used to assess mortality among native populations. Each of these data sets has limitations which restrict their use.

ACKNOWLEDGMENTS

This thesis is the culmination of the efforts of numerous persons to whom I will remain indebted. My wife Rosa deserves special credit for enduring the silence and loneliness, sharing the frustrations and anger, and providing encouragement and support. My children Jasmine and Tristan have stimulated my desire to complete this task. It is my sincerest hope that my family profits from this thesis.

I have been fortunate in working with an exceptional thesis committee. Dr. Yang Mao is especially appreciated for: providing the opportunity to undertake this study, believing in my abilities, and working as a thesis co-supervisor. Dr.Don Wigle for his critical analysis and support as the thesis supervisor. Dr. Robert Spasoff for his role as a thesis co-supervisor and residency program director and his personal concern during times of hardship.

Robert Semenciw of the Laboratory Centre for Disease Control has provided invaluable computer assistance. His devotion to meticulous detail is an inspiration. Ellen Bobet of the Demographics and Statistics Section of Medical Services Branch generously provided access to the MSB files in addition to insights into data quality. Elizabeth Coppock of Statistics Canada directed the processing of tapes and the record linkage. Her colleagues in this endeavour were Pierre Lalonde and Guy Quesnel.

A special thanks to the Department of Indian Affairs and Northern Development who provided the event files for use by LCDC.

To the faculty, students and support staff of the Department of Epidemiology and Community Medicine is extended a heart felt thanks for their assistance, support and interest in this project.

Finally, I would like to express my gratitude to the review committee: Dr. T.K. Young, Dr. G. Hill, and Dr. R.Nair, for their efforts in providing the comments and criticisms which solidify a thesis.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Natives in Canada carry the burden of a higher level of morbidity and mortality in comparison to the general Canadian population. Investigation of this inequity is hampered by the dearth of vital statistics on native populations. No method of current data collection in Canada has been proven to provide reliable or valid statistics on the mortality of native populations. Available information suggests that natives are at considerable risk for certain causes of death. This thesis will expand on the available information and will help prove the validity and reliability of currently used data sources.

A multitude of parties are involved in the provision of health care. Individuals, band councils, municipal agencies, provincial governments and federal government departments all share in the provision for health care without a clear definition of responsibility. This thesis involves four sectors of the federal government who contribute to the provision of native health; The Department of Indian Affairs and Northern Development (DIAND) who are mandated with the provision of services to registered natives, The Indian and Northern Health Services of the Medical Services Branch (MSB) of Health and Welfare who ensure the provision of health services to natives in Canada, Statistics Canada, and the Disease Surveillance and Risk Assessment Division of the Laboratory Centre for Disease Control (LCDC) in the Health Protection Branch of Health and Welfare Canada. It is through the encouragement and support of LCDC that this study is undertaken.

This thesis will explore two previously used measures of native mortality and will introduce a new technique to assess native mortality. These three approaches address natives from different perspectives. MSB collects vital status information on their native clients. LCDC has used the residence coding on death certificates to identify a native population. The new strategy involves the development of a file through

a record linkage of DIAND administrative files with the Canada Mortality Database (CMDB) at Statistics Canada. Variations between these study groups relate to differences in the populations under study and in methods of collection of data. Figure 1 illustrates the relative relationship and the approximate size of the native populations used in this study in 1981. The size of the intersecting areas are estimates and represent an "unknown" in comparing studies of native health.

The conceptual framework for the linkage component of this study was developed in 1986 by LCDC and the DIAND "event" files were obtained late in that year. A request for linkage of deaths from these files to the CMDB was submitted to Statistics Canada in June of 1987. Permission for use of the death records in the CMDB was obtained from the Provincial Vital Statistics Registrars in late 1987. Processing of the DIAND files in preparation for the linkage was undertaken by Statistics Canada and the computerized record linkage was performed in the spring of 1989. The linked records were processed in the summer of 1989 by LCDC in preparation for this study. This thesis originally focused on the availability of mortality measures of on-reserve deaths and the DIAND linked files.

Goal and Objectives

The goal of the study was to:

Assess mortality of Canada's Native Indians.

To achieve the goal of the study, the following objectives were established:

- Develop mortality indicators based on deaths from the DIAND event file linked with the CMDB.
- Compare the indicators based on the DIAND event file with indicators based on on-reserve deaths.
- Compare native mortality to the Canadian population.

Data from MSB were to be obtained in published format for comparison purposes. During the execution of study, MSB offered their data for inclusion in the study. The availability of these data supported the

original goal of the thesis and the data source was incorporated into the study. The objective of including this data set is discussed in Section 3.3.

A potential factor which could explain the differences in mortality between native populations and the Canadian general population is rural residence. The process of developing the files for use in this study allows for the selection of a comparison non-native population which also live in rural areas of Canada. The final objective of this study was to:

- Compare mortality indicators of the on-reserve population with mortality indicators of the population living off reserves in census divisions which surround reserves.

Structure of the Thesis

Chapter 2 of this thesis will discuss what is known about studying native mortality and what results should be expected based on a review of the known literature. Chapter 3 introduces and analyzes what is known regarding the data sources used in this thesis. A discussion of the theoretical aspects of record linkage is provided with an introduction to the Statistics Canada computerized procedure.

Chapters 4 and 5 present the methods and results respectively.

Chapters 6 to 9 discuss various aspects of the study. Chapter 6 focuses on native mortality in comparison to the general population. Chapter 7 extends the discussion of the data sources by noting the potential sources of error, their magnitude and direction. Chapter 8 discusses the comparability of the various native data sets and comparison populations. Chapter 9 reviews the overall limitations of the study.

Chapter 10 provides a series of specific conclusions and recommendations based on this thesis.

This thesis is an epidemiological study of native populations and has been undertaken as a step towards improving the health of native Canadians. It is hoped that this thesis provides some answers and stimulates more questions.

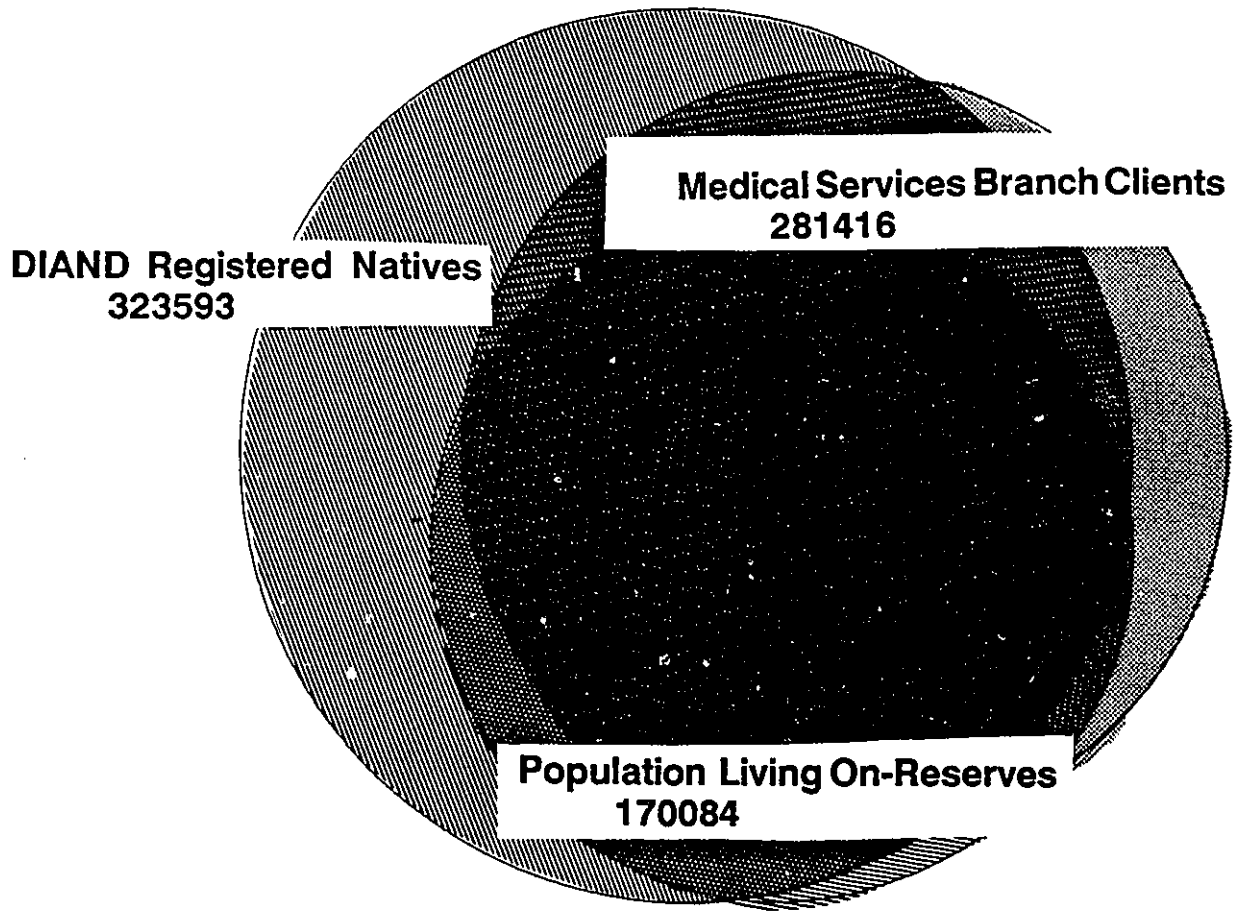


Figure 1: Relative coverage of strategies for the data collection and study of "Native" populations in Canada

Note: The intersecting areas are best estimates. The size of the populations are estimated to the year 1981. The length of time each of the groups is studied in this thesis varies from 1 year for the DIAND registered natives to 5 years for MSB clients and on-reserve populations

2. REVIEW OF THE LITERATURE ON NATIVE HEALTH STATUS

2.1 METHODOLOGY

A MEDLINE literature from 1980 to 1989 utilized North American Indians as the key concept. Cross referencing was performed by the key words of health status indicators, mortality and cause of death. A second search, done for the Ontario Zone of the Indian Health Services of the Medical Services Branch focused on Canadian studies of North American Indians. These searches identified 57 and 39 references respectively.

The national and regional offices of MSB were contacted for any unpublished information or government documents relating to native health. A recent government publication[1] incorporates a further comprehensive literature search of Canadian studies on native health. The authors of major studies on native health were contacted regarding recent manuscripts. All articles were searched for relevant secondary references.

To synthesize this information into a practical format this chapter is divided into three sections. Section 2.2 generalizes the methodological limitations noted in the studies on native health. Section 2.3 focuses on selected major native regions which have been intensively studied. The diseases of interest will be discussed in section 2.4. A synthesis of the results from the literature is appended (Appendix A) to allow the reader of this thesis to investigate any specific disease process in detail.

2.2 METHODOLOGICAL LIMITATIONS OF NATIVE HEALTH STATUS STUDIES

Most studies reviewed have focused on descriptive measures of native health. The main differences between studies relate to:

- definition of the population to be studied
- determining the population at risk
- determining the number of events in the population
- defining a comparison population
- selection of the categories of analysis: i.e. time, age, sex, ethnicity, and disease process
- presentation of results

These topics will be discussed individually in the following section.

Definition of the Population to be Studied

A single definition of native status does not exist. In Canada, natives are classified on the basis of registration under the Indian Act of 1876.[2] The federal government provides health care to registered (status) Indians. The Inuit are frequently grouped with status Indians as "natives". In some studies, mixtures of status Indians, non-status Indians, Inuit and Metis may all be referred to as "natives".

In the United States more confusion exists. Similar to Canada, provision of health services is based on a series of treaties signed in the 18th and 19th centuries. The provision of these services is not regarded as a statutory right.[3] As a result the definition of native status varies between tribes and is often based on a minimum percentage of native blood ancestry. The determination of national native health statistics is based on self-determined ethnic classification, which has been noted to change between two United States Censuses.[4]

Alternatives of the definition of native status include: living on a reserve,[5,6] living in a county with a reserve,[7] and living in an area serviced by a native health care facility.[8]

Determining the Number of Events in the Population

Many studies rely on death certificates to identify mortality events. In Canada, ethnicity is not recorded on the national death records. Native status is coded on provincial death certificate registrations in Manitoba, Alberta, Saskatchewan and British Columbia (until 1985). Geocodes for location of residence as on-reserve have existed since 1971.

Other approaches to identifying deaths include the use of MSB staff to identify events based on their knowledge of the community.[8] Some studies incorporate all known cases within a specified region (e.g.Wotton,[9] Ward[10]), or have amassed information from several different sources

(e.g.Gaudette,[11] Hildes[12]) into a single case series. The later two methods assume complete capture of all cases.

Ethnicity is recorded on American death certificates. This item is generally used to designate native status. The quality of the item was checked by Mahoney[13] and the sensitivity assessed as 95% among a native cohort. The specificity was not determined.

Determining the Population at Risk

Determining denominators is difficult. In Canada numbers of natives are generally set using the DIAND register, despite known limitations.[14] Census counts provide higher estimates of the numbers of natives. This may be attributed to native status being self-determined on the Census form.[15]

For regional studies and case series reports, estimates of the population are based on census estimates of population (e.g. Minuk[16]), native population based on the DIAND register (e.g. Young[17]), or patient lists of natives in health care regions(e.g. Young[18]).

In the United States reliance is placed on the Census to determine native status, despite known aberrations.[4,19] In a cohort study from New York on the health experiences of the Seneca nation, native status was determined from the tribal roll of 1951.[13]

Selecting a Comparison Population

The standardization of rates in many studies are to different reference populations. This can limit the comparability of results from different studies.

Various populations have been selected to which native results are contrasted. This is of particular concern when comparing standardized mortality, morbidity or incidence ratios between studies.

Categories of Analysis Based on Time, Age, Sex, Ethnicity, and Disease

This thesis focuses on the year 1981. Every attempt has been made to capture studies and statistics which include this year. Aggregated data from as early as 1953 is available.[20] Time series studies indicate that for most causes of death, decreases have occurred over the past few decades.[21] Mortality reduction among native groups have not proceeded at the same rate and is a function of location.[22]

Subdividing populations is of interest when this can be done. Most studies have size limitations which restrict subdivision. The presentation of sex specific data is uncommon. Aggregation of age specific data is rarely to similar age groupings. Mao limited the cause specific analysis of natives to populations to under the age of 70.[5] Studies of infant mortality are often published separately.

Most studies use the International Classification of Diseases (ICD).[23] Where possible ICD-9 or equivalent codings are presented for disease entities selected for this thesis. Interpretation of the disease classification according to the ICD may be unclear (e.g. Rhoades[24]). The selection of diseases reported in any study appears to be a function of their frequency as a cause of death. Aggregation into disease groups or ICD chapters increases numbers at the expense of specificity. Cause specific reports based on case series of an uncommon disease may have drawn attention to a potential risk (e.g. Wotton[9]).

Tribe is a major determinant of the health status of natives. Variations in tribal health status can be marked.[25] The reasons for these variations may be genetic,[26] lifestyle,[25] rate of acculturalization,[22] socioeconomic[27] or other factors. Most studies aggregate all natives, regardless of tribe, into a single heterogeneous category. Other studies, aggregate at more regional levels yet include a variety of tribes.[28] Studies done at the tribal level may lack generalizability of results, such as the work of Mahoney on a native cohort in New York.[13]

In Canada, classification of native groups is on the basis of language. There are 10 major language groups across the country with 58 separate dialects.[2] There are 576 registered bands[29] ranging in size from 2 to 9950.[2] Aggregation of these heterogeneous populations into one category is done without consideration of the variation between bands, dialect groups, and language groups.

Presentation of Results

Adjustment of rates has been done to a variety of standard populations. On occasion, crude rates are presented[21] and compared over time.[30] Interchangeable methods of analyses in the form of age specific mortality rates, life expectancy, or age specific mortality ratios may be presented. A variety of statistical tests have been applied.

Proportional Mortality Ratios have received limited attention with the exception of two New York papers.[31,32]

Potential years of life lost (PYLL) has been defined in a variety of fashions.[33] Inconsistencies and changes in definition regarding the age range for PYLL make comparisons illogical. PYLL rates are a recent epidemiological phenomenon.[34]

Rank listing of deaths, rates, or PYLL by disease is dependent on the level of aggregation of disease which varies between studies.

2.3 SPECIFIC APPROACHES TO THE STUDY OF NATIVE HEALTH STATUS

In this section, I will discuss: a national Canadian study, one regional area of Canada, and two United States studies of native health. These contributions present a variety of methods of collection, analysis and presentation of data on native health. The data collected by Medical Services Branch[1,8] have become integrated into the thesis. The technical discussion of this work will be addressed in section 3.3.

2.3.1 On-Reserve Deaths in Canada

This thesis adopts the approach used by Mao,[5] Morrison[6] and MacWilliam[35] of LCDC, and Beauvais's thesis from McGill University[36] in studying native health in Canada. The known limitations of using on-reserve deaths will be discussed in sections 3.1.3 (DIAND residence coding) and 3.2.3 (death certificate residence coding). Some specific limitations of the presentation of these studies will be discussed in this section.

Mao[5] focuses on the general mortality experience of natives from 1977-1982. The age specific results of the study indicated very low mortality for native populations over the age of 70. The authors of the study suspected that underreporting in this age group presented a significant bias and elected to exclude populations over the age of 70.

Beauvais[36] compared on-reserve deaths from Quebec, Ontario, and Manitoba with provincial aggregates and deaths occurring in "counties" with Indian reserves. Time comparisons from 1971-1977 and 1978-1984 are provided. Alberta and Saskatchewan were excluded because of data problems in the first time period. All ages are included in the analysis, contrasting with the work by Mao.

Morrison[6] and MacWilliam[35] present the infant mortality experience and deaths from childhood (ages 1-14) accidents respectively.

All of these studies are limited by the usefulness of the coding of residence on both the death certificate and the DIAND register. The childhood studies are further limited by late reporting of vital events to DIAND. These problems are discussed in detail as they relate to this thesis in section 3.1 and 3.2.3. The studies lack an external comparison to validate the use of this technique in assessing native mortality indicators.

2.3.2 Northwestern Ontario and Manitoba Regions

The Cree-Ojibwa reserves in Northwestern Ontario and Northern Manitoba have received considerable research attention.[17,18,22,37,38,39,40,41,42,43,44,45,46,47] The majority of these studies have been undertaken by Dr. T.K. Young, previously medical director with the Sioux Lookout Zone of the Medical Services Branch and currently with the Department of Social and Preventive Medicine of the University of Manitoba.

This area encompasses some 10,000 natives. Events and populations are drawn from available sources such as patient lists, deaths recorded on patient files, newspapers, and community worker knowledge. For the two mortality studies,[17,37] each of the 668 deaths was reviewed and classified according to ICD9 causes of death. For the morbidity studies, case registers[18,46] or coding of native ethnicity on administrative data sets[22,41] have been used to identify native cases. Denominators were determined from the DIAND band lists. Several of the papers are the result of community surveys undertaken by the researchers.[39,40,44,45,47]

The approach to ascertaining events is subject to two major potential biases, the first is the inclusion of non-status Indians as possible events. The process for determining events does not include validation of native status. Thus it is conceivable that non-status Indians may be included in the numerator but excluded from the denominator lists. This situation is more likely to occur when no other health services are available.

The second difficulty is the failure to identify all relevant events. Events occurring outside the region may be missed. No estimation is provided of the ability to capture all events occurring among persons from the region. It is noted that less than one third of the deaths in the population occurred in hospitals.[17] A bias may exist, in that identification of certain types of deaths such as infant mortality, accidental, and hospital deaths may be more completely ascertained - while

underestimating deaths at home in the older population. Only 9.4% of the deaths were autopsied to determine the exact causes of death.[17]

No attempt has been made to validate the band lists as appropriate indicators of population size. The utilization of the on-reserve - off-reserve category of the band lists is considered poor.[a] Such estimates are likely to result in an overestimation of the denominators and hence underestimation of true rates when this item is used.

2.3.3 The Seneca Nation of Indians in New York State

Mahoney in New York has undertaken to define the mortality and cancer morbidity experience of natives in New York state. Six articles have been published[13,31,32,48,49,50] along with an editorial[51] referring to this work. For five of the papers, Mahoney's methodology is similar to the development of the cohort component of this thesis. The tribal roll of the Seneca Nation in New York on January 1 1955 was used to identify a fixed Indian cohort. These 3,262 persons were then followed to death or assumed alive at the end of 1984. Deaths were ascertained by computer linkage of the tribal roll against New York State Department of Health vital records. Cancer incidence[49] was determined in similar fashion using linkage with the New York State Cancer Registry. Linkage matching criteria for the cancer registry included last name, first name, sex, year of birth and county of residence; no further methodological points regarding the linkage are provided.

These studies suffer from the static nature of enrolment. The current mortality experience of the pediatric population cannot be determined. The expected numbers of deaths according to the tribal roll and the number of deaths studied is inconsistent across studies.[13,31,50] No explanation is provided for the variations in totals. In the general mortality article death linkage success rates are provided at 92%, with

---

[a] See section 3.2.3 regarding the discussion of on-reserve coding by the DIAND register.

male recovery greater than female recovery. Recent deaths were 98% recovered while deaths during the first ten years were only 89% recovered. The author considers the major source of bias as the underascertainment of deaths. Some possible explanations are provided, including the suggestions that: incorrect names are recorded in either the tribal roll or death certificate, name changes were not recorded on the tribal roll, addresses were incorrect on the tribal roll, errors exist in recording the date of death, some deaths occurred outside New York state, and no death certificate was completed for some deaths.

The paper addressing the specific issue of PYLL in this cohort used calculations based to age 65 with exclusion of deaths under age one. Contrasts with the comparison population are made using average PYLL per death and the proportion of PYLL attributed to various causes.

The last of the series of papers[32] presents a second approach to studying the native mortality experience in New York State. Death certificates in New York State code ethnicity. Mahoney assessed the sensitivity of this coding for native Americans as 95%. Lacking however, is any indication of the actual population of Native Americans in New York State. In total 1038 Native American deaths from 1980-1986 outside of New York City were identified. Standardized Proportional Mortality Ratios were calculated using age, sex and cause in comparison to the New York state population excluding New York City.

2.3.4 New Mexico American Indians

A population-based study of natives living in New Mexico has resulted in the publication of seven papers.[52,53,54,55,56,57,58] The main purpose of this series of papers is to compare the health status of the three main ethnic groups in New Mexico: Hispanics, American Indians, and non-Hispanic Whites. As Hispanics constitute the largest minority population in New Mexico, considerable portions of these studies are devoted to the health

inequities between Hispanics and non-Hispanics.

The New Mexico population is reported to be 1.3 Million, 8% of whom are listed as American Indians.[52] The definition used by this group is that American Indians were persons claiming native status on the Census or identified by death certificate ethnicity. In the cancer survival study information from the New Mexico Cancer Registry was used which included a statement on ethnicity as the primary identifier and place of residence and treating hospital as secondary identifers.[52]

The methodology of the initial study[54] was to search manually all death certificates from 1969-1977 coded by ICD8 491,492, and 519.3 to obtain ethnicity. The second study[52] was a regional product from the New Mexico component of the U.S. SEER[65] (Surveillance, Epidemiology, and End Results) study. The main data source was the New Mexico Tumour registry which is periodically matched to the death records of the New Mexico Bureau of Vital Statistics and the National Death Index to capture unrecorded deaths. No information is provided on the linkage process or on how many deaths are identified through each of the data sources.

The remaining papers stem from a single study addressing the time period from 1958-1982. Populations were determined from the 3 census with adjustment of American Indians for the 1960 Census,[19] but no adjustment was made for underestimates on the 1970 Census.[4] The quality of native coding on the 1980 Census was not known.[53] To date the authors have published on the mortality experience from ischemic heart disease (ICD9 codes 410-414.9),[55] lung cancer and COPD (ICD9 491,492,496,162),[57] stomach cancer (ICD9 151),[53] injuries (ICD9 E800-999.9),[58] and rheumatic heart diseases (ICD9 390-398.9).[56] Information is also provided on deaths from symptoms and ill-defined conditions(ICD9 780.0-799.9).[57]

2.4 DISEASE SPECIFIC FINDINGS

This section reviews native health status. Each of the relevant disease entities will be discussed briefly. Appendix A tabulates for each disease: the principal author, the reference, the population studied, the comparison populations, the categories of analysis and the results for native and comparison groups. A ratio is derived between the native and comparison populations for those studies where ratios have not been determined. This ratio is provided solely for the purpose of allowing the reader to quickly evaluate the relative impact of the disease process across several studies. Specific comments are provided when necessary. The limitations outlined in the previous section should be considered by the reader in assessing the results.

Infectious Diseases ICD codes 001-139

Overall this chapter accounts for less than 2% of native deaths.[17] Consistently, measures of mortality and morbidity are elevated amongst native populations. Ratios are frequently greater than two times comparison populations.

Attention has been focused on tuberculosis incidence and mortality in natives. Incidence rates are consistently over ten times greater than the comparison populations. As a notable comparison of the historical importance of tuberculosis, Grzybowski reports mortality rates from 1886 as 9% of the Indian population per year.[59] Rieder reports of a reserve where the proportional mortality for one year was 65% in 1885. [60]

Minuk provides some information suggesting that Hepatitis B carriage may be very high in certain native populations.[16] Hepatitis B carriage is associated with elevated rates of liver cirrhosis and hepatoma.

Certain specific infections, namely: gastroenteritis, upper respiratory tract disease[61,62] and meningitis,[9] are classified to the digestive, respiratory and neurological chapters respectively.

Neoplasms (ICD codes 140-239)

Numerous studies have reported on multiple neoplastic processes. Canadian locales include the Sioux Lookout Zone,[37] Manitoba natives,[38] British Columbia,[63,64] and Inuit populations.[11] Several United States populations have also reported as regional reports of the U.S. Surveillance Epidemiology and End Results program.[65] The existence of tumour registries has allowed the proliferation of papers based on tumour incidence rather than mortality. Though not strictly comparable, incidence ratios help identify elevated cancer risks. Case fatality among natives may not be comparable for certain neoplasms.[52]

Native rates are generally lower than comparison populations, usually at a level of statistical significance. The notable exceptions to this trend are the Ontario[37] and British Columbia reports[63,64] showing almost no mortality difference between native females and comparison whites, and Alaskan reports[66,67] showing minimal reductions in incidence.

Specific forms of neoplasms seem more common in natives and will be discussed under specific neoplastic types. Most specific cancer causes are based on a series of tumours recorded in a specified population. These series extend over several years and include between 50 and 300 cases. Specific cells are often small and uncommon tumours are not reported.

Cancer of the Tongue, Mouth and Pharynx (ICD codes 141, 143-149) - Carcinoma of the nasopharynx and salivary glands is known to be elevated amongst Inuit populations.[12] This relationship is also found for Indians from Alaska.[67] The small proportion of these cancers found in native populations may preclude separate analysis of this group for most series.

Cancer of the Esophagus (ICD codes 150) - Studies of Canadian Inuit have reported elevated rates,[11,12] however most Indian studies do not report on this cause.

Cancer of the Stomach (ICD code 151) - The literature suggests that the various groups studied have varying experiences. Of note is the consistent elevation in proportional cancer ratios,[52] incidence rates[68] and mortality rates[53] from New Mexico.

Cancer of the Large Intestine and Rectum (ICD codes 153-154) - These causes are often separated into the two diseases. Most studies have found decreased mortality and incidence of these tumours in natives.

Cancer of the Liver (ICD codes 155.0 155.1) - Most series have insufficient power to detect a difference in liver cancer rates. Sievers[26] and Devor[68] report elevated ratios without indicating magnitude.

Cancer of the Gall Bladder (ICD 156) - Gall bladder disease in natives has received attention due to elevated rates of cholelithiasis and cholecystitis (see ICD codes 574-576). These pathologies may predispose to carcinomas. Many studies have found elevated rates of gall bladder cancer, particularly in females where non malignant pathology is also more common.

Cancer of the Pancreas (ICD code 157) - Native studies tend to have few reported cases, with incidence and mortality ratios often below unity. Some suggestion of reduced risk for natives exists with significant reductions noted for males in 2 studies[38,68] and females in one.[48]

Cancer of the Digestive Tract (ICD codes 150-159) - This heterogenous group provides a summary measure for the preceding 6 categories. Only Mao,[5] Beauvais[36] and Lanier[66] have used this category, with conflicting results.

Cancer of the Trachea/Bronchus/Lung (ICD codes 162-163 164.2 .3.8.9 165.) - These tumours have a high population attributable percentage due to smoking.[69] Until recently regular smoking was uncommon amongst natives, though this trend has changed dramatically with prevalence over 50% in some native groups.[39] The historically lower smoking prevalence rates are reflected in the almost universally lower incidence and mortality rates from pulmonary tumours. The notable exceptions to this trend is the report from Gaudette on Inuit lung cancer rates for 1970-1984 with elevated standardized incidence ratios and time trends consistent with rapid increases in the past decade.[11] The study of Samet also suggests increasing lung cancer mortality rates over the 25 years of study.[54]

Cancer of the Breast (ICD codes 174-175) - Traditionally breast tumours have been uncommon in natives with very low reported incidence and mortality rates.

Cancer of the Uterus (ICD 179-182) - Uterine carcinomas are of two major forms. Endometrial carcinoma, or corpus uteri, and cervical carcinoma. It is perhaps unfortunate that these two types of cancers have been mixed for this study as cervical cancer mortality is often elevated whereas corpus cancer is diminished. The relative rates in the native population suggest that rates of cervical cancer are ten times corpus tumours.[63]

Cancer of the Ovary (ICD code 183) - Many studies have identified significantly lower rates of ovarian tumours.

Cancer of the Prostate (ICD code 185) - Native populations consistently show lower rates of incidence and mortality from prostatic tumours.

Cancer of the Kidney (ICD codes 189.0 .1, .2) - Renal tumours show slightly increased incidence ratios, mortality ratios and proportional cancer incidence ratios in comparison to other populations. Considerable geographic variation in the magnitude of these differences are noted with the highest ratios in the Sioux Lookout Zone of 13 times the comparison population.[17]

Cancer of the Bladder (ICD 188) - Native populations have consistently shown extremely low rates of bladder tumours with ratios from 1/10th to 1/4th of comparison populations.

Cancer of the Brain (ICD 191) - Incidence and mortality rates of brain tumours are generally lower in natives compared with non-Native populations.

Lymphoid tumours (ICD 200-203) - These tumours can be subclassified into Hodgkin's and non-Hodgkin's lymphomas, and multiple myeloma. Aggregation of these heterogenous tumours increases power at the expense of specificity. Most studies have shown lower rates in native populations with some studies showing marked reductions.[49,68]

Leukemia (ICD 204-206, 207.0,.2,.8, 208) - This heterogeneous family of neoplastic diseases has generally shown incidence and mortality ratios below unity, achieving levels of significance amongst males in certain studies.[38,63,68]

Endocrine/Nutritional/Metabolic (ICD codes 240-279)

Analysis of this chapter has occurred rarely. The available information is conflicting regarding the contribution to native mortality.

Diabetes (ICD code 250) - A rapidly increasing prevalence of diabetes in native populations has been noted during recent decades. Many studies have found significantly elevated mortality, incidence or prevalence rates. Considerable intertribal variation in rates has been identified.[28,70] The rate of complications in natives is different from non-natives. Cardiac complications seem less common, whereas renal, vascular and ophthalmologic complications are more common.[26] Numerous theories regarding the reasons for the increases have been suggested.[26] A genetic predisposition appears possible given variations in insulin responses adjusted for weight.[71] Increased prevalence of obesity in natives has been noted[18] and may be environmentally or genetically related.[26]

Blood Disorders (ICD codes 280-289)

Mortality from blood disorders is uncommon in the general population, accounting for less than 1% of all deaths.

Mental Disorders (ICD codes 290-319)

Substance abuse is frequently reported among natives with emphasis given to alcohol ingestion[72] and solvent inhalation.[73] The only study addressing mortality found no cases in the study population during the ten years of observation with none expected.[17]

Alcoholic Psychosis, Alcoholism, Alcohol poisoning (ICD codes 291, 303, 305, 860) and/or Cirrhosis (ICD code 571) - This derived group of illnesses attempts to pull together alcohol related diseases. Rates for natives are consistently several fold higher than comparison populations. Rhoades provides evidence that rates of alcohol related deaths are decreasing in United States natives.[74] Mendenhall provides evidence of reduced survival in native liver alcohol injury patients.[75]

Nervous System/Sense Disorders (ICD codes 320-389)

This chapter is of importance because of increased reports of meningitis among native populations.[9,17] A report from Manitoba suggests that a variety of perinatal nervous system disorders have an overrepresentation from native populations.[76]

Circulatory Diseases (ICD codes 390-459)

Circulatory diseases are the number one cause of mortality in both native and comparison populations. Earlier studies indicate that cardiovascular mortality was often significantly lower amongst natives.[13,17,77] More recent studies reveal similar and in some instances higher rates than comparison populations.[8] Using crude rates over a decade Gillum argues that mortality is decreasing[30] in United States natives.

Ischemic Heart Disease (ICD codes 410-414) - This group of diseases accounts for the majority of the circulatory diseases. Comparison studies have frequently focused on this particular group of diseases with most studies finding reduced risk of natives for developing ischemic heart disease. As an exception, Mao noted elevated rates amongst native females under the age of 70.[5] Becker demonstrates falling ischemic heart disease mortality rates in New Mexico natives since the mid 1960's.[55]

Cerebrovascular Disease (ICD codes 430-438) - This is the second largest of the aggregates of diseases contributing to circulatory diseases. Most studies have found a non-significant reduction among natives. Mao however noted significantly elevated rates of cerebrovascular disease in both males and females when limiting the analysis to ages under 70.[5]

Rheumatic Fever and Chronic Rheumatic Heart Disease (ICD codes 393-398) - Death from rheumatic heart disease is commonly associated with lower socioeconomic status and race.[78] Becker has noted increased rates of chronic rheumatic heart disease in New Mexico natives compared with the comparison white population.[56]

Hypertensive Diseases (ICD codes 401-405) - Direct mortality attributed to hypertensive disorders appears uncommon with Michalek reporting on 15 of 796 deaths attributable to these disorders.[31] The prevalence of hypertension was noted on a native community survey to be 13.3%.[40]

Respiratory Diseases ICD 460-519

Studies have consistently shown that natives have an elevated risk of mortality from respiratory causes. Subclassification of this chapter into disease groups provides a better understanding of the risks.

Pneumonia and Influenza (ICD codes 480-486) - Most studies have found significantly higher rates of mortality from pneumonia and influenza in native populations.

Chronic Obstructive Pulmonary Disease (ICD codes 490-493 496) - Smoking remains the major cause for COPD deaths. Sievers and Samet found lower mortality amongst natives than in comparison populations.[26,54,57] Samet's two papers contain overlapping cases for the time periods under study.

Digestive Disorders ICD codes 520-579

Digestive disorders are of particular interest because of the frequency of gastroenteritis, cirrhosis of the liver and gall bladder disease in native populations. Cirrhosis of the liver has been discussed above in conjunction with other alcohol related illnesses. As a group of disorders they have been slightly elevated in most studies.

Ulcers (ICD codes 531-534) - Only a few studies have focused on ulcers with conflicting results.[13,26]

Gall Bladder Disease (ICD codes 574-576) - Numerous studies have noted elevated prevalence of cholelithiasis amongst native groups. These have been reviewed by Sievers.[26] Williams and Cohen have provided evidence for the increased prevalence of gall bladder diseases in Canada.[41,79]

Genitourinary Disease (ICD codes 580-692)

Most studies have focused on specific causes of genitourinary disease. Morbidity data from Manitoba and British Columbia fail to demonstrate any difference from comparison populations.[1,80]

Kidney disorders (ICD codes 580-593) Nephritis and Nephrosis (ICD codes 580-583, 587) - Evidence has been accumulating recently of the risk for natives to develop end stage renal disease.[80] Other studies provide suggestive evidence of an increased risk of death in native populations.

Complications of Pregnancy ICD 630-676

Extremely low numbers of maternal deaths make comparative analysis difficult. Rhoades provides evidence of marked improvements from the mid 1950's to the present with only 2 cases recorded for the entire country during the years 1981-1983.[21,24] Wittman suggests an increased rate amongst natives in British Columbia from 1971-1986. This is based on a greater than expected proportion of natives amongst maternal mortality cases investigated by the British Columbia College of Physicians and Surgeons.[81]

Skin and Subcutaneous Disorders (ICD codes 680-709)
Musculoskeletal Disorders (ICD codes 710-739)

Skin disorders and musculoskeletal disorders rarely result in mortality in the general population. As a consequence, little information is available on these diseases in natives.

Congenital Diseases (ICD codes 740-759); Perinatal Disorders (ICD codes 760-779); Infant mortality rates, perinatal mortality rates, neonatal mortality rates, and postneonatal mortality rates; Sudden Infant Death Syndrome (ICD 798)

Most studies reporting on infant mortality have found native mortality to exceed comparison groups. The chapters on Congenital disorders and Perinatal disorders are integrally related to the causes of death contributing to infant mortality rates, perinatal mortality rates, neonatal mortality rates, and postneonatal mortality rates. These health indicator rates include causes of death from other ICD chapters. The literature reviewing these rates is also found in Appendix A.

Infant mortality rates in Canadian natives consistently exceed those in comparison populations. In the United States, native infant mortality fell below the general United States population in the early 1980's. Perinatal mortality has fallen in Canada but continues to be elevated in relation to comparison populations. Neonatal mortality in Canada is slightly elevated in relation to comparison populations. Postneonatal mortality is substantially greater in native populations. This finding is also noted in the United States.[82,83] A proportion of this elevation may be explained through significantly elevated rates of SIDS (ICD code 798) among native populations. SIDS among natives has been studied in several populations and the ICD coding is included in the Appendix A.

Symptoms and Ill-defined disorders ICD codes 780-799

This chapter provides a heterogeneous group of diseases which allow for categorization of causes of death where the diagnosis has not been established. The lack of specificity may result in a tendency not to report these causes by many investigators. Others Investigators have grouped this category with a category "all other causes". All studies focusing on this category have found moderately elevated ratios of natives in relation to comparison groups. A special component of this group is the Sudden Infant Death Syndrome which has been discussed immediately above.

Accidents Poisoning and Violence (ICD codes E800-E999); Motor Vehicle Traffic Accidents (ICD codes E810-E819); Accidental poisoning (ICD codes E850-E869); Fires (ICD codes E890-E899); Drownings (ICD code E910) Suicide (ICD codes E950-E959); Homicide (ICD codes E960-E969)

Death from violent causes has been repeatedly studied among native populations with the consistent finding that mortality rates in natives are several fold higher than in comparison populations. The various causes of violent deaths have been subjected to considerable study by many authors.

In most studies mortality from MVTA has been increased. Only Hislop has specifically addressed the rate of accidental poisoning.[20] Death from falls has been found to be more frequent in some studies, but is still an infrequent cause of death. Death from fires has mortality ratios several fold higher in native populations. This finding has been consistently reproduced in the studies reported, all of which are Canadian. An almost identical pattern is noted for drownings.

Suicide rates amongst natives are several fold higher than comparison populations. Suicide has the greatest increase in the younger age groups and is infrequent amongst older natives.[1,20] Homicide rates are several fold higher amongst natives than comparison populations.

In summary, most studies have identified death from violent causes as a serious threat to life among natives. This threat is consistent across the various causes of violent death studied.

3. DATA SOURCES AND DATA MANAGEMENT ROUTINES

3.1 DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT MEMBERSHIP REGISTER

The Native Indian Register is maintained by the Department of Indian and Northern Affairs (DIAND) and contains vital status information on over 370,000 registered Indians. This data base is used in this study to identify a cohort of natives whose mortality experience can be determined. The register also serves to determine the populations. A thorough understanding of the register is required to recognize the uses and limitations with working with this data source.

3.1.1 Purpose of the DIAND Register

The Indian register was established with the Indian Act of 1951 under the mandate to maintain a current list of all registered Indians in Canada. It is used primarily for administrative purposes in determining eligibility for benefits. It is frequently used for determining the native population size and distribution.

Registration confers certain benefits on the native population. For the individual, numerous medical benefits, not covered by provincial insurance plans, are reimbursable. Tax levies are different between status Indians and others. Registered natives are eligible for a wider range of social benefits including education assistance and child day care. The major incentive for registration by the individual is the substantial financial benefit.

For the reserve on which a status Indian lives, annual registration at a specific point in time is used to determine the band roll. The length of the band roll determines the extent of federal funding to the reserve. Thus, it is advantageous to the band to enrol individuals as living on the reserve, and a disincentive to register deaths immediately.

For persons living off a reserve there is little incentive for early registration of births and no incentive to register deaths.

3.1.2 Methods of Maintenance

The DIAND registrar maintains two files. The first file, referred to as the roll, lists all currently alive natives. The second file, known as the event file, records all vital events occurring during the "history" of native individuals. Such events are typified by births, marriages, and deaths, but may also include information on divorces, changes of name, changes of reserve, and change of band number.

The process by which recordings take place is important in assessing the data quality. To register an event, DIAND requires a formal application in addition to specific valid documentation. For a birth, documentation would be a birth certificate. For deaths, a death certificate or statement from the funeral director is required. The extent to which these regulations are adhered to at regional offices is not known, but is considered high.

The linkage of various records is performed using the band number. This identifier is assigned to the male member of a family upon reaching a specified age (currently 18) and making an application for a band number. This number is then also given to his spouse upon marriage, and to his children upon birth. The children maintain this number until applying for their own number. Band number is essential in all transactions with DIAND and to receive any of the benefits.

Prior to 1951, band rolls were maintained by individual bands. In 1951 this function was assumed by the DIAND. Information on the effectiveness of this transfer is not known. Certain errors might be expected. Incomplete rolls may have existed at the time of the Indian Act passage and these may have been propagated during the transfer. Incomplete

or inaccurate information on the records may have existed. To date no attempt has been made to identify problems with the transfer of data.

Between 1951 and 1984 all records were manually maintained. In 1984 the system was transcribed onto computer. Only band number files considered active in 1984 were transcribed.

Transmission errors and encoding errors are likely to occur in any data set. No specific attempt has been made by DIAND to assess the quality of transcription or encoding. A process exists whereby any discovered errors will be corrected.

3.1.3 Identified Problems with the Membership Register

Late Registration

The existence of late reporting of events is recognized by the Department. Annual statistics are published which provide quantification of late reporting. Late registration was studied by Statistics Canada in 1985 in preparing population models for DIAND.[14,84,85] Most deaths are registered within 2-3 years following the event.

Delayed registration of births of greater than ten years occurs not infrequently. To adjust their population estimates Statistics Canada provided annual measures of late registrations, noting that estimates of underreporting of births range from 44.6% for one year delay to 2.8% at 9 years.[14] This would indicate that an undercount of the size of the registered Indian population may occur.

Failure to Report Events

Failure to report events does occur. DIAND officials admit that there are individuals on the register who cannot be alive. No attempt has been made to identify persons who are unlikely to be alive but remain listed in the file. The magnitude of this problem is currently

unascertainable, but it may require more careful consideration in the future if the data file is to be utilized.

Of concern is the problem that deaths occurring in infants who were not registered may never be recorded in the register.[14] These events may cause a significant underestimation of infant deaths in registered natives. To support this contention DIAND-recorded infant death rates have been compared to MSB-recorded infant death rates and a consistent underreporting of the order of 40% has been noted.[14]

Name Changes

DIAND officials noted that the use of alias names is a common practice among natives. It is not uncommon for an individual to change his/her name, act as if this were a legal change, register children and marriages under this assumed name, and die using the assumed name. Linkage of events by DIAND is done using the band number, and no active attempt is made to change the name of the person in the DIAND register or to record such changes. Some passive reporting of name changes does occur. It appears likely that a significant number of name changes may have occurred which were not recorded on the DIAND register.

Residence Coding

A specific data item of relevance to this study is the coding of residence as on-reserve or off-reserve. As noted in the above section, there is a specific advantage to bands to note members of the band as residing on the reserve. Previous users[b] have noted this variable to be highly suspect. The consensus of the DIAND officials is that considerably more individuals are listed on the reserve than actually live there at any one time. Despite this, some 30% of the native population are listed as living off reserve.[86] Falsely high estimates of on-reserve population will

---

[b] Petrie D.B. Memorandum to D. Bray dated May 4, 1987

result in underestimation of mortality rates in any of the studies utilizing DIAND reporting of population for determining the at risk population (e.g. Mao,[5] Beauvais[36] and Medical Services Branch[1,8]). This may have an effect on this thesis in determining rates of on-reserve deaths.

3.2 CANADIAN MORTALITY DATABASE:

The Canadian Mortality Database (CMDB) is a computerized file of all registered deaths in Canada since the early 1950's. The Database is maintained by the Vital Statistics and Disease Registries Section of the Health Division within Statistics Canada. Though efforts are made to achieve high quality, the potential for errors exists within any of the phases of developing the Database. As this study depends on the registration of death, an understanding of the quality of the relevant information in the CMDB is necessary.

3.2.1 Data Transcription and Encoding

In 1976, Statistics Canada published an internal report on data quality of vital event registrations.[87] A subsequent study of 1979 and 1980 deaths evaluated the coding of causes of death.[88] The study assessed all data handling procedures with identification of errors through comparison of a sample of machine recorded registrations with original microfilmed records at Statistics Canada.

These studies suggest that certain errors are frequent. Using weighted results of the samples to account for actual reporting distributions, processing errors of greater than 1% were noted for the items of birthdate, age, and autopsy, while processing errors occurred in 0.97% for place of death. Systematic errors of note include up to 3.3% of death certificates with illegible fields, 5.5% of fields with non-response, and a reporting problem identified in up to 3.9% of fields on

death certificates. No information is provided on multiple errors on the same certificate, nor the percentage of certificates with no errors.

The major biases of studies utilizing the CMDB is in the encoding of cause of death, age, and residence. Both studies found encoding errors in the ICD9 code for cause of death between 7 and 9%. The majority of these encoding errors occurred in the first two digits (2/3rds in 1976, 71% in 1979, and 50% in 1980).

Residence was incorrectly coded in 9% of death certificates in the 1976 evaluation. The effect of this error in producing bias cannot be assessed without further information on geocoding discrepancies.

On 11% of death certificates only age and death date are available. Birth date is imputed from this information. Some provinces do not report the day of death. As a result an additional 11% of death certificates have day of death assigned to the first day of the month.

In summary, three specific problems may arise using the computerized records: the cause of death is incorrectly coded in up to 9% of deaths, residence at death is incorrectly coded in 9% and birth date is imputed based on reported age in 11%. No information is available on percentage of death certificates with combinations of these errors.

3.2.2 The Death Certificate

The tacit acceptance of the validity of death certificates would confer considerable doubt on the acceptance of any study. Numerous studies have addressed the issue of validity of cause of death coding on death certificates. The result has been the propagation of the belief that causes of death should be used with considerable caution, if at all.

Several key questions must be posed regarding the use of the death certificate cause of death:

1. How valid is the coding of cause of death on death certificates?

2. Are there systematic differences in the coding of cause of death for natives in comparison to the general Canadian population?

In 1923, Wells first questioned the reliability of the death certificate for use in cancer statistics.[89] In the ensuing years numerous studies have found major discrepancies between recorded causes of death and a reference determination of the cause of death, the discrepancy ranging from 20-40 per cent of all death certificates.[90] An annotated bibliography of validation studies was produced for the United States National Centre for Health Statistics in 1982, which also suggests caution in the use of death certificates.[91]

The methodology for determining discrepancies limits the application of these results. Studies dependent on autopsy diagnosis for confirmation are subject to several important biases. Autopsies are more likely to be performed in cases where the diagnosis was not established prior to death. Thus an overrepresentation of certain disease categories is noted. Kircher addressed this discrepancy, noting substantially increased proportions for autopsy compared with all causes of death for the ICD chapters of trauma, ill-defined causes, perinatal, congenital, digestive and infectious disorders.[92] Neoplastic and cardiovascular causes were autopsied with considerably lower rates. Overall autopsies were performed in 13.6% of all deaths, similar to the estimated U.S. national average of 14%.[90] A bias towards autopsy of questionable causes of death for study would tend to underestimate the reliability of most death certificates.

Despite this selection bias, Kircher notes that from seven United States studies, total agreement between autopsy and stated cause of death exists in 44-75% of death certificates, while agreement at the chapter level exists in 71-88%.[92]

An important factor in reviewing this literature is that few of these studies have been done on death certificates since the change to ICD9[23] (1979 in Canada). Goldman demonstrated in a teaching institution that autopsy rates had fallen from 75% in 1960 to 38% in 1980, yet the accuracy of coding of the cause of death in comparison with autopsy had

remained at 90% in his institution.[93] Recent death certificates validation studies based on autopsies are more likely to be biased towards questionable diagnoses.

The validation of death certificates based on all deaths has rarely been undertaken. Notable studies include the Swedish Twin Study,[94] the U.S. Third National Cancer Survey,[95] the Vietnam Experience Study[96] and a study in Valencia Spain by Benavides.[97] The selection criteria for the studies differs: for the twins study the selection is based on a register of twins in Sweden, for the Spanish study on all death certificates in a geographic region, for the Vietnam veterans study on a sample of army veterans, and for the Cancer study on a diagnosis of cancer on the death certificate.

Presentation of the studies varies regarding the specificity of the diagnosis. Concordance is greatest at the highest level of aggregation,[97] less at the level of disease categories,[94] and lowest at the three digit disease code of the ICD.[95] Comparability of studies is thus limited. All studies exclude deaths where no information is available. This occurred most often with deaths from external causes.[94] The Vietnam study addresses injury-related causes of death only.[96] The Swedish study utilized only available clinical information at the time of death, autopsy results were not used to confirm the diagnosis. The other three studies depended heavily on autopsy results when this information was available.

Concordance and detection rates available for categories used in this study have been tabulated from these studies for comparison and are presented in Appendix B.

Certain key points are to be highlighted by these and other studies. Cancer is well coded in most circumstances. The lower detection and confirmation rates for liver tumours and nose and sinus tumors may effect this thesis. Mental disorders where alcohol and drug dependence is the underlying cause of death are frequently underreported.[92] Chronic respiratory diseases are often underreported.[98,99] A Swedish autopsy study

determined errors occurred three times more frequently when the patient was over 70.[100]

The symptoms and ill-defined chapter raises questions pertinent to native studies. In the Spanish study, the fourteen cases were redefined to the circulatory(4), respiratory(7), external(2) and genitourinary (1) chapters. Kircher found that half of the ill-defined cases (22 deaths) were traumatic in origin and that seven SIDS cases were correctly classified to this chapter.

The Swedish study generally had higher detection and confirmation rates. This difference is in part a function of omitting autopsy information. This consideration is important given that over 80% of deaths do not have autopsies performed. The relevant question may be how comparable are death registrations from various jurisdictions?

In summary, it would appear that for most diagnostic groups the routinely collected death certificate is reliable at the modest degree of aggregation to be used for this thesis.

The second question of this section is relevant in discussing the results of native studies. Are there reasons to believe that the coding of native deaths is different than the other populations?

Autopsies are not commonly performed amongst natives. Young noted an autopsy rate of 9.4% over ten years, mostly on coroner's orders.[17] Moreover, Jarvis found that 60% of native deaths occurred outside of a hospital.[101] Few native deaths occur in major hospital centres with diagnostic equipment to ensure accurate diagnoses of death. Some deaths occur without physician intervention, relying on diagnosis, treatment and certification of death by other health personnel.

3.2.3 Coding of On-reserve deaths

Section 2.3.1 discussed the study of natives by LCDC workers[5,6,35] using deaths of persons living on-reserve as a surrogate of native

mortality. This thesis uses this method to identify this population based on the death certificate geographic coding of residence.

In 1971 geographic coding of residence on a reserve was incorporated into the computerized residence coding of deaths. Unique geographic codings were instituted in most provinces beginning in 1971, Saskatchewan in 1974 and British Columbia in 1985. New Brunswick still does not include geocoding for reserve deaths. Coding for on-reserve residence is uniformly identified by terminal digit coding as "88".

The accuracy of coding of this component has not been formally evaluated. Certain irregularities have been identified. Figure 2 shows the absolute numbers of deaths occurring on reserves for Canada and the 5 western provinces (representing over 80% of all natives) since 1971. An apparent inconsistency in coding occurred in Manitoba and Saskatchewan in 1974-75. In an in-depth study of death certificates from Maniwaki Quebec, the number of deaths attributed to the reserve increased from 13 to 61 when residency coding was corrected.[102]

The final question raised by this code is what proportions of on-reserve deaths are not registered Indians. Estimates regarding the number of non-registered Indians living on reserves is approximately 10%.[103] These aberrations bring into question the validity of this coding component.

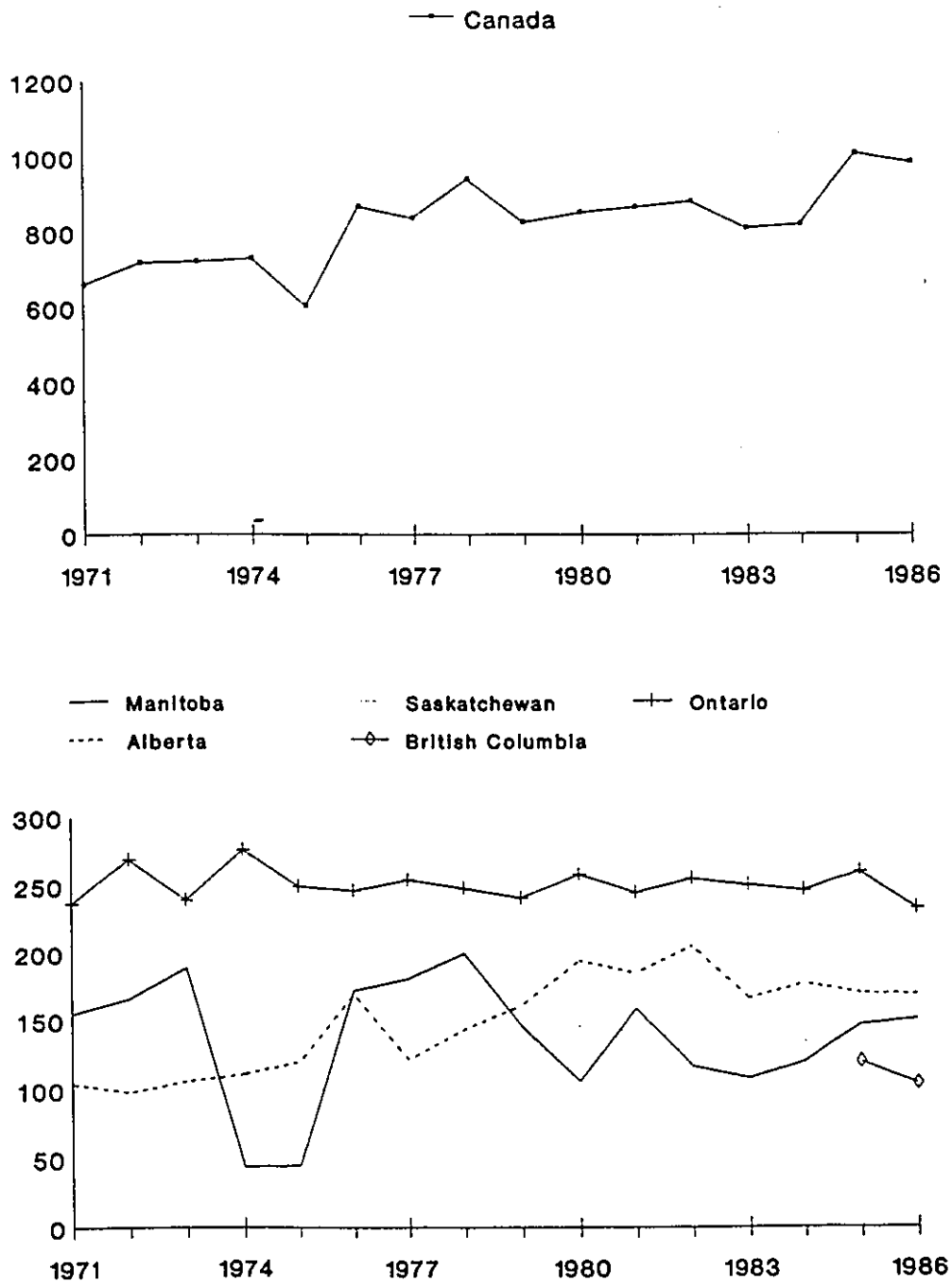


Figure 2: Annual numbers of on-reserve deaths for Canada, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia.

3.3 MEDICAL SERVICES BRANCH FILES

The provision of health care to status Canadian Indians is provided by the federal government. Responsibility for this service is mandated to the Indian and Northern Health Directorate of the Medical Services Branch of the Department of Health and Welfare (referred to in this thesis as MSB). Official statistics on native health in Canada derive from data collected by MSB. In the development and execution of this thesis the opportunity arose to incorporate raw data collected by MSB as a further measure of native health in Canada. As the primary goal of the study was to assess and measure mortality indicators of Canadian Native Indians. To ignore such an opportunity would be a violation of this principal goal. Thus, available MSB data were incorporated with the new objective:

> To compare the cohort and on-reserve death indicators of native mortality with the data collected by MSB.

The data provided for this study are the basis for materials published from the MSB.[1,8] Identical processing of MSB data will eliminate three of the methodological limitations in studying native health: defining a comparison population, selecting categories of analysis and presenting the results. The discussion of the limitations of MSB data can focus on the problems of: defining the population to be studied, determining the population at risk and determining the number of events in the population.

MSB is mandated to provide health care to all registered Indians in Canada, however, they provide direct health services to only 75%.[1] The country is divided into regions; specifically Atlantic, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, Yukon, and the Northwest Territories.

Two systems of data collection exist. The first used in the provinces from Ontario and east (and British Columbia as of 1987), involves the direct accumulation of data by MSB personnel regarding vital

status. The second process used in the western provinces (including British Columbia until 1985) and territories relies on the provincial health care system to report native health status.[8] This process is assisted by unique identifiers for status Indians.

Where MSB personnel collect data, the populations are based on the DIAND register of status Indians living on-reserves receiving MSB care. These lists are adjusted by community workers based on their knowledge of their communities and may include non-status persons. Events are reported by personnel based on their knowledge of the community. To ensure complete capture, MSB files are annually updated using the DIAND event file.

The provincial statistics report all native deaths where the classification status Indian has been made. The calculation of denominators is based on all DIAND registrants in the province or territory. These statistics include all natives living off reserves and not necessarily receiving care from MSB personnel.

To date no formal validatation of the data collected by MSB has occurred. This failure to validate is related to a lack of external comparison, which is a secondary objective for the inclusion of these data in this study.

3.4 RECORD LINKAGE AND THE GENERALIZED ITERATIVE RECORD LINKAGE SYSTEM

The concept of record linkage was first introduced to Canada by Dr. Halbert Dunn in 1946.[104] Pioneering of the technique of computerized record linkage was undertaken by Dr. H. Newcombe at the Chalk River Nuclear Laboratories in the late 1950's. His concepts were formalized into a theory for probabilistic record linkage by workers at Statistics Canada.[105] With the development of a solid theoretical ground, Statistics Canada has been developing the "Generalized Iterative Record Linkage System" (GIRLS) since 1978 with numerous completed linkages.[106]

Record linkage can be defined as "the process of identifying two or more records which refer to the same entity".[107] Two theoretical approaches to computerized record linkage have developed. Deterministic linkage uses unique identifiers to find records from various files. Probabilistic linkage assumes that there is a measurable likelihood that any two records refer to the same entity. This process, being most useful when files lack unique identifers, forms the basis for this study.

The theory of probability based computerized record linkage is that for every pair of records an odds ratio can be determined which reflects the likelihood that the records are truly linked versus the likelihood that the records are not linked. This logarithm of this ratio referred to as a "weight". For records with multiple linkable items, the weights can be summed to develop a summary estimate of the weight. Rigorously the formulation of the weights can be written as:

$$W=\log \frac{P(L|O_1)}{P(\text{not } L|O_1)} + \log \frac{P(L|O_2)}{P(\text{not } L|O_2)} + \ldots \log \frac{P(L|O_n)}{P(\text{not } L|O_n)}$$

Where; L are true links; not L are non-links; and O_i refers to the ith level of a comparison rule for the outcome. Total weights can then be used to develop a likelihood that true linkages exist. GIRLS utilizes logarithms to the base 2 and these weights are referred to as binits. An understanding of the GIRLS linkage procedure is helpful in comprehending the methods used in this analysis.

Preparing the Files for Linkage

Records are standardized to a format for linkage to the Canada Mortality Database. Thus, no two part names are accepted, illegal characters are removed, duplicate records are identified and discarded when necessary. Surnames are recoded phonetically in accordance with the

NYSIIS (New York State Identification and Intelligence System) code.[c,108] reducing the number of unique names in the CMDB to about 20% of the original 200,000.[109] These phonetic derivatives are then added to the record. Duplicate records based on maiden names, or double surnames are prepared. Fields are recoded to conform to certain standards (e.g. birth year must include the century). The file is divided by sex. The quality of various fields is pretested utilizing analytic packages to ascertain the value of the fields for the linkage procedure.

Searching

The basic step in the linkage processes is the field by field comparison of each file from each data source. A case by case search for 1000 deaths amongst the 200,000 deaths recorded each year in the CMDB, would result in 200,000,000 separate comparisons. This would be an inefficient process since most of these comparisons are unlikely matches. To facilitate the process, GIRLS utilizes "pockets" of similar records (e.g. sex). GIRLS can define these pockets under command of the operator. In most linkages pockets are developed based on NYSIIS coded surnames, implying that the surname item needs to be correct.

The operator specifies the fields to be used for comparison. GIRLS develops, or is programmed to utilize, comparison rules. Each compared field can be classified as having an outcome of: agreement, multiple levels of partial agreement, disagreement, or missing. Refinement of the GIRLS system includes a weight for the probability of death at each age.

Decision Making

Linkage weights are determined as the ratio of the likelihood of identifying certain outcomes in a pair of records that are truly matched,

---

[c]A discussion of the use of phonetically derived surnames is not appropriate in this thesis but an excellent discussion is available in the paper by Newcombe from the American Journal of Human Genetics 1967;19:335-359, which discusses the development of the phonetic codings and the testing for partial agreements.

to the likelihood of identifying the outcome in a pair of records which are actually not matched. For example, when comparing the item surname, the name Smith would carry less weight than a name such as Hluchowekczy.

For any pair of records, the weights of all items are totalled. Thus a record with linked items for Zowie Juniper Smith born in the Northwest Territories, February 29, 1920 might carry more absolute weight than S. Hluchowekczy born in Ontario, in 1977. Yet both may be equally successful in identifying matches. The following example of the odds and cumulative totals illustrates the process using items which are often available.

Identifier	ODDS	Cumulative Odds	Weight $10 \times \log_2$	Cumulative Weight $10 \times \log_2$
Chance	1/13,151,520	1/13,151,520	-237	-237
Surname	2,287/1	1/5,745	+112	-125
First initial	14/1	1/410	+38	-87
Second initial	14/1	1/29	+38	-49
First name	87/1	3/1	+64	+15
Marital status	2.6/1	8/1	+14	+29
Birth year	56/1	437/1	+58	+87
Birth month	12/1	5,242/1	+36	+123
Birth location	8.6/1	45,078/1	+31	+154
Residence province	4.4/1	198,343/1	+21	+175

Adapted from Smith M. Record Keeping and Data Preparation Practices to Facilitate Record Linkage[110]

This example utilizes only agreement linkages. Negative values are assigned when disagreement exists in a particular item. Likewise for various levels of partial agreement, either positive or negative weights might be expected depending on the likelihood ratio. Refinement of the weights can be undertaken following the initial comparisons based on specific weights determined during the initial comparison procedure. While a process of developing weights based on frequencies found in the two data sets can be used, a simpler version of the GIRLS program

(referred to as QUICKLINK) uses weights derived from a previous studies.

The operator develops a simple rule of the total weight to identify possible matches. This "threshold" is a weight below which all comparisons are discarded. A higher weight may be used to identify definite linkages, with a middle region representing doubtful or possible linkages.

The distribution of weights may overlap between positive and negative linkages with the result of observing false positives and false negatives. To date studies attempting to measure these values have confirmed that the sensitivity and specificity of such linkages are both very good.[111] Estimates of these values based on other standards would give the sensitivity as 0.999 and the specificity as 0.983.[112]

Grouping

The last major function of the GIRLS program is to list records where more than one possible linkage exists. GIRLS allows for various levels of grouping based on rules for one to one linkages, one to many, and many to many. Conflicts which are identified are resolved by the operator as discussed below.

Phases which require Operator assistance

The GIRLS system automates the functions of record linkage. Certain manual functions are used to improve the procedure. As noted above, the data sets to be linked need proper preparation. Weights can be created based on the relative frequency of certain fields within each of the data sets to be linked.[d,113] This process will increase the precision of the linkage.

In the analysis phase the operator defines the fields to be compared, sets rules for individual fields to determine the outcomes as

---

[d] Newcombe provides an example of assigning weights based on Workers Compensation Board files of known linkable and known unlinkable records with the Canada Mortality Data Base in his opening address to the Workshop on Computerized Record Linkage in Health Research

a classification: agreement, partial agreement, disagreement and missing.

Following the linkage, the operator stipulates grouping rules and resolves conflicts. These conflicts are often resolved by inspection of the weighting with the higher weight identified as a link. In cases where weights are close in absolute value then manual resolution is utilized, with the assistance of death certificates if necessary.

The final stage of the linkage is the preparation of the combined data file with amalgamated information from the data sources for utilization. With Statistics Canada linkages this includes the removal of personal identifiers to ensure confidentiality.

4. METHODS

4.1 DATA PREPARATION

4.1.1 Native Cohort:

The preparation of the records of native deaths from the DIAND event file, was performed so as to maintain confidentiality of the individuals on the record throughout the study. This process involved several governmental agencies in the development of the linked records. The event files from the years 1981-1984 was obtained by LCDC from the DIAND. Deaths and presumed deaths occurring in 1981 were extracted. These death records were forwarded to Statistics Canada for record linkage to the CMDB.

Preprocessing of the file for the linkage was done by Statistics Canada. Duplicate records were eliminated. Surnames, which commonly involved two parts, were contracted and duplicates for each part of the name were also produced. Duplicate records based on alternate surnames were produced when this information was provided. Surnames were encoded using NYSIIS coding and included in each record. Records were given sequence identifiers, with duplicate records encoded to the same identifier. Given names were split into separate fields.

Fields on each record were standardized to conform to the requirements for the linkage. Unnecessary fields were deleted. The records were split into two files on the basis of sex.

The comparison rules were established by Statistics Canada using information generated from previous studies. The initial comparison rules used in this study have been appended (Appendix C). The threshold weight was set a low level of -100 as the native death records contained only persons assumed to have died thus eliminating the possibility of false positives. Weights between -100 and 100 were considered doubtful and reviewed individually.

The death records were linked with the CMDB for the years 1981 to 1983 using the GIRLS system. Multiple linkages were usually resolved by visual inspection in favour of the highest linkage weight. Death certificates were consulted in 26 cases.

A linked file, referred to as the native COHORT file, was prepared providing information from the native death records on birth date, death date (year and month only), religion, sex, marital status, band, and province of residence. From the CMDB the underlying cause of death (ICD code), date of death, and province of death were added. This file was forwarded to LCDC for further processing.

The cohort file was processed by LCDC into a SAS system file with aggregated numbers of deaths based on age, sex, province, and cause of death. Cause of death was recoded to the LCDC disease classifications.[114]

4.1.2 On Reserve Deaths

CMDB was searched from 1979-1983 for records with geographic coding ending in the numbers 88. These records were processed to extract age, sex, province of death, year of death and cause of death (LCDC classification). This information was aggregated and filed in a SAS system file referred to as the ON-RESERVE file.

4.1.3 The Medical Service Branch Files

The MSB Indian Health Services, Demographics Section kindly provided aggregated mortality data by age, sex, year and cause of death (ICD chapters only). These files were transferred to a SAS system file in similar format to the above and referred to as the MSB file.

4.1.4 Off-Reserve Deaths in Census Divisions with Reserves

The CMDB was searched from 1979-1983 for records with geographic codings for census divisions in which reserves are located. British

Columbia and New Brunswick was excluded, as geographic coding for reserves did not occur during the years of the study. Newfoundland, the Yukon and Northwest Territories were excluded as the geographic definition of reserve does not exist there. Of the remaining 231 Canadian Census Divisions, ninety-five were included in the file preparation. Information was extracted from the records on age, sex, province of death, year of death and cause of death (LCDC classification).

An initial assessment of these data revealed that this process selected 20% of the national death file. The file included the geographic coding for major urban centres such as Edmonton, Calgary, Quebec City, London, and Halifax. As this was considered to counteract the purpose of using a rural based comparison group a secondary rule was established.

Census divisions with greater than 2500 deaths during the five year period of study were accordingly excluded from the file. This reduced the number of census divisions under consideration to fifty-six. Figure 3 provides a map of census divisions containing reserves, identifying those census divisions included in this file.

After extracting the mortality information from these records, aggregate totals at the provincial level were established. From these provincial aggregates the totals of on-reserve deaths for each age, sex, year of death and cause of death were subtracted to establish a SAS system file. In the uncommon occurrence when subtraction resulted in a negative number, cells were set to zero. This data set is referred to as the RESIDUAL file.

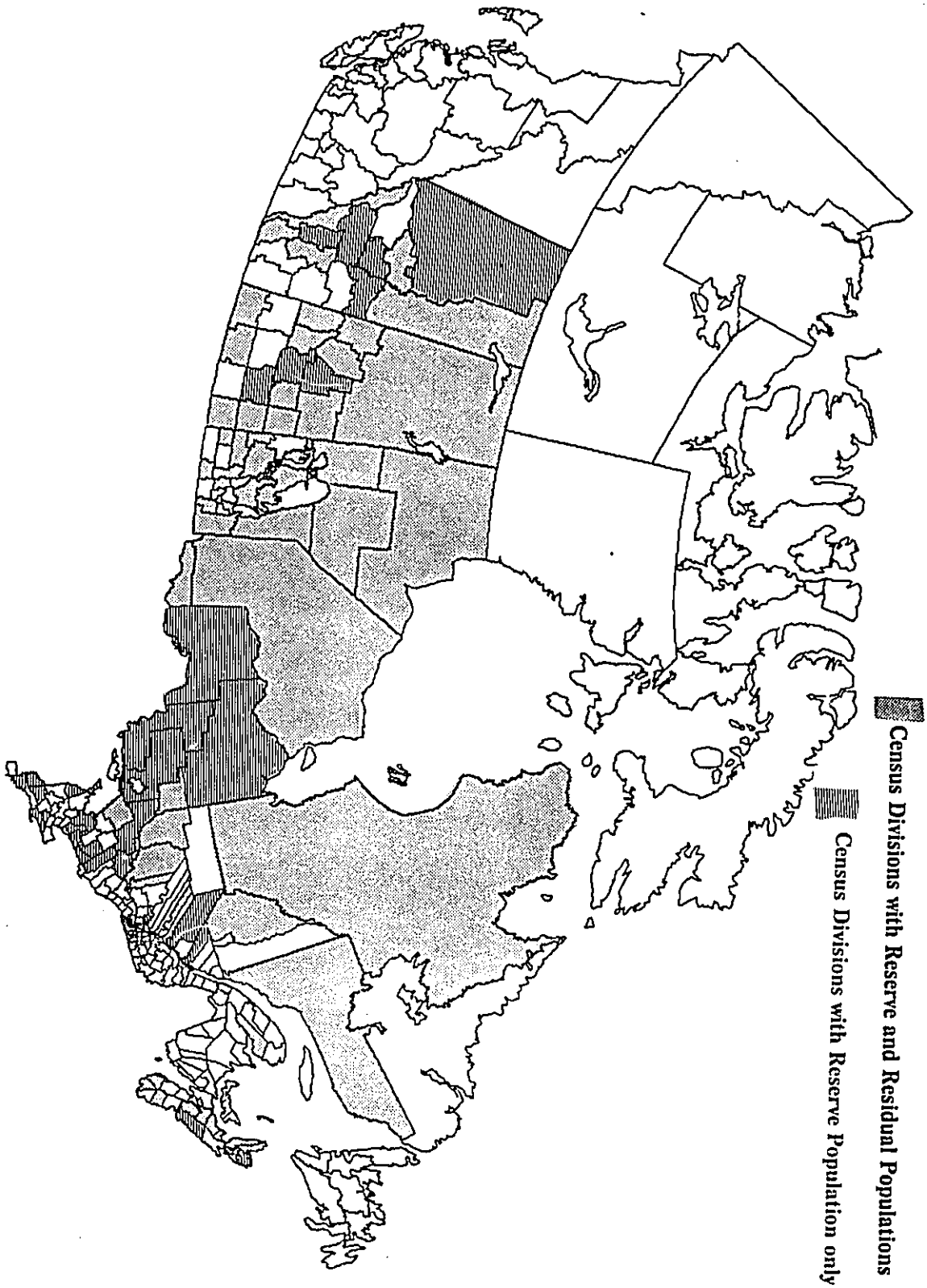


Figure 3: Canadian Census Divisions exhibiting census divisions with reserves used in this study and census divisions selected for the residual comparison population

Note: The provinces of New Brunswick and British Columbia are excluded because of a lack of death certificate coding of on-reserve residence. The province of Newfoundland and the Territories do not contain reserves.

4.1.5 National Comparison Population

A National comparison population was developed using national mortality records from 1979-1983. British Columbia, Newfoundland, New Brunswick and the Territories were excluded because of their exclusion from the on-reserve and residual files. Information from the CMDB was extracted regarding age, sex, province of death, year of death and cause of death (LCDC classification) and aggregated. The information was stored on a file referred to as the NATIONAL file.

4.1.6 Population Estimates

Annual population estimates for the native populations from 1979-1982 had been obtained from DIAND Indian status membership registrar in 1983. Population estimates from the register for the year 1983 were obtained in 1985. Tabulations were provided by year, age, sex, and province of residence.

The MSB data set included population estimates developed by MSB for the population it served. This was tabulated by year, age, sex, and province of residence.

To obtain population estimates for the residual and national populations, intercensal and census counts from Statistics Canada Demography tapes for 1979-1983[e] were used. For the residual population the census divisions under study were aggregated to the provincial level and provincial totals of native populations from the DIAND register were subtracted from these totals. Tabulations were generated by age, sex, and province of residence.

---

[e] Statistics Canada annually produces custom developed tapes for use by LCDC

4.2 DATA PROCESSING

4.2.1 Selection of Disease Processes for Study

On the basis of the literature review, specific disease processes were identified which are noted to have significant burden or are expected to vary from comparison populations. LCDC coding of aggregated disease groups were the minimum unit of analysis.[114] All ICD-9 chapter aggregations were also utilized. In total 18 ICD chapters and 40 LCDC disease aggregates were selected.

4.2.2 Computer Processing

To facilitate analyses of the five files, all information was processed using the LCDC program MORTCAN.[f] MORTCAN is a menu driven program which provides a series of descriptive epidemiological measures at the request of the programmer. Input requires two SAS[115] system files; one containing data on deaths by age, sex, location, and cause, and the second providing the necessary estimates of population. The standard population chosen for this study is the 1981 Canadian Census.

Comparisons between groups and calculations of confidence intervals were performed using the spreadsheet program VP-Planner Plus.[116] Non-parametric correlations were calculated using True Epistat.[117]

4.3 DATA ANALYSIS

4.3.1 Age-Sex Specific Mortality Rates, Life Expectancy and Survival

Age-specific Mortality Rates were computed for each 5 year age group to age 84 (79 for MSB data). Older ages were aggregated into a single category. The 0-4 age group was divided into 0-1 and 1-4 to identify infant mortality. Standard errors were calculated based on the assumption

---

[f] Semenciw R. Program for use by LCDC. (not copyrighted) Ottawa 1986.

of normally distributed proportions.[118] Life expectancy was determined using a first year survival fraction of 0.212 and life expectancy in the oldest age group as the inverse of the mortality rate.[119] Cumulative survival probabilities were determined for ages up to age 75. Life expectancy was also adjusted using the method of Statistics Canada[85] whereby mortality rates in the over 65 population are set to the national population.

4.3.2 Age-Standardized Cause-Specific Mortality Rates and Standardized Mortality Ratios

Age-standardized mortality rates were developed for each cause. The variance of the age-standardized rates was approximated by regarding the rate as a weighted average such that:[118]

$$\text{var(ASMR)} = \frac{\Sigma(N_i^2)p_iq_i/n_i}{(\Sigma N_i)^2}$$

N_i= standard population in ith group
n_i= study population in ith group
p_i= observed age specific death rate in ith group
q= (1-p)

Comparisons between the various files under study is illustrated below. The cell contents of the comparison indicate the type of analysis performed.

	Cohort			
On-reserve	ASMR	On-reserve		
MSB	ASMR	ASMR	MSB	
Residual	-	ASMR	-	Residual
National	SMR	SMR	SMR	ASMR

ASMR: Comparison of Age-standardized mortality rates using the z-test for proportions
SMR: Comparison to national population using Poisson Ratio test

Z-testing assumes that the mortality rates approximate a normal distribution. Poisson testing assumes that the expected variance in the

national reference population is negligible. 95% confidence intervals for SMR's were calculated using the Ury and Wiggins approximation[120] when the expected number was three or greater and the observed number was not zero. Exact significance testing was performed by MORTCAN when the expected number was less than three.

Age specific rates and ratios were developed for 6 age categories, namely; 0-1, 1-4, 5-14, 15-34, 35-64, 65 and over.

4.3.3 Potential Years of Life Lost

For each cause of death, PYLL to age 75 were calculated.[119] PYLL rates were calculated using the population estimates from above for populations below the age of 75.34 Rates were not age standardized.

4.3.4 Proportional Mortality Ratios

Proportional mortality from each cause was determined as cause-specific deaths as a proportion of all reported deaths. Proportional mortality ratios (PMR) were generated as the ratio of the proportional mortality in the data set to the proportional mortality in the national comparison population (multiplied by 100). Tabulations of crude and standardized PMR's were developed.[121,122]

4.3.5 Mortality Rankings

The least aggregated groupings for the causes of death under study were utilized to rank causes of death by: age-standardized mortality rate, potential years of life lost, proportional mortality ratio, and standard mortality ratios.

Spearman's rank correlation coefficient was calculated for the ordering of age-standardized mortality rates and PYLL.

5. RESULTS

5.1 THE RECORD LINKAGE

The Native event file death records were found to have the following availability of items[123]

Data Item	Availability
Surname	100.0%
Alternate surname	13.1
First initial	100.0
Remainder of first given name	100.0
Second initial	45.3
Remainder of second given name	43.5
Province of residence	100.0
Birth Year	99.0
Birth month	89.0
Birth day	78.3
Sex	100.0
Fathers first initial	7.0
Fathers second initial	2.7
Mothers first initial	15.4
Mothers second initial	10.0
Marital status	100.0

Of the 1,178 males known to have died, 1,065 good links were identified and of 754 females known to have died, 661 good links were found. The overall linkage rate was 89%.

5.2 POPULATIONS

The populations under study have been displayed in pyramid format in Figures 4 (a-e). These charts illustrate the relative youth of the native populations. The native charts are not corrected for the late reporting of births which may explain a portion of the apparent small childhood population. The Medical Services Branch file is truncated at age 79. The mean and median ages of the populations for the files are:

	Mean	Median
Native Cohort	24.1	19
On-reserve population	23.7	20
MSB population	23.1	20
Residual area	32.4	30
National	32.7	30

5.3 AGE SPECIFIC MORTALITY RATES

Table 1 presents the age specific mortality rates and significance testing for each of the five data sets. Native populations of both sexes have substantially higher mortality rates than the comparison populations in younger ages and lower mortality rates in the elderly. The following text table provides an estimation based on the number of tests and the observed and expected number of significant findings based on chance alone:

Comparison	Cohort:National	Reserve:National	MSB:National	
number	38	38	34	
expected p=0.05	1.90	1.90	1.70	
observed p=0.05	28	30	31	
expected p=0.01	0.38	0.38	0.34	
observed p=0.01	24	29	31	
Comparisons	**Cohort:Reserve**	**Cohort:MSB**	**MSB:On-reserve**	**Reserve:Residual**
number	38	34	34	38
expected p=0.05	1.90	1.70	1.70	1.90
observed p=0.05	4	2	25	30
expected p=0.01	0.38	0.34	0.34	0.34
observed p=0.01	0	0	13	25

This table suggests that the comparisons between the native groups and the comparison populations are unlikely to be explained by chance alone. Similarly it appears unlikely that the difference noted between the MSB and on-reserve populations is due to chance alone.

5.4 LIFE EXPECTANCY

Table 2 presents the sex specific life expectancies at all ages for each of the five populations. At birth, native males have lower life expectancy than their comparison counterparts. With increasing age native males appear to enjoy relative longevity. Native females have similar life expectancies at birth relative to the national population (with the exception of MSB clients who have a lower life expectancy). As with the

native males they appear to enjoy relative longevity with increasing age.

Using the native life expectancy adjustment procedure of Statistics Canada[85] reveals the following life expectancies at birth:

	Females	Males
Cohort	72.38	64.52
On-Reserve	74.02	65.90
MSB	70.54	62.32
Residual	79.07	71.29
National	77.49	70.09

5.5 SURVIVAL CURVES

Survival curves indicate the likelihood of an individual surviving to any specific point in time. Figures 5 a and 5 b provide the survival curves to age 75 for males and females respectively. The curves display the reduced likelihood of survival for natives to all ages below age 75.

5.6 AGE-STANDARDIZED CAUSE-SPECIFIC MORTALITY RATES

Tables 3a and 3c provide the age-standardized cause-specific mortality rates for males and females for the 18 ICD chapters. For all groups a substantial proportion of deaths are categorized under the ICD chapters of circulatory diseases, accidents/poisoning/violence and neoplasms.

Tables 3b and 3d detail the rates for the LCDC aggregate causes of death. All rates are provided with 95% confidence intervals. Significant differences between native groups and between the on-reserve and off-reserve populations are indicated. The following text table lists observed and expected numbers of significant relationships for the four tables aggregated based on levels of probability.

Comparisons	cohort:reserve	Cohort:MSB	MSB:On-reserve	Reserve:Residual
number	115	34	34	115
expected for p=0.05	5.75	1.70	1.70	5.75
observed for p=0.05	7	8	19	64
expected for p=0.01	1.15	0.34	0.34	1.15
observed for p=0.01	2	5	16	54

This chart supports the existence of substantial mortality differences between the on-reserve and residual populations. The MSB clientele appears to have a different mortality experience than the other two measures of native mortality

Age-standardized rates for the selected age groups can be found in Appendix D, with confidence intervals for each rate.

5.7 STANDARDIZED MORTALITY RATIOS

Tables 4a to 4d provide the SMR's with observed and expected values, using the national comparison population as the reference group. 95% confidence intervals for the SMR's are provided. The relative importance of various disease entities is emphasized by the mortality rankings provided below.

5.8 POTENTIAL YEARS OF LIFE LOST

Tables 5a and b provide sex-specific PYLL rates for each study population by cause. The proportion of PYLL attributed to various least aggregated disease groups is presented in Figures 6a-h. The relatively reduced importance of coronary heart disease in natives is highlighted by these charts. The importance on suicide and motor vehicle traffic accidents on native populations is emphasized. The proportion of PYLL attributable is various diseases also provides the ranking order for various causes of PYLL (and the PYLL rates which are not adjusted by age).

5.9 PROPORTIONAL MORTALITY RATIOS

Tables 6a and 6b provide the sex specific crude and age-standardized PMR's for each disease grouping by two native populations, in comparison to the national reference population. The relative prominence of the most important disease entities is highlighted by the rankings noted below.

5.10 MORTALITY RANKINGS

Tables 7-9 show the top ten ranked causes of mortality utilizing age-standardized mortality rates (Table 7), proportional mortality ratios (Table 8) and standardized mortality ratios (Table 9). Figures 3a-h display the rankings by PYLL.

Table 10 provides Spearman's correlation coefficients for ASMR and PYLL rankings. All coefficients are highly significant. Correlations between native and comparison groups are significantly lower ($p<0.05$) than correlations between the two native groups or between the two comparison groups, for all pairs except those of the male potential years of life lost. For male PYLL the native and comparison group correlations are significantly lower than the between comparison group correlation but not the between native group correlation.

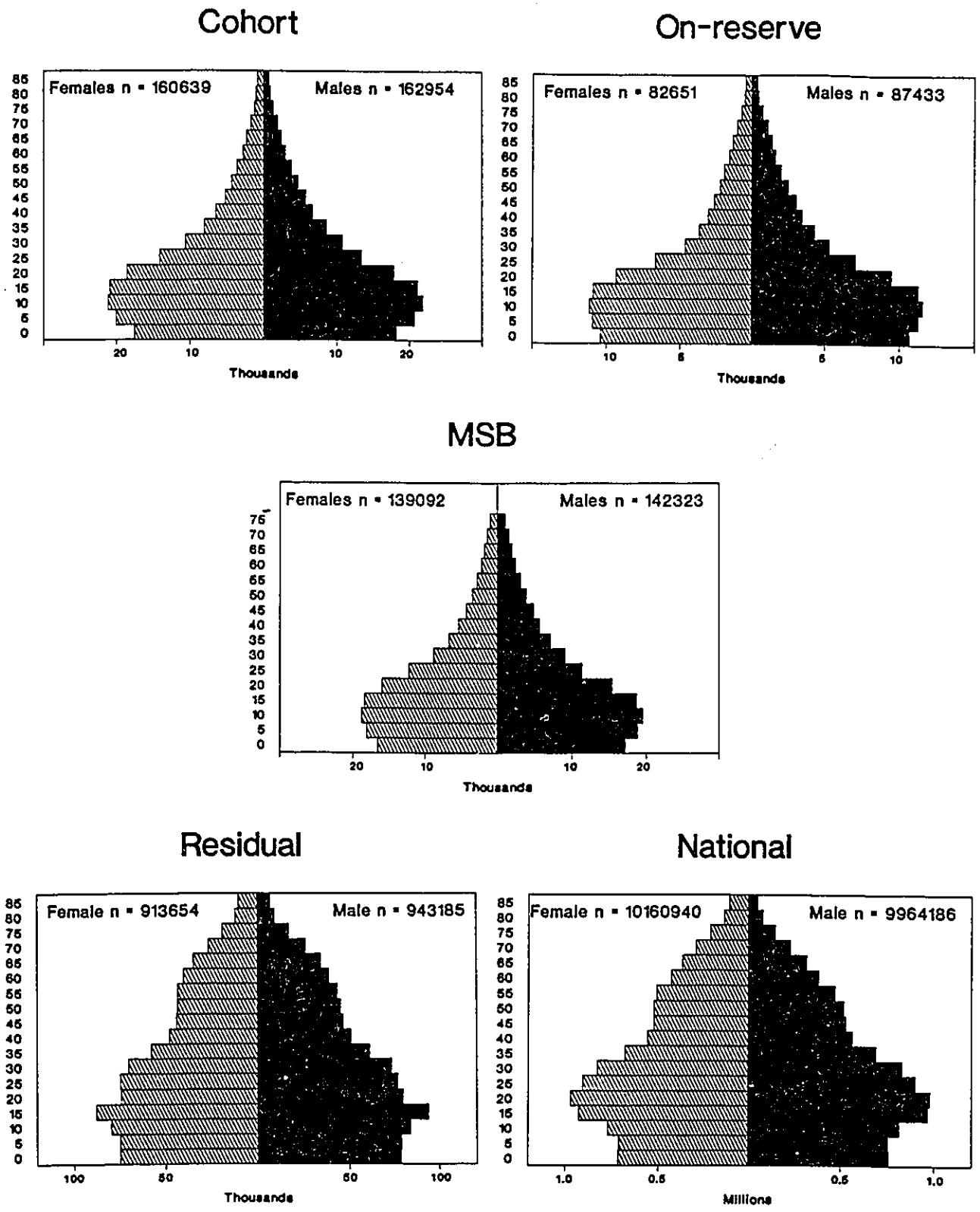


Figure 4: Population pyramids with average annual populations for native and

Table 1: Age Specific Mortality Rates for Three Native Groups and Two comparison Populations Providing Selected tests of Significance

Males
(Per 100,000 population per year)

Age	Cohort	Age-Specific Mortality Rates: On-reserve	MSB	Residual	National
<1	2888.22 ! ¤¤	2430.55 &&	3782.26 ++ ##	1188.83 $$	1240.60
1-4	180.30 ¤¤	117.81 &&	222.52 ++ ##	83.82 $	66.21
5-9	67.89 ¤	87.23 &&	100.60 ##	46.28 $$	39.74
10-14	105.38 ¤¤	71.19 &&	98.80 ##	52.18	42.74
15-19	327.40 ¤¤	320.87 &&	413.40 ++ ##	167.97 $$	144.84
20-24	513.61 * ¤¤	379.05 &&	554.00 ++ ##	238.47 $$	182.14
25-29	565.03 ¤¤	435.47 &&	579.75 ++ ##	167.56 $$	155.73
30-34	486.89 ¤¤	483.78 &&	582.40 ##	148.72 $$	157.06
35-39	607.47 ¤¤	497.55 &&	642.54 + ##	196.96 $$	197.65
40-44	708.84 ¤¤	682.99 &&	904.62 + ##	306.61 $$	314.36
45-49	631.80 !	722.54 &&	914.69 + ##	489.02 $$	524.56
50-54	993.73	854.01	1194.26 ++ ##	830.23	885.02
55-59	1332.26	1264.37	1732.71 ++	1269.71	1439.54
60-64	2234.82	2115.30	2281.11	1891.79	2273.60
65-69	3092.56	3152.11 &	3619.90	3047.24	3632.80
70-74	4172.31 ¤	4038.72 &&	4804.33 + ##	4757.09 $	5613.59
75-79	5896.41 ¤¤	5345.57 &&	6435.35 + ##	7247.25 $$	8707.87
80-84	7072.46 ¤¤	7397.44 &&	11733.09 N.T.	10812.75 $$	13378.55
85+	8773.23 ¤¤	11482.64 &&		20978.03 $$	25397.71

Females
(Per 100,000 population per year)

Age	Cohort	Age-Specific Mortality Rates: On-reserve	MSB	Residual	National
<1	2296.02 ¤¤	1728.02 &&	2731.26 ++ ##	932.69 $$	976.79
1-4	106.12 ¤¤	100.38 &&	150.46 + ##	55.78 $$	52.48
5-9	39.77	36.71	50.59 ##	28.14	26.92
10-14	37.78	43.11 &	55.19 ##	24.65 $	24.56
15-19	152.79 * ¤¤	95.66 &&	159.71 ++ ##	60.65 $$	52.43
20-24	221.07 * ¤¤	147.82 &&	206.19 + ##	57.79 $$	53.23
25-29	269.06 * ¤¤	171.24 &&	277.17 ++ ##	58.60 $$	59.69
30-34	311.65 ¤¤	274.57 &&	329.70 ##	65.98 $$	74.26
35-39	284.24 ¤¤	253.42 &&	424.31 ++ ##	101.48 $$	113.76
40-44	356.67 ¤¤	365.24 &&	545.27 + ##	168.03 $$	182.32
45-49	599.43 ¤¤	466.23 &&	729.61 ++ ##	271.97 $$	288.86
50-54	677.17 ¤	674.53 &&	909.11 + ##	405.42 $$	465.59
55-59	1130.26 ¤¤	1114.11 &&	1440.55 + ##	594.17 $$	719.41
60-64	1632.50 ¤	1203.24	1683.90 + ##	915.45 $	1105.61
65-69	1793.13	1845.01	2195.86 ##	1489.82 $	1777.00
70-74	2441.86	2126.58 &&	3398.95 ++ ##	2420.98	2812.33
75-79	4280.31	4104.36	4973.50 ##	3992.85	4646.33
80-84	4527.55 ¤¤	4936.68 &&	9305.55 N.T.	7147.03 $$	8063.45
85+	6323.62 ¤¤	8544.30 &&		15539.27 $$	18304.46

	p <0.05	p<0.01
Cohort:On-reserve	*	**
Cohort: MSB	!	!!
Cohort:National	¤	¤¤
MSB:On-reserve	+	++
MSB:National	#	##
On-reserve:National	&	&&
Residual:On-reserve	$	$$

Based on t-testing of proportions

Table 2: Male and Female Life Expectancy at Five Year ages

Life Expectancy (Years)

Males

Age	Cohort	On-reserve	MSB	Residual	National
0	67.54	68.49	63.54	71.28	70.09
1	68.50	69.15	64.93	71.13	69.96
5	64.98	65.47	61.49	67.36	66.14
10	60.19	60.74	56.79	62.51	61.26
15	55.50	55.95	52.06	57.67	56.39
20	51.37	51.81	48.09	53.13	51.78
24	47.64	47.75	44.37	48.74	47.23
30	43.93	43.75	40.60	44.13	42.58
35	39.95	39.75	36.72	39.44	37.89
40	36.10	35.69	32.83	34.80	33.25
45	32.31	31.84	29.23	30.30	28.73
50	28.26	27.92	25.48	25.99	24.43
55	24.57	24.02	21.88	21.98	20.42
60	21.08	20.42	18.62	18.25	16.74
65	18.25	17.40	15.55	14.80	13.44
70	15.85	14.90	13.09	11.79	10.59
75	13.89	12.63	10.91	9.23	8.14
80	12.69	10.66	9.02	7.09	6.12
85	11.89	9.20		5.26	4.43

Females

Age	Cohort	On-reserve	MSB	Residual	National
0	77.10	77.40	71.29	79.06	77.49
1	77.86	77.74	72.23	78.80	77.24
5	74.18	74.04	68.65	74.97	73.40
10	69.33	69.18	63.82	70.07	68.50
15	64.45	64.32	58.99	65.16	63.58
20	59.93	59.62	54.44	60.35	58.74
24	55.57	55.04	49.98	55.51	53.89
30	51.28	50.49	45.64	50.67	49.04
35	47.05	46.15	41.36	45.83	44.21
40	42.69	41.71	37.19	41.05	39.45
45	38.41	37.43	33.14	36.37	34.79
50	34.50	33.25	29.28	31.84	30.26
55	30.60	29.30	25.52	27.44	25.91
60	27.22	25.83	22.23	23.19	21.77
65	24.31	22.27	18.95	19.15	17.86
70	21.34	19.16	15.83	15.43	14.27
75	18.75	16.01	13.27	12.08	11.03
80	17.56	14.04	11.24	9.15	8.21
85	16.31	12.20		6.93	5.96

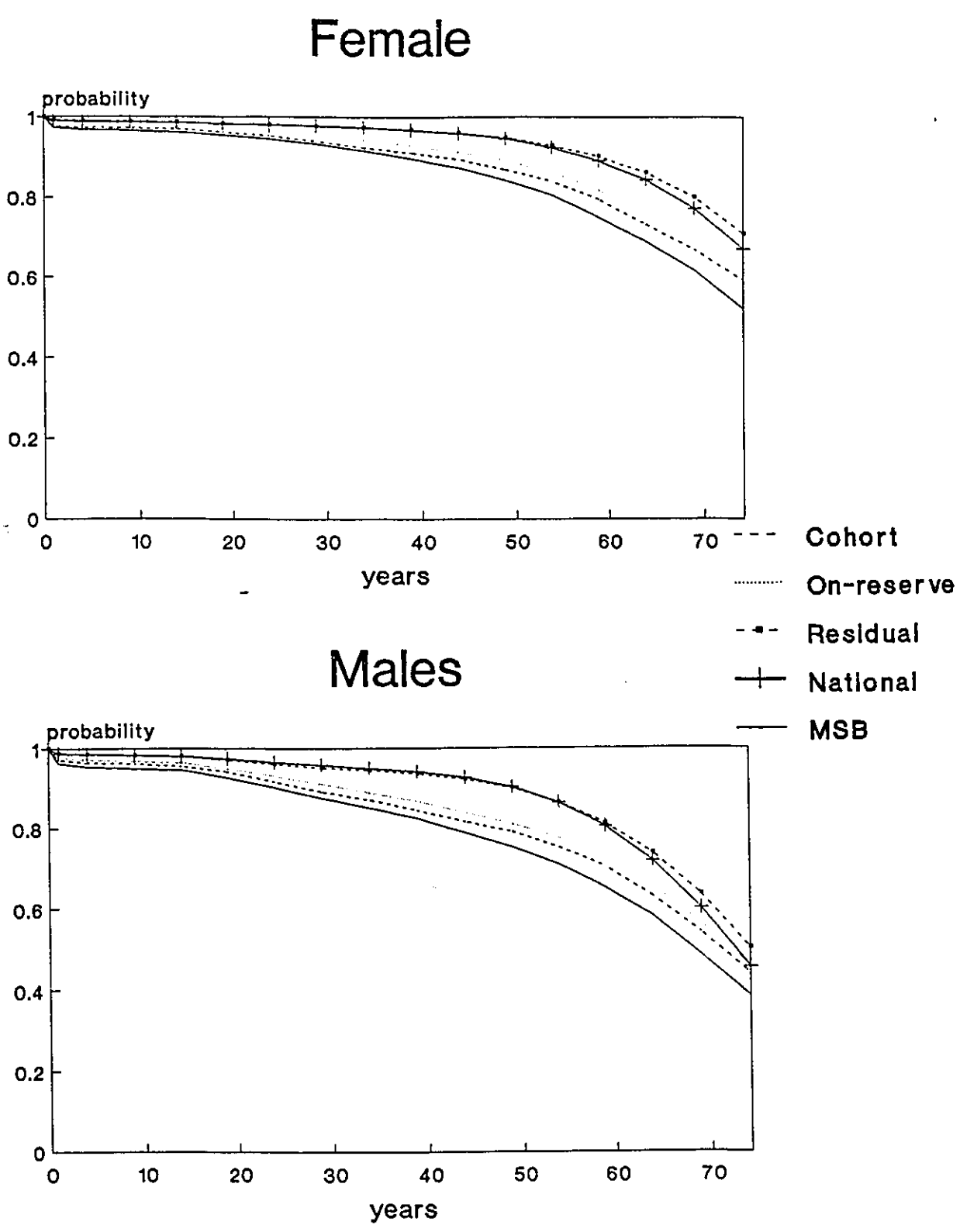


Figure 5: Probability of Survival to Specified Ages

Table 3a: Male Cause-Specific Age-Standardized Mortality Rates for ICD Chapters

Males
(Per 100,000 population per year)

Causes	Age Standardized Mortality Rates: ICD chapters				
	Cohort	On-reserve	MSB	Residual	National
All Causes	1010.3 (946.4-1074.1)!!**	966.4 (928.3-1004.4)	1217.7 (1183.2-1252.1)++	945.1 (936.4-953.7)	1082.4 (1079.4-1085.3)
Infective and Parasitic Diseases	17.5 (8.8-26.1)	12.9 (8.3-17.4) &&	21.1 (16.3-25.8) +	4.5 (3.9-5.0)	5.2 (5.0-5.3)
Neoplasms	102.9 (80.3-125.4)	112.1 (97.9-126.2)&&	122.4 (110.2-134.5)	209.8 (205.6-213.9)	250.6 (249.0-252.1)
Endocrine/Nutritional/Metabolic	23.7 (12.6-33.7)	28.9 (21.6-36.1) &&	23.4 (18.1-28.6)	16.5 (15.3-17.6)	19.8 (19.4-20.1)
Blood Diseases	5.1 (0-10.1)	0.9 (0-2.0)&	3.7 (1.5-5.8) ++	3.2 (2.6-3.7)	3.5 (3.3-3.6)
Mental Disorders	27.1 (15.9-38.2)	17.1 (12.0-22.1) &&	17.7 (13.5-21.8)	6.5 (5.7-7.2)	9.3 (8.9-9.6)
Nervous System/Sense Diseases	14.1 (6.6-21.5)	11.1 (6.9-15.2)	13.2 (9.6-16.7)	10.7 (9.7-11.6)	13.7 (13.3-14.0)
Circulatory Diseases	321.6 (282.2-360.9) !!	329.4 (305.4-353.3)&&	383.6 (362.4-404.7) ++	424.7 (418.8-430.5)	501.2 (499.0-503.3)
Respiratory Diseases	81.3 (61.8-100.7) !	86.2 (74.0-98.3)	104.4 (93.4-115.3) +	78.2 (75.6-80.7)	86.7 (85.7-87.6)
Digestive Diseases	50.0 (35.3-64.7)	38.3 (30.6-45.9)	62.3 (54.0-70.5) ++	32.8 (31.2-34.3)	42.7 (42.1-43.2)
Genitourinary Disease	12.1 (4.4-19.7)	15.6 (10.5-20.6)	18.2 (13.4-22.9)	12.7 (11.7-13.6)	14.2 (13.8-14.5)
Skin/Subcutaneous Tissue	0.5 (0-1.4)	0.5 (0-1.4)	0.7 (0-1.6)	0.5 (0-1.0)	0.6 (0.6-0.6)
Musculoskeletal	3.6 (0-7.7)	3.0 (0.6-5.3)	1.1 (0-2.2)	1.8 (0.9-2.7)	2.0 (1.8-2.1)
Congenital	10.7 (5.8-15.6)	7.7 (5.1-10.2)	11.0 (8.6-13.3)	6.6 (5.8-7.3)	7.5 (7.3-7.6)
Perinatal	13.5 (8.0-18.9)	10.5 (7.7-13.2) &	18.0 (15.0-20.9) ++	7.2 (6.4-7.9)	8.1 (7.9-8.2)
Symptoms/Ill-defined	26.7 (16.9-36.5) !	25.7 (19.8-31.5) &&	38.8 (32.9-44.6) ++	12.3 (11.3-13.2)	12.6 (12.2-12.9)
Accidents/Poisonings/Violence	300.4 (270.0-330.7) !!	266.4 (248.7-284.0)&&	369.0 (352.3-385.6) ++	117.2 (114.0-120.3)	104.7 (103.7-105.6)

p < 0.05
p < 0.01

Cohort:On-reserve
*
**

Cohort:MSB
!
!!

On-reserve:residual
&
&&

MSB:On-reserve
+
++

Table 3b: Male Cause-Specific Age-Standardized Mortality Rates by LCDC Disease Aggregates

Males (Per 100,000 population per year)	Age Standardized Mortality Rates: LCDC disease aggregations									
	Cohort			On-reserve			Residual		National	
Cancer	102.9	(80.3-125.4)		111.2	(97.0-125.3)	&&	207.5	(203.3-211.6)	248.5	(246.9-250.0)
Tongue/mouth/ pharynx	1.4	(0-4.1)		4.7	(1.7-7.6)		3.3	(2.7-3.8)	5.6	(5.4-5.7)
Esophagus	1.3	(0-3.8)		2.2	(0.2-4.1)	&&	3.7	(3.1-4.2)	5.5	(5.3-5.6)
Stomach	5.0	(0-10.0)		4.3	(1.5-7.0)	&&	14.9	(13.7-16.0)	15.3	(14.9-15.6)
Large Intestine and Rectum	15.9	(6.8-24.9)		14.3	(9.2-19.3)	&&	26.0	(24.6-27.3)	32.5	(31.9-33.0)
Liver	1.4	(0-4.1)		0.5	(0-1.4)		1.2	(0.8-1.5)	2.1	(1.9-2.2)
Gall Bladder	1.4	(0-4.1)		3.3	(0.7-5.8)		1.9	(1.5-2.2)	2.3	(2.1-2.4)
Pancreas	4.5	(0-9.2)		3.8	(1.2-6.3)	&&	13.1	(12.1-14.0)	13.5	(13.1-13.8)
Digestive Tract	30.9	(18.3-43.4)		30.3	(22.8-37.7)	&&	64.2	(61.8-66.5)	74.5	(73.7-75.2)
Trachea/ Bronchus/ Lung	24.8	(13.8-35.7)		33.0	(25.3-40.6)	&&	62.8	(60.4-65.1)	79.3	(78.5-80.0)
Breast	0			0.5	(0-1.4)		0.2	(0.0-0.3)	0.3	(0.3-0.3)
Prostate	18.9	(8.9-28.8)		15.2	(9.9-20.4)	&&	23.3	(21.9-24.6)	26.1	(25.5-26.6)
Kidney	1.4	(0-4.1)		4.7	(1.7-7.6)		4.9	(4.3-5.4)	5.5	(5.3-5.6)
Bladder	0			0			6.5	(5.7-7.2)	8.3	(8.1-8.4)
Brain	0.8	(0-2.3)		0.8	(0-1.7)	&&	5.1	(4.5-5.6)	6.1	(5.9-6.2)
Lymphoid	7.9	(1.6-14.1)		8.0	(4.2-11.7)		10.8	(9.8-11.7)	12.1	(11.7-12.4)
Leukemia	6.5	(1.4-11.5)		4.3	(1.7-6.8)	&&	9.1	(8.3-9.8)	9.9	(9.5-10.2)
Diabetes	15.4	(6.7-24.0)		23.7	(17.2-30.1)	&&	12.2	(11.2-13.1)	14.9	(14.5-15.2)
Alcoholic Psychosis/Alcoholism	33.1	(20.7-45.4)	**	17.0	(12.1-21.9)	&&	4.0	(3.4-4.5)	5.3	(5.1-5.4)
Coronary Heart Disease	183.0	(153.0-212.9)		205.7	(186.6-224.7)	&&	262.7	(257.9-267.4)	333.0	(328.2-331.7)
Stroke	50.8	(34.9-66.6)		52.3	(42.6-61.9)	&&	67.4	(65.0-69.7)	78.2	(77.4-78.9)
Rheumatic Fever and Chronic RHD	4.8	(0-9.7)		5.8	(2.6-8.9)		4.3	(3.7-4.8)	5.5	(5.3-5.6)
Hypertensive Disorders	2.6	(0-6.3)		3.7	(1.1-6.2)		6.3	(5.5-7.0)	7.4	(7.2-7.5)
Influenza	0			0.5	(0-1.4)	&	1.9	(1.5-2.2)	1.3	(1.1-1.4)
Pneumonia	40.6	(27.0-54.1)		41.3	(33.0-49.5)	&	31.3	(29.7-32.8)	31.3	(30.7-31.8)
Chronic Obstructive Lung Disease	30.2	(18.0-42.3)		31.0	(23.5-38.4)		37.2	(35.4-38.9)	44.6	(44.0-45.1)
Ulcers	4.2	(0-8.9)		3.4	(1.0-5.7)		4.4	(3.8-4.9)	5.0	(4.8-5.1)
Cirrhosis of Liver	26.2	(15.8-36.5)		18.0	(12.7-23.2)	&	11.8	(10.8-12.7)	17.8	(17.4-18.1)
Gallbladder Diseases	5.1	(0.0-10.1)		3.2	(0.8-5.5)		2.2	(1.8-2.5)	2.6	(2.4-2.7)
Nephritis and Nephrosis	0			5.6	(2.4-8.7)		3.2	(2.6-3.7)	4.1	(3.9-4.2)
Kidney Disease	5.9	(0.4-11.3)		11.2	(6.8-15.5)		9.7	(8.7-10.6)	10.7	(10.3-11.0)
Motor Vehicle Traffic Accidents	93.1	(76.6-109.5)	*	72.8	(63.7-81.8)	&&	40.9	(39.1-42.6)	33.7	(33.1-34.2)
Accidental Falls	17.3	(8.6-25.9)		8.4	(4.8-11.9)		7.7	(6.9-8.4)	11.1	(10.7-11.4)
Fires	18.9	(11.4-26.3)		17.2	(12.6-21.7)	&&	5.5	(4.9-6.0)	3.9	(3.7-4.0)
Drownings	24.7	(15.4-33.9)		22.4	(17.1-27.6)	&&	6.2	(5.4-6.9)	4.1	(3.9-4.2)
Suicide	54.3	(42.5-66.0)		54.0	(46.5-61.4)	&&	24.8	(23.4-26.1)	25.6	(25.2-25.9)
Homicide	13.1	(7.0-19.1)	*	23.3	(18.0-28.5)	&&	2.8	(2.4-3.1)	3.6	(3.4-3.7)
Accidental Poisoning	10.3	(3.8-16.7)		6.7	(3.9-9.4)	&&	2.2	(1.8-2.5)	3.1	(2.9-3.2)

Cohort:On-reserve p< 0.05 *, p <0.01 ** On-reserve:Residual p <0.05 &, p <0.01 &&

Table 3c: Female Cause-Specific Age-Standardized Mortality Rates for ICD Chapters

Females (Per 100,000 population per year) Causes	Age Standardized Mortality Rates: ICD chapters									
	Cohort		On-reserve		MSB		Residual		National	
All Causes	652.4 (599.4-705.3)	!!	604.8 (573.2-636.3)	&&	840.7 (810.5-870.8)	++	534.1 (528.0-540.1)		612.3 (610.3-614.2)	
Infective and Parasitic Diseases	10.5 (3.6-17.3)		9.4 (5.4-13.3)	&&	15.4 (11.4-19.3)	+	3.2 (2.6-3.7)		3.2 (3.0-3.3)	
Neoplasms	115.6 (91.8-139.3)		106.1 (92.1-120.0)	&&	117.7 (105.5-129.8)		132.0 (128.8-135.1)		155.6 (154.6-156.5)	
Endocrine/Nutritional/Metabolic	19.8 (9.6-29.9)		28.8 (21.3-36.2)	&&	30.7 (24.4-36.9)		16.6 (15.4-17.7)		17.5 (17.1-17.8)	
Blood Diseases	3.4 (0-7.3)		0.9 (0-2.1)	&	2.2 (0.6-3.7)		2.3 (1.9-2.6)		2.6 (2.4-2.7)	
Mental Disorders	10.3 (3.4-17.1)		13.0 (8.2-17.7)	&&	12.2 (8.6-15.7)		2.9 (2.5-3.2)		4.8 (4.6-4.9)	
Nervous System/Sense Diseases	10.2 (3.3-17.0)	*	2.6 (0.8-4.3)	&&	8.1 (5.1-11.0)	++	8.0 (7.2-8.7)		9.3 (9.1-9.4)	
Circulatory Diseases	192.4 (161.6-223.1)	!!	206.6 (187.1-226.0)	&&	269.3 (250.8-287.7)	++	246.8 (242.6-250.9)		287.7 (286.3-289.0)	
Respiratory Diseases	51.0 (36.1-65.8)	!!	54.4 (44.7-64.0)	&&	75.8 (66.3-85.2)	++	33.0 (31.4-34.5)		34.6 (34.2-34.9)	
Digestive Diseases	56.5 (40.8-72.1)		43.2 (34.7-51.6)	&&	65.6 (56.9-74.2)	++	20.9 (19.7-22.0)		25.2 (24.8-25.5)	
Genitourinary Disease	13.3 (5.2-21.3)		15.4 (10.1-20.6)	&&	21.7 (16.4-26.9)		8.0 (7.2-8.7)		8.1 (7.9-8.2)	
Complications of Pregnancy	0.6 (0-1.7)		0		0.1 (0-0.2)		0.2 (0.0-0.3)		0.2 (0.2-0.2)	
Skin/Subcutaneous Tissue	2.2 (0-5.3)		1.4 (0-2.9)		1.5 (0.1-2.8)		0.4 (0.2-0.5)		0.6 (0.6-0.6)	
Musculoskeletal	2.2 (0-5.3)		1.8 (0.0-3.5)		2.7 (0.9-4.4)		2.8 (2.4-3.1)		3.2 (3.0-3.3)	
Congenital	9.5 (4.9-14.0)	*	3.7 (2.1-5.2)		8.3 (6.3-10.2)	++	5.3 (4.7-5.8)		6.5 (6.3-6.6)	
Perinatal	9.1 (4.5-13.6)		6.7 (4.5-8.8)		13.1 (10.5-15.6)	++	5.7 (5.1-6.2)		6.1 (5.9-6.2)	
Symptoms/Ill-defined	25.1 (14.9-35.2)		16.9 (12.1-21.6)	&&	34.6 (28.7-40.4)	++	8.2 (7.4-8.9)		7.7 (7.5-7.8)	
Accidents/Poisonings/Violence	120.7 (101.2-140.1)	* !	94.0 (83.0-104.9)	&&	144.1 (133.3-154.8)	++	37.8 (36.0-39.5)		39.3 (38.7-39.8)	

	Cohort:reserve	Cohort: MSB	On-reserve:residual	MSB:On-reserve
p < 0.05	*	!	&	+
p < 0.01	**	!!	&&	++

Table 3d: Female Cause-Specific Age-Standardized Mortality Rates by LCDC Disease Aggregates

Females

(Per 100,000 population per year)	Age Standardized Mortality Rates: LCDC disease aggregations			
	Cohort	On-reserve	Residual	National
Cancer	115.6 (91.8-139.3)	103.9 (90.1-117.6) &&	130.3 (127.1-133.4)	153.8 (152.8-154.7)
Tongue mouth pharynx	0	1.4 (0-2.9)	1.1 (0.9-1.2)	1.6 (1.4-1.7)
Esophagus	0	0	1.2 (1.0-1.3)	1.7 (1.5-1.8)
Stomach	1.5 (0-4.4)	3.5 (0.9-6.0) &	6.4 (5.6-7.1)	6.8 (6.6-6.9)
Large Intestine and Rectum	10.9 (3.6-18.1)	11.9 (7.1-16.6) &&	21.6 (20.2-22.9)	24.5 (24.1-24.8)
Liver	0	0	0.4 (0.2-0.5)	1.0 (1.0-1.0)
Gall Bladder	5.4 (0.1-10.6)	4.1 (1.3-6.8)	2.5 (2.1-2.8)	2.8 (2.6-2.9)
Pancreas	4.4 (0.0-8.7)	5.6 (2.4-8.7)	7.9 (7.1-8.6)	8.4 (8.2-8.5)
Digestive Tract	24.3 (13.5-35.0)	25.6 (18.7-32.4) &&	42.6 (40.8-44.3)	47.5 (46.9-48.0)
Trachea Bronchus/Lung	8.8 (2.1-15.4)	12.6 (7.7-17.5)	15.3 (14.1-16.4)	19.6 (19.2-19.9)
Breast	17.9 (8.2-27.5)	12.5 (7.6-17.4) &&	25.7 (24.3-27.0)	31.4 (31.0-31.7)
Uterus	18.7 (9.2-28.1)	15.3 (10.0-20.5) &&	7.1 (6.3-7.8)	8.3 (8.1-8.4)
Ovary	5.7 (0.0-11.3)	5.0 (2.0-7.9)	6.8 (6.0-7.5)	9.0 (8.8-9.1)
Kidney	5.8 (0.1-11.4)	2.5 (0.3-4.6)	2.2 (1.8-2.5)	2.5 (2.3-2.6)
Bladder	1.0 (0-2.9)	1.5 (0-3.2)	1.8 (1.4-2.1)	2.3 (2.1-2.4)
Brain	3.4 (0.4-6.3)	1.6 (0.2-2.9) &	3.4 (2.8-3.9)	4.2 (4.0-4.3)
Lymphoid	4.2 (0-8.9)	5.7 (2.5-8.8)	7.1 (6.3-7.8)	8.0 (7.8-8.1)
Leukemia	5.2 (0.4-9.9)	4.3 (1.7-6.8)	5.1 (4.5-5.6)	5.8 (5.6-5.9)
Diabetes	18.4 (8.6-28.2)	26.2 (19.1-33.2) &&	12.7 (11.7-13.6)	13.3 (12.9-13.6)
Alcoholic Psychosis/Alcoholism	14.7 (6.8-22.5)	12.1 (7.7-16.4) &&	0.9 (0.7-1.0)	1.4 (1.2-1.5)
Coronary Heart Disease	86.1 (65.1-107.0)	95.0 (81.6-108.3) &&	124.6 (121.6-127.5)	161.3 (160.3-162.2)
Stroke	55.4 (38.9-71.8)	55.0 (45.0-64.9)	57.7 (55.7-59.6)	64.9 (64.3-65.4)
Rheumatic Fever and Chronic RHD	3.2 (0-6.9)	3.2 (0.8-5.5)	4.4 (3.8-4.9)	5.8 (5.6-5.9)
Hypertensive Disorders	4.6 (0.1-9.1)	8.7 (4.5-12.8)	7.0 (6.2-7.7)	6.6 (6.4-6.7)
Acute Respiratory Infections	1.8 (0-3.9)	0.4 (0-0.9)	0.4 (0.2-0.5)	0.4 (0.4-0.4)
Influenza	0.5 (0-1.4)	1.1 (0-2.4)	1.7 (1.3-2.0)	1.2 (1.2-1.2)
Pneumonia	29.4 (17.8-40.9)	32.2 (24.9-39.4) &&	17.7 (16.5-18.8)	17.3 (16.9-17.6)
Chronic Obstructive Lung Disease	10.1 (3.2-16.9)	13.1 (8.2-18.0)	9.3 (8.5-10.0)	10.9 (10.7-11.0)
Ulcers	1.2 (0-3.5)	2.3 (0.3-4.2)	2.2 (1.8-2.5)	2.6 (2.4-2.7)
Cirrhosis of Liver	32.9 (21.1-44.6)	20.3 (14.4-26.1) &&	4.4 (3.8-4.9)	7.5 (7.3-7.6)
Gallbladder Diseases	3.0 (0-6.3)	3.0 (0.8-5.1)	1.6 (1.2-1.9)	1.8 (1.6-1.9)
Nephritis and Nephrosis	1.8 (0-4.3)	4.0 (1.2-6.7)	2.8 (2.4-3.1)	2.6 (2.4-2.7)
Kidney Disease	11.0 (3.5-18.4)	12.0 (7.2-16.7) &	7.0 (6.2-7.7)	6.8 (6.6-6.9)
Motor Vehicle Traffic Accidents	35.3 (24.3-46.2)	26.9 (21.0-32.7) &&	14.2 (13.0-15.3)	12.4 (12.0-12.7)
Accidental Falls	8.0 (2.1-13.8)	4.4 (1.8-6.9)	5.6 (5.0-6.1)	7.0 (6.8-7.1)
Fires	8.1 (2.8-13.3)	6.7 (3.7-9.6) &	2.9 (2.3-3.4)	1.9 (1.7-2.0)
Drownings	7.8 (2.7-12.8)	2.5 (0.7-4.2) &&	1.1 (0.7-1.4)	0.9 (0.9-0.9)
Suicide	19.0 (11.9-26.0)	14.7 (10.7-18.6) &&	5.6 (4.8-6.3)	7.9 (7.7-8.0)
Homicide	12.2 (6.1-18.2)	9.5 (6.1-12.8) &&	1.6 (1.2-1.9)	1.9 (1.7-2.0)
Accidental Poisoning	11.6 (5.5-17.6)	5.3 (2.5-8.0) &&	0.9 (0.7-1.0)	1.5 (1.3-1.6)

Cohort:On-reserve p< 0.05 *, p <0.01 **

On-reserve:Residual p <0.05 &, p <0.01 &&

Table 4a: Male Native Expected and Observed Deaths for ICD Chapters with Standardized Mortality Ratios based on the National Reference Population

Males	Standardized Mortality Ratios								
	Cohort			On-reserve			Medical Services Branch		
Causes	obs	exp	SMR	obs	exp	SMR	obs	exp	SMR
All Causes	1065	955	1.12 (1.05 -1.18)	2699	2594	1.04 (1.00 -1.08)	5403	3866	1.40 (1.36 -1.44)
Infective and Parasitic Diseases	18	5	3.61 (2.14 -5.66)	36	14	2.64 (1.80 -3.55)	87	21	4.22 (3.32 -5.11)
Neoplasms	83	202	0.41 (0.33 -0.51)	245	556	0.44 (0.39 -0.50)	404	818	0.49 (0.45 -0.54)
Endocrine/Nutritional/Metabolic	20	17	1.19 (0.72 -1.81)	64	46	1.40 (1.07 -1.78)	84	67	1.25 (1.00 -1.55)
Blood Diseases	4	3	1.28 (0.36 -3.31)	3	8	0.36 (0.08 -1.05)	13	12	1.04 (0.57 -1.84)
Mental Disorders	25	8	3.11 (2.00 -4.60)	47	21	2.19 (1.65 -2.97)	79	32	2.47 (1.96 -3.08)
Nervous System/Sense Diseases	17	14	1.25 (0.71 -1.93)	32	37	0.86 (0.59 -1.22)	66	57	1.16 (0.90 -1.47)
Circulatory Diseases	258	400	0.65 (0.57 -0.73)	721	1080	0.67 (0.62 -0.72)	1264	1573	0.80 (0.76 -0.85)
Respiratory Diseases	73	71	1.02 (0.81 -1.29)	207	191	1.08 (0.94 -1.24)	386	279	1.39 (1.25 -1.53)
Digestive Diseases	48	36	1.34 (0.98 -1.76)	101	97	1.04 (0.85 -1.26)	246	144	1.71 (1.50 -1.94)
Genitourinary Disease	10	12	0.85 (0.40 -1.52)	36	31	1.16 (0.81 -1.61)	63	45	1.40 (1.07 -1.79)
Skin/Subcutaneous Tissue	1	0		1	1	0.79	2	2	1.07
Musculoskeletal	3	2	1.81	7	4	1.57 (0.70 -3.55)	4	7	0.61 (0.15 -1.41)
Congenital	19	13	1.45 (0.88 -2.27)	40	40	1.00 (0.72 -1.35)	96	63	1.51 (1.23 -1.86)
Perinatal	23	14	1.67 (1.04 -2.45)	57	44	1.29 (0.98 -1.67)	150	70	2.16 (1.81 -2.51)
Symptoms/Ill-defined	33	13	2.45 (1.75 -3.46)	88	38	2.30 (1.86 -2.85)	211	58	3.61 (3.16 -4.16)
Accidents/Poisonings/Violence	430	145	2.97 (2.69 -3.26)	1014	385	2.63 (2.47 -2.80)	2246	619	3.63 (3.48 -3.78)

Table 4b: Male Native Cohort and On-reserve Expected and Observed Deaths for LCDC Disease Aggregates with Standardized Mortality Ratios based on the National Reference

Males	Standardized Mortality Ratios					
	Cohort			On-reserve		
Causes	obs	exp	SMR	obs	exp	SMR
Cancer	83	200	0.41 (0.33 -0.51)	242	550	0.44 (0.38 -0.50)
Tongue mouth pharynx	1	5	0.22 (0.01 -0.99)	10	12	0.81 (0.40 -1.52)
Esophagus	1	4	0.23 (0.01 -1.24)	5	12	0.42 (0.13 -0.95)
Stomach	4	12	0.33 (0.09 -0.83)	9	33	0.27 (0.12 -0.51)
Large Intestine and Rectum	12	26	0.47 (0.24 -0.80)	30	70	0.43 (0.29 -0.61)
Liver	1	2	0.58	1	5	0.21 (0.01 -0.99)
Gall Bladder	1	2	0.56	7	5	1.42 (0.56 -2.84)
Pancreas	4	11	0.38 (0.09 -0.90)	8	29	0.28 (0.12 -0.54)
Digestive Tract	24	59	0.41 (0.26 -0.60)	64	161	0.40 (0.31 -0.51)
Trachea Bronchus Lung	20	61	0.33 (0.20 -0.50)	71	170	0.42 (0.33 -0.53)
Breast	0	0		1	1	1.83
Prostate	14	20	0.69 (0.38 -1.17)	32	55	0.58 (0.40 -0.82)
Kidney	1	4	0.23 (0.01 -1.24)	10	12	0.82 (0.40 -1.52)
Bladder	0	6	0 **	0	18	0 **
Brain	1	6	0.17 (0.01 -0.83)	3	16	0.18 (0.04 -0.52)
Lymphoid	6	10	0.57 (0.22 -1.28)	18	29	0.63 (0.37 -0.98)
Leukemia	8	10	0.82 (0.35 -1.55)	12	27	0.45 (0.23 -0.77)
Diabetes	13	12	1.08 (0.58 -1.83)	51	33	1.57 (1.15 -2.03)
Alcoholic Psychosis/Alcoholism	30	5	6.14 (4.05 -8.55)	48	13	3.63 (2.72 -4.89)
Coronary Heart Disease	144	261	0.55 (0.47 -0.65)	448	710	0.63 (0.57 -0.69)
Stroke	40	63	0.64 (0.45 -0.86)	114	168	0.68 (0.56 -0.82)
Rheumatic Fever and Chronic RHD	4	4	0.89 (0.27 -2.48)	14	12	1.14 (0.64 -1.94)
Hypertensive Disorders	2	6	0.34 (0.04 -1.13)	8	16	0.50 (0.22 -0.97)
Influenza	0	1	0	1	3	0.33 (0.01 -1.65)
Pneumonia	38	27	1.43 (0.99 -1.93)	103	70	1.48 (1.20 -1.78)
Chronic Obstructive Lung Disease	25	35	0.71 (0.46 -1.05)	67	96	0.7 (0.54 -0.89)
Ulcers	3	4	0.75 (0.15 -2.10)	8	11	0.74 (0.31 -1.41)
Cirrhosis of Liver	26	15	1.72 (1.13 -2.53)	47	41	1.14 (0.84 -1.52)
Gallbladder Diseases	4	2	1.93	7	6	1.27 (0.47 -2.36)
Nephritis and Nephrosis	0	3	0 **	13	9	1.42 (0.77 -2.45)
Kidney Disease	5	9	0.56 (0.18 -1.26)	26	24	1.1 (0.71 -1.58)
Motor Vehicle Traffic Accidents	138	53	2.58 (2.19 -3.08)	285	142	2.01 (1.78 -2.25)
Accidental Falls	17	10	1.65 (0.99 -2.71)	23	27	0.85 (0.54 -1.27)
Fires	30	5	5.46 (4.05 -8.55)	71	15	4.78 (3.70 -5.97)
Drownings	31	7	4.43 (3.01 -6.27)	84	19	4.45 (3.53 -5.47)
Suicide	87	33	2.61 (2.11 -3.25)	225	88	2.55 (2.23 -2.91)
Homicide	21	5	4.19 (2.60 -6.39)	83	13	6.25 (5.09 -7.91)
Accidental Poisoning	11	4	2.82 (1.37 -4.88)	26	10	2.52 (1.70 -3.80)

* p <0.05 Poisson exact testing
** p <0.01 Poisson exact testing

Table 4c: Female Native Expected and Observed Deaths for ICD Chapters with Standardized Mortality Ratios based on the National Reference Population

Females	Standardized Mortality Ratios								
	Cohort			On-reserve			Medical Services Branch		
Causes	obs	exp	SMR	obs	exp	SMR	obs	exp	SMR
All Causes	654	556	1.18 (1.08 -1.27)	1540	1437	1.07 (1.02 -1.13)	3366	2112	1.59 (1.54 -1.62)
Infective and Parasitic Diseases	10	3	3.01 (1.60 -6.06)	24	9	2.73 (1.71 -3.96)	70	13	5.22 (4.20 -6.80)
Neoplasms	96	128	0.75 (0.61 -0.92)	232	335	0.69 (0.61 -0.79)	386	499	0.77 (0.70 -0.85)
Endocrine/Nutritional/Metabolic	15	15	0.98 (0.56 -1.64)	60	40	1.52 (1.15 -1.93)	100	58	1.74 (1.40 -2.10)
Blood Diseases	3	3	1.19 (0.20 -2.79)	2	6	0.31 (0.04 -1.12)	8	9	0.84 (0.38 -1.73)
Mental Disorders	10	4	2.26 (1.20 -4.55)	32	11	2.90 (1.99 -4.10)	52	16	3.27 (2.43 -4.26)
Nervous System/Sense Diseases	10	9	1.06 (0.53 -2.02)	11	25	0.44 (0.22 -0.78)	40	38	1.05 (0.75 -1.43)
Circulatory Diseases	155	247	0.63 (0.53 -0.73)	442	625	0.71 (0.64 -0.78)	840	884	0.95 (0.89 -1.02)
Respiratory Diseases	50	31	1.59 (1.19 -2.12)	136	80	1.69 (1.43 -2.01)	278	116	2.40 (2.12 -2.70)
Digestive Diseases	54	22	2.46 (1.85 -3.20)	108	56	1.92 (1.58 -2.33)	249	83	3.01 (2.64 -3.40)
Genitourinary Disease	11	7	1.54 (0.79 -2.79)	34	18	1.88 (1.31 -2.63)	69	26	2.65 (2.07 -3.36)
Complications of Pregnancy	1	0	3.25	0	1	0	1	1	0.76
Skin/Subcutaneous Tissue	2	1	3.82	4	1	3.03	5	2	2.61
Musculoskeletal	2	3	0.72 (0.08 -2.26)	4	7	0.56 (0.15 -1.42)	10	11	0.95 (0.44 -1.65)
Congenital	17	11	1.53 (0.90 -2.46)	20	34	0.58 (0.36 -0.90)	69	54	1.28 (0.99 -1.61)
Perinatal	15	10	1.48 (0.84 -2.46)	36	33	1.09 (0.76 -1.51)	108	51	2.12 (1.74 -2.56)
Symptoms/Ill-defined	27	9	3.13 (1.97 -4.35)	61	24	2.56 (1.95 -3.26)	166	36	4.62 (3.94 -5.37)
Accidents/Poisonings/Violence	176	52	3.40 (2.90 -3.92)	334	131	2.54 (2.28 -2.84)	859	215	3.99 (3.73 -4.27)

Table 4d: Female Native Cohort and On-reserve Expected and Observed Deaths for LCDC Aggregates with Standardized Mortality Ratios based on the National Reference

Females	Standardized Mortality Ratios					
	Cohort			On-reserve		
Causes	obs	exp	SMR	obs	exp	SMR
Cancer	96	127	0.76 (0.61 -0.92)	226	331	0.68 (0.60 -0.78)
Tongue mouth pharynx	0	1	0	3	3	0.88 (0.20 -2.80)
Esophagus	0	1	0	0	4	0 *
Stomach	1	6	0.18 (0.01-0.83)	8	14	0.56 (0.25 -1.11)
Large Intestine and Rectum	9	20	0.46 (0.21-0.84)	26	51	0.51 (0.33 -0.74)
Liver	0	1	0	0	2	0
Gall Bladder	4	2	1.83	8	6	1.40 (0.58 -2.59)
Pancreas	4	7	0.61 (0.15 -1.42)	12	17	0.69 (0.37 -1.22)
Digestive Tract	20	38	0.53 (0.32 -0.81)	55	99	0.56 (0.42 -0.72)
Trachea-Bronchus Lung	7	15	0.46 (0.19 -0.95)	25	40	0.62 (0.41 -0.92)
Breast	14	26	0.55 (0.29 -0.90)	26	66	0.39 (0.26 -0.58)
Uterus	16	7	2.34 (1.31 -3.69)	34	18	1.92 (1.31 -2.63)
Ovary	4	7	0.56 (0.15 -1.42)	11	19	0.58 (0.29 -1.02)
Kidney	4	2	1.96	5	5	0.93 (0.32 -2.28)
Bladder	1	2	0.52	3	5	0.61 (0.12 -1.68)
Brain	5	4	1.25 (0.41 -2.84)	6	10	0.57 (0.22 -1.28)
Lymphoid	3	7	0.44 (0.09 -1.19)	13	18	0.74 (0.39 -1.23)
Leukemia	5	6	0.81 (0.27 -1.90)	12	16	0.76 (0.39 -1.30)
Diabetes	14	11	1.29 (0.69 -2.12)	53	28	1.88 (1.42 -2.47)
Alcoholic Psychosis/Alcoholism	15	1	12.13 **	31	3	9.86 (7.03 -14.64)
Coronary Heart Disease	66	135	0.49 (0.38 -0.62)	198	345	0.57 (0.50 -0.66)
Stroke	46	57	0.81 (0.59 -1.08)	120	143	0.84 (0.70 -1.00)
Rheumatic Fever and Chronic RHD	3	5	0.64 (0.12 -1.68)	7	12	0.57 (0.23 -1.18)
Hypertensive Disorders	4	6	0.71 (0.18 -1.65)	18	14	1.27 (0.76 -2.02)
Influenza	1	1	0.88	2	3	0.72 (0.08 -2.26)
Pneumonia	28	16	1.70 (1.16 -2.52)	84	41	2.03 (1.64 -2.54)
Chronic Obstructive Lung Disease	9	9	1.01 (0.46 -1.88)	30	23	1.28 (0.88 -1.86)
Ulcers	1	2	0.45	5	6	0.89 (0.27 -1.90)
Cirrhosis of Liver	33	6	5.27 (3.79 -7.71)	50	16	3.08 (2.32 -4.12)
Gallbladder Diseases	3	2	1.93	7	4	1.79 (0.70 -3.55)
Nephritis and Nephrosis	2	2	0.89	9	6	1.57 (0.69 -2.81)
Kidney Disease	9	6	1.52 (0.69 -2.81)	26	15	1.72 (1.13 -2.53)
Motor Vehicle Traffic Accidents	49	19	2.55 (1.91 -3.41)	97	49	1.98 (1.61 -2.41)
Accidental Falls	8	7	1.2 (0.49 -2.22)	13	16	0.79 (0.43 -1.38)
Fires	11	3	3.8 (1.83 -6.50)	26	8	3.41 (2.13 -4.75)
Drownings	12	2	7.14 (3.11 -10.39)	12	5	2.65 (1.24 -4.16)
Suicide	31	9	3.28 (2.34 -4.88)	58	23	2.50 (1.92 -3.26)
Homicide	18	3	6.43 (3.56 -9.43)	35	7	4.95 (3.49 -6.94)
Accidental Poisoning	16	2	8.73 **	18	5	3.95 (2.14 -5.66)

* p <0.05 Poisson exact testing
** p <0.01 Poisson exact testing

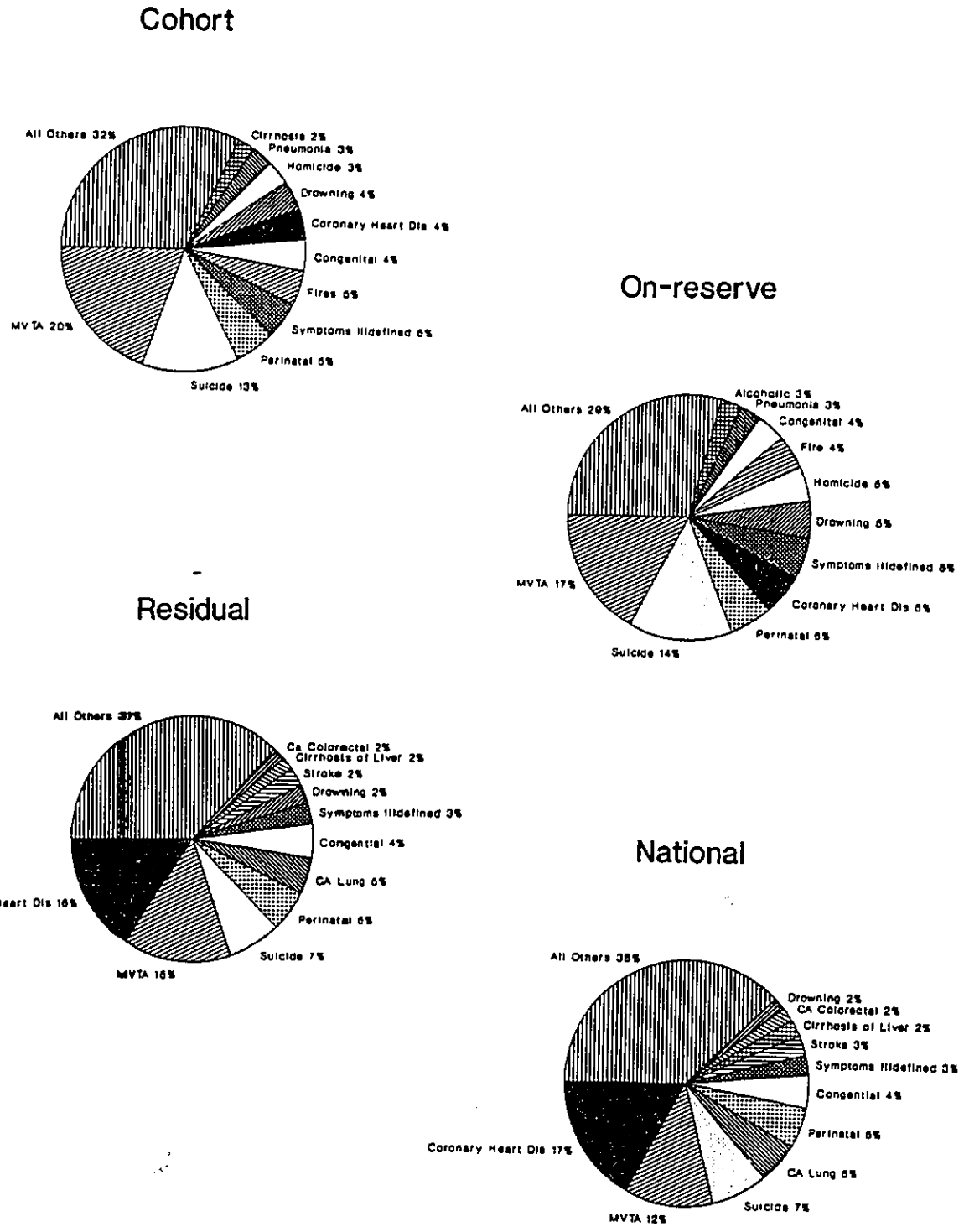
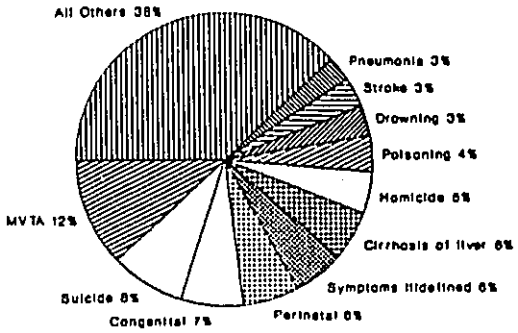
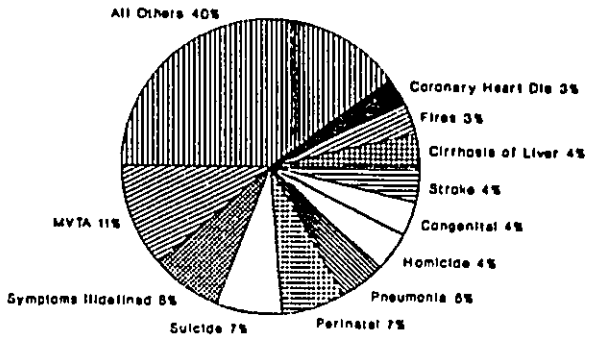


Figure 6a-d: Male Potential Years of Life Lost to Age 75

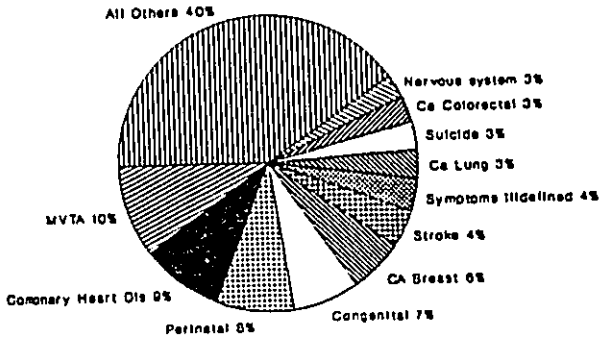
Cohort



On-reserve



Residual



National

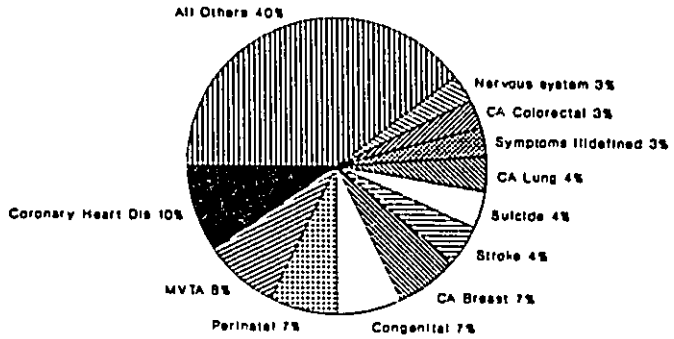


Figure 6e-h: Female Potential Years of Life Lost to Age 75

Table 5a: Male Rate of Potential Years of Life Lost to Age 75

Male **Annual Rate of Potential Years of Life Lost to age 75**

Per 100,000 population	Cohort	On-reserve	Residual	National
All Causes	20190.01	17831.52	11710.28	11733.01
Infective and Parasitic Diseases	341.71	272.19	69.62	76.81
Neoplasms	656.05	542.04	1867.20	2085.32
Endocrine/Nutritional/Metabolic	252.92	172.27	168.56	168.03
Blood Diseases	20.31	22.13	38.00	29.29
Mental Diseases	357.71	307.42	77.87	96.94
Nervous System/Sense	419.19	234.90	225.76	223.34
Circulatory	1447.94	1539.87	2601.10	2846.69
Respiratory Disease	934.09	823.25	458.83	428.07
Digestive Disorders	785.20	618.06	357.82	449.17
Genitourinary Disorders	64.04	105.36	47.20	57.63
Skin/Subcutaneous Disorders	32.80	0	0.93	3.92
Musculoskeletal Disorders	24.99	15.14	14.78	14.48
Congenital Anomalies	832.69	651.06	523.59	526.32
Perinatal Mortality	1076.36	994.31	628.49	643.52
Symptoms/Ill-defined	989.45	951.52	325.55	322.78
Accidents/Poisoning/Violence	11954.54	10581.99	4318.38	3760.69
Cancer	656.05	517.59	1831.65	2059.73
Tongue/Mouth/Pharynx	0	10.48	38.08	60.74
Esophagus	10.93	18.63	30.72	44.84
Stomach	40.61	12.23	106.56	102.39
Large Intestine and Rectum	67.17	48.91	184.76	218.90
Liver	7.81	1.75	12.25	23.27
Gall bladder	1.56	8.15	11.38	13.63
Pancreas	46.86	11.06	103.42	102.86
Digestive Tract	179.63	101.86	481.62	533.82
Trachea/Bronchus/Lung	139.02	156.04	558.17	655.52
Breast	0	1.75	2.09	1.70
Prostate	43.76	23.87	64.79	63.51
Kidney	1.56	22.13	55.15	54.41
Bladder	0	0	29.13	33.62
Brain	20.31	36.08	112.56	120.70
Lymphoid	34.36	48.33	134.41	144.26
Leukemia	190.57	75.69	136.41	146.47
Diabetes	149.96	103.06	80.67	94.92
Alcoholic Psychosis/Alcoholism	404.57	334.21	78.75	101.56
Coronary Heart Disease	826.31	964.19	1824.65	2067.90
Stroke	142.14	231.15	285.63	312.15
Rheumatic Fever and Chronic RHD	53.11	66.38	44.79	48.43
Hypertensive Disorders	0	16.89	27.53	31.46
Influenza	0	0	4.78	5.06
Pneumonia	580.64	489.55	163.93	137.98
Chronic Obstructive Lung Disease	182.07	108.16	177.91	179.67
Ulcers	14.06	34.33	32.31	28.22
Cirrhosis of Liver	452.68	287.02	198.60	279.40
Gallbladder Disease	14.06	14.56	8.85	9.53
Nephritis and Nephrosis	0	37.26	17.59	25.70
Kidney Disease	59.36	84.98	42.48	51.65
Motor Vehicle Traffic Accidents	3966.93	3041.94	1704.09	1466.44
Accidental Falls	226.49	136.83	94.20	115.56
Fires	927.78	796.95	207.91	136.62
Drownings	778.52	885.45	288.33	190.14
Suicide	2628.90	2526.35	844.10	907.46
Homicide	644.81	813.63	112.40	143.22
Accidental Poisoning	192.13	269.00	79.62	105.86

Table 5b: Female Rate of Potential Years of Life Lost to Age 75

Female	Annual Rate of Potential Years of Life Lost to age 75			
Per 100,000 population	Cohort	On-reserve	Residual	National
All Causes	11663.79	9700.48	5908.03	6273.64
Infective and Parasitic Diseases	190.29	184.85	66.72	59.80
Neoplasms	918.69	862.19	1522.66	1801.45
Endocrine/Nutritional/Metabolic	82.51	199.77	141.71	137.74
Blood Diseases	7.93	5.55	22.05	26.17
Mental Diseases	184.07	218.30	18.23	34.01
Nervous System/Sense	176.07	149.68	153.34	165.48
Circulatory	904.47	957.33	1039.82	1147.25
Respiratory Disease	688.86	742.66	239.47	252.13
Digestive Disorders	951.88	680.77	205.92	246.37
Genitourinary Disorders	74.58	101.75	44.52	48.49
Complications of Pregnancy	30.15	0	11.23	9.33
Skin/Subcutaneous Disorders	31.74	36.97	2.58	4.12
Musculoskeletal Disorders	34.91	8.63	29.11	31.07
Congenital Anomalies	779.56	367.68	412.83	439.11
Perinatal Mortality	713.10	665.10	497.89	461.41
Symptoms/Ill-defined	660.87	746.38	213.31	194.47
Accidents/Poisoning/Violence	5234.11	3772.87	1298.89	1215.22
Cancer	918.69	811.62	1495.90	1776.44
Tongue/Mouth/Pharynx	0	9.87	10.26	18.68
Esophagus	0	0	7.57	12.44
Stomach	4.76	32.07	62.81	54.97
Large Intestine and Rectum	57.12	71.53	170.33	192.67
Liver	0	0	2.81	12.35
Gall bladder	3.17	11.72	14.79	18.08
Pancreas	46.02	26.52	55.88	64.68
Digestive Tract	128.53	141.83	335.91	375.18
Trachea/Bronchus/Lung	66.65	67.22	184.95	239.36
Breast	95.21	55.50	361.58	436.30
Uterus (inc cervix)	203.11	159.71	91.76	102.30
Ovary	25.39	43.17	82.53	116.43
Kidney	25.39	7.40	23.14	27.31
Bladder	0	1.85	7.05	11.85
Brain	168.14	69.44	79.15	85.41
Lymphoid	23.80	57.84	74.56	92.01
Leukemia	76.17	104.19	101.86	106.27
Diabetes	82.51	141.83	75.08	76.58
Alcoholic Psychosis/Alcoholism	299.90	239.88	25.33	29.60
Coronary Heart Disease	304.66	305.25	524.29	604.65
Stroke	374.48	364.27	238.45	269.57
Rheumatic Fever and Chronic RHD	55.54	30.22	42.12	50.02
Hypertensive Disorders	1.59	44.40	22.35	21.91
Influenza	36.50	2.47	6.97	3.35
Pneumonia	334.05	488.30	108.07	95.74
Chronic Obstructive Lung Disease	67.91	124.37	77.94	86.04
Ulcers	14.28	8.63	9.74	12.78
Cirrhosis of Liver	645.82	355.81	79.12	128.91
Gallbladder Disease	58.71	24.67	8.99	7.37
Nephritis and Nephrosis	44.43	38.85	20.80	20.24
Kidney Disease	60.30	77.08	39.99	42.01
Motor Vehicle Traffic Accidents	1388.06	1110.33	591.92	502.34
Accidental Falls	169.72	83.25	24.58	31.99
Fires	309.11	323.11	127.56	72.43
Drownings	401.46	170.69	61.95	43.83
Suicide	955.25	695.59	179.10	259.60
Homicide	547.06	419.55	65.18	78.59
Accidental Poisoning	453.50	189.81	32.37	48.69

Table 6a: Male Crude and Standardized Proportional Mortality Ratios in Comparison to the National Reference

Males	Proportional Mortality Ratios			
	Cohort		On-reserve	
	Stand	Crude	Stand	Crude
Infective and Parasitic	275.78	346.00	223.90	273.05
Neoplasms	44.39	33.06	49.74	38.51
Endocrine/Nutritional/Metabolic	122.27	104.80	150.36	132.33
Blood Disorders	128.77	120.96	37.88	35.80
Mental Disorders	291.32	274.65	216.19	203.75
Nervous System/Sense Disorders	87.09	121.71	67.39	90.40
Circulatory Disease	84.05	54.14	86.75	59.70
Respiratory Disease	133.66	91.91	141.21	102.84
Digestive Diseases	133.50	111.48	108.11	92.56
Genitourinary Disorders	119.47	78.87	158.69	112.04
Skin/Subcutaneous Disorders	229.87	192.82	88.63	76.09
Musculoskeletal Disorders	201.99	154.31	180.78	142.07
Congenital Anomalies	62.28	213.99	51.79	177.76
Perinatal Mortality	71.67	237.45	66.32	232.21
Symptoms/Ill-defined	154.26	252.85	161.63	266.06
Accidents/Poisoning/Violence	129.48	366.01	134.45	340.58
Cancer	44.94	33.34	49.71	38.36
Tongue/Mouth/Pharynx	22.78	17.19	86.72	67.84
Esophagus	27.60	17.79	50.92	35.10
Stomach	40.51	26.56	33.89	23.58
Large Intestine and Rectum	56.63	37.55	52.68	37.04
Liver	53.56	46.24	21.01	18.24
Gall Bladder	70.51	44.42	182.30	122.70
Pancreas	44.60	29.55	33.16	23.32
Digestive Tract	48.56	32.46	48.26	34.16
Trachea/Lung/Bronchus	37.76	24.57	49.75	34.42
Breast	0	0	228.65	152.86
Prostate	110.24	59.16	89.92	53.36
Kidney	23.44	17.76	88.97	70.08
Bladder	0	0	0	0
Brain	10.86	14.93	13.18	17.67
Lymphoid	47.73	48.46	57.30	57.37
Leukemia	59.67	79.91	36.29	47.30
Diabetes	128.56	90.41	189.93	139.95
Alcoholic Psychosis/Alcoholism	487.84	511.58	267.87	328.93
Coronary Heart Disease	70.17	45.10	80.56	55.36
Stroke	89.45	56.13	93.91	63.12
Rheumatic Fever and Chronic RHD	91.47	72.42	123.20	100.02
Hypertensive Disease	48.18	29.05	70.05	45.86
Influenza	0	0	45.82	34.63
Pneumonia	198.63	138.53	200.15	148.17
Chronic Obstructive Lung Disease	98.34	59.85	96.69	272.33
Ulcers	96.62	63.33	95.48	66.64
Cirrhosis of Liver	142.54	133.52	100.60	95.24
Gall Bladder Disease	281.19	169.62	180.10	117.13
Kidney Diseases	73.93	51.51	143.19	105.69
Nephritis and Nephrosis	0	0	167.75	133.04
Motor Vehicle Traffic Accidents	105.40	355.63	96.00	289.81
Accidental Falls	144.22	164.08	79.95	87.60
Fires	253.21	698.43	264.20	652.24
Drownings	186.10	649.29	222.39	694.23
Suicide	109.24	297.14	125.31	303.23
Homicide	168.26	510.46	294.94	796.09
Accidental Poisoning	120.03	312.62	125.63	291.57

Table 6b: Female Crude and Standardized Proportional Mortality Ratios in Comparison to the National Reference

Females	Proportional Mortality Ratios			
	Cohort		On-reserve	
	Stand	Crude	Stand	Crude
Infective and Parasitic	189.87	298.54	200.75	304.28
Neoplasms	58.08	59.89	59.67	61.46
Endocrine/Nutritional/Metabolic	91.25	80.04	151.83	135.96
Blood Disorders	104.05	106.46	29.48	30.14
Mental Disorders	232.98	188.43	311.65	256.07
Nervous System/Sense Disorders	64.42	104.77	31.76	48.94
Circulatory Disease	81.79	48.77	90.06	59.07
Respiratory Disease	166.98	132.06	183.16	152.54
Digestive Diseases	216.97	201.92	181.55	171.50
Genitourinary Disorders	167.42	124.29	209.98	163.15
Complications of Pregnancy	82.03	560.38	0	0
Skin/Subcutaneous Disorders	372.32	322.14	313.32	273.15
Musculoskeletal Disorders	57.63	59.18	50.73	50.27
Congenital Anomalies	66.66	283.67	32.57	141.73
Perinatal Mortality	63.61	269.61	61.93	274.80
Symptoms/Ill-defined	194.00	335.45	186.14	321.85
Accidents/Poisoning/Violence	140.62	452.42	137.03	364.61
Cancer	58.95	60.59	58.96	60.58
Tongue/Mouth/Pharynx	0	0	76.92	76.70
Esophagus	0	0	0	0
Stomach	16.49	13.92	55.03	47.29
Large Intestine and Rectum	44.65	34.81	52.05	42.70
Liver	0	0	0	0
Gall Bladder	191.99	136.02	152.16	115.53
Pancreas	59.48	45.35	71.20	57.78
Digestive Tract	50.50	39.99	56.36	46.70
Trachea/Lung/Bronchus	35.87	35.29	53.33	53.53
Breast	39.44	44.06	31.31	34.75
Uterus (including cervix)	166.04	188.18	155.06	169.82
Ovary	40.65	43.92	47.89	51.29
Kidney	160.13	153.38	83.50	81.42
Bladder	60.68	39.76	71.66	50.66
Brain	68.31	120.62	37.42	61.47
Lymphoid	31.95	36.12	61.31	66.47
Leukemia	49.97	83.74	53.81	85.35
Diabetes	134.24	98.12	205.41	157.74
Alcoholic Psychosis/Alcoholism	593.86	1119.22	586.37	982.29
Coronary Heart Disease	65.10	37.21	74.25	47.41
Stroke	102.33	63.90	105.09	70.79
Rheumatic Fever and Chronic RHD	57.20	49.54	55.47	49.09
Hypertensive Disease	98.56	54.87	168.08	104.85
Influenza	133.56	73.19	102.11	62.17
Pneumonia	209.21	143.66	245.89	183.03
Chronic Obstructive Lung Disease	93.79	78.13	129.03	110.60
Ulcers	53.75	35.16	106.17	74.66
Cirrhosis of Liver	322.10	445.05	216.07	286.37
Gall Bladder Disease	257.55	152.98	231.43	151.59
Kidney Diseases	160.88	122.17	189.44	149.89
Nephritis and Nephrosis	81.48	73.04	154.98	139.59
Motor Vehicle Traffic Accidents	92.48	415.91	97.79	349.65
Accidental Falls	154.56	101.05	99.16	69.73
Fires	169.02	587.07	186.82	589.29
Drownings	323.97	1376.47	142.82	584.55
Suicide	114.20	410.46	115.08	326.13
Homicide	218.76	1026.88	225.38	847.95
Accidental Poisoning	319.53	1090.94	191.18	521.21

Table 7: Ranking of Top Ten Causes of Age-Standardized Mortality Rates for Males and Females

Ranking by Age-Standardized Mortality Rates

Males

Cohort	On-reserve	Residual	National
CHD	CHD	CHD	CHD
MVTA	MVTA	Cerebrovascular	Ca Lung
Suicide	Suicide	Cancer Lung	Cerebrovascular
Cerebrovascular	Cerebrovascular	MVTA	COPD
Pneumonia	Pneumonia	COPD	MVTA
Alcoholic Psychosis	Cancer Lung	Pneumonia	Ca Colorectal
COPD	COPD	Ca Colorectal	Pneumonia
Symptoms Ill-defined	Symptoms Ill-defined	Suicide	Ca Prostate
Cirrhosis of Liver	Diabetes	Ca Prostate	Suicide
Cancer Lung	Homicide	Ca Stomach	Cirrhosis of Liver

Females

CHD	CHD	CHD	CHD
Cerebrovascular	Cerebrovascular	Cerebrovascular	Cerebrovascular
MVTA	Pneumonia	Ca Breast	Ca Breast
Cirrhosis of Liver	MVTA	Ca Colorectal	Ca colorectal
Pneumonia	Diabetes	Pneumonia	Ca lung
Symptoms Ill-defined	Cirrhosis of Liver	Ca Lung	Pneumonia
Suicide	Symptoms	MVTA	Diabetes
Ca Uterus	Ca Uterus	Diabetes	MVTA
Diabetes	Suicide	COPD	COPD
Ca Breast	COPD	Symptoms/ill-defined	Ca Ovary

Table 8: Ranking of Top Ten Male and Female Native Causes of Proportional Mortality with Respect to the National Reference

Ranking by Proportional Mortality Ratios			
Cohort		On-reserve	
Males			
Standard	**Crude**	**Standard**	**Crude**
Alcoholic Psychosis	Fires	Homicide	Homicide
Gall Bladder	Drowning	Alcoholic Psychosis	Drowning
Infective/Parasitic	Alcoholic	Fires	Fires
Fires	Homicide	Ca breast	Alcoholic Psychosis
Skin/Subcutaneous	MVTA	Infective/Para	Suicide
Musculoskeletal	Infective/Parasitic	Drowning	Poisoning
Pneumonia	Poisoning	Pneumonia	MVTA
Drowning	Suicide	Diabetes	Infective/Parasitic
Homicide	Symptoms Ill-defined	Cancer Gallbladder	COPD
Symptoms Ill-defined	Perinatal Conditions	Musculoskeletal	Symptoms Ill-define
Females			
Alcoholic Psychosis	Drowning	Alcoholic Psychosis	Alcoholic Psychosis
Skin subcutaneous	Alcoholic Psychosis	Skin subcutaneous	Homicide
Drowning	Poisoning	Pneumonia	Fires
Cirrhosis	Homicide	Gallbladder Disease	Drownings
Poisoning	Fires	Homicide	Poisoning
Homicide	Pregnancy compl.	Cirrhosis	MVTA
Pneumonia	Cirrhosis	Diabetes	Suicide
Symptoms Ill-defined	MVTA	Infective/Parasitic	Symptoms Ill-def
Cancer Gallbladder	Suicide	Fires	Infective
Infective/Parasitic	Symptoms Ill-defined	Symptoms Ill-defined	Cirrhosis

Table 9: Ranking of Top Ten Standardized Mortality Ratios for the Native Cohort and On-reserve Deaths by Sex

Ranking by Standardized Mortality ratio

Males

Cohort	On-reserve
Alcoholic Psychosis	Homicide
Fires	Fires
Drowning	Drowning
Homicide	Alcoholic Psychosis
Infective/Parasitic	Acute RTI
Accidental Poisoning	Infective/Parasitic
Suicide	Suicide
MVTA	Accidental Poisoning
Acute RTI	Symptoms/Ill-defined
Symptoms Ill-defined	MVTA

Females

Alcoholic Psychosis	Alcoholic Psychosis
Accidental Poisoning	Homicide
Homicide	Accidental Poisoning
Cirrhosis of Liver	Fires
Skin/subcutaneous	Cirrhosis of Liver
Fires	Skin/subcutaneous
Suicide	Infective/Parasitic
Complications of Pregnancy	Drowning
Symptoms ill-defined	Symptoms ill-defined
Infective/Parasitic	Suicide

Table 10: Spearman's Correlation Coefficients for Rank ordering of Least Aggregated Disease Groups

MALE AGE-STANDARDIZED MORTALITY RATES

	Cohort		
On-reserve	.924	On-reserve	
Residual	-	.736	Residual
National	.664	.695	.974

FEMALE AGE-STANDARDIZED MORTALITY RATES

	Cohort		
On-reserve	.899	On-reserve	
Residual	-	.742	Residual
National	.641	.745	.976

MALE POTENTIAL YEARS OF LIFE LOST

	Cohort		
On-reserve	.921	On-reserve	
Residual	-	.849	Residual
National	.821	.833	.987

FEMALE POTENTIAL YEARS OF LIFE LOST

	Cohort		
On-reserve	.923	On-reserve	
Residual	-	.786	Residual
National	.693	.763	.981

6. DISCUSSION OF THE RESULTS

The discussion is divided into four chapters: a discussion of the results (Chapter 6), a discussion of the errors (Chapter 7), a discussion of the intergroup comparisons (Chapter 8), and a discussion of the use of administrative data sets (Chapter 9).

Chapter 6 reviews the various health indicators and disease specific results are discussed in the context of the literature. Specific problems are identified and highlighted. This chapter addresses the major goal and the two of the objectives of the thesis namely, to assess native health status through a series of mortality indicators for natives and comparisons measures with the Canadian population.

Chapter 7 focuses on the errors which effect the results of this study. An analysis of the extent of the errors is provided.

Chapter 8 focuses on the associations between the various native measures and comparison populations. The validity and reliability of each of the native groups is reviewed in light of the errors discussed in Chapter 7 and the associations from the results section. The on-reserve population is compared with the residual population, and a brief comment on the differences between the residual population and the general Canadian population is offered.

Chapter 9 addresses the fundamental question of using routinely collected administrative data for epidemiologic research. The chapter views the potential errors in the results, stressing the limitations of this approach to epidemiologic study.

6.1 DISCUSSION OF THE ANALYTIC RESULTS

In all of the native groups, both male and female all cause standardized mortality ratios (Tables 4a and 4c) are greater than unity, but the apparent size of the effect of native ethnicity is small. Comparisons using the all cause SMR (and all cause ASMR) as a summary statistic should be cautiously interpreted given the significant interactions with both age and disease between the native and comparison populations.

Age-Sex Specific Mortality Rates, Life Expectancy and Survival Age-specific rates (Table 1) demonstrate a substantial variation with age. In infancy the risk of death for natives is double the national standard for the cohort and on-reserve populations and triple for MSB clients. This is similar to previous Canadian studies.[1,8,124] The maximum risk for natives in comparison to the national group is in the 25-29 age group, being 3-4 times higher in males and 4-5 times in females. Rates are elevated among natives from infancy through to ages 40-60. These associations have previously been noted in MSB clients,[8] on-reserve populations,[5] and the U.S. Navajo Indians.[27] Similar trends using larger age ranges are apparent in British Columbia[20] and Northwestern Ontario.[17]

Native mortality rates approach the national comparison at ages 65-75. In older ages, natives have a significantly lower mortality experience than the national population. In the oldest age group, native mortality is reduced to one-third of the national comparison. This relationship has been noted previously in Canada[5,8,85] and Broudy found a similar trend in the U.S. Navajo population.[27] Three explanations for the reduction are hypothesized: use of the DIAND register may lead to an overestimation of the size of the elderly population, there may be underreporting of elderly native deaths, or the observed reduction may exist with elderly natives

enjoying longevity.

Statistics Canada has questioned the lower observed native mortality among persons over age 65 and has used the national average to determine native life expectancy.[85] This reduces the life expectancy for the cohort natives by 3 to 5 years. This difference raises questions about the reliability of this measure of native health.

A more flexible measure of native longevity is achieved through survival curves (Figure 5). In comparison to the national population, the three native populations have lower survival probabilities to all ages up to 74. No previous study has used survival curves to display the mortality experience of natives.

Potential Years of Life Lost

The recency of the introduction of PYLL and PYLL rates as measures of health status limit the comparability of the results of this thesis. The failure to apply a uniformly consistent age limit for PYLL limits further comparisons. Layne[125] and MSB[8] have provided Canadian native PYLL rates, but MSB used the age of 70 to calculate PYLL and Layne utilized combined sex rates.

Rhoades provided PYLL rates for U.S. natives using the age of 65 as the cutoff.[24] Mahoney provided cause-specific PYLL as a proportion of all PYLL to measure the impact of various diseases.[50] Neither of these approaches is directly comparable with the analysis of this study.

Proportional Mortality Ratios

PMR's have their greatest utility when mortality can be identified but the age structure of the population at risk is poorly defined. Mahoney uses this approach in defining native mortality in New York State from death certificates.[32] Michalek also presented SPMR's among the cohort of Seneca natives from New York State.[31]

I have presented both crude and standardized proportional mortality ratios. The crude PMR in this study provides a useful measure of the comparative burden of certain causes of death, specifically, alcohol related and external causes of death.

The cause-specific standardized mortality ratio can be approximated by the product of the cause specific standardized proportional mortality ratio and the overall SMR.[121,122] This relationship holds for many of the causes of death, but underestimates the observed SMR for extreme causes like alcohol-related and various violent causes of death.

The similarity in the magnitude of the associations is reassuring. Chapter 7 will discuss significant sources of bias in this study. The PMR should remain reliable even if significant numbers of deaths have been excluded in the cohort study, or if a significant error in on-reserve deaths was identified.

Identifying Burden of Illness through Ranking Health Measures

Few studies rank measures of health impact in order to identify the major health problems facing native populations. Ranking ASMR identifies similar causes of death among natives and the national comparison, with some notable differences. Ranking by PYLL identifies more violent causes of death as significant burdens in the native population. Nonetheless, six of the top ten rankings by PYLL are found on both the native and national comparison lists.

Ranking by SMR and PMR identifies causes of death which are more common among natives than in the general Canadian population. These lists help to identify and publicize the inequities suffered by native populations. The SMR and crude PMR lists each have 4 to 6 of the seven violent causes of death reviewed in this thesis. All of these lists include the alcohol-related diseases. Cirrhosis of the liver is identified in the majority.

6.2 DISCUSSION OF DISEASE-SPECIFIC RESULTS

For most disease-specific causes of death, the direction of the results of the three native groups is consistent, but the magnitude varies. The variations between native groups will be discussed in chapter 8. The purpose of this section is to discuss the findings of this study with respect to previous works. Where unusual differences exist between the native groups this will be mentioned.

Infectious and Parasitic Diseases ICD codes 001-139

Mortality from Infectious and Parasitic disorders is consistently elevated among the native cohort across sex and age groups. The magnitude of the relationship is similar to previous findings. Ranking by SMR and PMR illustrate the relative importance. MSB clients have elevated mortality rates in comparison to the cohort and on-reserve groups.

Neoplasms ICD codes 140-239

As with most native studies, all native measures in this study have found significantly fewer deaths from neoplastic processes than the general population. The magnitude of the relationship is similar to other native studies.

Despite considerable interest in cancer of the nasopharynx as a "traditional" cancer, the numbers of deaths in the native population from this cause were extremely low and no conclusive statement can be made regarding native risk.

Esophageal cancer is a rare cancer in the general population. The results suggest that esophageal cancer may be less likely in native populations. This finding is consistent with the study of Threlfall[63] in British Columbia natives. These findings among native Indians contrast with those for Inuit populations.[11,12]

In this study, cancer of the stomach is decreased in native populations. Previous Canadian studies have revealed mixed results.[63,38] These findings contrast with studies from New Mexico which consistently show elevations.[52,68,53]

As with most other native studies significantly decreased risks for colorectal cancer have been noted in this study.

No significant differences in the native risk for gallbladder carcinomas were noted in relation to the comparison populations. Previous studies (e.g.[37,63,126]) have noted elevations which were several times comparison populations. The contrasting results suggest that perhaps only certain native populations are at an elevated risk.

The reduced risk for pancreatic cancer in males is consistent with the findings of Young[38] and Devor.[68]

Aggregation of digestive tract tumours improves the precision of the measurement at the expense of specificity. In this study tumours of the digestive tract are significantly lower in both males (SMR=0.4) and females (SMR=0.5).

This study suggests that natives are at a lower risk for lung tumours. Given increases in smoking in native populations,[40] rises in tumour rates might be expected in future years. This has been noted by Samet[54] and Gaudette.[11] Despite the apparent reduced risk, carcinoma of the lung ranks in the top ten causes of death for male natives.

As with most other studies of native populations, I have also found a reduced risk for death from breast tumours in this population.

Uterine tumours were the only tumour for which natives are at an elevated risk. Since the majority of these are cervical in origin,[52,63] preventive measures could reduce mortality rates. The impact of the tumour on native females is demonstrated by its seventh position rank as a cause of death by ASMR.

Reduced risk for prostatic cancer mortality was noted in the on-reserve native group. The cohort had a non-significant reduction in mortality from cancer of the prostate.

Renal tumours were not shown to be elevated as a cause of death in either the cohort or on-reserve population. These findings are not consistent with the elevations found in several native studies.[37,66]

Consistent with all previous native studies, death rates from bladder tumours in males was found to be extremely low. No cases were recorded in either the cohort or the on-reserve male population. Females demonstrated a non-significant reduction in risk.

Brain tumours were found to be an uncommon cause of death in native populations. Male SMR was significantly decreased, consistent with previous studies.

The aggregated group of lymphoid tumours was noted to be consistently below unity in the native populations. This study failed to demonstrate the marked reductions noted in some previous studies.[49,68]

Consistent with most previous studies, this study has demonstrated ratios less than unity for leukemia.

Endocrine/Nutritional/Metabolic ICD codes 240-279

Deaths from diseases within this chapter were noted to be increased for the on-reserve deaths and for MSB clients. The cohort is noted to have comparable risks to the national comparison population. The majority of the deaths in this chapter are attributable to diabetes.

Diabetes was noted to be significantly elevated in the on-reserve population. The magnitude of the relationship is less than many previous studies.[5,36,13,77]

Blood Disorders ICD codes 280-289

Blood disorders accounted for 0.4% of deaths among the cohort. No significant associations were noted for this chapter of diseases.

Mental Disorders ICD codes 290-319

Mortality from mental disorders in natives is twice the comparison population. The greatest difference occurring in the 15-64 year age group for both sexes. Only Young has previously compiled mortality data on this chapter and found no cases during the ten year study period.[17]

Despite low expected numbers of deaths, SMR's from the alcohol-associated diseases were found to be over 6 in males and over 12 in females in the cohort. Respectively, SMR's were over 3 and over 9 in the on-reserve population. This category of diseases ranks highest for both sexes in the cohort SMR's and standardized PMR's. They also rank in the top ten for the cohort in crude PMR and male ASMR.

For males the difference between the rates for on-reserve population and the cohort was significant ($p<0.01$). The magnitude of the relationship found among the cohort is higher than in previous native studies.

Two non-probabilistic hypotheses are presented to explain these differences:

1. A tendency for individuals with severe alcohol problems to emigrate from reserves.
2. An increased likelihood for death certificates of natives uying off-reserves to be completed with underlying causes of death related to alcohol.

Nervous System/Sense Disorders ICD codes 320-389

Observed associations between native groups and the comparison population fail to reveal any differences between populations. If meningitis persists as a major cause of infant and childhood mortality, age-specific mortality rates should be elevated. The number of deaths in these age groups are limited and do not support this hypothesis.

Circulatory Diseases ICD codes 390-459

As a disease chapter circulatory diseases have been noted to be reduced in relation to comparison populations. With the exception of female MSB clients, all groups had significantly reduced mortality experiences. Comparison of rates between the native groups reveal significant differences. For both sexes, MSB clients had a significantly ($p<0.01$) higher mortality experience than the other two native groups.

Coronary heart disease is the number one cause of death in the native groups. The mortality experience for natives is significantly lower than comparison populations. This is consistent with most native mortality studies.

Cerebrovascular disease is the second ranked cause of death in native females and fourth in males. In males SMR's are significantly lower than the national comparison. In females the reduction is not significant in either native group.

The few deaths from rheumatic heart disease do not support the contention that natives are at higher risk.[56]

Respiratory Diseases ICD 460-519

In females, native mortality from respiratory diseases is significantly elevated. A significant elevation is noted in male MSB clients. Age-specific rates show risk ratios for infant mortality from respiratory diseases over 6 times the national population for both sexes. For both sexes, Medical Services Branch clients had significantly higher mortality experience than either other native group.

Influenza mortality was expected and observed to be low. Pneumonia mortality is noted to be elevated in native populations. This is consistent with most previous studies.

COPD was found to be slightly depressed in only the male on-reserve group. Both COPD and Pneumonia are ranked among the top ten causes of death according to ASMR for males. Pneumonia ranks in the top five for females.

Digestive Disorders ICD codes 520-579

SMR's are elevated for all native female groups and for male MSB clients. SMR's for male on-reserve and cohort deaths are slightly above unity. MSB clients demonstrate significantly higher mortality in comparison to the on-reserve deaths and cohort measures. A significant interaction exists with age. Mortality rates in infancy are 7 times the national rate. In older populations the ratio approaches unity.

Despite the expected morbidity associated with gall bladder disease in natives, few cases of death resulting from gall bladder disorders were identified.

Female SMR's for cirrhosis of the liver are elevated several fold in relation to the national comparison. Such a relationship does not exist for males. The impact of cirrhosis of the liver is demonstrated in the rankings for ASMR, female PYLL rates, female PMR, and female SMR's.

Many previous studies combine cirrhosis of the liver with other causes of alcohol mortality. Separately both disease groups demonstrate a significant burden in native populations.

Genitourinary Disease ICD codes 580-692

The three native groups demonstrate elevated risks for mortality from these diseases for females. For males, only MSB clients demonstrate an elevation.

On-reserve females demonstrate an elevated risk for kidney diseases. Male SMR's are contradictory between the two groups, but the difference is not significant.

Complications of Pregnancy ICD 630-676

Only one case in each of the cohort and MSB client groups was noted from this chapter of diseases, similar to the expected number.

Skin and Subcutaneous Disorders ICD codes 680-709

Few cases attributed to this chapter were noted in any of the groups. Among females, SMR's are elevated and this chapter is ranked in the top ten SMR's and standard PMR's. The elevation is not significantly different from unity.

Musculoskeletal Disorders ICD codes 710-739

Mortality from musculoskeletal disorders was uncommon and no significant association was identified.

Congenital Diseases ICD codes 740-759

Mortality from congenital disorders has mixed results. In males the SMR's were above unity in the cohort and MSB clients, with the later relationship achieving significance. In females, the on-reserve group demonstrated significantly lower than unity SMR's. Ranking by potential years of life lost place congenital diseases in the top ten for natives.

Perinatal Disorders ICD codes 760-779

Standardized Mortality Ratios of perinatal disorders are consistently greater than unity, achieving elevation at the 95% probability level for MSB clients and males in the cohort. MSB clients have significantly higher rates than the on-reserve native measure. PYLL rankings place perinatal causes fourth for males and third for females for both the cohort and on-reserve populations.

Symptoms and Ill-defined Disorders ICD 780-799

Native groups have consistently higher risks for death from this category. This finding has been noted previously by several authors.[8,17,57] In this study 22 of the 60 observed cases are in the under 1 age group. Since most of these cases are likely Sudden Infant Death Syndrome, this study confirms several reports of elevated risk for SIDS among natives.[1,6,82,127,128] The mortality ratio for this age group being 3.4 for males and 2.8 for females. This impact is further supported by the high ranking of this chapter as potential years of life lost. MSB clients have significantly higher rates than on-reserve deaths.

Accidents, Poisoning and Violence ICD codes E800-E999

Death from violent causes has been repeatedly studied among native populations with the consistent finding that mortality rates in natives are several fold higher than in comparison populations. This thesis confirms the impact of these causes of death in native populations.

Consistent with most studies, mortality from MVTA is elevated. Death from fires and drownings have mortality ratios several fold higher in native populations.

Suicide rates among natives are several fold higher than the comparison populations. Age specific mortality rates reveal that suicide is infrequent amongst older natives, with the greatest increase in the younger age groups. This finding is consistent with other Canadian studies.[1,20] Homicide rates are several fold higher among native populations.

Various violent causes of death consistently rank in the top ten for all measures of mortality used in this study.

7. DISCUSSION OF SOURCES OF ERROR

This thesis has assembled three measures of the health of natives in Canada. In Utopia, I would demonstrate that the three measures are complementary and display similar results. If one of these could be regarded as a gold standard, the discussion would prove easier and more succinct. However, the validity of the MSB and on-reserve measures has been questioned and the linkage of the DIAND register to the CMDB was incomplete. The potential therefore exists for significant errors.

This chapter identifies and discusses in greater detail the potential errors associated with these three native measures. Various supplemental data is used to analyze the extent of certain errors. The conclusion to this section is disappointing, but the results should be useful for planning studies of native health.

7.1 IRREGULARITIES IN THE DIAND REGISTER COHORT

7.1.1 The Missing 206

The 206 unduplicated deaths recorded on the DIAND register which failed to link to death certificates are a threat to the validity of this study. To further delineate the cause of the discrepancy, demographic characteristics of the missing 207 were formulated and compared with the linked deaths regarding age, sex and province of residence. These findings are provided in Table 11. Females were less likely to be linked (X^2 test 1 df p=0.026). The geographic distribution of the missed linkages is significantly different over eight regions (X^2 test 7df p<0.001) (Atlantic provinces and territories aggregated). Ontario and Quebec have higher ratios of unlinked to linked records. The overall age distribution is not significantly different. A manual inspection by Statistics Canada of the names of the missed linkages failed to reveal a systematic problem with

multiple names as found with some native groups (e.g. Annie Who Got Shot).[123]

Explanations which may contribute to the poor linkage rate are:

- persons listed as dead in the DIAND event file who are not actually dead
- persons for whom no death certificate was completed
- persons who died outside Canadian jurisdictions who have not had death certificates filed with Statistics Canada
- persons who are listed as having died in 1981 but who actually died in previous years
- records which have sex incorrectly coded
- persons for whom incorrect surnames are recorded in either the DIAND file or on the death certificate

DIAND records events from legal certificates. All vital events are recorded on the same file. The identification item for events is a two digit code on the event file. Events identified as deaths or presumed deaths have been included in this study. Encoding errors of the event item may result in other events incorrectly coded as deaths, and vice versa. A systematic coding error might occur if stillbirths were coded as deaths and would tend to increase the number of infant deaths noted. Crosstabulation of birth month and death month from the event file for unlinked infant deaths shows that 5 of the 10 deaths did not occur in the month of birth.

Persons dying, who do not have death registered with Statistics Canada would not be linked. This includes some persons dying outside Canada[111] and those for whom no body is recovered.[129] Canada maintains bilateral agreements with all states in the U.S., but not all states consistently forward certificates of Canadian nationals (M.Smith, personal communication, 1989). Natives, by virtue of aboriginal rights may pass freely between countries, thus natives dying in the U.S. may not be correctly identified as being Canadian. Persons presumed dead were included in the event file used for this linkage. These may include records of persons missing for whom no death certificate would be filed without recovery of the body.

Systematic encoding errors may result in a tendency for the recording of late registered events (see section 7.1.2) into incorrect years of occurrence.

The last two possibilities are of particular interest. These items relate to the linkage process itself and thus raise questions regarding the efficacy of the GIRLS program for this linkage. The CMDB records are divided by sex. To perform the linkage, the DIAND event file was divided by sex. If this coding item is incorrect on either file, then linkage failure is assured.

In a similar fashion, the GIRLS program defines "pockets" on the basis of surname. If a name has been changed, and the change not recorded on the DIAND files, then linkage is improbable since records with dissimilar surnames would not be compared. Name changes from marriages registered with DIAND should have alternate surnames provided on the records, but only 13.1% of the records had alternate surnames. If all these records were females, then only 33.6% of females had alternate surnames. It would seem reasonable to assume that a certain percentage of the death certificates may have been filed under "married" names unknown to the DIAND event file. Known maiden names are encoded on the CMDB and duplicate death records are used. Cases in which one record is coded in the maiden name and the other in the married name, without providing the alternative name, would not be linked by the GIRLS process.

As the tribal rolls were maintained by local councils until 1951 the quality of the information prior to this year has not been ascertained. Records may not have been transcribed accurately at that time. Marriages, name changes or other relevant information may not have been provided to DIAND during transfer of the rolls. If age at death is dichotomized at age 30 (corresponding to birth in 1951), then the unlinked records are more often older than the linked records (X^2 p=0.048). Computerization of the

records in 1984 may also have resulted in omission of fields useful for the linkage.

Natives are known not infrequently to change their names and assume "aliases" (J.Allen, personal communication, 1989). These aliases are rarely recorded on the DIAND register as events are linked by band number and not surname. DIAND officials believe that the majority of the linkage problems can be attributed to unrecorded name changes.

It is conceivable that the 11% missed linkages can be explained by a combination of the above factors. This failure to link introduces a significant source of bias to the study. This will be discussed in detail in section 7.4.

7.1.2 Late Reporting of Deaths: Another Source of Systematic Error

The computer tape of 1981 deaths was developed from the "1982", "1983" and "1984" DIAND event files. The three year lag was designed in the study to limit the effects of late reporting. Appendix E is provides a listing of the "1981" - "1984" events files showing the year of deaths and the year of processing. The 1981 deaths were reported as: 1398 in "1982", 453 in "1983", and 82 in "1984". It is apparent that a significant number of events are reported more than 3 years after their occurrence. If the rate of late reporting remains equivalent to the average of these four years, then an additional 151 records would be expected.

Late reporting will result in a underreporting of the numbers of deaths. This underreporting will change both the numerator and denominator in the determination of rates. The net effect would result in an underestimation of mortality rates and associations.

Table 11: Comparison of Linked and Unlinked records from the DIAND Event file.

AGE AT DEATH	UNLINKED	LINKED
0-1	10	129
1-4	5	44
5-9	2	22
10-14	1	31
15-19	11	101
20-24	15	132
25-29	12	113
30-34	8	85
35-39	7	75
40-44	10	70
45-49	8	67
50-54	9	75
55-59	13	90
60-64	15	110
65-69	15	114
70-74	23	119
75-79	12	125
80-84	16	107
85+	20	110
	unknown 1	
RESIDENCE		
PEI	0	3
Nova Scotia	1	25
New Brunswick	4	35
Quebec	30	118
Ontario	55	330
Manitoba	23	265
Saskatchewan	27	232
Alberta	27	290
British Columbia	40	370
Yukon	2	24
N.W.T.	4	27
Other	-	7
SEX		
Male	114	1065
Female	99	661

7.1.3 The Failure to Report Infant Deaths

Concern has been raised regarding the reporting of infant deaths to DIAND.[14] The potential exists for failure to report deaths occurring in children who have not been registered as births. This effect would show as a lower infant mortality rate in the cohort compared to either MSB or the on-reserve population, since infant deaths are likely to be known and reported to these files. In this study the infant mortality rate of the cohort was intermediate between the rates noted from the on-reserve population and from MSB. This relationship is similar to other age ranges, suggesting that the effect is small. The possibility persists that underreporting of infant deaths has occurred and that the observed infant mortality rate in the cohort is an underestimation because of failure to report both birth and death to DIAND.

7.2 MSB ASCERTAINMENT OF DEATHS

7.2.1 Irregularities in the Collection of Events

Since the reporting of deaths occurring in the eastern regions of MSB is dependant on the knowledge of community workers, several potential sources of error exist. MSB personnel often provide the sole source of health care to communities. Communities may include numbers of non-registered Indians and non-Indians. The potential exists that vital events on non-status individuals may be included in MSB reporting but not included on the community patient registers. Duplicate reporting of events may occur. These tendencies would lead to an overestimation of the number of events.

Deaths unknown to MSB personnel may not be reported leading to an underreporting of events. This may be managed by the annual updating MSB files using the DIAND event file.

7.2.2 Classification of Cause of Deaths

The cause of death reported by MSB personnel in some eastern zones may not be the same as recorded on the death certificate. The community worker uses the best available information to assign a cause of death. This may introduce a significant source of misclassification bias into the study. If this were the situation, certain causes of death would be more likely to be overreported than others. The ratio of mortality rates from the MSB files to both the cohort and on-reserve deaths appears consistent across cause of death, suggesting that systematic misclassification is not a major problem in this study.

7.3 PROBLEMS WITH THE POPULATION ESTIMATES

The three native measures all suffer from questionable ascertainment of populations. These have been discussed under the appropriate sections in Chapter 3. The biases incurred by these estimates will be discussed in greater detail in the general context of the results in section 7.4. In this section, the specific problems will be compared and contrasted.

Each of the groups uses as its base population the DIAND register. In the purest situation, the cohort is formed from all and only registrants on the native roll.

The on-reserve population is derived from the DIAND coding of natives living on-reserves. This coding element is thought to be inaccurate,[85] as discussed in section 3.1.3. Mao noted that census estimates of total on-reserve populations were 85 - 102% of the DIAND estimates[5] without considering non-status persons living on-reserves. Statistics Canada has questioned the reliability of censuses on reserves.[15]

The MSB population in the western provinces is based on the DIAND register. In the eastern provinces population estimates are based on patient lists which have been generated using DIAND tribal roll records. These are updated by individual community workers based on their knowledge

of the community. The native cohort lists a total population of 323,593, while the MSB population is 87% of this at 281,415. MSB estimates that they provide health care for only 75% of native Indians.[8] The 38,720 person discrepancy between these values may represent either an inaccurate estimate or the number of non-status persons receiving health care.

All three methods rely on the DIAND register. In section 3.1 the irregularities in the maintenance of the register were discussed. Population estimates for MSB are based on yearly DIAND reports. Those for the on-reserve and cohort populations are based on correspondence received in 1983 (1979-1982) and again in 1986 (1983) (R. Semenciw, personal communication, 1989). The accuracy of these reports with regards to the updating of the population estimates based on reporting to the event file has not been determined. Such records, if not updated, are expected to include late reported deaths and exclude late reported births. The former problem will result in an overestimation of the population at risk and the later in an underestimation of the population at risk.

The final relevant question is how many persons on the DIAND register have died and remain registered. Since DIAND has not attempted to "clean" their files such a problem is likely. The magnitude of the problem has not been measured. This systematic problem would likely inflate the number of elderly persons listed on the file. This problem would result in low age specific rates for older populations. This is of concern in this study as this situation exists in all the native groups.

7.4 ESTIMATING THE DIRECTION AND MAGNITUDE OF THE ERRORS

For each of the native groups, the effect of the possible errors will be discussed with regard to direction, and where possible magnitude. This discussion is imperative to the comparison of the three native measures in chapter 8.

7.4.1 The DIAND Cohort

The first objective of this thesis was to develop measures of native health based on a linkage of the DIAND register to the Canada Mortality Database. The successful accomplishment of this objective would have signified a major advance to studying aboriginal health in Canada.

Two major sources of error have been identified: the failure of the linkage procedure to find matching death certificates for 207 individuals recorded as having died by DIAND, and the late reporting of deaths to the event file. The second error may involve close to 151 individuals.

Given that only 1726 records were linked of a total expected 2084, an underestimation of all rates and associations of 21% would be expected. The uniform application of the correction can only be assumed if there is no bias towards the specific causes of death or age groups. It has been shown that the unlinked records were more likely to be older. The effect on mortality would be greatest for the causes of death for older native populations. The most common causes for this age group are neoplasms and circulatory diseases, both of which displayed significantly lower mortality than the national comparison population.

It may be concluded that associations noted to be elevated would have been higher in the "true" case. Associations found to be lower than the comparison population should be carefully reviewed given the likelihood of significant underestimations.

The effect of the population estimates should have only a minimal effect on the cohort population. The possibility of an overestimation of the size of the elderly population limits any interpretation of this information from the native groups.

7.4.2 The On-reserve Population

Three major biases effecting the on-reserve population are: the inaccurate coding of on-reserve residence to the DIAND register, the residence of non-status persons on reserves, and the reliability of the residency coding on death certificates.

The first problem would tend to overestimate the actual population living on reserves, since natives accrue certain benefits when living on reserves. Overestimation of the population would result in an underestimation of the magnitude of the associations noted in this study.

The number of non-status inhabitants of reserves has been estimated at 10%. Since the on-reserve population is based on DIAND counts of natives only, this would tend to underestimate the actual population by this amount. If these persons were correctly identified on the death certificates as living on reserves then the actual associations noted in this study would be overestimates of the true association.

The final problem relates to coding on the death certificate. Mao's assessment of the Maniwaki community showed that the direction of misclassification was to underreport reserve residence. In this particular case study, only 21% were correctly coded as living on-reserve.[102] If this problem were universal across Canada then under counting the actual number of deaths would lead to a systematic underestimation of the associations noted in this study. Some evidence from the Maniwaki study suggests that the causes of death that were most likely incorrectly coded were those which had required transportation outside of the community. Sudden causes of death would be minimally effected. Neoplasms and chronic diseases may be effected to a greater extent.

7.4.3 Medical Services Branch Clients

The collection of the data for the Medical Services Branch clients was not central to the original objectives of this study. The failure to specifically identify a major error may be a function of the failure to carefully analyze the data collection process rather than the lack of any problem. Of the three data sources, I have the least confidence in the accuracy of MSB data since collection and processing occurred before the data were made available.

Nonetheless the irregularities introduced in section 3.3 and discussed in sections 7.2 and 7.3 require careful evaluation before this data set should be accepted as presented.

Two contrasting methods of compiling data are used to develop the MSB database. These methods cover different populations whose health experience may be different. The collection, reporting and compiling of data from the eastern provinces requires further validation before this process can be accepted.

The direction and the magnitude of a systematic error, if one exists, cannot be determined at this time. Certain internal validation studies would help define the role of the MSB data set in assessing native health. The differences between the MSB data set and the two other native groups is discussed further in sections 8.1 and 8.2.

The MSB data collection is limited in the aggregation of disease entities. More detailed information is available on suicides, accidents, and infant causes of death which has not been provided here[8]. For most causes of death, specificity is lacking in the reporting system.

---

[8] This information is provided by the Demographics and Statistics section of Indian and Northern Health Services of the Medical Services Branch.

8. INTERPRETATIVE DISCUSSION

The goal of this thesis is to assess and measure mortality indicators of Canada's native people. Objectives of this study include: assessing the use of on-reserve deaths as a surrogate for native mortality, comparing the on-reserve population with a "rural" comparison population, and comparing the cohort and on-reserve deaths with data provided by Medical Services Branch.

The first three sections of this chapter consolidate this study in light of these objectives. The final section touches on the relation between the residual and national populations.

8.1 COHORT AND ON-RESERVE DEATHS

These two measures of native health can be compared in two respects: the magnitude and the relative importance of the observed relationships.

The all-cause ASMR for the on-reserve deaths is lower than for the cohort deaths by 4% (males) and 7% (females). Age-specific rates, PYLL rates, and cause-specific rates are generally higher in the cohort than on-reserve population. As noted in sections 5.3 and 5.6 the number of significant increases is approximately what might be expected by chance alone. The Spearman's correlations between these two native groups are between 0.899 to 0.924 (Table 10), suggesting that the relative importance of diseases is consistent between the native groups.

The magnitude of underestimation of numbers of deaths in the cohort approaches 20%. If the mortality experience on reserves is similar to that of the native cohort, then the use of the coding of on-reserve deaths may be an underestimation of the order of 25-30%.

8.2 MEDICAL SERVICES BRANCH FILES

The discussion of the MSB files is limited by the aggregations of disease to ICD chapters. The MSB all-cause ASMR is 20% higher in males

and 28% higher in females than the cohort measure. The direction and magnitude of this relationship is seen at most ages and many ICD chapter groups. This suggests that a significant difference exists between these measures.

The magnitude of the difference can be explained in a great part by the suspected 21% underestimation of the linkage procedure and the effects of late reporting. In this respect, this study may help to validate the MSB files as a fairly accurate measure of native mortality. The lack of disease specificity on the MSB files limits their utility.

8.3 COMPARISON OF THE ON-RESERVE DEATHS WITH THE RESIDUAL

The third objective of this study is to determine if a portion of the deaths in natives can be attributed to rural living. The selection of the residual comparison population is an attempt to identify deaths in a non-native population which are at a similar risk.

If a specific lifestyle component is expected, it would most likely affect the ICD chapter of Accidents, Poisoning, and Violence. All violent causes of death, except accidental falls are significantly elevated in comparison to the residual population, even without correcting for the suspected 30% underestimate of on-reserve mortality.

With only a few exceptions the direction and magnitude of the associations are similar whether the on-reserve deaths are compared to the residual or to the national population. This relationship is confirmed by the non-parametric correlations which reveal higher correlations between the on-reserve deaths and the cohort than between on-reserve deaths and either the residual or national groups.

This suggests that natives have a substantially different mortality experience than non-natives, even if rural habitation is considered.

8.4 RESIDUAL AND THE NATIONAL COMPARISON GROUPS

This study was not designed to compare these two groups. A significant difference between these two populations was expected and would reflect the effects of rural living.

The residual population generally has a lower mortality experience than the national comparison population. Age-specific mortality rates are higher in childhood and young adulthood, becoming lower with increasing years. The exceptions to the reduced mortality are in certain violent causes of death (MVTA, drowning and fires) which are more common in rural areas. The high non-parametric correlations suggest that the mortality experience of rural inhabitants is similar to their urban counterparts. Two possible explanations for these relationships are that either a significant drift of unhealthy persons from rural areas to urban centres occurs or that rural living is protective for many diseases.

9. THE USE OF ADMINISTRATIVE DATA FOR EPIDEMIOLOGIC RESEARCH

This thesis relies on administrative data to support an epidemiological investigation into the health of natives in Canada. Two major sources of administrative data have been utilized. The first is the death certificate - collected to fulfil legal requirements. The second is the native Indian register - maintained to administer the Indian Act of 1951.

This study has been made feasible by computerized record linkage through the comparison of 1933 native deaths to 200,000 Canadian death records from 1981. This chapter addresses the problems of using routinely collected administrative data for epidemiologic research. The outcome result of this study, with the potential 20% bias in the cohort and 30% in on-reserve deaths, is in part an illustration of this problem. In essence the questions become why use administrative data rather than collecting primary data? and What are the advantages and the limitations of this type of study?

Few guidelines exist regarding the use of administrative data for epidemiological research. Several authors have addressed the limitations and approaches to these data banks. Most of these authors have focused on the advantages of this form of research as being in: increasing sample size, eliminating participation refusal, reducing loss-to-follow up, reducing Hawthorne bias, eliminating recall bias,[130] often being less expensive and less time consuming.[131] Rigorous evaluation of the data bases are important prior to their use.[132,133,134] Procedures to adjust data quality problems and errors have not been validated.

The concept of using administrative data for epidemiologic research has been questioned.[135] Criticisms include: that "the high standards of laboratory science and randomized trials, however have not been extended to epidemiological *para-analysis*",[135] that analytic procedures devised for observational and quasiexperimental designs have been applied to 'data

barges' without consideration of the implications, and that the justification for some of these studies has been the doctrine of *"faute de mieux"* (lack of anything better).

These valuable comments help frame this thesis. What are the implications of these concerns for this study? The specific errors measured in this thesis are an important consideration given that:

1. Data coding errors in the Canada Mortality Database are known to be of the order of 6-9% for the ICD code, 9% for residence and 11% for age. The implications of these presumably random errors are unknown (section 3.2.1).
2. The accuracy of death certificates is no greater than 90% for the level of disease aggregation used in this study (section 3.2.2). Evidence suggests that misclassification is partially random, but systematic error may be introduced.
3. The record linkage procedure failed to match 11% of the known native deaths.(section 7.1.1).
4. Late reporting of death events to the native register may have resulted in a substantial systematic error.(section 7.1.2).
5. Population estimates based on the Native register are possibly biased (section 7.3).

Every attempt has been made to provide a critical objective evaluation of the various components of this study. The determination of these errors raises questions regarding the validity of the study. Some of the errors are measurable while others can only be "hoped" to be random. The gratifying relationship between a 'corrected' cohort and the MSB files is a reassurance that the data provide useful information. The fact that the biases lead to underestimates provides credence to the causes of death noted to be elevated in comparison to the national population.

The analytic procedures used in this study have provided a wide range of different approaches. Multiple testing has been pervasive throughout this study and no adjustment procedure for multiple testing has been used. The lack of truly independent observations between the native measures raises questions of the appropriateness of the statistical

techniques. The consistency of the relationships between the three different native health data sources and the national comparison populations lends support to the credibility of the study.

The *faute de mieux* doctrine might be applicable to this study. This study has attempted to validate some of the currently used methods of statistical collection with a successful outcome. Until a rigorous study of native health is undertaken these methods of data collection will prove better than nothing.

We are faced with the policy dilemma that natives appear to be suffering the injustice of inequitable health status, yet problems in determining their health status exist. This study is a step in defining the exact health status of natives. Nonetheless, the errors discovered will raise substantial criticisms to the validity of this approach. Is it more important to develop policy or undertake better research? Undoubtably, readers of this thesis will arrive at diverse conclusions, contributing to the dilemma.

Using routinely collected administrative data has provided a useful measure of native health status. Many of the advantages in using administrative data noted at the beginning of this section have been realized: the sample size of 1726 in the cohort deaths is sufficient to study many causes of death, the resources required for the study are less than a labour intensive study, and recall bias and participant refusal have been eliminated. The rigorous evaluation of the data sets has identified, and where possible, measured the magnitude of errors.

The potential exists to expand and refine the methods of this study for future research through adjustments to the process by which the administrative data is collected. These data are not collected for the sole purpose of epidemiological research. The results of research may however, influence the quality and quantity of information collected.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1 CONCLUSIONS

This thesis started with the goal to assess and measure native mortality in Canada. In achieving this goal the objectives of the study have been attained. A series of mortality rates derived from three possible measures of native mortality have been developed. These rates have been compared between native measures and with a national comparison population. The effect of rural living on explaining native mortality has also been addressed.

Conclusions to the study can be categorized as: the use of the materials and methods in the study, the health of natives, and the comparability of the various data sets.

Materials and Methods

- The DIAND event file has substantial sources of error which have resulted in 11% unexplained missed record linkages. The method of processing the event file suggests that similar problems exist with the DIAND register file.
- The Generalized Iterative Record Linkage System, in circumstances when the quality of the data sources is good, has an excellent record of successful record linkage. In this study a significant problem - possibly related to the use of the QUICKLINK procedure - has resulted in a relatively low linkage rate.
- The use of the event file is constrained by late reporting, reducing the timeliness of any analyses derived from the event file.
- The use of death certificates for determining cause of death is relatively reliable at moderate levels of disease aggregation.
- The coding of residence on death certificate as on-reserve is not reliable on a national basis.

Native Health

Native populations experience a different pattern of mortality from the national population. Where a consistent pattern across the possible native measures has been identified it is reasonable to conclude that a true relationship likely exists. This argument is strongest for causes of death for which natives have elevated rates in comparison to the national population.

Where decreased mortality is observed, the potential bias in both the cohort analysis and the on-reserve deaths must be considered to underestimate the true value. The magnitude of this bias can be approximated as 20% in the cohort and 30% in the on-reserve deaths. With this knowledge some tentative conclusions can be reached.

In cases where no substantial difference is noted between the cohort or on-reserve populations, and the national population, caution must be exercised. The potential exists for a clinically relevant relationship to exist which has not been identified because of the potential biases or limited power.

- Infant mortality is 2-3 times higher in natives than the national population.
- Native youth (ages 1-19) have mortality rates 2-4 times higher, males being at a greater risk.
- Young adults (ages 20-34) have mortality rates 2.5-5 times higher.
- Older adults (ages 35-64) have mortality rates which are also higher than the national population. With increasing age the risk ratio approaches unity.
- Elderly natives (ages 65+) may enjoy a comparatively lower mortality rate than their national counterparts. This relationship may be exaggerated by a potential overestimation of the size of the elderly native population

- The cumulative effect of this interaction between age and mortality risk is that survival probability to ages less than 65 is lower in natives.
- Life expectancy is a poor health indicator when discussing native populations because of the unexplained reduced mortality in older ages.
- Natives are at higher risk for the following causes of death in both sexes:

ICD chapters	LCDC disease aggregates
All causes	Alcoholic psychosis/alcoholism
Infective and Parasitic Disorders	Motor vehicle traffic accidents
Mental Disorders	Pneumonia
Symptoms and ill-defined disorders	Fires
Accidents,poisoning and violence	Drowning
	Suicide
	Homicide
	Accidental poisoning

Females are also at higher risk for cancer of the uterus(including cervix) and cirrhosis of the liver.

Natives of both sexes are probably also at higher risk for the following causes:

ICD chapters	LCDC disease aggregates
Endocrine,nutritional and metabolic disorders	Diabetes
Respiratory Diseases	
Digestive Diseases	
Perinatal Conditions	

Males may be at higher risk for cirrhosis of the liver.

Natives of both sexes are probably at a lower risk for death from the following causes:

ICD chapter	LCDC disease aggregates
Neoplasms	Digestive tract cancers
Circulatory Diseases	Colorectal cancer
	Lung cancer
	Coronary Heart Disease

Male natives probably have a lower risk for cancers of the bladder and brain. Female natives likely have a lower risk for breast cancer

- The impact of these causes of death is confirmed by the use of PYLL rates and proportional mortality ratios.

Comparability of the Data Sets

- A significant bias exists in the cohort data set which results in an approximately 20% underestimation of native mortality. This bias can be explained by a 11% failure of the linkage procedure and an 8% potential for the late reporting of deaths to the event file.
- A significant bias exists in the on-reserve deaths which results in an approximately 30% underestimation of the native mortality.
- The Medical Services Branch files are the most reliable available source of data on native mortality.
- The elevated mortality of natives cannot be explained by their living in rural areas of Canada.

10.2 RECOMMENDATIONS

A plethora of recommendations can be written based on multiple aspects of this study. To be of the greatest efficacy in catalyzing appropriate action, recommendations directed to the responsive sectors and to researchers in general need to be specific in focus and limited in number. These few recommendations are based on the materials and results from this study.

Recommendations for the Laboratory Centre for Disease Control

- Provide surveillance of time series trends through the use of on-reserve deaths, with the knowledge that the potential for significant bias in reporting exists.

Recommendations for the Native Health Section of Medical Services Branch

- To improve the utility of their collected statistics, cause of death should be categorized to ICD 3 digit classification. Failing the capacity to do this, recording should be at least at the level of the LCDC disease aggregate classifications.
- Actively engage in research on native health.
- Collaborate with LCDC and Statistics Canada to ensure high quality data collection and processing and to identify areas for research.

Recommendations for Statistics Canada

- Before considering further use of the DIAND administrative files in native research, complete a study into the 206 failed linkages to explain the linkage difficulty.
- To improve the utility of the residence coding on death certificates, study the reliability and validity of the coding of on-reserve deaths. If possible institute mechanisms to improve the quality of this coding item.
- To develop an accurate denominator for researchers, undertake an accurate census of native populations.

Recommendations for the Department of Indian Affairs and Northern Development

- Before considering further research using administrative files, undertake a study of the data quality of the current information contained in the register and event files.
- Consider a death clearance of the DIAND register to assist in providing more accurate estimates of native populations. Such a procedure may entail a linkage of the register with the CMDB.

Recommendations for the study of Native Health

- Study the mortality of elderly native populations.
- Study the health differences between native language groups.
- Study the specific health problems facing natives residing on-reserves in comparison to natives residing in urban centres.
- Identify and study the health of natives not enjoying status registration.

This study has focused on the native population in Canada which is the easiest to study. Status Indians receive health care from the federal government and to this extent may well be "better off" than certain non-status natives and Metis groups. Inuit populations who also enjoy the health services provided by the federal government, and more recently territorial government, appear to be at an even higher risk for various causes of mortality and morbidity,[1] It is hoped that this study will act as a stepping stone to the improvement of health among native Canadian populations.

REFERENCES

1. Indian and Northern Health Services. Health Status of Canadian Indians and Inuit: update 1987. Health and Welfare Canada, Medical Services Branch. Ottawa 1988.

2.Indian and Northern Affairs Canada. Indian Conditions: A survey. Department of Indian Affairs and Northern Development, Ottawa, 1980, cat no. R32-45/1980E.

3.Rhoades E.R., Reyes L.L., Buzzard G.D. The Organization of Health Services for Indian People. Public Health Reports 1987;102:352-356.

4.Passel J.S. Provisional Evaluation of the 1970 Census Count of American Indians. Demography 1976;13:397-409.

5.Mao Y., Morrison H., Semenciw R., Wigle D. Mortality on Canadian Indian Reserves 1977-1982. Can J Public Health 1986;77:263-268.

6.Morrison H.I., Semenciw R.M., Mao Y., Wigle D.T. Infant Mortality on Canadian Indian Reserves 1976-1983. Can J Public Health 1986;77:269-273.

7.Kenen R., Hammerslough C.R. Reservation And Non-Reservation American Indian Mortality in 1970 and 1978. Social Biology 1987;34:26-36.

8.Indian and Northern Health Services. Health Indicators Derived From Vital Statistics for Status Indian and Canadian Populations 1978-1986. Health and Welfare Canada, Ottawa, 1988.

9.Wotton K.A., Stiver H.G., Hildes J.A. Meningitis In The Central Arctic: A 4-Year Experience. Can Med Assoc J 1981;124:887-890.

10.Ward J.A., Fox J. A Suicide Epidemic On An Indian Reserve. Can Psychiatr Assoc J 1977;22:423-426.

11.Gaudette L.A., Freitag S., Barreto L.A.V., Miller A.B. Cancer Patterns in the Inuit Population of Canada 1970-1984. Canadian Epidemiology Conference (poster session), August 1989, Ottawa.

12.Hildes J.A., Schaefer O. The Changing Picture Of Neoplastic Disease In The Western And Central Canadian Arctic(1950-1980). Can Med Assoc J 1984;130:25-32.

13.Mahoney M.C., Michalek A.M., Cummings K.M., Nasca P.C., Emrich L.J. Mortality in a Northwestern Native American Cohort, 1955-1984. Am J Epidemiol 1989;129:816-826.

14.Statistics Canada. Population Projections of Registered Indians 1982-1996. Indian and Northern Affairs Canada, Ottawa, February 1985.

15.Boxhill W. 1981 Census Data on the Native People of Canada. Canadian Statistical Review. February 1985 cat no 11-003E.

16.Minuk G.Y., Ling N., Postl B., Waggoner J.G., Nicolle L.E., Hoofnagle J.H. The Changing Epidemiology Of Hepatitis B Virus Infection In The Canadian North. Am J Epidemiol 1985;121:598-604.

17.Young T.K. Mortality Pattern Of Isolated Indians In Northwestern Ontario: A 10-Year Review. Public Health Reports 1983;98:467-475.

18.Young T.K., McIntyre L.L., Dooley J., Rodriguez J. Epidemiologic Features Of Diabetes Mellitus Among Indians In Northwestern Ontario And Northeastern Manitoba. Can Med Assoc J 1985;132:793-797.

19.Akers D.S., Larmon E.A. Indians and smudges on the census schedule. In: Proc. Soc Stat Sect; Am Stat Assoc 1967. Washington, DC: The Association, 1967; 369-373.

20.Hislop T.G., Threlfall W.J., Gallagher R.P., Band P.R. Accidental and Intentional Violent Deaths Among British Columbia Native Indians. Can J Public Health 1987;78:271-274.

21.Rhoades E.R., D'Angelo A.J., Hurlburt W.B. The Indian Health Service Record Of Achievement. Public Health Reports 1987;102:356-360.

22.Young T.K. Are Subarctic Indians Undergoing The Epidemiologic Transition? Social Science and Medicine 1988;26:659-671.

23.International Classification of Disease. Manual of the international statistical classification of disease, injuries and causes of death. Ninth Revision. Geneva: World Health Organization, 1977.

24.Rhoades E.R., Hammond J., Welty T.K., Handler A.O., Amler R.W. The Indian Burden Of Illness And Future Health Interventions. Public Health Reports 1987;102:361-368.

25.Christian C.M., Dufour M., Bertolucci D. Differential Alcohol-Related Mortality Among American Indians Tribes In Oklahoma, 1968-1978. Social Science and Medicine 1989;28:275-284.

26.Sievers M., Fisher. Disease of North American Indians. In: Rothschild H. ed. Biocultural Aspects of Disease. New York, Academic Press, 1981:191-252.

27.Broudy D.W., May P.A. Demographic And Epidemiologic Transition Among The Navajo Indians. Social Biology 1983;30:1-16.

28.Ghodes D.M. Diabetes in American Indians: A Growing Problem. Diabetes Care 1986;9:609-613.

29.Department of Indian Affairs and Northern Development. Registered Indian Population by Sex and Residence for Bands, Districts, Regions, and Canada, December 31, 1981. Indian Affairs and Northern Development, Ottawa, 1982.

30.Gillum R.F. Ischemic Heart Disease Mortality in American Indians, United States 1969-1971 and 1979-1981. American Heart Journal 1988;115:1141-1144.

31.Michalek A.M., Mahoney M.C., Cummings K.M., Hanley J., Snyder R. Mortality Patterns among a Native American population in New York State. NY State J Med 1989;89:557-561.

32.Mahoney M.C., Ellrott M.A., Michalek A.M. A Mortality Analysis of Native Americans in New York State, 1980-1986. Int J Epidemiol 1989;18:403-412.

33.Wise Methodological Alternatives for Measuring Preventive Mortality. American Journal of Preventive Medicine 1987;4:226.

34.Centres for Disease Control. Premature Mortality in the United States: public health issues in the use of years of potential life lost. MMWR 1986;35(suppl no 2S):1S-11S.

35.MacWilliam L., Mao Y., Nicholls E., Wigle D.T. Fatal Accidental Childhood Injuries In Canada. Can J Public Health 1987;78:129-135.

36.Beauvais J.E. Health Status on Canadian Indian Reserves 1971-1984 (Thesis). Montreal, McGill University 1988.

37.Young T.K., Frank J.W. Cancer Surveillance in a Remote Indian Population in Northwestern Ontario. Am J Public Health 1983;73:515-520.

38.Young T.K., Choi N.W. Cancer Risks Among Residents Of Manitoba Indian Reserves, 1970-1979. Can Med Assoc J 1985;132:1269-1272.

39.Young T.K. Self Perceived and Clinically Assessed Health Status of Indians in Northwestern Ontario: Analysis of a Health Survey. Can J Public Health 1982;73:272-277.

40.McIntyre L., Shah C.P. Prevalence Of Hypertension, Obesity And Smoking In Three Indian Communities In Northwestern Ontario. Can Med Assoc J 1986;134:345-349.

41.Cohen M.M., Young T.K., Hammarstrand K.M. Ethnic Variation in Cholecystectomy Rates and Outcomes, Manitoba, Canada, 1972-84. Am J Public Health 1989;79:751-755.

42.Young T.K. Cardiovascular Risk Factors in an Indian Population. Chronic Dis Can 1986;7:3-4.

43.Young T.K., Hershfield E.S. A Case-Control Study To Evaluate The Effectiveness Of Mass Neonatal BCG Vaccination Among Canadian Indians. Am J Public Health 1986;76:783-786.

44.Young T.K., Sevenhuysen G. Obesity in Northern Canadian Indians:patterns, determinants, and consequences. Am J Clin Nutr 1989;49:786-793.

45.Young T.K., Krahn J. Comparison of Screening Methods in a Diabetes Prevalence Survey Among Northern Indians. Clin Invest Med 1988;11:380-385.

46.Young T.K., Casson R.I. The Decline and Persistence of Tuberculosis in a Canadian Indian Population: Implications for Control. Can J Public Health 1988;79:302-306.

47.Munroe M., Shah C.P., Badgley R. Bain H.W. Birth weight, length, head circumference and bilirubin level in Indian newborns in the Sioux Lookout Zone, northwestern Ontario. Can Med Assoc J 1984;131:453-456.

48.Mahoney M.C., Michalek A.M., Cummings K.M., Nasca P.C., Emrich L.J. Cancer Mortality in a Northeastern Native American Population. Cancer 1989;64:187-190.

49.Mahoney M.C., Michalek A.M., Cummings K.M., Nasca P.C., Emrich L.J. Cancer Surveillance in a Northeastern Native American Population. Cancer 1989;64:191-195.

50.Mahoney M.C., Michalek A.M., Cummings K.M., Hanley J., Synder R.L. Years of Potential Life Lost Among a Native American Population. Public Health Reports 1989;104:279-285.

51.Editorial. Cancer Mortality Among Native Americans In New York State. NY State J Med 1988;88:666-667.

52.Samet J.M., Key C.R., Hunt W.C., Goodwin J.S. Survival of American Indian and Hispanic cancer patients in New Mexico and Arizona, 1969-1982. JNCI 1987;79:457-463.

53.Wiggins C.L., Becker T.M., Key C.R., Samet J.M. Stomach Cancer Among New Mexico's American Indians, Hispanic Whites, And Non-Hispanic Whites. Cancer Research 1989;49:1595-1599.

54.Samet J.M., Wiggins C.L., Key C.R., Becker T.M. Mortality from Lung Cancer and Chronic Obstructive Pulmonary Disease in New Mexico, 1958-1982. Am J Public Health 1988;78:1182-1186.

55.Becker T.M., Wiggins C., Key C.R., Samet J.M. Ischemic Heart Disease Mortality In Hispanics, American Indians, And Non-Hispanic Whites In New Mexico, 1958-1982. Circulation 1988;78:302-309.

56.Becker T.M., Wiggins C.L., Key C.R., Samet J.M. Ethnic Differences in Mortality From Acute Rheumatic Fever and Chronic Rheumatic Heart Disease in New Mexico, 1958-1982. West J Med 1989;150:46-50.

57.Samet J.M., Key C.R., Kutvirt D.M., Wiggins C.L. Respiratory Disease Mortality in New Mexico's American Indians and Hispanics. Am J Public Health 1980;70:491-497.

58.Sewell C.M., Becker T.M., Wiggins C.L., Key C.R., Hull H.F., Samet J.M. Injury Mortality in New Mexico's American Indians, Hispanics, and non-Hispanic Whites, 1958-1982. West J Med 1989;150:708-713.

59.Grzybowski S. Tuberculosis. A Look At The World Situation. Chest 1983;84:756-761.

60.Rieder H.L. Tuberculosis Among American Indians of the Contiguous United States. Public Health Reports 1989;104:653-657.

61.Evers S.E., Rand C.G. Morbidity in Canadian Indian and non-Indian Children in the First Year of Life. Can Med Assoc J 1982;126:249-252.

62.Evers S.E., Rand C.G. Morbidity in Canadian Indian and non-Indian Children in the Second Year of Life. Can J Public Health 1983;74:191-194.

63.Threlfall W.J., Gallagher R.P., Spinelli J.J., et al. Cancer Patterns In British Columbia Native Indians. British Columbia Medical Journal 1986;28(7):508-510.

64.Gallagher R.B., Elwood J.M. Cancer Mortality Among Chinese, Japanese, And Indians In British Columbia,1964-1973. Natl Cancer Inst Monogr 1979;53:89-94.

65.Centres for Disease Control. Cancer patient Survival by Racial/Ethnic Group: United States. MMWR 1985;34:248-255.

66.Lanier A.P., Blot W.J., Bender T.R., Fraumeni J.F. Cancer in Alaskan Indians, Eskimos, and Aleuts. JNCI 1980;65:1157-1159.

67.Lanier A.P., Bender T.R., Blot W.J., Fraumeni J.F. Cancer in Alaskan Natives 1974-1978. Nat Cancer Inst Monogr 1982;62:79-81.

68.Devor E.J., Buechley R.W. Gallbladder Cancer In Hispanic New Mexicans: I.General Population. Cancer 1980;45:1705-1712.

69.Rothenberg R., Nasca P., Mikl J., Burnett W., Reynolds B. Cancer. in Closing the Gap: The Burden of Unnecessary Illness. Amler R.W., Dull H.B. editors, Oxford University Press, New York, 1987, pp30-34.

70.Carter J., Horowitz R., Wilson R., Sava S., Sinnock P., Gohdes D. Tribal Differences in Diabetes: Prevalence Among American Indians in New Mexico. Public Health Reports 1989;104:665-669.

71.Bennett P.H., Rushforth N.B., Miller M., LeCompte P.M. Epidemiologic studies of diabetes in the Pima Indians. Recent Progress in Hormone Research 1976;32:333-376.

72.May P.A. Substance Abuse and American Indians: Prevalence and Susceptibility. Int J of the Addictions 1982;17(7):1185-1209.

73.Remington G., Hoffman B.F. Gas Sniffing as a Form of Substance Abuse. Can J of Psychiatry 1984;29:31-35.

74.Rhoades E.R., Mason R.D., Eddy P., Smith E.M., Burns T.R. The Indian Health Service Approach To Alcoholism Among American Indians And Alaska Natives. Public Health Reports 1988;103:621-627.

75.Mendenhall C.L., Gartside P.S., Roselle G.A., Grossman C.J., Weesner R.E., Chedid A. Longevity Among Ethnic Groups in Alcoholic Liver Disease. Alcohol and Alcoholism, 1989;24:11-19.

76.Evans J.A., Hunter A.G.W., Thompson D.R., Ramsay S. A Study of Institutionalized Mentally Retarded Patients in Manitoba: Over-representation by Canadian Indian Children. J Ment Defic Res 1985;29:153-164.

77.Stratton R., Stratton R. Oklahoma Indians Have Lower Cardiovascular and Cancer Mortality Rates Than Oklahoma Whites. Journal of the Oklahoma State Medical Association 1984;77:183-185.

78.Gordis L., Lilenfield A., Rodriguez R. Studies of the epidemiology and preventability of rheumatic fever: Demographic factors and the incidence of acute attacks. J Chronic Dis 1969;21:645-654.

79.Williams C.N., Johnston J.L., Weldon K.L.M. Prevalence of Gallstones and Gallbladder Disease in Canadian Micmac Indian Women. Can Med Assoc J 1977;117:758-760.

80.Young T.K., Kaufert J.M., McKenzie J.K., Hawkins A., O'Neil J. Excessive Burden of End-State Renal Disease among Canadian Indians: A National Survey. Am J Public Health 1989;79:756-758.

81.Wittmann B.K., Murphy K.J., King J.F., Yuen B.H., Shaw D., Wittmann A.G. Maternal Mortality In British Columbia in 1971-1986. Can Med Assoc J 1988;139:37-40.

82.Vanlandingham M.J., Buehler J.W., Hogue C.J., Struass L.T. Birthweight-specific Infant Mortality for Native American's Compared With Whites, Six States, 1980. Am J Public Health 1988;78:499-503.

83.Honigfeld L.S., Kaplan D.W. Native American Postneonatal Mortality. Pediatrics 1987;80:575-578.

84.Statistics Canada. Migration Projections of Registered Indians 1982-1996. Indian and Northern Affairs Canada, Ottawa, 1985.

85.Rowe G., Norris M.J. Mortality Projections of Registered Indians 1982-1996. Indian and Northern Affairs Canada, Ottawa, 1985.

86.Indian and Northern Affairs. Native Peoples and the North: A Profile. Indian and Northern Affairs, Ottawa 1982.

87.Nagnur D.N., Currie S.G., Heath B. Quality Assessment of vital Statistics (A pilot study), Health Division, Statistics Canada, Ottawa 1981 Cat 4-2302-534.

88.Vital Statistics and Disease Registries Section, Quality Assessment Study of Death Coding Data Years 1979 and 1980, Health Division, Statistics Canada (not dated, not catalogued)

89.Wells H.G. Relation of Clinical to Necropsy Diagnosis in Cancer and Value of Existing Cancer Statistics. JAMA 1923;80:737-740.

90. Carter J.R. The Problematic Death certificate. N Engl J Med 1985;313:1285-1286.

91. Bittelsohn A.M., Royston P.N. Annotated bibliography of Cause-of-death Validation Studies, 1958-1979. Vital and Health Statistics, series 2, no 89. U.S. Government Printing Office, Washington 1982 (DHHS no PHS 81-1368).

92. Kircher T., Nelson J., Burdo H. The autopsy as a measure of accuracy of the death certificate. N Engl J Med 1985;313:1263-1269.

93. Goldman L., Sayson R., Robbins S., Cohn L.H., Bettmann W., Weisberg M. The value of the Autopsy in Three Medical Eras. N Engl J Med 1983;308:1000-1005.

94. de Faire U., Friberg L., Lorich U., Lundman T. A Validation of Cause-of-death Certification in 1,156 Deaths. Acta Med Scand 1976;200:223-228.

95. Percy C., Stanek E., Gloeckler L. Accuracy of Cancer Death Certificates and Its Effect on Cancer Mortality Statistics. Am J Public Health 1981;71:242-250.

96.Moyer L.A., Boyle C.A., Pollock D.A. Validity of Death Certificates for Injury-related Causes of Death. Am J Epidemiol 1989;130:1024-1032.

97. Benavides F.G., Bolumar F., Peris R. Quality of Death Certificates in Valencia, Spain. Am J Public Health 1989;79:1352-1354.

98. Anderson D.O. Geographic Variation in Deaths due to Emphysema and Bronchitis in Canada. Can Med Assoc J 1968;98:231-241.

99.Mitchell R.S., Maisel J.C., Dart G.A., Silvers G.W. The Accuracy of the Death Certificate in Reporting Cause of Death in Adults: With Specific Reference to Chronic Bronchitis and Emphysema. Am Rev Respir Dis 1971;104:844-850.

100.Britton M. Diagnostic Errors Discovered at Autopsy. Acta Med Scand 1974;196:203-210.

101.Jarvis G.K., Boldt M. Death Styles Among Canada's Indians. Social Science and Medicine 1982;16:1345-1352.

102.Mao Y., McCourt C., Morrison H., Pepin-Laplante O., Semenciw R., Silins J., Spasoff R., Trempe N., Wigle D.T. Community-based mortality surveillance: The Maniwaki experience. Investigation of excess mortality in a community. Can J Public Health 1984;75:429-433.

103.Wigle D.T. Application to Link for an Indian Mortality Study. (communication) June 1987.

104.Dunn H.L. Record Linkage. Am J Public Health 1946;36:1412-1416.

105.Fellegi I.P., Sunter A.B. A theory of record linkage. J Am Stat Assoc 1969;40:1183-1210.

106.Fair M. Studies and References Relating to Uses of the Canadian Mortality Data Base, Occupational and Environmental Health Research Unit, Statistics Canada, Ottawa August 1989.

107.Systems Development Division, Generalized Iterative Record Linkage System: GIRLS: Concepts. **Statistics Canada, March 1989.**

108.Newcombe H.B., Record Linkage: The Design of Efficient Systems for Linking Records into Individual and Family Histories. Am J Hum Genet 1967;19:335-359.

109.Smith M. Record Linkage: Present Status and Methodology, J for Clinical Computing 1984;13:52-69.

110.Smith M. **Record Keeping and Data Preparation Practices to Facilitate Record Linkage, Proceedings** of the Workshop on Exact Matching Methodologies, Arlington Va. May 9-10 1985 pp 321-326.

111.Shannon H.S., Jamieson E., Walsh C., Julian J.A., Fair M.E., Buffet A. Comparison of Individual Follow-up and Computerized Record Linkage Using the Canadian Mortality Data Base. Can J Public Health 1989;80:54-57.

112.Smith M.E., Newcombe H.B. Automated Follow-up Facilities in Canada for Monitoring Delayed Health Effects, Am J Public Health 1980;70:1261-1268.

113.Newcombe H.B., Smith M.E., LaLonde P. Computerized Record Linkage in Health Research: An overview. Proceedings of the Workshop on Computerized Record Linkage in Health Research May 21-23 1986 Ottawa pp 28-34.

114.Laboratory Centre for Disease Control. LCDC disease codes with ICD7-9 equivalents. Ottawa, undated.

115.SAS Institute Inc. Statistical Analysis System. Cary N.C. 1988.

116.Stephenson Software Inc. VP-Planner Plus. Paperback Software International. Berkeley, U.S.A., 1987.

117.Gustafson T.L., True Epistat 3rd edition. Richardson, Texas 1989.

118.Armitage P., Berry G. Statistical Methods in Medical Research. Blackwell Scientific Publications, Oxford 1987.

119.Péron Y., Strohmenger C. Demographic and Health Indicators: Presentation and Interpretation. Statistics Canada, cat no. 82-543, Ministry of Supply and Services, Ottawa 1985.

120.Ury H.K., Wiggins A.D. Another Shortcut Method for Calculating the Confidence Interval of a Poisson Variable. Am J Epidemiol 1985;120:197-198.

121.Kupper L.L., McMichael A.J., Symons M.J., Most B.M. On the Utility of Proportional Morality Analysis. J Chronic Dis 1978;31:15-22.

122.Decouflé P., Thomas T., Pickle L.W. Comparison of the Proportionate Mortality Ratio and Standardized Mortality Ratio Risk Measures. Am J Epidemiol 1980;111:263.

123.Copock E. Mortality Follow-up of a cohort of Registered Indians. Unpublished summary, Statistics Canada, Ottawa May 1989.

124.Millar W.J. Observations on the Mortality of Alberta Indians. Chronic Dis Can 1981;2:14-17.

125.Layne N. Potential Years Of Life Lost Among Registered Indians In Canada, 1978 And 1983. Chronic Dis Can 1986;7(1):7-8.

126.Boss L.P., Lanier A.P., Dohan P.H., Bender T.R. Cancers of the Gallbladder and Biliary Tract in Alaskan Natives: 1970-1979. JNCI 1982;69:1005-1007.

127.Kaplan D.W., Bauman A.E., Krous H.F. Epidemiology Of Sudden Infant Death Syndrome In American Indians. Pediatrics 1984;74:1041-1046.

128.Adams M.M., The Descriptive Epidemiology Of Sudden Infant Deaths Among Natives And Whites In Alaska. Am J Epidemiol 1985;122(4):637-643.

129.Hasselback P., Neutel I. The case of the Missing Bodies: A Significant Source of Bias in a Linkage with the Canadian Mortality Data Base. (presentation) Canadian Epidemiology Research Conference, Ottawa, August 1989.

130. Roos L.L., Nicol J.P., Cageorge S.M. Using Administrative Data for Longitudinal Research: Comparisons with Primary Data Collection. J Chronic Dis 1987;40:41-49.

131. Connell F.A., Diehr P., Hart L.G. The Use of Large Data Bases in Health Care Studies. Annual Rev Public Health 1987;8:51-74.

132. Roos L.L., Roos N.P., Cageorge S.M., Nicol J.P. How Good are the Data? Reliability of One Health Care Data Bank. Med Care 1982;20:266-276

133. Bright R.A., Avorn J., Everitt D.E. Medicaid Data as a Resource for Epidemiological Studies: Strengths and Limitations. J Clin Epidemiol 1989;42:937-945.

134. Roos L.L., Sharp S.M., Wajda A. Assessing Data Quality: A Computerized Approach. Social Science and Medicine 1989;28:175-182.

135.Feinstein A.R. Para-Analysis, Faute de Mieux, and the Perils of Riding on a Data Barge. J Clin Epidemiol 1989;42:929-935.

136.Millar W.J. Mortality Patterns In A Canadian Indian Population. Can Stud Pop 1982;9:17-31.

137.Carr B.A., Lee E.S. Navajo Tribal Mortality: A Life Table Analysis of the Leading Causes of Death. Social Biology 1978;25:279 -287.

138.Enarson D.A., Grzybowski S. Incidence Of Active Tuberculosis In The Native Population Of Canada. Can Med Assoc J 1986;134:1149-1152.

139.Grzybowski S. Tuberculosis. A Look At The World Situation. Chest 1983;84:756-761.

140.Morgan K., Laing L.M. The Incidence Of Cancer In Registered Indians Of Alberta, 1974-1978. Chronic Dis Can 1981;2(3):33.

141.Robinson E. The Health of the James Bay Cree. Can Fam Physician 1988;34:1606-113.

142.Norsted T.L., White E. Cancer Incidence among Native Americans of Western Washington. Int J Epidemiol 1989;18:22-27.

143.Gillis D. Diabetic Profile Saskatchewan Region. Regina Medical Services Branch, Saskatchewan Region, Department Of National Health And Welfare, 1980.

144.Medical Services Branch. Diabetes in Saskatchewan: An Update, 1985. unpublished document, Regina 1985.

145.Szathmary E.J., Ritenbaugh C., Goodby C.S. Dietary Change And Plasma Glucose Levels In An Amerindian Population Undergoing Cultural Transition. Soc Sci Med 1987;24:791-804.

146.Schaefer O. Glycosuria And Diabetes Mellitus In Canadian Eskimos. Can Med Assoc J 1968;99:201-206.

147.Trott L., Barnes G., Dumoff R. Ethnicity and Other Demographic Characteristics as Predictors of Sudden Drug-related Deaths. J of Studies on Alcohol 1981;42:564-578.

148.Schaefer O., Timmermans J.F.W., Eaton .D.P., Mathews A.R. General And Nutritional Health In Two Eskimos Populations At Different Stages Of Acculturation. Can J Public Health 1980;71:397-404.

149.Bates C.E., Van Dam C.H. Low Incidence of Schizophrenia in British Columbia Coastal Indians. J Epidemiol Commun Health 1984;38:127-130.

150.Stratton R. Relationship Between Prevalence of Alcohol Problems and Socioeconomic Conditions Among Oklahoma Native Americans. Currents in Alcoholism 1981;8:315-325.

151.Julien G., Baxter J.D., Cargo M., et al. Chronic Otitis Media and Hearing Deficit Among Native Children in Kuujjuaraapik (Northern Quebec): a pilot project. Can J Public Health 1987;78:57-61.

152.Baxter J.D., Julien G., Tewfik T.L., Ilecki H.J., Crago M.B. Observations On The Prevalence Of Ear Disease In The Inuit And Cree Indian School Population Of Kuujjuaraapik. J Otolaryngol 1986;15:25-30.

153.Wilson A.L. The State Of South Dakota's Child--1987. This Paper Reviews Infant Mortality Rates In South Dakota Between 1975-1984. South Dakota J Med 1988;41:5-9.

154.Layne N. Potential Years Of Life Lost From Suicide Among Registered Indians In Canada, 1978 And 1983, With Special Reference To High Risk Age And Sex Groups. Chronic Dis Can 1986;7(2):28-29.

155.Ross C.A., Davis B. Suicide And Parasuicide In A Northern Canadian Native Community. Can J Psychiatry 1986;31:331-334.

APPENDICES

LIST OF APPENDICES

APPENDIX A

Review of Native Literature by Causes

This appendix is provided to assist the reader who is interested in a specific cause of mortality among natives. Ratios between native groups and comparison populations are provided to assist the reader in synthesizing the direction and magnitude of the associations.

Notes of Explanation

1. Findings: Unless otherwise stated the finding presented is a mortality rate.
2. Rate units are: mortality rates - per 100,000 persons per year
   PYLL rates - per 1000 persons per year
   infant mortality, neonatal mortality, postneonatal mortality, perinatal mortality rate
   - per 1000 live births
3. Hospital separations and patient days are presented as per 1000 persons
4. 95% Confidence intervals are presented when provided by the author
5. Author - indicates first author's name only. References are found in the reference section of the theses
6. Significance testing when provided by the author is indicated as * = $p < 0.05$, ** = $p < 0.01$.
7. If known, when associations are based on less than five cases this is indicated by a "+". In many circumstances actual numbers are not provided in the original articles.

Abbreviations:
SMR - Standardized Mortality Ratio
PMR - Proportional Mortality Ratio
PYLL - Potential Years of Life Lost
SPMR - Standardized PMR
SIR - Standardized Incidence Ratio
PIR - Proportional Incidence Ratio
RR - relative risk

Cause: All Cause Mortality ICD codes: 001-999

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [8]	MSB clients	Canada	78-81	1085.2	726.1	1.5	
			82-85	967.9	677.2	1.4	
				life expectancy			
			male	64.02	72.39		
			female	72.79	80.14		
			PYLL rate				
			78-81	207.0	67.1	3.1	
			82-85	157.2	56.5	2.8	
MSB [1]	MSB clients 1980-1984	Canada 1984	<1	3226	812	4.0	
			1-4	179	46	3.9	
			5-9	61	25	2.4	
			10-14	72	25	2.9	
			15-19	268	72	3.7	
			20-24	358	89	4.0	
			25-29	412	84	4.9	
			30-34	425	91	4.7	
			35-39	473	121	3.9	
			40-44	661	193	3.4	
			45-49	754	312	2.4	
			50-54	996	532	1.9	
			55-59	1579	862	1.8	
			60-64	1957	1368	1.4	
			65-69	2893	2129	1.4	
			70-74	4100	3261	1.3	
			75-79	5672	5109	1.1	
			80+	9874	11064	0.9	
			hospital separation	209.8	148.6	1.4	
			days	1352.9	1161.9	1.2	
Mao [5]	on reserve population 1977-1982	all Canada	Canada 1971				
			males				
			SMR			1.65**	
			all ages	407.7			
			1-9	118.4	49.8	2.4	
			10-19	218.1	92.5	2.4	
			20-29	438.7	158.0	2.8	
			30-39	517.1	163.9	3.2	
			40-49	716.4	391.1	1.8	
			50-59	1131.4	1054	1.1	
			60-69	2507	2545	1.0	
			70+	5884	7944	0.7	
			females				
			SMR			1.93**	
			all ages	200.7			
			1-9	91.3	37.2	2.5	
			10-19	85.1	37.1	2.3	
			20-29	184.2	52.1	3.5	
			30-39	276.2	84.2	3.3	
			40-49	424.8	215.7	2.0	
			50-59	854.4	535.3	1.6	
			60-69	1578.8	1246	1.3	
			70+	4229	5449	0.8	

Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	809 506	802 455	1.0 1.1	
Layne [125]	"registered Indians 1978 and 1983"	Canada	PYLL rates 1978 1983	 222.2 156.2	 86.7 70.5	 2.6 2.2	
Hislop [20]	B.C. native deaths 1953-1978	non native B.C.	1971 Canada male all age 0-19 20-65 65+ female all age 0-19 20-65 65+	 1293.9 683.8 1068.7 6314.0 1187.8 485.0 933.0 5716.6	 876.4** 180.9** 573.4** 6935.8** 586.2** 118.6** 285.6** 4371.1**	 1.5 3.8 1.9 0.9 2.0 4.1 3.3 1.3	
Millar [124]	Alberta natives MSB clients	Alberta 75-77	life expect male female	 57.8 60.3	 71.1 77.9		
Millar [136]	Canadian natives 1965-1968		life expect male female	 60.5 65.6			
Young [17]	Sioux Lookout Region 1972-1981	Canada 1975 and 1978	0-4 5-14 15-24 25-44 45-64 65+ crude standard	1066 63 399 548 1098 5110 640 1150	296 37 106 144 856 5091 716	3.6 1.7 3.8 3.8 1.3 1.0 1.6	
Rhoades [24]	U.S. IHS clients	U.S. whites	life expectancy 1970 1980 81-83 all cause PYLL rate	 65.1 71.1 695.1 113.9	 71.7 74.4 60.0	 1.9	
Rhoades [74]	U.S. I.H.S. clients 83-85	none		474.0			crude rate
Kenen [7]	On reserve natives determined by counties with majority of a reservation	Off reserve natives determined by counties lacking majority of a reservation	1980 U.S. male 0-4 5-14 15-64 65+ female 0-4 5-14 15-64 65+	on-reserve off-rese 1978 data only 77.8 10.2 125.7 651.0 58.0 5.8 50.1 455.4	 64.5* 6.1* 82.9* 546.0* 42.3* 3.7 42.8* 377.4*		life expectancy 1978 male 67.1 female 75.1
Sievers [26]	U.S. DHEW 1975	U.S. all races 1975		824.8	638.3	1.3	

Carr [137]	IHS clients and Navajos 1973	U.S. white	life expectancy	58.8	68.9		
			males	71.8	76.6		
			female	64.9	72.7		
			total IHS	65.1			
Gillum [30]	all U.S. natives	crude rates only	crude	1969-71	79-1981		crude rates
			male	848	588		
			female	535	366		
			total	689	475		
Samet [57]	New Mexico 1969-1977 both sexes	non-Hispanic whites 1969-1977 and all U.S. 1973	1970 U.S. pop				
			males	1513.6	1169.9	1.3	
			females	844.6	706.7	1.2	
Broudy [27]	Navajos 1978	U.S. 1977	male				824 cases.
			0-14	240	150	1.6	
			15-24	640	166	3.9	
			25-34	1150	189	6.1	
			25-44	1250	330	3.8	
			45-54	1220	833	1.5	
			55-64	1490	2000	0.7	
			65+	4220	6675	0.6	
			female	1180			
			0-14	180	115	1.6	
			15-24	210	59	3.6	
			25-34	390	82	4.8	
			25-44	460	181	2.5	
			45-54	630	448	1.4	
			55-64	650	1006	0.6	
			65+	4170	4570	0.9	
Mahoney [13]	Seneca Indians 1955-1984	New York state 1955-1984	adjusted	SMR			
			males			1.24 (1.14-1.35)	
			females			1.06 (0.99-1.17)	

Cause: Infective and Parasitic Diseases ICD codes: 001-139

Author	Population studied	Comparison population	Groups	native	Findings comparison		ratio	comments
MSB [8]	MSB clients	Canada same period	1978-1981	20.97	3.50		6.0	
			1982-1985	15.43	3.90		4.0	
MSB [1]	B.C. MSB clients	B.C. non-natives	hospital	per 1000 population				
			separations	7.2	2.4		3.0	
			patient days	55.0	16.3		3.4	
Mao [5]	on reserve mortality ages under 70	Canadian population in same provinces	males			SMR	2.88**	
			females				4.44**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male	11	4		2.8	
			female	12	3		4.0	
Morrison [6]	infants on reserves 1976-1983	non-reserve regional population	neonatal			SMR	2.54	
			postneonatal			SMR	11.79**	

Young [17]	Sioux Lookout Zone	Canada	chapter intestinal Tuberculosis chapter		SMR PMR	4.5** 9.5** 7.7** 2.4	
Young [22]	Manitoba natives 81-82 Hospitalizations	Manitoba non-natives	Morbidity Ratios		chapter intestinal tuberculosis	4.3 5.0 23.8	hospital separation
Rhoades [24]	U.S. Indian Health Service	all races 1982	1981-1983 PYLL rate to age 65	13.6/100,000 2.0	0.8	2.5	"SMR>2".Tb incidence 2-7 times whites
Mahoney [13]	Seneca Natives	New York state	SMR (95% CI) male female male female	Chapter causes Tuberculosis 		3.57 (1.84-6.23) 3.91 (1.88-7.19) 4.44 (1.63-9.67) 5.08 (1.05-1,485)+	
Michalek [31]	Seneca Natives in New York state 1955-1984	New York State excepting New York City 1960, 1970, 1980	SPMR males females males females	infectious diseases tuberculosis 		2.82 (1.53-4.91) 2.05 (0.82-4.23) 3.20 (1.03-7.48) 2.20 (0.27-7.90)+	
Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males females males females	all infections tuberculosis 		0.79 (0.26-1.85) 0.96 (0.31-2.24) 5.74 (1.18-16.78)+ 0 (0-12.98)+	
MSB [1]	MSB clients	Tuberculosis	incident cases 1976-1979 1980-1983 by age 1983 0-4 5-14 15-24 25-34 35-44 45-54 55-64 65+	per 100,000 144.2 97.3 36.3 84.0 86.0 85.2 124.0 220.9 224.6 283.3	12.9 10.4 3.8 3.1 5.4 8.0 8.4 12.6 16.2 25.1	11.2 9.4 9.6 27.1 15.9 10.6 14.8 17.5 13.9 11.3	13% of all cases in Canada for the year 1983
Enarson [138]	Tb notifications using Census data for denominators	for natives, inuits, and whites	Tb incidence per 100,000	109 Inuit 168	7	15.6	
Grzybowski [139]	Saskatchewan natives 1881-1886		TB mortality 1881 1886 incidence 1970's	 1000/100,000 9000/100,000 1-3/1000/yr			

Young [46]	Sioux Lookout 1971-1984	Canada	Tb incidence 1981 SIR 1975-79 SIR 1980-85	60	18	3.3 15 9	
Young [43]	Sioux Lookout Zone	none	Tb incidence 0-14 age group	136/100,000			
Rhoades [21]	U.S. Indian Health Service		Tuberculosis 1954-1956 1981-1983	mortality 55.1 2.3			
Sievers [26]	U.S. DHEW 1975	U.S. all races 1975	Tuberculosis mortality	9.9	1.2	8.3	
Broudy [27]	Navajo 1975-1977	U.S. General	Tb mortality	12.1	1.1 all U.S. natives 9.9	11.0	
Samet [57]	New Mexico natives 1969-1977	New Mexico non-Hispanic whites	Tb mortality males females	24.4 15.5	2.8 0.7	8.7 1.8	ICD codes 010-019
Minuk [16]	Chesterfield Inlet		Hepatitis B prevalence <20 >40	22% positive 7% 64%			

Cause: Neoplasms ICD codes: 140-239

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	1978-81 1982-85 PYLL rates 1978-1981 1982-1985	118.0 120.5 10.4 8.5	168.0 171.1 12.2 11.9	0.7 0.7 0.8 0.7	
MSB [1]	MSB Clients 1976-1984	Canadian population	1980-1984 B.C. hospital separations patient days	125 4.0 40.5	172 10.3 117.6	0.7 0.4 0.3	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	103 90	189 118	0.6 0.8	
Layne [125]	Registered natives 1978 and 1983	Canadian population 1978 and 1983	PYLL rates males females	8.1 6.1	16.7 16.4	0.5 0.4	
Hildes [12]	Inuit diagnosed cancers 1950-1980		case series of 239 total cancers	noting decreases in nasopharyngeal cancers and increases in lung and cervix over the thirty year time period			
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	111.1 152.6	213.1 152.8	0.5 1.0	

Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	males females	83.3** 114.5	151.8 120.4		0.6 0.9	includes Gallagher [64] cases
Morgan [140]	Registered Natives in Alberta 1974-1978	Alberta general population 1975	males females			SIR	0.58 0.70	
Jarvis [101]	Alberta native case series in 1976	Alberta population 1976	PMR				0.35	
Young [22]	Manitoba natives 1981-1982	Manitoba non-natives	Hospital separations				0.7	
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	standard incidence ratios <25 25-34 35-44 45-54 55-64 >64			males 0.37* 0.38 0.37* 0.28* 0.26* 0.43*	females 0.58 0.71 0.62 0.30* 0.54* 0.55*	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR PMR				0.9 0.43	see Young [37]
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR Male Female				 0.67* 1.44	52 cases over 10 years
Robinson [141]	James Bay Cree 1975-1981	Quebec	SMR				0.72	
Rhoades [24]	Indian Health Services Clients 1981-1983	U.S. all races 1982	mortality rate PYLL rates to 65	92.9 4.9	 9.3		0.5	
Rhoades [74]	Indian Health Services Clients 1983-1985			64.2				crude rate
Gillum [30]	Indian Health Service Clients		crude rates males females total	1969-71 58 62 54	1979-81 52 55 48			
Sievers [26]	Indian U.S. DHEW reports 1975	All races 1975		79.8	130.9		0.6	

MMWR [65]	Surveillance, Epidemiology and End Results Program natives	White anglo races in same study	survival analysis	data on survival is provided for various sites. Almost three-quarters of these results are included in the paper by Samet [52] and a number in the paper by Norsted [142]				
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male female				0.4** 0.7**	
Broudy [27]	Navajo Indians 1975-1977	U.S. General population 1976		70.7 all U.S. natives 79.8	132.3		0.5	
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	survival analysis	data on survival at various sites indicating for most sites a decreased survival compared to whites, adjusting for stage at diagnosis and treatment.				
Stratton [77]	Oklahoma natives 1980	Oklahoma whites 1980	male female	150 100	260 170		0.6 0.6	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females				0.89 0.92	120 deaths
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SIR male female				0.98 0.91	141 deaths
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	SMR males females			0.78 (0.60-0.99) 0.73 (0.55-0.95)		
Norsted [142]	Seattle-Puget Sound cancer Registry natives 1974-1983	whites in the same registry	male female	151 196	358 350		2.4 1.8	
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males females			0.64 (0.51-0.79) 0.53 (0.42-0.66)		
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR males females			0.78 (0.60-0.99) 0.73 (0.55-0.95)		

Cause: Cancer of the Tongue, Mouth or Pharynx ICD codes: 141, 143-149

Author	Population studied	Comparison population	Groups	native	Findings comparison	ratio	comments
Hildes [12]	Inuit 1950-1980	Canada 1968-1972	nasopharyngeal males females		SMR	48.4 10.0	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	salivary nasopharynx		SIR male 9** 21**	female 20** 27**	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females			0.53+ 3.33+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR salivary gland nasopharynx other oral		male 0+ 9.1**+ 0.5+	female 7.1+ 14.3+ 1.0+	
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	males females		SIR 0.5* 0.1*	PIR 1.3 0.2	oral cavity
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males		0.71 (0.19-1.82)		
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR males females		1.67 (0.75-4.27) 1.00 (0.03-5.55)		

Cause: Cancer Esophagus ICD codes: 150

Author	Population studied	Comparison population	Groups	native	Findings comparison	ratio	comments
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	males	0.9*	3.3	0.3	
Hildes [12]	Inuit 1950-1980	comparison to Alberta population	males females		SMR	6 10	possibly PMR
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR male female			2.5* 5.0*+	

Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females				1.0+ 0+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female				0.9+ 0	

Cause: Cancer Stomach ICD codes: 151

Author	Population studied	Comparison population	Groups	Findings native	comparison		ratio	comments
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR males females				0.41* 0.58	
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR males females				0+ 0+	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	10.5* 13.8	21.3 8.9		0.5 1.6	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	males females	10.7* 10.2*	15.8 8.0		0.7 1.3	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites · 1974-1976	SMR total male female				1.03 0.89 1.13	4th ranked
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male female				1.8** 1.3	
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports				4.5	
Wiggins [53]	New Mexico natives 1958-1982	New Mexico non-Hispanic whites	1973-1977 males females 1978-1982 males females	17.5 4.1+ 16.1 9.4	5.9 3.8 6.2 3.8		2.9 1.1 2.6 2.5	
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	 males females			SIR 0.5 1.5	PIR 1.3 2.3	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females				0.38+ 4.17*	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female				0.6+ 0.8+	

Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state except city 1960,70,80.	SIR males females		0.35 (0.04-1.26) 0.81 (0.17-3.27)
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state except city 1960,70,80.	SMR males females		0.66 (0.14-1.93) 1.54 (0.50-3.60)

Cause: Cancer Large intestine and Rectum ICD codes: 153-154

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR males females			0.3+ 1.7+	ICD code 153 only
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR colon rectum		males 0.19** 0.51	females 0.35** 0	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	colon males females rectum males females	9.8* 8.8 8.0 5.2+	18.6 17.6 10.3 7.0	0.5 0.5 0.8 0.7	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	colon males females rectum males females	6.7** 10.3 5.1 2.0*	12.9 13.8 7.7 5.2	0.5 0.7 0.7 0.4	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR male female			0.9 1.0	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR colon male female rectum			0.43* 0.66 0.39 0.50*	2nd ranked
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male female		rectum 0.3** 0.4*	colon 0.1** 0.2**	
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports			0.46	

Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females		colon 1.56 1.11	rectum 1.67 1.90+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female			1.6 0.7	
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	males females		SIR 0.5** 0.8	PIR 1.1 1.3	"large intestine"
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males females	colon 0.64 (0.29-1.21) 0.43 (0.17-0.89)	rectum 1.06 (0.46-2.09) 0.62 (0.17-1.59)		
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR males females	colon 1.00 (0.46-1.90) 0.48 (0.16-1.12)	rectum 2.13 (0.86-4.39) 0.72 (0.09-2.60)		

Cause: Cancer Liver ICD codes: 155.0,155.1

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	0+ 2.0+	1.2	1.7	
Hildes [12]	Inuit 1950-1980	comparison to Canadian population 1968-1972	SMR			6+	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR total male female			1.15 1.01 1.38	10th ranked
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male female			1.3 1.4	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females			0+ 3.33+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female			2.7+ 0+	
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males			2.65 (0.55-7.75)	

Cause: Cancer Gall Bladder ICD codes: 156

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR males females			 0.74 3.07*+	
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR males females			 5.9+ 6.8*+	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	2.2+ 18.3**	2.6 3.5	0.8 0.5	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	males females	2.3 11.6**	1.8 2.8	1.3 4.1	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR female			 5.0**	
Hildes [12]	Inuit 1950-1980	external comparison to Alberta population	total	SMR 4 cases of male biliary tract cancer with 0 expected		2+	possibly PMR
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR total male female			 4.35* 4.44 4.32	7th ranked
Devor [68]	New Mexico natives 1957-1977	New Mexico Anglos	SIR male female			 4.9** 9.3**	
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports			17.5	
Boss [126]	Alaskan natives 1970-1979	U.S. whites 1969-1971	male female	4.4* 17.6**	1.1 2.1	4.0 8.4	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females	other biliary tract passages males 6.7 and females 10 *+		0+ 7.5*+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female			1.6+ 5.2*+	
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state except city 1960,70,80.	SIR males females			1.09 (0.03-6.06) 0.56 (0.01-3.11)	

Cause: Cancer Pancreas ICD codes: 157

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR males females			0.13** 1.08	
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR males females			0.5+ 1.6+	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	6.5 5.4+	13.3 8.6	0.5 0.6	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR total male female			0.81 0.71 0.98	5th ranked
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male female			0.3** 1.8	
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports			0.90	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females			0.8+ 0.8+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female			0.4+ 0.7+	
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	males females			SIR PIR 0.4 0.9 0.7 1.1	
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males females			1.32 (0.48-4.88) 0 (0-0.69)	
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR males females			113 (0.37-264) 0 (0-0.73)	

Cause: Cancer Digestive Tract ICD codes: 150-159

Author	Population studied	Comparison population	Groups	Findings native	Findings comparison	ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	SMR males females			0.53** 0.57**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	33 25	56 36	0.6 0.7	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females			1.14 1.83*	

Cause: Cancer Trachea/Bronchus/Lung ICD codes: 162-163, 164.2,.3,.8,.9, 165

Author	Population studied	Comparison population	Groups	Findings native	Findings comparison	ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	males females	17.7	35.3 10.3	0.50** 0.8	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	28 11	63 15	0.4 0.7	
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR males females			0.33** 0.72	
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR males females			0.3** 0.9	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	15.9** 7.5	59.5 10.5	0.3 0.7	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	males females	12.9** 3.8**	39.2 8.9	0.3 0.4	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR male female			2.0** 7.0**	

Hildes [12]	Inuit 1967-1980 over age 40	Canada 1968-1972 over age 40	SMR Western Artic males females Central Artic males females			1.9 8.5 2.6 20.7	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR total male female			0.43* 0.39 0.66	1st ranked
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male female			0.1** 0.4*	
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports			0.27	
Samet [54]	New Mexico natives 1958-1982	New Mexico non-Hispanic whites 1958-1982	males 1973-1977 1978-1982 females 1973-1977 1978-1982	7.7 10.8 2.3 4.2	56.6 62.9 17.9 19.9	0.1 0.2 0.1 0.2	ICD9 code 162 only
Samet [57]	New Mexico natives 1969-1977	New Mexico non-Hispanic whites 1969-1977	males mortality incidence females mortality incidence	8.6 10.5 4.7 5.0	60.8 75.9 17.2 20.8	0.1 0.1 0.3 0.2	
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	males females			SIR PIR 0.4** 0.8 0.3** 0.6	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females			0.53 1.0+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female			1.2 0.9+	
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males females			0.49 (0.27-0.82) 1.19 (0.60-2.08)	
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR males females			0.62 (0.35-1.02) 1.63 (0.84-2.84)	

Cause: Cancer Breast ICD codes: 174-175

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	SMR females			< 0.35**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	female	11	24	0.5	
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR females			0.44**	
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR			0.8+	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	females	21.8	33.5	0.7	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	females	14.0**	25.4	0.6	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR female			0.2**	
Hildes [12]	Inuit 1950-1980	external comparison to Alberta population	females	SMR		0.06	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR female			0.53*	3rd ranked
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR female			0.3**	
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports			0.45	
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	females		SIR 0.5**	PIR 1.0	

Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR		0.47*
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR female		1.0
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR females		0.33 (0.18-0.56)
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR		0.42 (0.17-0.87)

Cause: Cancer uterus including cervix ICD codes: 179-182

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	ASMR	10.7		3.95**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	female	11	3	3.7	
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR			cervix 1.34 body 0.48	
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR			0+	cervix only
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	cervix corpus	30.5** 2.5	6.8 4.2	4.5 0.6	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	cervix corpus	23.1** 3.4	5.6 3.5	4.1 1.0	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR cervix corpus chorio-carcinoma			 3.0** 0.1**+ 17**++	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR female			2.29*	6th ranked

Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR cervix corpus			1.5** 0.2**
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports	ratio cervix to body 11:1 in natives, 2.5:1 in whites	cervix 3.07 uterus 0.50	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR cervix corpus			0.47+ 0.23+
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR cervix corpus			1.5 0.2+
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	cervix corpus		SIR 1.6* 0.2**	PIR 3.0** 0.5**
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR cervix invasive in situ uterus			 1.37 (0.63-2.60) 0.54 (0.17-1.26) 0.72 (0.29-1.48)
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR cervix uterus			2.71 (1.17-5.33) 0.49 (0.10-1.43)

Cause: Cancer Ovary ICD codes: 183

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR			0.12**	
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR			1.3+	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	females	5.5*	12.1	0.5	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites		3.4	3.5	1.0	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR			0.3+	

Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR female			0.56*
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports			0.96
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR			0+
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR			0.3+
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry			SIR 0.3*	PIR 0.6
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR		0.27 (0.01-1.50)	
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR		0.39 (0.05-1.41)	

Cause: Cancer Prostate ICD codes: 185

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR			0.68*	
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR			0.9+	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males	10.6*	22.1	0.5	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites		9.0**	14.9	0.6	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR			0.1**+	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR male			0.57*	8th ranked

Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male			0.6**
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports			0.89
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR			0.95
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR			0.8
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	males		SIR 0.2**	PIR 0.5*
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting city for 1960,1970, 1980.	SIR		0.61 (0.31-1.09)	
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state except city for 1960,1970, 1980.	SMR		0.94 (0.38-1.94)	

Cause: Cancer Kidney ICD codes: 189.0,.1,.2

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR males females			1.17 2.86*	kidney and other GU
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR males females			6.9**+ 13.1**+	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	males females	4.3 2.4	3.7 1.9	1.2 1.3	
Hildes [12]	Inuit 1950-1980	external comparison to Alberta population	Proportional cancer incidence			3.5	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR total male female			1.54* 1.45 1.71	9th ranked

Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports		1.63
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females		 2.5 4.4*+
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female		 1.2+ 0+
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	 males females	SIR 0.9 0.7	PIR 1.9 1.3
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males females	 1.59 (0.51-3.71) 1.01 (0.12-3.64)	
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR males females	 0.53 (0.01-2.94) 0 (0-2.54)	

Cause: Cancer Bladder ICD codes: 188

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR males females			 0.28** 0.32	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	4.3+ 0+	7.6 4.4	0.6 0	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	males females	2.6* 0.4+	5.5 2.0	0.5 0.2	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR male			0.1**+	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR total			0.25*	
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male female			 0.1** 0.2**	

Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports		0.17
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females		 0.22+ 0.83+
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female		 0.0**+ 0+
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	 males females	SIR 0.3** 0.2	PIR 0.8 0.3
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males females	0.10 (0.01-0.55) 0 (0-0.88)	
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR males females	0.61 (0.07-2.20) 0 (0-2.17)	

Cause: Cancer Brain ICD codes: 191

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	2.6+ 3.1+	5.7 4.0	0.5 0.8	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	males females	2.0* 1.8*	5.0 3.6	0.4 0.5	nervous system tumors
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR total			0.52*	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females			 0+ 0.7+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female			 1.4+ 0+	
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	 males females		SIR 0.1*+ 0.8	PIR 0.3+ 1.6	nervous system cancers.

Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR females			1.05 (0.13-3.79)	

Cause: Lymphoid Tumors ICD codes: 200-203

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR males females			 0.33* 0.12**	ICD codes 200-202 only
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	12.9 0+	11.6 7.7	1.1 0	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	Hodgkin's males females non-Hodgkin's males females	 0.9+ 0.0+ 1.9* 4.3	 1.8 1.0 1.4+ 1.0	 0.5 0 1.4 4.3	
Sievers [26]	Indian U.S. DHEW reports 1974-1976	U.S. whites 1974-1976	SMR Hodgkin's total			0.28*	
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male female			 0.5* 0.1**	
Samet [52]	New Mexico natives registered in Cancer Registry	New Mexico non-Hispanic whites	Proportional cancer reports			1.0	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females			lymphoma myeloma .51+ 2.5+ .4+ 0+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female			lymphoma myeloma 0.3+ 0.4+ 1.1+ 0+	
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	 males females			SIR PIR 0.5 1.4 0.1** + 0.2 +	
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males females	lymphoma 0.32 (0.04-1.16) 0 (0-0.61)		myeloma 1.42(0.17-5.13)	

Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR males females	lymphoma 0.78 (0.16-2.28) 0.34 (0.01-1.89)	myeloma 0 (0-2.90) 0 (0-2.62)

Cause: Leukemia ICD codes: 204-206,207.0,.2,.8,208

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [38]	Manitoba natives 1970-1979 residents on reserves	Manitoba cancer registry 1970-1979	SIR males females			0.28* 0.85	
Young [37]	Sioux Lookout Zone 1972-1981	Canadian population 1976-1978	SMR males			4.0+	
Gallagher [64]	British Columbia natives 1964-1973	British Columbia whites 1964-1973	males females	2.6** 3.3	9.3 6.2	0.3 0.5	
Threlfall [63]	British Columbia natives 1953-1978	British Columbia whites	males females	3.5** 2.6	7.4 5.0	0.5 0.5	
Gaudette [11]	Inuit population 1970-1984	Canadian population 1970-1984	SIR male			1.1	
Devor [68]	New Mexico natives 1969-1976	Third U.S. National Cancer Survey 1969-1971	SIR male female			0.3** 1.1	
Lanier [66]	Alaskan Indians 1969-1973	U.S. Third National Cancer Survey	SIR males females			0.88+ 0.5+	
Lanier [67]	Alaskan Indians 1974-1978	U.S. Third National Cancer Survey	SMR male female			0.3+ 0.5+	
Norsted [142]	Natives in the Seattle Puget Sound Cancer Registry 1974-1983	Whites in the same registry	males females			SIR 0.9 1.1 PIR 1.7 2.1*	including myeloma
Mahoney [49]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SIR males females			0.45 (0.05-1.62) 0.81 (0.17-2.37)	
Mahoney [48]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1960,1970, 1980.	SMR males females			0.30 (0.01-1.67) 1.03 (0.21-3.01)	

Cause: Endocrine/Nutritional/Metabolic ICD codes: 240-279

Author	Population studied	Comparison population	Groups	Findings native	Findings comparison	ratio	comments
Young [17]	Sioux Lookout Project 1972-1981	all Canada 1975 and 1978	SMR PMR			0.6 0.3	
Young [22]	Manitoba hospital separations	non-native Manitobians	hospital separations ratio			3.9	
MSB [1]	B.C. MSB clients	B.C. non-natives	hospital separations patient days	per 1000 population 4.0 40.1	 2.6 28.0	 1.5 1.4	
Mahoney [50]	Seneca Indians in New York State 1955-1984	New York State excepting New York City. 1961, 1971, 1981	PYLL % males females	 14.8 8.8			includes blood disorders ICD codes 280-289

Cause: Diabetes ICD codes: 250

Author	Population studied	Comparison population	Groups	Findings native	Findings comparison	ratio	comments
Mao [5]	on reserve population under age 70	Canadian population in same provinces	males females			2.16** 4.12**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	24 23	12 10	2.0 2.3	
Gilles [143]	MSB on reserve population Saskatchewan	none		prevalence of 13.9/1000			
MSB Sask. office [144]	MSB in six Sask. communities only	none	1980 1985	prevalence	18.8/1000 44.3/1000		
Young [17]	Sioux Lookout Project 1972-1981	all Canada 1975 and 1978	SMR			0.2	
Young [38]	Sioux Lookout and Manitoba based on known cases		 all ages 0-14 15-24 25-44 45-64 65+	prevalence 27.5(24.8-30.2) 0.5 4.0 53.1 125.5 95.7			
Szathmary [145]	Dogrib natives of NWT		prevalence	10%			

Schaefer [146]	Inuit	none	prevalence	1 per 1000 (prevalence in whites approximately 10%)				urine screening with serum
Gohdes [28]	U.S. Indian Health Service	U.S.	ambulatory care visits	proportion				
			<25	2%				
			25-44	21%				
			45-64	51%				
			>65%	25%				
			discharges	proportion of all discharges				
			<15	0.37%	0.60%**		0.6	
			15-44	1.09	1.02		1.1	
			45-64	6.10	2.77**		2.2	
			>65	4.14	2.24**		1.8	
			death rates					
			1981 all age	20.9	9.8		2.1	
			25-34	2.6	1.4		1.9	
			35-44	5.7	3.5		1.6	
			45-54	26.7	9.6		2.8	
			55-64	83.0	25.6		3.2	
			65-74	132.0	61.9		2.1	
			75-84	189.2	127.7		1.5	
			85+	125.9	217.2		2.8	
Sievers [26]	U.S. DHEW 1975	U.S. 1975		23.8	11.6	SMR	2.1	
Gillum [30]	Indian Health Service 1969-71 and 1979-81	no comparison population	mortality	1969-71	1979-81			crude rates
			total	19	14			
			male	16	12			
			female	22	15			
				PMR				
			total	2	3			
			male	2	2			
			female	4	4			
Rhoades [24]	Indian Health Service		1981-1983 mortality	25.5				
			PYLL rate	1.1	0.6		1.8	
Rhoades [74]	Indian Health Service		1983-1985	15.9				
				10.1	11.1		0.9	
Broudy [27]	Navajo 1975-1977	U.S. whites and all natives		all natives 23.8				
Mahoney [13]	Seneca Indians	New York State	males				4.04 (2.61-5.96)	
			females				3.05 (1.99-4.47)	

Michalek [31]	Seneca Natives in New York state 1955-1984	New York State excepting New York City 1960, 1970, 1980	SPMR males females			3.37 (2.08-5.15) 3.00 (1.85-4.58)	
Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males females			2.56 (1.58-3.91) 3.20 (2.15-4.60)	
Stratton [77]	Oklahoma whites		male total	40	10	4.0	? small numbers
			30-40	10	0		
			40-50	20	10	2.0	
			50-60	90	10	9.0	
			60-70	150	20	7.5	
			70-80	140	60	2.3	
			81+	610	80	7.6	
			female total	20	10	2.0	
			30-40	0	0		
			40-50	50	10	5.0	
			50-60	40	10	4.0	
			60-70	150	30	5.0	
			70-80	30	70	0.4	
			81+	80	100	0.8	

Cause: Blood disorders ICD codes: 280-289

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Young [17]	Sioux Lookout 1972-1981	Canadian national 1975 and 1978	SMR PMR			0.9 0.3	

Cause: Mental Disorders ICD codes: 290-319

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB clients	none	Yukon	alcohol related visits 18.0	3.3	5.5	
			prevalence use of solvents in Manitoba high school students	ever / regular / social 20% / 3% / 3% 15% / 2% / 7%			
Young [17]	Sioux Lookout 1972-1981			no cases reported			
Young [39]	Sioux Lookout		self reported drinking on a survey	20.3% considered drinkers			

Trott [147]	medical examiner reports of native deaths in Manitoba 1976		males	72.9% definitely drug related, another 7.2% possible
			females	66.7% definite, 7.2% possible
				34% of sudden deaths alcohol related, 66% of accidents, 83& of suicides and 100% of the homicides.
Schaefer [148]	Inuvik Indians	case series		4 of 33 adults were noted to have cirrhosis while 16 had drinking problems
Remington [73]	One Northern Ontario Community	none		25% of the 5-15 years olds visiting the nursing station had a note regarding gas sniffing
Bates [149]	British Columbia natives	historical white population	Schizophrenia incidence prevalence	10 /100,000/yr 50-134
May [72]	review article			good information on usage and approaches to alcohol, marijuana

Cause: Alcohol related disorders — ICD codes: 291,303,305.0, +/- 860(Alcohol poisoning) +/- 571(Cirrhosis)

Author	Population studied	Comparison population	Groups	Findings native	comparison		ratio	comments
Jarvis [101]	Series of native deaths in Alberta 1976	Alberta 1976		42.2% of all deaths are related to the use of alcohol				not defined by ICD codes
Mao [5]	on reserve population under age 70	off reserve population	cirrhosis males	32.6	17.3	SMR	1.37*	separate definitions of alcohol related disorders
			females	25.0	6.5		3.8**	
			Alcoholic psychosis, alcoholism	males			3.97**	
				females			10.44**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male	13	4		3.3	
			female	7	1		7.0	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR				0.3	ICD 571
Mendenhall [75]	Patients with diagnosed alcohol liver injury			natives had significantly shorter survival from diagnosis				
Rhoades [24]	U.S. Indian Health service clients 1981-1983	U.S. all races	mortality rate	52.7				no ICD codes
			PYLL rate	7.4	1.5		4.9	

Rhoades [74]	Indian Health Services Clients 1983-1985	U.S. all races		21.8			"chronic liver disease and cirrhosis"
Rhoades [74]	IHS clients 1978-1985	U.S. all races	1978 1981 1985	54.5 35.8 26.1	8.1 7.0 6.2	6.7 5.1 4.2	291, 303, 305, 571.0
Sievers [26]	U.S. DHEW 1975	U.S. all races 1975		61.4	13.8	4.4	571 only
Broudy [27]	Navajo 1975-1977	U.S. general 1976	"alcoholism" cirrhosis	46.8 35.2 all U.S. natives 61.4	2.2 13.6	21.3 2.6	"Alcoholism"
Christian [25]	Oklahoma deaths with likelihood of native status	whites in Oklahoma	1968-1978 PMR crude rate	441		1.25	"alcoholism"
Stratton [150]	Oklahoma natives 1972-1975			tribe specific rates vary from 6 - 294 (Mean 53.5) but are not provided in terms of absolute numbers of deaths, or populations at risk.			
Stratton [77]	Oklahoma natives 1980	state whites 1980	male 30-40 40-50 50-60 60-70 70-80 80+ all ages female 30-40 40-50 50-60 60-70 70-80 80+ all ages	 60 40 40 150 150 0 40 40 20 40 40 70 0 20	 0 10 50 40 50 30 10 0 10 20 20 20 10 10	 4.0 0.9 1.3 1.0 0 4.0 2.0 2.0 2.0 3.5 0 2.0	? small numbers
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	males females			2.98 (1.91-4.43) 2.43 (1.22-4.35)	ICD 571
Michalek [31]	Seneca Natives in New York state 1955-1984	New York State excepting New York City 1960, 1970, 1980	SPMR males females			2.03 (1.25-3.11) 1.41 (0.65-2.67)	
Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males females			2.49 (1.70-3.52) 2.43 (1.39-3.94)	cirrhosis only

Cause: Nervous System/ Sense ICD codes: 320-389

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	British Columbia	Other B.C. 1983-1984	hospital separations	12.9	7.2	1.8	
			patient days	69.6	43.4	1.6	
Young [17]	Sioux Lookout 1972-1981	Canadian national 1975 and 1978	SMR			2.7*	
			PMR			2.0	
			meningitis SMR			12.1*	
Young [22]	Manitoba natives	Manitoba non-natives	hospital separations				
			all codes			2.7	
			meningitis			3.3	
Wotton [9]	Churchill Health Centre catchment		incidence	157/100,000 natives 202/100,000 Inuit 19/100,000 whites			case series with estimates of denominators
Evans [76]	Manitoba institution children			18% of children were natives versus only 6.8% of general population.			
Julien [151] and Baxter [152]	Kuujjuaraapik P.Q.	Cree and Inuit	prevalence of ear pathology	Cree	30%		
				Inuit	87%		

Cause: Circulatory ICD codes: 390-459

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	1978-81	313.8	344.3	0.9	
			1981-85	315.0	301.2	1.0	
			PYLL rates				
			1978-81	19.1	12.2		
			1982-85	16.3	10.1		
MSB [1]	MSB Clients 1976-1984	Canadian population	1976-1980	159	344	0.5	crude rates
			1980-1984	139	324	0.4	
				per 1000 population			
		British Columbia hospitals	separations	8.7	16.5	0.5	
			patient days	89.5	183.7	0.5	
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	males			1.02	
			females			1.52**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male	282	365	0.8	
			female	179	205	0.9	

Young [22]	Manitoba natives 1981-1982	Manitoba non-natives	hospital separations ratio			1.80	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR PMR			0.6** 0.29	
Layne [125]	Registered Natives 1978 and 1983	Canadian population 1978 and 1983	PYLL rates 1978 1983	 15.9 12.7	 19.5 16.4	 0.8 0.8	
Robinson [141]	James Bay Cree 1975-1981	Quebec	SMR			0.77	
Rhoades [24]	Indian Health Services Clients 1981-1983	U.S. all races 1982	mortality rate PYLL rates to 65	192.3 8.0	 10.0	 0.8	? ICD codes
Gillum [30]	Indian Health Service clients			1969-71	1979-81		crude rates
			total	184	133		
			males	222	155		
			females	148	111		
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	males females			0.84 (0.73-0.97) 0.79 (0.68-0.92)	
Michalek [31]	Seneca Natives in New York state 1955-1984	New York State excepting New York City 1960, 1970, 1980	SPMR males females			 0.87 (0.75-1.00) 0.99 (0.83-1.16)	
Stratton [77]	Oklahoma natives 1980	Oklahoma whites 1980	male				based on small numbers
			total adjusted	350	490	0.7	
			20-30	0	10	0	
			30-40	60	40	1.5	
			40-50	220	170	1.3	
			50-60	860	560	1.5	
			60-70	1010	1370	0.7	
			70-80	2030	3420	0.6	
			80+	3660	9360	0.4	
			female				
			total adjusted	200	320	0.6	
			20-30	10	10	1.0	
			30-40	40	10	4.0	
			40-50	20	60	0.3	
			50-60	210	160	1.3	
			60-70	460	580	0.8	
			70-80	1250	1890	0.7	
			80+	3380	7150	0.5	

Cause: Rheumatic Heart Disease ICD codes: 393-398

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB Clients 1976-1984		British Columbia	2.45 per 1000 population			case lists
			Saskatchewan	0.67 per 1000			
Becker [56]	New Mexico natives 1958-1982	New Mexico non-Hispanic whites	1973-1977				Chronic R.F. only small numbers
			males	10.0	4.5	2.2	
			females	8.5	4.0	2.1	
			1978-1982				
			males	1.4	3.0	0.5	
			females	4.7	3.2	1.5	

Cause: Ischemic Heart Disease ICD codes: 410-414

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	males	104.5	116.1 SMR	0.90	
			females	41.6	33.4	1.25**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male	179	239	0.7	
			female	92	113	0.8	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			0.7**	includes codes 393-398,410-414,422,427-428.
Jarvis [101]	Alberta natives series of 173 deaths	Alberta general population 1976	male		PMR	0.31	"heart attack or disease"
			females			0.16	
Broudy [27]	Navajo Indians 1975-1977	U.S. General population 1976		84.0	216.7	0.4	"Disease of the Heart"
				all U.S. natives 147.4			
Sievers [26]	Natives in reservation states	U.S. all races 1975		147.5	220.5	0.7	ICD codes 390-398,402,404-429.
Becker [55]	New Mexico natives 1958-1982	New Mexico non-Hispanic whites	1973-1977				
			males	98.4	282.5	0.3	
			females	39.4	127.4	0.3	
			1978-1982				
			males	76.6	231.4	0.3	
			females	28.3	109.8	0.3	
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	males			0.64 (0.50-0.81)	only code 410.
			females			0.73 (0.54-0.96)	

Mahoney [32]	New York natives 1980-1986	New York state except for New York City	males females		SPMR 0.91 (0.79-1.05) 0.97 (0.82-1.14)	ICD codes 390-398, 402, 404-429

Cause: Cerebrovascular Disease ICD codes: 430-438

Author	Population studied	Comparison population	Groups	Findings native	comparison		ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	ASMR males females	22.9 24.0	16.6 12.1	SMR	1.39** 2.06**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	49 46	58 47		0.8 1.0	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR				0.8	
Sievers [26]	Natives in reservation states	U.S. all race 1975		43.5	54.5		0.8	
Broudy [27]	Navajo Indians 1975-1977	U.S. General population 1976		28.9 all U.S. natives 43.5	51.4		0.6	
Gillum [30]	Indian Health Service clients		crude rates total males females	1969-71 41 42 40	1979-81 23 23 23			
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	males females				0.88 (0.59-1.27) 0.73 (0.50-1.03)	
Michalek [31]	Seneca Natives in New York state 1955-1984	New York State excepting New York City 1960, 1970, 1980	SPMR males females				0.95 (0.62-1.39) 0.81 (0.52-1.19)	
Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males females				1.40 (0.99-1.93) 1.15 (0.84-1.57)	

Cause: Hypertensive Disorders ICD codes: 401-404

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB Clients 1976-1984		British Columbia	prevalence 2.8 per 1000			case lists
			Saskatchewan	prevalence 4.6 per 1000			
McIntyre [40]	Sioux Lookout Region	none	community prevalence	prevalence 13.3%			community survey and case lists
Michalek [31]	Seneca Natives in New York state 1955-1984	New York State excepting New York City 1960, 1970, 1980	SPMR males			1.39 (0.56-2.86)	
			females			1.34 (0.58-2.64)	

Cause: Respiratory ICD codes: 460-519

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	1978-81	102.7	46.5	2.2	
			1981-85	90.6	49.9	1.8	
			PYLL rates				
			1978-1981	11.8	2.4	4.9	
			1982-1985	8.7	1.9	4.6	
MSB [1]	MSB Clients 1976-1984	Canadian population	1976-1980	60	47	1.3	crude rates. The SMR is 2.2
			1980-1984	52	49	1.1	
		British Columbia hospitals	separations	30.5	12.7	2.4	
			patient days	189.3	75.5	1.2	
Young [22]	Manitoba natives 1982	Manitoba non-natives	hospital separations ratio			3.0	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			4.0*	
			PMR unadjusted	2.1			
Robinson [141]	James Bay Cree 1975-1981	Quebec	SMR			2.6	
Layne [125]	Registered Indians 1978	Canada	PYLL rates				PYLL to age 75
			1978	15.2	3.5	4.3	
			1983	10.0	2.8	3.6	
Rhoades [24]	Indian Health Services Clients 1981-1983	U.S. all races 1982	mortality rate	42.2			"respiratory diseases"
			PYLL rates to 65	4.1	2.0	2.1	

Cause: Pneumonia and Influenza ICD codes: 480-486 487

Author	Population studied	Comparison population	Groups	native	Findings comparison	ratio	comments
Mao [3]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	SMR males females			2.92** 3.45**	excludes influenza
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	33 27	25 15	1.3 1.8	
Young [22]	Manitoba natives 1982	Manitoba non-natives	hospital separations ratio	6.7			
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			6.5*	
Rhoades [21]	Indian Health Services Clients 1981-1983		mortality rate	16.2			31% higher than U.S. average. PYLL rate is 3 times as great [24]
Rhoades [74]	Indian Health Services Clients 1983-1985	U.S. all races	mortality rate	16.1			
Sievers [26]	U.S. natives 1975	U.S. all races 1975		36.1	16.6	2.2	
Broudy [27]	Navajo Indians 1975-1977	U.S. General population 1976		56.1 all U.S. Indians 36.1	17.4	3.2	
Samet [57]	New Mexico natives 1969-1977	New Mexico non-Hispanic whites	males females	90.8 61.2	49.3 33.6	1.8 1.8	
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	SMR males females			1.41 (0.82-2.26) 1.90 (1.17-2.91)	excludes influenza
Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males females			1.95 (1.25-2.90) 1.53 (0.87-2.48)	

Cause: Chronic Obstructive Pulmonary Disease ICD codes: 490-493, 496

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB Clients patient lists 1985			prevalence			case lists
			Pacific	1.8/1000			
			Saskatchewan	2.4/1000			
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	SMR males			0.76	
			females			1.32	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male	23	30	0.8	
			female	10	7	1.4	
Sievers [26]	U.S. natives 1975	U.S. all races 1975		3.7	8.6	0.4	
Samet [57]	New Mexico natives 1969-1977	New Mexico non-Hispanic whites	males	10.9	62.6	0.2	ICD8 codes 491-493, 519.3
			females	4.6	14.4	0.3	
Samet [54]	New Mexico natives 1958-1982	New Mexico non-Hispanic whites	males				
			1973-1977	13.9	56.3	0.2	
			1978-1982	12.2	64.5	0.2	
			females				
			1973-1977	2.3	17.9	0.1	
			1978-1982	4.2	19.9	0.2	
Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males			1.25 (0.71-2.03)	
			females			0.70 (0.23-1.64)	

Cause: Digestive Disorders ICD codes: 520-579

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	1978-81	70.8	28.9	2.4	
			1981-85	49.2	26.1	1.9	
			PYLL rate				
			1978-1981	11.1	2.5	4.4	
			1982-1985	7.1	1.8	3.9	
MSB [1]	MSB Clients 1976-1984	Canadian population B.C hospitals	1976-1980	37	33	1.1	crude rates
			1981-1984	27	28	1.0	
			separations				
			patient days	23.8	15.9	1.5	
				152.3	113.3	1.3	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			0.5	
			PMR			0.26	
Layne [125]	Registered Indian Population 1978-1983	Canada 1978 and 1983	PYLL rate				"digestive disease"
			1978	6.2	3.5	1.8	
			1983	6.8	2.6	2.6	

Rhoades [21]	Indian Health Services Clients 1955-1983		mortality rate	39.2	2.9	13.5	"gastroint estinall diseases"
Rhoades [24]	Indian Health Services Clients 1981-1983	U.S. all races 1982	mortality rate PYLL rates to 65	24.2 2.6	2.2	1.2	

Cause: Gallbladder Disease ICD codes: 574-576

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Cohen [41]	Manitoba natives	Manitoba non-natives using hospital data	1981	cholecystectomy rate			
			male	1.2	1.2	1.0	
			female	5.5	2.8	2.0	
Williams [79]	Micmac female Natives in Nova Scotia		prevalence gallstones	211/1000			
			gall bladder disease	244/1000			
Rhoades [24]	Indian Health Services Clients 1981-1983	U.S. all races 1982		rates for gallstones 6 times the U.S. rate			
Sievers [26]	Pima Indians	Framingham Mass.	prevalence clinical disease %	Pima	Chippewa	Whites	
			30-39	17.7	4.4	1.3	
			40-49	21.9	12.0	3.7	
			50-62	23.5	16.1	6.9	
			Pima prevalence of cholelithiasis	males	females		
			15-24	0	12.7		
			25-34	4.4	73.2		
			35-44	11.1	70.8		
			45-54	31.9	75.8		
			55-64	66.3	62.0		
			65+	67.8	89.5		
			all ages	31.7	65.4		

Cause: Ulcers ICD codes: 531-534

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Sievers [26]	Phoenix Indian Medical Centre 1956-78	U.S. whites	morbidity	Standardized Morbidity Ratio			
			gastric ulcer			0.15	
			duodenal ulcer			0.02	
Rhoades [24]	Indian Hea Clients 1981-1983	U.S. all races 1982		ulcer rate slightly below U.S. rates			

Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	SMR males females			2.39 (0.96-4.93) 1.29 (0.16-4.66)	peptic ulcer only

Cause: Genitourinary ICD codes: 580-692

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB Clients 1983-1984	British Columbia	hospital separations patient days	10.2 63.0	12.3 71.7	0.8 0.9	
Young [80]	Manitoba natives	Manitoba non-natives	hospital separations	15.5	10.2	1.5	

Cause: Nephritis and Nephrosis/Kidney Diseases ICD codes: 580-583, 587/ 580-593

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	SMR males females			2.04* 4.34**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	9 10	8 5	1.1 2.0	
Young [80]	Natives on the Canadian National Renal Failure Registry. Denominators are based on registered natives.	All others	rate ratios total males 0-4 5-14 15-24 25-44 45-64 65+ all ages females 0-4 5-14 15-24 25-44 45-64 65+ all ages			2.50 (2.23-2.80) 1.90 (0.46-7.94) 3.31 (1.45-7.62) 3.46 (2.28-5.29) 2.52 (1.82-3.48) 4.04 (3.15-5.20) 3.32 (2.31-4.76) 2.15 (1.84-2.51) 1.87 (0.25-13.91) 4.41 (2.11-9.07) 2.76 (1.61-4.71) 4.02 (2.89-5.60) 6.34 (4.87-8.24) 5.26 (3.51-7.89) 3.03 (2.56-3.59)	ICD codes 580-589 A broader definition of population reduces these SIR by about 40%
		Manitoba hospitals	hospital separations	1.4	0.4	3.5	
Rhoades [24]	Indian Hea Clients 1981-1983	U.S. all races 1982	mortality rate PYLL rates to 65	11.7 0.8	0.3	2.7	"renal failure"

Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	SMR males females		1.47 (0.18-5.31) 5.13 (1.88-11.18)	chronic nephritis (582-583)
Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males females		1.41 (0.52-3.07) 1.93 (0.78-3.98)	

Cause: Complications of Pregnancy ICD codes: 630-676

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB Clients 1983-1984	British Columbia	hospital separations patient days	31.3 135.7	20.6 89.7	1.5 1.5	
Wittman [81]	British Columbia 1971-1986			The percentage of native maternal deaths in the province was greater than the "expected" with a proportion of 13-16%.			
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			10.8 +	
Rhoades [21]	Indian Health Services Clients 1955-1983		maternal mortality rate	1954-56 55.1	1981-83 2.3		
Rhoades [24]	Indian Health Services Clients 1981-1983	U.S. all races 1982	mortality rate	0.0 +			

Cause: Skin/Subcutaneous ICD codes: 680-709

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB Clients 1983-1984	British Columbia	hospital separations patient days	5.0 54.3	2.0 16.0	2.5 3.4	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			4.0 +	

Cause: Musculoskeletal ICD codes: 710-739

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB Clients 1983-1984	British Columbia	hospital separations patient days	8.6 81.2	9.1 70.3	0.9 1.2	

Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			0.9 +	

Cause: Congenital ICD codes: 740-759

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	PYLL rates 1978-81 1981-85	7.8 7.6	4.4 3.7	1.8 2.1	
MSB [1]	MSB Clients 1976-1984	Canadian population	1981-1983 1983-1985	3.3 2.9	Canada 1984 2.5	1.3 1.2	
Morrison [6]	On reserve infant deaths 1976-1983	All other Canadian infant deaths 1976-1983	SMR neonatal postneonatal			1.11 1.30	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR PMR			1.6 2.8	
Layne [125]	Registered Indians 1978 and 1983	Canadian general population	PYLL rates per 1000 population 1978 1983	11.1 10.1	4.7 3.7	2.4 2.7	
Rhoades [21]	Indian Health Service clients 1954-56 and 1981-83			1954-56 19.0	1981-83 6.8		
Vanlandingham [82]	6 states using the National Infant Morality Surveillance project 1980	whites in these states	per 1000 neonatal survivors	0.89	0.47	RR 1.9 (1.0-3.5)	

Cause: Perinatal ICD codes: 760-779

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB Clients 1976-1984	Canadian population	1981-1983 1983-1985	4.0 3.5	Canada 1984 2.3	1.7 1.5	ICD codes 764-765, 768-770
MSB [8]	MSB clients 1978-1986	Canadian Population	PYLL rates 1978-81 1981-85	12.9 9.8	5.2 4.0	2.5 2.5	
Morrison [6]	On reserve infant deaths 1976-1983	All other Canadian infant deaths 1976-1983	1979-1983 SMR			1.46**	perinatal conditions

Layne [125]	Registered Indians 1978 and 1983	Canadian general population	PYLL rates per 1000 population 1978 1983	15.2 8.3	5.7 4.0	2.7 2.1	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR PMR			1.6* 3.5	
Young [22]	Manitoba natives 1981-1982	Manitoba non-natives	hospital separations	morbidity ratio		1.9	
Rhoades [21]	Indian Health Service clients 1954-56 and 1981-83		per 100,000 population	1954-56 67.6	1981-83 9.7		? ICD codes used
Rhoades [74]	Indian Health Services Clients 1983-1985	U.S. all races		9.1			? ICD codes used

Cause: Infant Mortality

Author	Population studied	Comparison population	Groups	Findings native per 1000 live births	comparison	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	1978-81 1981-85	25.25 17.96	10.73 8.40	2.4 2.1	
MSB [1]	MSB Clients 1976-1984	Canadian population	1981-1985	18.8	8.6	2.2	
Millar [124]	Alberta registered natives	Provincial totals	1972 1973 1974 1975 1976	40.2 33.3 37.2 27.7 25.5	14.9 12.2 12.7 13.4 11.4	2.7 2.7 2.9 2.1 2.2	
Robinson [141]	James Bay Cree 1975-1981	Quebec	1981-83	22.2			
Rhoades [21]	Indian Health Service clients 1954-56 and 1981-83			1954-56 62.7	1981-83 11.0		
Vanlandingham [82]	6 states using the National Infant Morality Surveillance project 1980	whites in these states	IMR	15.3	8.7	1.8 (1.5-2.0)	
Honigfeld [83]	Indian Health Services	U.S. whites	1970 1981-83	24.6 11.0	20.0 11.6	1.2 0.9	
Rhoades [24]	Indian Health Services Clients 1981-1983	U.S. all races 1982	mortality rate PYLL rates to 65	12.6 21.2	11.6	1.8	

Broudy [27]	Navajo Indians 1975-1977	U.S. General population 1976	1965 1978	52 15.2			
Wilson [153]	South Dakota non-whites 1980-1984	South Dakota whites		22.3	8.8	2.5	Natives constitute 93% of non-whites

Cause: Perinatal Mortality Rate

Author	Population studied	Comparison population	Groups	Findings native per 1000	comparison live births	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	1978-81 1981-85	20.85 16.81	9.85 9.31	2.1 1.8	
MSB [1]	MSB Clients 1976-1984	Canadian population	1981 1982 1983 1984 1985	20.6 15.3 16.2 16.8 19.6	10.7 10.1 9.5 8.7 6.2	1.9 1.5 1.7 1.9 3.2	
Millar [124]	Alberta registered natives	Provincial totals	1972 1973 1974 1975 1976	23.1 19.1 26.2 22.6 24.3	18.6 14.7 14.0 13.3 13.8	1.2 1.3 1.9 1.6 1.8	

Cause: Neonatal Mortality Rate

Author	Population studied	Comparison population	Groups	Findings native per 1000	comparison live births	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	1978-81 1981-85	11.32 6.94	7.08 5.45	1.6 1.3	
MSB [1]	MSB Clients 1976-1984	Canadian population	1976-1980 1981-1985	12.3 7.7	7.9 5.6	1.6 1.4	
Morrison [6]	On reserve infant deaths 1976-1983	Five provinces infant deaths 1976-1983	SMR			1.38**	
Millar [124]	Alberta registered natives	Provincial totals	1969 1976	22.9 12.3	5.4 4.9	4.2 2.5	
Robinson [141]	James Bay Cree 1975-1981	Quebec	1981-83	5.9			
Rhoades [21]	Indian Health Service clients 1954-56 and 1981-83			1954-56 23.1	1981-83 5.0		
Honigfeld [83]	Indian Health Services	U.S. whites	1981-83	5.0	7.7	0.6	

Vanlandingham [82]	6 states using the National Infant Morality Surveillance project 1980	whites in these states	neonatal mortality rate adjusted for birthweights			1.1 (0.9-1.4)	
Broudy [27]	Navajo Indians 1975-1977	U.S. General population	1978	7.6	9.9	0.8	

Cause: Post neonatal mortality

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
				per 1000 live births			
MSB [8]	MSB clients 1978-1986	Canadian Population	1978-81 1981-85	13.93 11.02	3.65 2.95	3.8 3.7	
MSB [1]	MSB Clients 1976-1984	Canadian population	1976-1980 1981-1985	16.7 11.1	4.0 3.0	4.2 3.7	
Morrison [6]	On reserve infant deaths 1976-1983	Five provinces infant deaths 1976-1983	SMR			3.99**	
Millar [124]	Alberta registered natives	Provincial totals	1969 1976	22.9 12.3	5.4 4.9	4.2 2.5	
Robinson [141]	James Bay Cree 1975-1981	Quebec	1981-83	16.3			
Rhoades [21]	Indian Health Service clients 1954-56 and 1981-83			1954-56 39.7	1981-83 6.1		
Honigfeld [83]	Indian Health Services	U.S. whites	1981-83	6.1	3.6	1.7	
Broudy [27]	Navajo Indians 1975-1977	U.S. General population	1978	10.46	4.2	2.5	
Vanlandingham [82]	6 states using the National Infant Morality Surveillance project 1980	whites in these states	postneonatal mortality adjusted for birthweight			3.0 (2.4-3.6)	

Cause: Accidents/Poisoning/Violence ICD codes: E800-999

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	1978-81 1982-85	278.1 218.2	64.3 55.0	4.3 4.0	
			PYLL rates 1978-1981 1982-1985	101.2 70.6	21.2 16.9	4.8 4.2	

MSB [1]	MSB Clients 1976-1984	Canadian population	1980-1984	235	60		3.9
			B.C. hospital separations	30.5	15.6		2.0
			patient days	188.3	121.1		1.6
			1980-1984				
			<1	178	25		7.1
			1-4	100	19		5.3
			5-9	42	13		3.2
			10-14	60	14		4.3
			15-19	241	60		4.1
			20-24	305	68		4.5
			25-29	305	57		5.4
			30-34	279	51		5.5
			35-39	268	47		5.7
			40-44	315	52		6.1
			45-49	274	54		5.1
			50-54	249	63		4.0
			55-59	299	62		4.8
			60-64	228	64		3.6
			65-69	307	65		4.7
			70-74	248	79		3.1
			75-79	344	127		2.7
			80+	325	308		1.1
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	males			SMR	3.17**
			females				3.74**
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male	202	82		2.5
			female	69	30		2.3
Hislop [20]	British Columbia registered natives 1953-1978	British Columbia non-natives 1953-1978	male				
			all age	365.3	98.1		3.7
			0-19	194.0	56.4		3.4
			20-65	454.0	117.2		3.9
			65+	671.3	190.7		3.5
			female				
			all age	188.5	36.6		5.2
			0-19	110.0	23.7		4.6
			20-65	211.2	30.7		6.9
			65+	393.8	127.1		3.1
Young [22]	Manitoba natives 1981	Manitoba non-natives 1981	hospital separations ratio				3.3
MacWilliam [35]	on reserve children ages 1-14 1977-1982	Canadian children 1-14 1977-1982	all reserves	66.5	20.5		3.2
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR				4.5**
			PMR				3.9
Robinson [141]	James Bay Cree 1975-1981	Quebec	SMR				2.0 "injuries"
Jarvis [101]	Prospective series of Alberta native deaths 1976	Alberta general population 1976	male				PMR 3.6
			female				3.9
Layne [125]	Registered Natives 1978 and 1983	Canadian General Population	PYLL rates 1978	116.0	24.3		4.8
			1983	74.2	18.8		3.9

Rhoades [21]	Indian Health Service clients 1954-56 and 1981-83			1954-56 155.6	1981-83 84.4		
Rhoades [24]	Indian Health Services Clients 1981-1983	U.S. all races 1982	mortality rate PYLL rates to 65	116.5 37.5	11.9	3.2	
Rhoades [74]	Indian Health Service Clients 1983-1985			75.9			crude
Gillum [30]	Indian Health Services Clients 1969-1981		 males females	1969-71 271 92	1979-1981 183 59		crude rate
Sievers [26]	U.S. DHEW 1975	U.S. General population 1975		170.5	44.8	3.8	
Honigfeld [83]	Indian Health Services Clients 1981-1983	U.S. all race 1982	<1 year of age	78.5	39.4	2.0	
Broudy [27]	Navajo Indians 1975-1977	U.S. General population 1976		236.2 all U.S. natives 170.5	43.2	5.5	unintentional injuries
Kenen [7]	Counties with Indian Reservations 1978	Counties without Indian Reservations	1978 male	reserve	non-reserve		
			0-4	164	152	1.1	
			5-14	49	34	1.4	
			15-64	372*	223	1.7	
			65+	911*	383	2.4	
			female				
			0-4	139	122	1.1	
			5-14	32*	12	2.7	
			15-64	124*	83	1.5	
			65+	380	240	1.6	
Sewell [58]	New Mexico natives 1958-1982	New Mexico non-Hispanic whites 1958-1982	males	1978-1982			
			all ages	350	125	2.8	
			15-19	373.7	155.2	2.4	
			20-24	662.1	220.0	3.0	
			25-29	538.3	184.5	2.9	
			30-34	381.0	143.2	2.7	
			35-39	470.2	154.1	3.1	
			40-44	531.3	119.9	4.4	
			females				
			all ages	98	45	2.2	
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	males females			SMR 4.00(3.25-4.87) 2.65(1.78-3.81)	excludes suicide and homicide (E950-969)
Michalek [31]	Seneca Indian in New York 1955-1984	New York state excepting New York City: 1960, 1970, 1980	males females			SPMR 1.41 (1.11-1.75) 1.89 (1.29-2.67)	

Mahoney [32]	New York natives 1980-1986	New York state except for New York City	males females		SPMR 1.21 (0.94-1.54) 0.94 (0.58-1.44)

Cause: Motor Vehicle Traffic Accidents ICD codes: 810-819

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Mao [3]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	ASMR males females	68.3** 29.6**	29.9 10.9	2.3 2.7	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	44 15	28 10	1.6 1.5	
MSB [1]	MSB Clients 1976-1984		crude rate	56			
MacWilliam [35]	on reserve children ages 1-14 1977-1982	Canadian children 1-14 1977-1982	all reserves	14.0	8.8	1.6	
Hislop [20]	British Columbia registered natives 1953-1978	British Columbia non-natives 1953-1978	male female	107.3 62.3	39.4 14.9	2.7 4.2	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			0.97	
Jarvis [101]	Case series of Alberta natives 1976	Alberta general population 1976	male female			PMR 1.9 2.6	
Rhoades [74]	Indian Health Services Clients 1983-1985	U.S. all races		41.3			crude rate
Broudy [27]	Navajo Indians 1975-1977	U.S. General population 1976		152.5 all U.S. natives 94.1	21.5	7.1	
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	SMR males females			4.06(3.03-5.31) 2.43(1.22-4.35)	
Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males females			1.27 (0.91-1.72) 1.11 (0.62-1.83)	
Michalek [31]	Seneca Indian in New York 1955-1984	New York state excepting New York City: 1960, 1970, 1980	SPMR males females			1.31 (0.95-1.76) 1.64 (1.00-2.66)	

Stratton [77]						tribe specific rates vary from 57-355 (Mean 124) but no populations or numbers of deaths are provided.	

Cause: Accidental Poisoning ICD codes: 850-869

Author	Population studied	Comparison population	Groups	Findings native	Findings comparison	ratio	comments
MSB [1]	MSB Clients 1976-1984		crude rate	11			
Hislop [20]	British Columbia registered natives 1953-1978	British Columbia non-natives 1953-1978	male female	21.1 19.9	8.8 4.5	2.4 4.4	

Cause: Falls ICD codes: 880-888

Author	Population studied	Comparison population	Groups	Findings native	Findings comparison	ratio	comments
Mao [3]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	SMR males females			2.36** 2.28	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	9 2	7 5	1.2 0.4	
MSB [1]	MSB Clients 1976-1984		crude rate	7			
MacWilliam [35]	on reserve children ages 1-14 1977-1982	Canadian children 1-14 1977-1982	all reserves	1.0	0.4	2.5	
Hislop [20]	British Columbia registered natives 1953-1978	British Columbia non-natives 1953-1978	male female	21.9 19.7	10.9 8.6	2.0 2.3	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			1.0	

Cause: Fires ICD codes: 890-899

Author	Population studied	Comparison population	Groups	Findings native	Findings comparison	ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	males females	18.5 12.6		SMR 5.87** 6.85**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	12 7	3 2	4.0 3.5	
MSB [1]	MSB Clients 1976-1984		crude rate	18			
MacWilliam [35]	on reserve children ages 1-14 1977-1982	Canadian children 1-14 1977-1982	all reserves	15.2	2.5	6.1	
Hislop [20]	British Columbia registered natives 1953-1978	British Columbia non-natives 1953-1978	male female	40.5 28.1	4.3 2.4	9.4 11.7	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			10.8**	
Jarvis [101]	Series of Alberta native deaths 1976	Alberta general population 1976	male female			PMR 27.2 28.6	

Cause: Drownings ICD codes: 910

Author	Population studied	Comparison population	Groups	Findings native	Findings comparison	ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	SMR males females	ASMR 26.1		5.56** 2.44**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	21 5	4 1	5.3 5.0	
MSB [1]	MSB Clients 1976-1984		crude rate	21			
MacWilliam [35]	on reserve children ages 1-14 1977-1982	Canadian children 1-14 1977-1982	all reserves Nova Scotia Quebec Ontario Manitoba Saskatch Alberta	13.5 10.6 17.6 11.5 21.8 6.4 12.0	3.0	4.4	

Hislop [20]	British Columbia registered natives 1953-1978	British Columbia non-natives 1953-1978	male female	48.6 12.4	8.1 1.6		6.0 7.8
Robinson [141]	James Bay Cree 1975-1981	Quebec	SMR				10.0
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR				6.5**

Cause: Suicide ICD codes: 950-959

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratios	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	1982-1985	male	female	ratios	
				nat whi	nat whit	male female	
			0-09	0 0	0 0		
			10-14	5.5 2.1	4.3 0.4	2.6 10.8	
			15-19	121.9 20.9	26.8 3.4	5.8 7.9	
			20-24	179.9 32.3	25.7 5.2	5.6 4.9	
			25-29	107.8 30.6	21.3 7.1	3.5 3.0	
			30-34	76.0 28.0	18.8 7.9	2.7 2.4	
			35-39	44.5 24.3	17.9 9.0	1.8 2.0	
			40-44	26.2 27.0	18.7 10.3	1.0 1.8	
			45-49	21.4 27.6	23.1 11.0	0.8 2.1	
			50-54	25.7 30.2	21.4 10.6	0.9 2.0	
			55-59	16.4 31.2	17.4 11.0	0.5 1.6	
			60-64	21.2 27.6	0 9.4	0.8 0	
			65-69	13.5 26.5	14.6 9.5	0.5 1.5	
			70-74	16.5 31.3	0 7.7	0.5 0	
			75-79	23.8 30.0	0 6.3	0.7 0	
			80+	0 33.2	0 4.7	0 0	
MSB [1]	MSB Clients 1976-1984	Canadian population	1976	31.1	12.8	2.4	
			1977	46.6	14.4	3.2	
			1978	50.5	14.8	3.4	
			1979	33.9	14.2	2.4	
			1980	39.5	14.0	2.8	
			1981	42.9	14.0	3.1	
			1982	39.6	14.3	2.8	
			1983	33.8	14.7	2.3	
			1984	34.9	13.7	2.5	
			1985	32.0	12.6	2.5	
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	males females	53.0** 17.0**	19.9 6.4	2.7 2.7	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	38 7	20 6	1.9 1.2	

Layne [154]	Registered Canadian natives 1978 and 1983	Canadian population	1978 male female 1983 male female			PYLL rate ratio 3.8 5.5 2.9 2.3	
Jarvis [101]	Series of Alberta natives deaths 1976	Alberta general population 1976	male female			PMR 3.5 5.1	
Hislop [20]	British Columbia registered natives 1953-1978	British Columbia non-natives 1953-1978	male all age 0-19 20-65 65+ female all age 0-19 20-65 65+	39.4 19.5 56.3 27.0 13.1 7.2 19.7 0	20.7 31.2 40.1 40.1 8.0 1.0 12.7 11.0	 1.9 0.7 1.4 1.9 1.6 7.2 1.6 0	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			1.8*	
Robinson [141]	James Bay Cree 1975-1981	Quebec	both sexes	6.85			
Ross [155]	Norway House Manitoba case series treaty natives	2 non treaty native suicides	male female	142 24 +			? denominator determination
Rhoades [74]	Indian Health Services Clients 1983-1985	U.S. all races		13.7			crude rate
Sievers [26]	U.S. DHEW 1975	U.S. General population 1975		26.0	12.6	2.1	
Broudy [27]	Navajo Indians 1975-1977	U.S. General population 1976		28.5 all U.S. natives	12.3	2.3 26.0	
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	SMR males females			 1.79 (0.92-3.12) 1.98 (0.64-4.63)	
Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males females			 0.71 (0.38-1.21) 1.53 (0.61-3.15)	

Cause: Homicide ICD codes: 960-969

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
Mao [5]	on reserve populations 1977-1982 under age 70	off reserve population in provinces with reserves	SMR males females	 24.1 8.5		 7.84** 5.76**	
Beauvais [36]	On-reserve deaths Manitoba, Ontario, Quebec	provincial aggregates	male female	19 7	3 2	6.3 3.5	
Hislop [20]	British Columbia registered natives 1953-1978	British Columbia non-natives 1953-1978	male all age 0-19 20-65 65+ female all age 0-19 20-65 65+	 31.5 14.4 44.7 30.5 17.6 4.6 28.6 9.3	 3.0 1.2 4.4 2.8 1.8 1.2 2.3 1.3	 10.5 12 10.1 10.9 9.8 3.8 12.5 7.2	
Jarvis [101]	Case series of Alberta natives 1976	Alberta general population 1976	male female			PMR 8.2 2.8	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR			9.4**	
Rhoades [24]	Indian Health Services Clients 1981-1983	U.S. all races 1982	mortality rate PYLL rates to 65	43.1 15.3	 6.6	 2.3	
Rhoades [74]	Indian Health Services Clients 1983-1985	U.S. all races		13.7			crude rate
Sievers [26]	U.S. DHEW 1975	U.S. General population 1975		26.5	2.5	10.5	
Broudy [27]	Navajo Indians 1975-1977	U.S. General population 1976		21.9 all U.S. natives 26.5	9.5	2.3	
Mahoney [13]	Seneca Indians in New York state 1955-1984	New York state excepting New York city for 1961,1971, 1981.	SMR males females			 1.89 (0.51-4.83) 6.25(2.02-14.60)	
Stratton [77]	Oklahoma natives 1972-1975			tribe specific rates vary from 4.4-31.2 (Mean 12.7)			

Mahoney [32]	New York natives 1980-1986	New York state except for New York City	SPMR males females			0.88 (0.32-1.92) 1.69 (0.55-3.95)

Cause: Symptoms Ill-defined ICD codes: 780-799

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [8]	MSB clients 1978-1986	Canadian Population	PYLL rates 1978-81 1981-85	 9.3 10.3	 2.1 2.4	 4.4 4.3	
Young [17]	Sioux Lookout MSB clients 1972-1981	Canada 1975-1978	SMR PMR			6.8* 6.1	
Layne [125]	Registered Indians 1978 and 1983	Canadian general population	PYLL rates per 1000 population 1978 1983	 11.0 10.0	 2.6 2.3	 4.2 4.4	
Samet [54]	New Mexico natives 1958-1982	New Mexico non-Hispanic whites	males 1973-1977 1978-1982 females 1973-1977 1978-1982	 139.4 115.6 80.4 81.7	 49.1 49.2 23.9 27.9	 2.8 2.3 3.4 2.9	
Samet [57]	New Mexico natives 1969-1977	New Mexico non-Hispanic whites		134.6	56.1	2.4	
Gillum [30]	Indian Health Services 1969-1981	crude rates only and no comparison population developed	 total males female	1969-71 31 38 24	1979-81 22 28 18		

Cause: SIDS ICD codes: 798

Author	Population studied	Comparison population	Groups	Findings native	comparison	ratio	comments
MSB [1]	MSB Clients 1976-1984	Canadian population	1981-1983 1983-1985	3.7 3.5	Canada 1984 1.1	3.4 3.2	
Morrison [6]	On reserve infant deaths 1976-1983	All other Canadian infant deaths 1976-1983	SMR	neonatal period postneonatal period		3.52** 3.61**	
Vanlandingham [82]	6 states with high proportion of natives	whites in these six states	postneonatal mortality risk per 1000 neonatal survivors	2.33	0.66	3.5 (2.4-5.2)	
Kaplan [127]	Oklahoma natives 1975-1981	Oklahoma whites	mortality per 1000 live births	2.32	1.80	1.29*	rates 6.6 in NC 5.9 in Cal

Adams [128]	Alaska natives	Alaska whites	mortality per 1000 live births	6.3	2.1		3.0

APPENDIX B

Validity of Death Certificate Studies

	Swedish[94] detection	n=1,156 confirm	3rd Cancer[95] detection	n=48,826 confirm	Spanish[97] detection	n=1,176 confirm
Infectious					28.6	33.3
Neoplastic	98.2	99.5			89.9	95.3
oral cavity			78.6	92.5		
esophagus			93.2	86.1		
stomach	95.1	97.5	89.2	90.9		
colon and rectum	100.0	100.0	92.9	95.0		
liver	100.0	100.0	49.6	76.7	53.8	37.9
gall bladder			80.2	86.5		
pancreas	100.0	96.2	90.2	89.0		
nose/sinus			57.0	74.6		
trachea/lung/bronchus	100.0	97.7	95.0	93.9	84.6	91.7
breast	98.2	100.0	95.0	98.1	88.0	95.7
uterus	100.0	95.7				
cervix			79.0	90.4		
corpus			81.5	71.5		
ovary	90.5	100.0	88.3	88.2		
prostate	100.0	100.0	94.7	96.3		
kidney			87.9	93.0		
bladder	100.0	100.0	91.1	93.6		
brain	100.0	100.0	83.2[2]	87.4[2]		
lymphoid			83.2[2]	88.4[2]		
leukaemia	81.3	100.0	96.1	96.7		
Endocrine/nutritional					58.8	68.8
diabetic	60.0	81.8				
Blood Disorders					100.0	25.0
Mental Disorders	59.1	100.0			66.7	28.6
Alcoholism	81.0	94.4				
Nervous System	59.1	100.0			75.0	46.2
Circulatory	97.8	94.3			87.5	80.5
rheumatic heart disease	85.3	96.7				
hypertensive disorders	100.0	83.3				
ischemic heart disease	93.9	92.2				
cerebrovascular	96.0	97.0				
Respiratory					55.3	60.3
Pneumonia	66.7	33.3				
COPD	100.0	100.0				
Digestive					73.7	87.5
ulcers (531-533)[3]	87.5	87.5				
Gallbladder (574-575)[3]	80.0	80.0				
Genitourinary	100.0[3]	96.0[3]			50.0	48.3
Pregnancy					100.0+	100.0+
Skin					0+	0+
Musculoskeletal	66.7[3]	80.0[3]			50.0+	100.0+
Congenital					100.0	85.7
Perinatal					75.0+	100.0+
Ill-defined	14.3	33.3+			0	0+

			Veteran's[96]	n=446		
External causes					74.7	84.3
accidents(E800-940,960-990)	100.0	98.0				
motor vehicle accidents			97.0	99.0		
unintentional poisoning			50.0	97.8		
homicide			95.9	99.0		
suicide	96.2	100.0	90.0	100.0		

[1] Gall bladder cancer has been included with liver cancer in the Swedish study

[2] for non-Hodgkin's lymphoma only - Hodgkin's lymphoma and Multiple myeloma listed separately (detection rates 86.7% and 96.6% with confirmation rates 92.5% and 98.1%). Aggregation of these categories would likely increase the confirmation and detection rates.

[3] Subcategories of ICD codes used in this study. Detection and confirmation rates would be expected to be higher if all ICD codes were included from these studies

+ less than 5 references cases for detection rates, 5 certificate cases for confirmation rates.

Appendix C:

Weights Used in the Record Linkage

Adapted from Copock[123] and expanded (Copock E.,personal communication,1990)

Birth Year		WEIGHTS			
Outcomes	Condition	Pos	Neg	Miss	Total
Full	Equal	72	- 2		70
Partial 2	differ by 1 year	62	- 28		34
Partial 3	differ by 2-3 years	52	- 49		3
Partial 4	differ by 4-6 years	46	- 53		- 7
Partial 5	differ by 7-10 year	41	- 70		- 29
Disagree	differ by >10 years	0	- 70		- 70
Blanks	either record			- 10	- 10
Birth Month					
Full	Equal	36	- 1		35
Partial 2	differ by 1 month	27	- 47		- 20
Partial 3	differ by 2 months	28	- 54		- 26
Partial 4	differ by 3 months	30	- 69		- 39
Partial 5	differ by 4-11 mths	10	- 60		- 50
Disagree	all others	0	- 42		- 42
Blanks	either record			- 5	- 5
Birth Day					
Full	equal	49	- 2		47
Partial 2	differ by 1 day	40	- 48		- 8
Partial 3	differ by 2-3 days	30	- 57		- 27
Partial 4	differ by 4-9 days	17	- 45		- 28
Partial 5	differ 10-10 days	11	- 51		- 40
Disagree	all other		- 40		- 40
Blanks	blanks			- 5	- 5

Inversion of Birth day and Birth Month
if this occurs weight assigned at 170

Age at Death
Weightings are based on likelihood of death with increasing age. This component is a function of the birth and death dates and the agreement for outcome based on birth year.

Initial of the First and Second Given Names, Fathers Initial and Mothers Initials

All combinations of the initials are compared. DIAND given initial (1 and 2 represented as D1 and D2 respectively, CMDB initials C1 and C2

	4 initial available			
Full	D1=C1, D2=C2	100	- 15	85
Partial 2	D1=C2, D2=C1	100	- 50	50
Partial 3	D1=C1 OR D2=C2	50	- 55	- 5
Partial 4	D1=C2 OR D2=C1	50	- 70	- 20
Partial 5	all disagree	25	-105	- 80
	3 initial available			
Partial 6	D1=C1	60	- 5	55
Partial 7	D1=C2 OR D2=C1	60	- 35	25
Partial 8	all disagree	10	- 80	- 70
	2 initial available			
Partial 9	agree	60	- 15	45
Partial 10	disagree	20	- 70	- 50

First Given Name, Second Given Name, and Cross comparisons

Full	7 characters agree	29	- 2	27
Partial 2	4 agree, 3 missing	81	- 51	30
Partial 3	4 agree, 3 disagree	59	- 54	5
Partial 4	3 agree, 4 missing	87	- 70	17
Partial 5	3 agree, 4 disagree	54	- 56	- 2
Partial 6	2 agree, 5 missing	87	- 70	17
Partial 7	2 agree, 5 disagree	23	- 55	- 32
Partial 8	1 agree, 6 disagree	7	- 54	- 47

Surname

13 characters are compared, 6 NYSIIS, Partial for the surname

Full	13 characters	*	- 1	- 1
Partial 2	10, NYSIIS and 4 surname	*	- 30	- 30
Partial 3	6 NYSIIS only	*	- 50	- 50

* positive component derived from weight class which follows

Weight Class

indicates the rarity of a particular surname

Full	Very Common	75	75
Partial 2	Common	95	95
Partial 3	Relatively rare	125	125
Partial 4	Rare	155	155
Partial 5	Very rare	185	185

Marital Status				
If DIAND file listed as married:				
Partial	CMDB single			-25
Full	CMDB married			+5
Partial	CMDB divorced			-10
Partial	CMDB widowed			0
Partial	CMDB separated			-22
Agreement	All other are equal			+3
Disagreement or missing	All other are not equal			-3
Province of Residence				
For British Columbia or Ontario	residence listed in either province on either file	3	-20	-17
All other province	residence listed in both files	15		15
Agreement	Equality	6		6

APPENDIX D

Age Grouping Cause Specific Mortality Rates

All Cause

males

	cohort	reserve	MSB	residual	Provincial
00-01	2867.2 (2219.0-3515.3)	2401.4 (2069.-2733.)	3712 (3385.0-4038.9)	1181.8 (1106.9-1256.6)	1233 (1208.3-1257.6)
01-04	180.1 (113.-246.)	117.7 (85.9-149.4)	222.3 (188.0-256.6)	83.8 (73.6-93.9)	66.2 (63.3-69.1)
05-14	87.3 (59.0-115.5)	78.9 (62.6-95.1)	99.6 (85.4-113.7)	49.3 (44.4-54.2)	41.3 (39.9-42.6)
15-34	470.5 (415.0-525.96)	401.1 (369.3-432.8)	528.9 (500.6-557.1)	181.8 (175.1-188.4)	160 (158.2-161.7)
35-64	1004.9 (888.6-1121.1)	944.2 (875.4-1012.9)	1191.3 (1129.1-1253.4)	744.7 (730.7-758.6)	834.4 (829.8-838.9)
65-	4676.8 (4193.6-5159.9)	4802 (4510.3-5093.6)	5808.7 (5543.1-6074.2)	6290.7 (6221.3-6360.0)	7502.8 (7476.7-7528.8)

female

	cohort	reserve	MSB	residual	Provincial
00-01	2270 (1682.1-2857.8)	1713.2 (1429.7-1996.6)	2694.5 (2410.3-2978.7)	928.4 (860.5-996.2)	972 (949.5-994.5)
01-04	106.1 (54.1-158.0)	100.3 (70.7-129.8)	150.4 (121.7-179.0)	55.8 (47.3-64.2)	52.5 (49.7-55.2)
05-14	38.7 (19.6-57.7)	40 (28.2-51.7)	53 (42.4-63.5)	26.3 (22.7-29.8)	25.7 (24.5-26.8)
15-34	235.7 (196.5-274.9)	169 (146.8-191.1)	239.7 (220.4-258.9)	60.6 (56.6-64.5)	59.4 (58.2-60.5)
35-64	711.9 (609.3-814.4)	627.8 (568.2-687.3)	887.2 (830.7-943.6)	396.6 (386.6-406.5)	430.5 (427.3-433.6)
65-	3041.8 (2649.6-3433.9)	3159.6 (2918.9-3400.2)	4277.6 (4043.3-4511.8)	3833.4 (3783.0-3883.7)	4438.1 (4421.6-4454.5)

Circulatory

males

	cohort	reserve	MSB	residual	Provincial
00-01	39.3 (0-116.3)	24.5 (0-58.4)	85.6 (35.0-136.1)	15 (6.5-23.4)	9.9 (7.7-12.1)
01-04	0	2.2 (0-6.5)	9.7 (2.4-16.9)	1.3 (.1-2.4)	1.7 (1.3-2.0)
05-14	2.4 (0-7.1)	.9 (0-2.6)	4.2 (1.2-7.4)	1.2 (.4-1.9)	1.1 (.9-1.2)
15-34	18.9 (1.2-36.5)	10.2 (4.7-15.6)	18.5 (13.0-23.9)	9.1 (7.5-10.6)	8.5 (8.1-8.8)
35-64	263.9 (201.3-326.4)	307.5 (266.9-348.0)	320.3 (286.9-353.6)	306.8 (297.7-315.8)	348.2 (345.2-351.1)
65-	2361.9 (2016.5-2707.2)	2338.5 (2131.7-2545.2)	2801.1 (2613.5-2988.6)	3319.7 (3267.9-3371.4)	3971.2 (3951.6-3990.8)

female

	cohort	reserve	MSB	residual	Provincial
00-01	0	49.7 (1.0-98.3)	32.1 (.7-63.4)	5.2 (.1-10.2)	8.9 (6.7-11.0)
01-04	0	4.6 (0-10.8)	7.1 (.8-13.3)	1.4 (.0-2.7)	1.3 (.9-1.7)
05-14	0	.9 (0.8-2.6)	3.8 (1.0-6.0)	.7 (.1-1.4)	1 (.8-1.2)
15-34	16.6 (5.6-27.5)	8.2 (2.9-13.4)	13.2 (8.3-18.1)	5.9 (4.7-7.0)	4.7 (4.3-5.0)
35-64	177.7 (124.5-230.8)	183.6 (150.6-216.5)	220 (190.9-249.0)	105.2 (99.9-110.4)	117.4 (115.8- 118.9)
65-	1336 (1074.3-1597.6)	1481.7 (1315.8-1647.5)	1984 (1822.4-2145.5)	2160.6 (2122.3-2198.8)	6.4 (0-4990.2)

Digestive

males

	cohort	reserve	MSB	residual	Provincial
00-01	117.8 (0-251.0)	85.8 (22.2-149.3)	85.6 (35.0-136.1)	13.7 (5.6-21.7)	12.3 (9.7-14.8)
01-04	6.4 (0-18.9)	2.2 (0-6.5)	8.3 (1.6-14.9)	2.2 (.6-3.7)	1.3 (.9-1.6)
15-34	12.7 (3.0-22.3)	11.2 (5.5-16.8)	14.6 (9.5-19.6)	1.8 (1.2-2.3)	2.3 (2.1-2.4)
35-64	90.2 (54.7-125.6)	64.9 (47.0-82.7)	109.2 (90.1-128.2)	38.4 (35.2-41.5)	51 (49.8-52.1)
65-	153.1 (62.5-243.6)	127.6 (78.6-176.6)	215.3 (162.1-268.4)	202.2 (189.0-215.3)	261.4 (256.3- 266.4)

female

	cohort	reserve	MSB	residual	Provincial
00-01	121.6 (0-259.1)	74.5 (14.9-134.0)	80.2 (30.6-129.7)	20.8 (10.6-30.9)	11.6 (9.0-14.1)
01-04	0	9.1 (0.1-18.1)	5.7 (.2-11.1)	4.1 (1.7-6.4)	1.6 (1.2-1.9)
15-34	30.4 (14.9-45.8)	15.9 (8.6-23.1)	16.5 (11.0-21.9)	1.2 (.6-1.7)	1.5 (1.3-1.6)
35-64	82.3 (48.0-116.6)	55.3 (37.8-72.7)	106.9 (87.8-125.9)	15.9 (13.7-18.0)	23.8 (23.0-24.5)
65-	182.5 (82.1-282.8)	185 (125.8-244.1)	250.9 (192.4-309.3)	151.7 (141.3-162.0)	172.5 (169.1- 175.8)

Endocrine/nutrition/metabolic

males

	cohort	reserve	MSB	residual	Provincial
15-34	0	0	3.4 (1.0-5.7)	1.4 (.8-1.9)	1.4 (1.2-1.5)
35-64	27 (6.8-47.1)	32.4 (19.0-45.7)	24.4 (14.9-33.8)	13 (11.2-14.7)	13.7 (13.1-14.2)
65-	125.6 (43.4-207.7)	185.7 (126.7-244.6)	136.3 (93.5-179.0)	116.8 (106.8-126.7)	148.3 (144.3- 152.2)

female

	cohort	reserve	MSB	residual	Provincial
15-34	0	2.3 (0-5.0)	1.6 (.0-3.1)	1.3 (.7-1.8)	1.4 (1.2-1.5)
35-64	18.6 (1.9-35.2)	42.1 (26.2-57.9)	44.3 (31.1-57.4)	9.4 (7.8-10.9)	9.6 (9.2-9.9)
65-	143.3 (53.9-232.6)	149.5 (95.0-203.9)	159.3 (112.6-205.9)	129.6 (119.9-139.2)	138.7 (135.7- 141.6)

Genitourinary

males

	cohort	reserve	MSB	residual	Provincial
15-34	1.2 (0-3.5)	1.2 (0-2.7)	2.6 (.6-4.5)	.6 (.2-.9)	.5 (.3-.6)
35-64	3.5 (0-10.3)	12.8 (4.7-20.8)	17.6 (9.7-25.4)	4 (3.0-4.9)	4.9 (4.5-5.2)
65-	108 (32.7-183.2)	112.4 (66.5-158.2)	118.3 (79.1-157.5)	114.5 (104.5-124.4)	126.9 (123.1-130.6)

female

	cohort	reserve	MSB	residual	Provincial
15-34	2.2 (0-6.5)	1.2 (0-2.9)	0.8 (0-1.9)	.5 (.1-.8)	.5 (.3-.6)
35-64	11.3 (0-24.2)	21.3 (10.1-32.4)	27.1 (16.9-37.2)	3.2 (2.2-4.1)	4 (3.6-4.3)
65-	91.2 (22.4-159.9)	85.1 (45.5-124.6)	129.1 (86.7-171.4)	68.8 (61.9-75.6)	67.4 (65.2-69.5)

Infective and Parasitic

males

	cohort	reserve	MSB	residual	Provincial
00-01	39.3 (0-116.3)	98 (30.1-165.8)	108.9 (51.8-165.9)	10 (3.1-16.8)	12.3 (9.7-14.8)
01-04	6.4 (0-18.9)	2.2 (0-6.5)	5.5 (0-10.9)	2.9 (.9-4.8)	2.1 (1.5-2.6)
05-14	4.7 (0-11.1)	.9 (0-2.6)	0.5 (0-1.4)	0.1 (0-.2)	.5 (.3-.6)
15-34	5.2 (0-11.0)	2.7 (0-5.4)	3.3 (1.1-5.4)	0.4 (.2-.5)	.8 (.6-.9)
35-64	23.2 (5.7-40.6)	12.3 (4.0-20.5)	24.1 (14.8-33.3)	4.3 (3.3-5.2)	4.1 (3.7-4.4)
65-	71.8 (8.8-134.7)	64.4 (29.3-99.4)	105.3 (68.2-142.3)	27.9 (23-32.8	33.1 (31.3-34.8)

female

	cohort	reserve	MSB	residual	Provincial
00-01	81.1 (0-193.4)	74.5 (14.9-134.0)	160.4 (90.2-230.5)	13 (4.9-21.0)	12.4 (9.8-14.9)
01-04	0	0	7.1 (.8-13.3)	2.4 (.6-4.1)	1.5 (1.1-1.8)
05-14	2.5 (0-7.4)	0	1.1 (0-2.6)	.8 (.2-1.3)	.4 (.2-.5)
15-34	1.7 (0-5.0)	.7 (0-2.0)	2.1 (.1-4.0)	.6 (.2-.9)	.6 (.4-.7)
35-64	7.5 (0-36.5)	14.4 (5.3-23.4)	18.1 (10.0-26.1)	2.2 (1.4-2.9)	2.9 (2.7-3.0)
65-	41.4 (0-88.8)	35.6 (9.1-62.0)	61.1 (31.8-90.3)	18.7 (14.9-22.4)	18.1 (16.9-19.2)

Mental

males

	cohort	reserve	MSB	residual	Provincial
15-34	9.2 (.9-17.4)	8.6 (3.5-13.6)	7.5 (4.1-10.8)	1.1 (.5-1.6)	1 (.8-1.1)
35-64	43.8 (18.5-69.0)	34 (21.2-46.7)	33.3 (23.1-43.4)	7.1 (5.7-8.4)	9.6 (9.2-9.9)
65-	98.8 (25.4-172.1)	34.1 (8.8-59.3)	44.5 (20.3-68.6)	38.8 (33.1-44.4)	59.8 (57.2-62.3)

female

	cohort	reserve	MSB	residual	Provincial
15-34	7.1 (.0-14.1)	9.5 (3.8-15.1)	6.4 (3.0-9.7)	.3 (.1-.4)	.4 (.4-.4)
35-64	10.2 (0-21.9)	17.6 (7.9-27.2)	20.2 (11.7-28.6)	1.7 (1.1-2.2)	3 (2.8-3.1)
65-	46.2 (0-98.5)	41.2 (12.5-69.8)	31.9 (10.9-52.8)	23.4 (19.4-27.3)	37.9 (36.3-39.4)

Neoplasms

males

	cohort	reserve	MSB	residual	Provincial
00-01	0	12.3 (0-36.4)	15.6 (0-37.1)	10 (3.1-16.8)	7 (5.0-8.9)
01-04	0	0	4.1 (0-9.5)	9 (5.6-12.3)	7.4 (6.4-8.3)
05-14	4.7 (0-11.1)	3.4 (.0-6.7)	3.6 (.8-6.3)	5.5 (3.9-7.0)	6.4 (5.8-6.9)
15-34	4.3 (0-9.2)	3.7 (.5-6.8)	6.6 (3.4-9.7)	10.1 (8.5-11.6)	10.9 (10.5-11.2)
35-64	124.5 (81.3-167.6)	107.2 (82.7-131.7)	126 (104.6-147.3)	203.7 (196.4-210.9)	239.2 (236.8-241.5)
65-	630.1 (446.4-813.7)	782 (661.2-902.7)	812.1 (709.3-914.8)	1439.3 (1405-1473.6)	1740.1 (1727.1-1753.0)

female

	cohort	reserve	MSB	residual	Provincial
00-01	40.5 (0-119.8)	12.4 (0-36.7)	16 (0-38.1)	1.3 (0-3.8)	3.9 (0-8.4)
01-04	0	9.1 (.0-18.1)	5.7 (.2-11.1)	5.4 (2.6-8.1)	5.7 (4.9-6.4)
05-14	2.5 (0-7.4)	3.5 (0-7.0)	1.6 (0-3.3)	4.3 (2.9-5.6)	4.8 (4.2-5.3)
15-34	14.3 (3.7-24.8)	12 (5.7-18.2)	15 (9.9-20.0)	10 (8.4-11.5)	10.2 (9.8-10.5)
35-64	166 (115.6-216.3)	130.4 (102.9-157.8)	151.7 (127.7-175.6)	163.3 (156.6-169.9)	194.5 (192.3-196.6)
65-	587 (411.1-762.8)	609.5 (500.5-718.4)	653.3 (558.4-748.1)	779.6 (755.6-803.5)	917.9 (910.0-925.7)

Nervous

males

	cohort	reserve	MSB	residual	Provincial
0-1	39.3 (0-116.3)	49 (.9-97.0)	62.3 (19.1-105.4)	35 (22.0-47.9)	25.7 (22.1-29.2)
01-04	19.3 (0-41.0)	4.4 (0-10.4)	11 (3.3-18.6)	7.7 (4.5-10.8)	5.2 (4.4-5.9)
05-14	2.4 (0-7.1)	3.5 (.1-6.8)	3.6 (.8-6.3)	1.8 (.8-2.7)	2 (1.6-2.3)
15-34	5.5 (0-11.7)	1.3 (0-3.2)	3.4 (1.0-5.7)	2.9 (2.1-3.6)	3.2 (3.0-3.3)
35-64	19.2 (3.3-35.0)	12.3 (4.0-20.5)	16.3 (9.0-23.5)	7.9 (6.5-9.2)	10.6 (10.0-11.1)
65-	41.4 (0-88.6)	53.7 (21.9-85.4)	48.1 (22.8-73.3)	60.9 (53.8-67.9)	84.2 (81.2-87.1)

female

	cohort	reserve	MSB	residual	Provincial
00-01	40.5 (0-119.8)	24.8 (0-59.2)	16 (0-38.1)	24.7 (13.5-35.8)	19 (15.8-22.1)
01-04	0	2.3 (0-6.6)	5.7 (.2-11.1)	3 (1.0-4.9)	4.1 (3.3-4.8)
05-14	0	1.8 (0-4.1)	2.1 (0-4.2)	.9 (.3-1.4)	1.6 (1.4-1.7)
15-34	2.8 (0-6.7)	2.6 (0-5.3)	4.2 (1.8-6.5)	2.1 (1.3-2.8)	2.2 (2.0-2.3)
35-64	14.8 (0-29.6)	2.8 (0-6.7)	7.5 (2.2-12.7)	7.4 (6.0-8.7)	8.4 (8.0-8.7)
65-	40.4 (0-86.8)	0	34.2 (13.0-55.3)	23.4 (19.4-27.3)	43.6 (37.9-49.2)

Respiratory

	males				
	cohort	reserve	MSB	residual	Provincial
00-01	392.8 (149.7-635.8)	330.8 (206.1-455.4)	420.2 (308.2-532.1)	76.2 (56.9-95.4)	58.3 (53.0-63.5)
01-04	19.3 (0-41.0)	11.1 (1.3-20.9)	19.3 (9.1-29.4)	7.1 (4.1-10.0)	5.2 (4.4-5.9)
05-14	0	.9 (0-2.6)	3.1 (.5-5.6)	1.1 (.3-1.8)	1.3 (1.1-1.4)
15-34	3.1 (0-7.4)	3.7 (.3-7.0)	5.5 (2.3-8.6)	3.4 (2.4-4.3)	2.6 (2.4-2.7)
35-64	57.6 (28.7-86.4)	48.8 (32.5-65.0)	66.1 (50.8-81.3)	29.4 (26.6-32.1)	33.3 (32.3-34.2)
65-	563.2 (392.8-733.5)	652.7 (542.7-762.6)	753.6 (655.4-851.7)	674 (650.0-697.9)	755.8 (746.9-764.6)

female					
	cohort	reserve	MSB	residual	Provincial
00-01	283.7 (73.7-493.6)	273.1 (159.0-387.1)	328.8 (228.2-429.3)	27.3 (15.5-39.0)	39.3 (34.7-43.8)
01-04	19.9 (0-42.4)	20.5 (7.1-33.8)	24.1 (12.7-35.4)	4.7 (2.1-7.2)	4 (3.2-4.7)
05-14	2.4 (0-7.1)	.9 (0-2.6)	1.1 (0-2.4)	1.4 (.6-2.1)	1.2 (1.0-1.3)
15-34	5.6 (0-12.0)	.6 (0-1.7)	4.9 (2.1-7.6)	1.8 (1.2-2.3)	1.8 (1.6-1.9)
35-64	25.1 (4.9-45.2)	31 (17.6-44.3)	52.8 (38.4-67.1)	16.1 (13.9-18.2)	17 (16.4-17.5)
65-	361 (229.4-492.5)	399.3 (312.6-485.9)	520.8 (437.8-603.7)	269.8 (256.2-283.3)	282.1 (277.7- 286.4)

Skin/subcutaneous disorders

	males				
	cohort	reserve	MSB	residual	Provincial
65-	0	4.8 (0-14.2)	6.7 (0-16.1)	4.7 (2.7-6.6)	4.5 (3.7-5.2)

	female				
	cohort	reserve	MSB	residual	Provincial
65-	0	5.3 (0-15.6)	10.5 (0-22.4)	2.9 (1.5-4.2)	4.5 (3.3-5.6)

Symptoms - Illdefined

	males				
	cohort	reserve	MSB	residual	Provincial
00-01	549.9 (262.5-837.2)	539.1 (380.1-698.0)	980.5 (810.1-1150.8)	157.4 (129.9-184.8)	163.8 (154.7- 172.8)
01-04	0	0	4.1 (0-8.8)	1.6 (.2-2.9)	1.4 (1.0-1.7)
05-14	0	.9 (0-2.6)	0	.5 (.1-.8)	.2 (.0-.3)
15-34	11.7 (2.8-20.5)	6 (1.8-10.1)	5.4 (2.4-8.3)	2.3 (1.5-3.0)	2.3 (2.1-2.4)
35-64	19.2 (3.5-34.8)	14 (5.9-22.0)	14.3 (7.2-21.3)	7.6 (6.2-8.9)	9.5 (9.1-9.8)
65-	84.1 (16.6-151.5)	112.1 (66.4-157.7)	178.3 (130.2-226.3)	66.3 (58.6-73.9)	63.7 (61.1-66.2)

	female				
	cohort	reserve	MSB	residual	Provincial
00-01	324.3 (99.8-548.7)	384.9 (249.6-520.1)	850 (688.8-1011.1)	123.7 (98.8-148.5)	115.3 (107.4-123.1)
01-04	6.6 (0-19.5)	4.6 (0-10.8)	4.3 (0-9.2)	.7 (0-1.6)	1.3 (.9-1.6)
05-14	2.4 (0-7.1)	0	2.2 (.0-4.3)	.5 (0-1.0)	.3 (.1-.4)
15-34	5.7 (0-12.1)	4.3 (.9-7.6)	4.1 (1.5-6.6)	.8 (0.4-1.1)	1.1 (.9-1.2)
35-64	31.8 (9.4-54.1)	11.5 (3.4-19.5)	14.2 (6.9-21.4)	3.1 (2.1-4.0)	4.3 (3.9-4.6)
65-	76 (14.0-137.9)	58.5 (26.5-90.4)	192.6 (142.6-242.5)	50.8 (44.9-56.6)	42.4 (40.8-43.9)

Accidents Poisoning and Violence

males					
	cohort	reserve	MSB	residual	Provincial
00-01	196.4 (24.5-368.2)	147 (63.8-230.1)	194.5 (118.2-270.7)	37.5 (24.1-50.8)	40.6 (36.0-45.1)
01-04	115.8 (62.2-169.3)	88.9 (61.4-116.3)	133.9 (107.2-160)	41.7 (34.4-48.9)	30.3 (28.3-32.2)
05-14	68.6 (43.7-93.4)	65.1 (50.2-79.9)	78.9 (66.3-91.44)	35.6 (31.4-39.7)	25.5 (24.3-26.6)
15-34	389.5 (339.5-439.4)	351.1 (321.5-380.6)	471.6 (445.1-498.0)	147.4 (141.5-153.2)	124.3 (122.7-125.8)
35-64	316.8 (256.0-377.5)	291.8 (255.5-328.0)	421.7 (386.6-456.7)	118 (112.3-123.6)	104.8 (103.2-106.3)
65-	400.5 (254.6-546.3)	304.9 (229.0-380.7)	434 (358.3-509.6)	186 (173.4-198.5)	208.1 (203.3-212.804)

female					
	cohort	reserve	MSB	residual	Provincial
00-01	243.2 (48.7-437.6)	111.7 (38.7-184.6)	200.5 (121.9-279.0)	46.9 (31.6-62.1)	30.1 (26.2-34.0)
01-04	72.9 (29.7-116.0)	50.2 (29.2-71.1)	73.8 (53.8-93.7)	27.4 (21.5-33.2)	20.4 (18.8-21.9)
05-14	29.1 (12.6-45.5)	30.2 (19.8-40.5)	37.9 (29.0-46.7)	14.6 (11.8-17.3)	12.6 (11.8-13.3)
15-34	143.3 (114.0-172.5)	110.7 (93.2-128.1)	164.2 (148.5-179.8)	34.4 (31.4-37.3)	32.6 (31.8-33.3)
35-64	147.7 (103.6-191.8)	112.0 (87.6-136.3)	181.7 (157.3-206.0)	36.6 (33.4-39.7)	39.8 (38.8-40.7)
65-	101.7 (25.8-177.5)	96.2 (52.6-139.7)	146.8 (101.7-191.8)	95.5 (87.2-103.7)	116.9 (114.1-119.6)

Symptoms - Illdefined

	males				
	cohort	reserve	MSB	residual	Provincial
00-01	549.9 (262.5-837.2)	539.1 (380.1-698.0)	980.5 (810.1-1150.8)	157.4 (129.9-184.8)	163.8 (154.7- 172.8)
01-04	0	0	4.1 (0-8.8)	1.6 (.2-2.9)	1.4 (1.0-1.7)
05-14	0	.9 (0-2.6)	0	.5 (.1-.8)	.2 (.0-.3)
15-34	11.7 (2.8-20.5)	6 (1.8-10.1)	5.4 (2.4-8.3)	2.3 (1.5-3.0)	2.3 (2.1-2.4)
35-64	19.2 (3.5-34.8)	14 (5.9-22.0)	14.3 (7.2-21.3)	7.6 (6.2-8.9)	9.5 (9.1-9.8)
65-	84.1 (16.6-151.5)	112.1 (66.4-157.7)	178.3 (130.2-226.3)	66.3 (58.6-73.9)	63.7 (61.1-66.2)

	female				
	cohort	reserve	MSB	residual	Provincial
00-01	324.3 (99.8-548.7)	384.9 (249.6-520.1)	850 (688.8-1011.1)	123.7 (98.8-148.5)	115.3 (107.4-123.1)
01-04	6.6 (0-19.5)	4.6 (0-10.8)	4.3 (0-9.2)	.7 (0-1.6)	1.3 (.9-1.6)
05-14	2.4 (0-7.1)	0	2.2 (.0-4.3)	.5 (0-1.0)	.3 (.1-.4)
15-34	5.7 (0-12.1)	4.3 (.9-7.6)	4.1 (1.5-6.6)	.8 (0.4-1.1)	1.1 (.9-1.2)
35-64	31.8 (9.4-54.1)	11.5 (3.4-19.5)	14.2 (6.9-21.4)	3.1 (2.1-4.0)	4.3 (3.9-4.6)
65-	76 (14.0-137.9)	58.5 (26.5-90.4)	192.6 (142.6-242.5)	50.8 (44.9-56.6)	42.4 (40.8-43.9)

Accidents Poisoning and Violence

males					
	cohort	reserve	MSB	residual	Provincial
00-01	196.4 (24.5-368.2)	147 (63.8-230.1)	194.5 (118.2-270.7)	37.5 (24.1-50.8)	40.6 (36.0-45.1)
01-04	115.8 (62.2-169.3)	88.9 (61.4-116.3)	133.9 (107.2-160)	41.7 (34.4-48.9)	30.3 (28.3-32.2)
05-14	68.6 (43.7-93.4)	65.1 (50.2-79.9)	78.9 (66.3-91.44)	35.6 (31.4-39.7)	25.5 (24.3-26.6)
15-34	389.5 (339.5-439.4)	351.1 (321.5-380.6)	471.6 (445.1-498.0)	147.4 (141.5-153.2)	124.3 (122.7-125.8)
35-64	316.8 (256.0-377.5)	291.8 (255.5-328.0)	421.7 (386.6-456.7)	118 (112.3-123.6)	104.8 (103.2-106.3)
65-	400.5 (254.6-546.3)	304.9 (229.0-380.7)	434 (358.3-509.6)	186 (173.4-198.5)	208.1 (203.3-212.804)

female					
	cohort	reserve	MSB	residual	Provincial
00-01	243.2 (48.7-437.6)	111.7 (38.7-184.6)	200.5 (121.9-279.0)	46.9 (31.6-62.1)	30.1 (26.2-34.0)
01-04	72.9 (29.7-116.0)	50.2 (29.2-71.1)	73.8 (53.8-93.7)	27.4 (21.5-33.2)	20.4 (18.8-21.9)
05-14	29.1 (12.6-45.5)	30.2 (19.8-40.5)	37.9 (29.0-46.7)	14.6 (11.8-17.3)	12.6 (11.8-13.3)
15-34	143.3 (114.0-172.5)	110.7 (93.2-128.1)	164.2 (148.5-179.8)	34.4 (31.4-37.3)	32.6 (31.8-33.3)
35-64	147.7 (103.6-191.8)	112.0 (87.6-136.3)	181.7 (157.3-206.0)	36.6 (33.4-39.7)	39.8 (38.8-40.7)
65-	101.7 (25.8-177.5)	96.2 (52.6-139.7)	146.8 (101.7-191.8)	95.5 (87.2-103.7)	116.9 (114.1-119.6)

APPENDIX E

Year of Reporting to DIAND by the year of Occurrence of Death

year	1981	1982	1983	1984
1954		1		
1955	1			
1956				
1957	2	1	1	
1958				
1959		1		
1960			1	
1961	1		3	**
1962				2
1963			3	2
1964	1	1	1	1
1965				1
1966	4		2	
1967	3	5	2	4
1968	1		2	
1969	4	4	4	2
1970	10	9	3	4
1971	14	2	6	7
1972	6	5	7	3
1973	13	6	12	7
1974	19	10	13	7
1975	14	10	12	8
1976	32	14	9	9
1977	33	13	15	14
1978	56	32	21	15
1979	418	60	38	32
1980	1428	424	91	42
1981		1398	453	82
1982			1276	475
1983				1357
Total	2060	1996	1975	2078

Year of Death tabulated by Year of Processing on DIAND Event file

** Four deaths were reported in 1983 with date of death prior to 1961

1st	67.3%
2nd	21.8%
3rd	3.6%
4th	1.7%
5th	1.2%
6th	0.6%

over 6 years 3.6%

Mean percentage of deaths reported from preceding years.