WHO AND WHAT IS A CANADIAN INDIAN?

THE IMPACT OF BILL C-31 UPON DEMOGRAPHIC AND EPIDEMIOLOGIC MEASURES OF THE REGISTERED INDIAN POPULATION OF MANITOBA.

BY

HARPA K. ISFELD

A Thesis
Submitted to the Faculty of Graduate Studies
In Partial Fulfilment of the Requirements
for the Degree of

MASTER OF ARTS

Department of Anthropology
University of Manitoba
Winnipeg, Manitoba

January, 1997

National Library
of Canada

Acquisitions and
Bibliographic Services Branch

395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale
du Canada

Direction des acquisitions et
des services bibliographiques

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file *Votre référence*

Our file *Notre référence*

ISBN 0-612-16169-2

Canada

THE UNIVERSITY OF MANITOBA

FACULTY OF GRADUATE STUDIES

*****

COPYRIGHT PERMISSION PAGE

WHO AND WHAT IS A CANADIAN INDIAN? THE IMAPCT OF BILL C-31 UPON DEMOGRAPHIC AND EPIDEMIOLOGIC MEASURES OF THE REGISTERED INDIAN POPULATION OF MANITOBA

BY

HARPA K. ISFELD

A Thesis/Practicum submitted to the Faculty of Graduate Studies of The University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF ARTS

ABSTRACT

Adopting the premise that "Indian" is a socially and politically constructed mutable concept, this thesis examines the implications of amendments to the legislative definition of Indian for the quality of Registered Indian vital statistics. In 1985, Bill C-31 introduced significant changes to the registration provisions of the Indian Act. The implications of population growth and compositional changes resulting from Bill C-31 for demographic and epidemiologic rates have not been addressed in the literature. This study compares 1980 through 1991 Registered Indian data for a sample of six Manitoba bands to distinguish differentials in compositional variables over time and across residence divisions and model these effects upon demographic and epidemiologic rates. The principal methodologies employed include direct standardization of mortality rates, life table analysis of mortality, and deterministic analysis of fertility and reproduction. These analyses reveal an increased proportionate contribution of the off-reserve population to the total band population over time, substantial decreases in standardized mortality rates, increases in life expectancy, particularly for off-reserve females, and decreases in off-reserve measures of fertility and reproductive success. The observed trends and differentials are attributed mainly to increases in population without commensurate increases in mortality and fertility during the study period. The results of these analyses demonstrate off-reserve and total band data to be significantly flawed for the 1985 to 1991 period.

ACKNOWLEDGEMENTS

I wish to acknowledge the Medical Services Branch for provision of demographic data employed herein. I would particularly like to thank Monique Neufeld and Cathy Menard for assisting in securing this data and providing me with information necessary to its interpretation.

I thank Dr. Dwight Rokala for his commitment of time in this project, his patience, and for sharing his insights and experience with me over the years. I also extend thanks to members of my committee, Dr's T. Kue Young and Richard Lobdell, for their suggestions and to Dr. William Koolage for several years of moral support and employment.

I owe a great deal of thanks to Deborah, Shannon, Val, and Rosemary whose understanding and generous support sustained me through the thesis process. Special thanks also go to Gunnur and Ingthor Isfeld, whose love and faith enabled me to see this goal to completion.

Any errors and omissions in this work are entirely mine.

TABLE OF CONTENTS

LIST OF TABLES

APPENDIX A.

APPENDIX B.

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

"Who and What is an American Indian?" was the apparently simple question posed by Frell M. Owl (1962) the year after the North Carolina Cherokee retired from thirty-three years of service for the U.S. Bureau of Indian Affairs. His answer, twenty pages of densely written prose, was notably complex and infused with an unspoken dismay at the staggering proliferation of labels that had accrued to define persons of aboriginal decent. Over thirty years later, the question is still an appropriate one and transportable to our Canadian situation. The result of a complex history of resettlement and political domination by European populations, disguised by `multiculturalism' rhetoric, the Canadian multi-cultural milieu of today calls for continual re-negotiation and assertion of identity by ethnic minorities in competition for political, cultural, and economic resources. Although several categories of aboriginal Canadians have emerged from this process of political posturing, one abstraction, that of "Indian", has figured most prominently in legal and scholarly discourse, as well as in the public vernacular. By viewing ethnic identity as part of a political process, the answer to the question `who or what is a Canadian Indian' becomes contingent upon not only self-ascription by "Indians" but upon a complex interactive history of legislation and administration dominated by a Euro-Canadian

bureaucracy. By recognizing that *the* Indian population is neither natural or real, we may proceed to deconstruct the concept of Indian. If nothing else, we have called into question any literature which purports to characterize *the Canadian Indian.*

In the Canadian context, "Indian" is essentially a legal concept, developed over 100 years ago as a means of regulating the relationship between a colonial and an indigenous population. The definition of Indian was formalized and entrenched by the *Indian Act* of 1876 and continues to be legitimized by the administrative arm of the political majority. The administrative counterpart to the legal concept, the status or Registered Indian category, arose from the need to define a single, discrete and manageable service population, entitled to rights and subject to restrictions imposed by federal legislation. The status Indian population, however, represents merely an abstraction drawn from the culturally and biologically diverse population of aboriginal Canadians. Furthermore, the parameters of the Indian concept were conceived and validated, not by "Indians" themselves, but largely by the politically dominant Euro-Canadian majority. As a result, Canadian aboriginals have found the terms of their ethnicity tied to somewhat arbitrary and changeable criteria, subject to tides of public sentiment, economic change and political relations among Canadians, the most recent example being the Bill C-31 amendments to the Indian concept in 1985.

A common misconception perpetuated in bureaucratic and academic literature alike, is that "Indian" represent an `ethnic group'. Thus, the Indian Registry, a "service frame", is commonly employed as a "sampling frame" to arrive at generalizations regarding *the Indian population.* Population scientists in fields such as biological

anthropology and biocultural epidemiology employ status Indian populations in the calculation of their statistics where data on persons of aboriginal ancestry are lacking (e.g. Moffat et al. 1988). A closer examination of the criteria employed in the legal definition of Indian, however, reveals little or no overlap between these and either cultural or biological variables. Halli and associates further clarify the problem of Indian populations by placing them in the proper demographic context relative to the greater Canadian population. With the understanding that the interplay of fertility, mortality and net migration determines the size and growth of the Canadian population and the recognition that ethnic groups are affected by these variables in addition to acculturation processes, it becomes evident that Indians, within this context, represent the most complex situation as they gain and lose members through changes in legal status of individuals as well (Halli, Trovato, and Driedger 1990). Further complicating this scenario is the fact that the legal definition of Indian has changed over time, most recently and most dramatically with the implementation of the Bill C-31 amendments in 1985.

Bill C-31 introduced significant changes to the definition of Registered Indian, allowing for the reinstatement of many women who had lost status through the application of discriminatory clauses in former legislation, as well as their children who were denied status and other enfranchised individuals. Thus, the crux of the problem is that re-registrants and first time registrants resulting from Bill C-31 are unlikely to present a random distribution of age-sex variables upon introduction to the Registered Indian data set. Therefore, certain demographic anomalies may be apparent in the Registered Indian data which are not accounted for by demographic models based on natural populations

whose structure is contingent simply upon fertility, mortality and migration. Consequently, the validity of demographic and epidemiological rates based on this data set will be compromised. The underlying question is then, can we as population scientists reconcile the concept of Indian and the resultant Registered Indian data to our concept(s) of population?

The research reported herein represents an attempt to apply the perspective of anthropology and the theories and methodological tools of demography to assess the impact that the Bill C-31 amendments to the definition of Indian had upon demographic and epidemiological measures of the Registered Indian population. The analysis consists of examining the demographic composition of one segment of the Registered Indian population, the Manitoba regional population. The specific focus of the analysis is to discern any anomalies in the patterning of age, sex, and residence variables before and after Bill C-31 for the period from 1980 through 1991 and to model the effects of the age-sex structure on fertility and mortality rates. The research will also afford a discussion of the relationship between the legal definitions, administrative policies and several historical factors which indirectly impact upon data quality. Thus, by tracing the Registered Indian population from concept through to the consequent data and vital rates we may better understand who this population is comprised of and to what ends we as scientists can legitimately apply this data.

CHAPTER 2

LITERATURE REVIEW

Concepts and Assumptions Pertaining to the Categorization of Indian

There are several co-existing views on who the Indian population of Canada is comprised of, each of which reflects a particular belief system, mandate, and subjective history of experience. Although the legislative creation of aboriginal identity in Canada has dominated social discourse and published works, the concept "Indian" is a single abstraction drawn from several co-existing definitions of aboriginal ethnicity and no more valid than alternative concepts. This work represents an examination of the legal concept, "Indian", and its administrative derivative, "Registered Indian", from anthropological and demographic viewpoints. This section begins with an examination of the categorization process of Indians in relation to the concept of ethnicity, which brings a critical perspective to bear on the often indiscriminate use of administrative terminology. Thereafter, it proceeds with a review of the literature pertaining to the parameters of the Indian concept, and perspectives on its applicability for the population so defined. Thus, the present section makes explicit the social construction of the Indian population and the importance of political strength in defining the parameters of this population.

The concept of ethnicity/ethnic category. According to Isajiw, an ethnic group refers to "an involuntary group of people who share the same culture or to descendants of such people who identify themselves and/or are identified by others as belonging to the same involuntary group" (1985, 16). Isajiw arrives at this definition following his analysis of 27 definitions of ethnicity, taken from theoretically oriented works (1985, 5-17). Although alternative definitions abound and vary in emphases, this definition is sufficiently comprehensive as it encompasses both objective and subjective elements. The objective nature of ethnicity derives from the inheritance of physical and cultural attributes that entitle individuals to membership from birth. While these criteria provide the basis for ethnic distinctions, the subjective process of self identification or identification by others ultimately determines an individual's ethnic group membership and provides for the persistence of the group, regardless of cultural change (Isajiw 1985).

Isajiw's definition draws upon Barth's idea of ethnic boundary maintenance, a process by which ethnic group members and non-members both contribute to the construction of the boundary which sets them apart (1969, 14-15). Boundaries constitute those distinguishing characteristics recognized as being shared by members of an ethnic group which come to symbolize and maintain social separation between groups. Thus, Barth conceptualizes ethnicity as a double boundary; a boundary from within, maintained by the socialization process, and a boundary from without established by the process of intergroup relations. To this Isajiw (1985) adds that external boundaries at the societal level provide important insight on how various ethnic groups are perceived and identified by the power-holding, policy-making and influence-exerting bodies within societies.

Particularly relevant to these analyses, are Stymeist's (1975) views regarding Indian ethnicity in the Canadian context. Stymeist's focus is on external boundaries, which he describes as a process of ethnic categorization existing at the level of social consciousness as a system of classification. According to Stymeist, ethnic categorization is decidedly political, relative political strength having much to do with the success of any one group in categorizing another and averting misclassification by others. To this he adds that ethnic categories are largely initiated and promulgated by official bureaucracies of a society, although these ultimately infiltrate the system of social categories held by the general public to become part of the public vernacular.

The emergence of the Indian ethnic category. The Canadian Indian - as an ethnic category - did not exist prior to contact with Europeans (Kallen 1982). The great cultural diversity which predated the arrival of Europeans sponsored an equally complex and long-standing tradition of ethnic differentiation among aboriginal populations. The fact that aboriginal regional cultures today comprise eleven major language families and approximately 58 languages attests to the degree of complexity likely among indigenous peoples prior to contact (Darnell 1986). However, the arrival of Europeans resulted in the lines of ethnicity being re-drawn from the perspective of European-Canadians, as conceived by their administrators. The criteria employed by European-Canadians in distinguishing Indians were at once indiscriminate and arbitrary and reflected European-Canadian values and political motives. Weaver (1977) contends that the impetus for an "Indian" ethnic classification, as shaped by non-Indians, was the administrative

convenience such a category offered in delimiting the population. Having distinguished a target population, the Canadian government could then effectively exert control over Indians in relation to land occupancy and assimilation policy.

According to Weaver (1977), the Canadian Indian ethnic category was formed through the imposition of boundary maintaining mechanisms by government agencies, apart from the influence of aboriginal, internal boundary mechanisms. Those internal boundaries that were maintained by aboriginals existed only at a band level. Historically, a poor, dispersed, diverse and marginal population, aboriginal Canadians have lacked sufficient political strength to affect legislation concerning their population. However, in 1969, the threat of decentralization of Indian Affairs and dissolution of Indian status proposed by the Trudeau government's White Paper fuelled greater political activism among Indians. Since then, Indians have begun to play a more active role in defining and defending their own ethnic boundaries and rights to self determination (Weaver 1977, 1984; Mawhiney 1993). However, viewpoints regarding the extent to which Indians have succeeded in achieving self determination vary widely in the literature. Dyck (1991) chronicles Indian resistance to Euro-Canadian domination since the mid-19th century and the increasing use by Euro-Candians of coersive powers of the law to subvert these efforts. Boldt (1993) contends that even on the brink of self-government, the "survival of Indians as Indians" still appears tenuous as Euro-Canadian interests continue to direct mainstream policies at the expense of Indian interests.

Legal terminological distinctions. Aboriginal Canadian ethnicity has been apportioned into several categories distinguished in legal terminology. Daniels (1981) identifies at least thirteen terms for aboriginal persons in official usage. Of these, a sub-category including status, Registered and treaty Indians, are singled out for special attention under a federal mandate as "legal Indians". Kallen (1982) has described some of the distinctions made between major categories of "Indian" which provides context for the subsequent study pertaining to the Registered Indian population. According to Kallen, Indian legal status has historically been acquired in one of two ways; either through land cession treaty or through voluntary registration. This explains the division within the status Indian category into treaty and non-treaty Indians. Under long-standing patriarchal government policy, legal status has also been acquired by non-status or non-Indian women through marriage to status Indian males. Registered Indians represent those eligible for status under the terms of the *Indian Act* and whose names are included on a "band list" or "general list" administered by the Department of Indian Affairs. "Non-status" has referred to those persons of Indian or part-Indian ancestry who do not have and are not entitled to acquire legal Indian status. These individuals may have revoked, or been denied status as a result of marriage to a non-status or non-Indian male, taking scrip, or other enfranchisement policies. Although once recognized as a distinct ethnic group and accorded separate legal status, within the last half century the Metis category has been broadened to include almost all people with at least some aboriginal ancestry. Increasingly the terms non-status and non-registered Indian, as administrative categories of ethnicity, have come to replace the Metis designation (Morse 1985). Despite the terminological

specificity necessary to the *Indian Act,* Elliot has argued that all aboriginal Canadians, including non-status Indians as well as Inuit are "Indians" for the purpose of *BNA Act* . Thus, the Canadian government may have constitutional jurisdiction over twice as many aboriginal people as those for whom it has chosen to legislate (Elliot 1992).

The validity of the Indian concept. Although the term "Indian" has become widely accepted in public usage, academic debate continues as to whether or not the administrative category is an appropriate ethnic category, respectful of cultural differences, and meaningful to Indians themselves. In this regard, Daniels (1981) has observed that the *Indian Act* definition of Indian makes no mention of culture and language, two aspects central to the concept of ethnicity. In a similar vein, Kallen (1982) contends that neither ethnic or racial status is coterminous with Indian legal status in Canada, which creates a great deal of confusion in the public mind regarding "Who is an Indian?" According to Weaver (1977), the term Indian represents an imposed rubric, which does not reflect a cultural unit, but merely an aggregate category of individuals and bands. Regardless of the apparent lack of fit between the Indian category and the concept of "ethnicity", the census continues to pose the question on ethnicity in such a way that assumes that the terms "status or Registered Indian" and "non-status Indian" are ethnic or cultural identifiers. Daniels advises that these terms should rather be viewed in the context of their administrative and legal origins and their formulation by a 19th century Canadian government (Daniels 1981). The official reality is, however, difficult to cull from societal perceptions as "ethnicity is partly a demographic construct of reality" (Halli, Trovato, and

Driedger 1990). That is, the way the census records the ethnic question and categorizes individuals gradually invades national rhetoric and shapes thinking.

Given that the term "Indian" predominates in administrative nomenclature and has largely found acceptance in the public realm, academics have attempted to characterize the aboriginal perspective - or vying perspectives - on Indian identity (Larsen 1977, Slobodin 1971). From the view point of status Indians, government defined concepts of identity have been received with ambivalence. Although Indians welcome the recognition of special status by the government and the attendant benefits, they are resentful of the imposition that *Indian Act* legislation has meant for their lives. This prevalent view is well represented by Harold Cardinal's remarks.

> We do not want the *Indian Act* retained because it is a good piece of legislation, it isn't. It is discriminatory from start to finish. But it is a lever in our hands and an embarrassment to the government, as it should be... We would rather continue to live in bondage under the *Indian Act* than surrender our sacred rights (Cardinal 1969).

In respect of such views, Dyck (1980) urges social scientists to acknowledge the significance administrative categories hold for Indian people themselves. Dyck argues that these categories are neither arbitrary or unimportant but rather reflect substantial historical, social, political and cultural differences between these populations. He contends that the original policy regarding the definition of Indian and late admissions to treaty were sufficiently permissive as to effectively distinguish between self-identifying populations, giving the categories 'real' bases. Dyck concedes that it is justifiable to speak of Indian status as being originally the product of 'others' rather than of 'self', however, he contends that it is more important to recognize that one hundred years of reserve life have

made Indians distinct from other peoples of aboriginal ancestry. That these distinctions are recognized and vehemently defended by Indians themselves is, for Dyck, sufficient grounds to maintain them. Similarly, Inglis (1971) criticizes the practice of discounting reserve populations as artificial, arguing that legal boundaries have been reinforced by social ones and new stable social structures formed. Furthermore, Weaver points out that Indian "public ethnicity" as viewed by administrators is real and worthy of study simply because it constitutes the basis upon which the nation state formally assigns resources that affect this population's well being (1984, 185).

Although the definition of Indian has, to some extent, gained the approval of Indians themselves, this group has benefitted from the status quo to a greater extent than other disenfranchised groups who have not endorsed this definition. Thus, some authors regard Indian acceptance of imposed labels in the context of a power imbalance vis a vis the larger non-Indian society, as well as in relation to other aboriginal factions. Furthermore, the domination of aboriginal ethnic identity by non-Indian administrative authorities is recognized as having disruptive and divisive effects on families, communities, and political organizations (Daniels 1981, Morse 1985, Sawchuk 1985).

Daniels states that "the problem of `Who is a Native' is inextricably tied to the larger problem of how subordinate groups are defined in polynational states... (where) dominant groups ... reserve the right to define subordinate groups, even to the point of defining them out of existence" (1981, 7). He cites the example of the Metis who, despite considerable success in defining their own ethnic identity, met with several obstructions to self determination, primary among which was the exclusive legal definition of Indian by

the non-Indian political authority. By denying non-status aboriginal people input in defining the boundaries of their ethnic identities, the federal government effectively invalidated and marginalized such self-defined groups as the Metis. Daniels adds that the exclusive federal definition of Indian is often rationalized in terms of administrative convenience by bureaucrats who fear the costs of recognizing all aboriginals for benefits attendant to status (Daniels 1981).

According to Sawchuk, "a measure of an ethnic group's powerlessness and the relative extent of its domination by the larger society surrounding it is the ease with which a foreign or inappropriate identity... can be imposed on it for political expediency or other reasons" (1985, 135). Sawchuk contends that aboriginal identity is vulnerable to such political manipulation. He cites the 1982 constitutional definition of aboriginal peoples of Canada (1982 Section 35(2) of the *Constitution Act*) as an example of a government-defined concept being accepted and even defended by some aboriginal factions vying for official confirmation and legitimacy. The constitutional definition, which included Indian, Inuit and Metis, but neglected non-status Indians, resulted in the Metis disassociating themselves from non-status Indians, formerly their political allies in contesting exclusion from the *Indian Act* definition. According to Sawchuk, no significant attempts have been made at united opposition by aboriginals to imposed categories. Although those dispossessed reject the categorization, more often this develops into an expression of dissension in the aboriginal community than an expression of solidarity against shared subjugation (Sawchuk 1985).

The foregoing description of the parameters of and perspectives on the Indian definition represents more than a semantic polemic. Understanding the process of categorization, viewed with reference to the concept of ethnicity, may dispel false assumptions of there being one natural, discrete or homogenous Indian population. That is, in answering the question 'who is a Canadian Indian?' we must also ask who is defining the concept "Indian". The literature described thus far demonstrates that the demography of Canadian Indians is inseparable from the political context and legislative activity responsible for creating the category of "Indian".

History of Legislation Pertaining to the Definition of Indians

Historically, the definition of Indians in Canadian legislation has been a complex and controversial endeavour. Many significant revisions and minor amendments to the *Indian Act* have led to a very precise definition of an Indian as recognized by the federal government (INAC 1993a). In this section, the history of legislation pertaining to registration and enfranchisement is reviewed for the period from 1850 to 1985. Specific attention is given to those provisions which were later revised by Bill C-31. Added description of general policy issues is also provided as context to the legislation.

Pre-Confederation policy contexts. European-Canadian policy regarding Indians in the early pre-Confederation period was primarily motivated by the needs of vying colonial powers to form military alliances. Thus, policy was typically ad hoc, that is, specific to individual tribes and circumstance (Leslie and Maguire 1978). However, the

importance of Indians as military allies declined after the war of 1812. By the 1830's, the importance of Indians in the fur trade had also declined. In fact, the only economic interest that Indians held for the British Empire in the mid-19th century was their land. Thus, after 1830, the Colonial government adopted a policy of gradual assimilation of Indians into Euro-Canadian society in order to facilitate a peaceful transfer of Indian lands to the Crown (Upton 1973). According to Nichols (1989), pre-confederation Indian policies developed in response to the threat of American expansion to the northwest more so than in reaction to conflicts with Indians. Thus, in seeking control over western territories, Canadian legislation regarding Indians was more formal, extensive and emphasized assimilation to a greater extent than American legislation of the time. By the latter half of the 19th century, Euro-Canadian western expansion and the associated disruption to aboriginal subsistence had heightened inter-group tensions. Growing unrest demanded a more formalized policy from the Imperial government to mediate the relationship between Indian and non-Indian civilians. The dominant ideology that emerged in this era viewed the isolation and protection of Indians and their lands from the influence of settlers as essential to their civilization and the development of Canadian territories (Upton 1973, Guillemin 1978, Tobias 1991).

Indians broadly defined. The first legal definition of "Indian" appeared in *An Act for the Better Protection of the Lands and Property of the Indians in Lower Canada* of 1850, the first Canadian legislation to govern Indians. For the purpose of this legislation, "Indians" included:

> Firstly. All persons of Indian blood, reputed to belong to the particular body or tribe of Indians interested in such lands and their descendants.
>
> Secondly. All persons intermarried with any such Indians and residing amongst them, and the descendants of all such persons.
>
> Thirdly. All persons residing among such Indians, whose parents on either side were or are Indians of such body or tribe or entitled to be considered as such, and
>
> Fourthly. All persons adopted in infancy by any such Indian, and residing in the village or upon the lands of such tribe or body of Indians and their descendants. (quoted in Smith, 1975)

Notably broad in scope, the Indian definition of 1850 included all people of Indian ancestry, whether full blood or mixed blood, as well as white people adopted by or married to Indians. This early definition is significant as it did not favour the male lineage over the female (Leslie and Maguire 1978). Although many times remodelled to restrict entitlement to Indian status, this definition would set a precedent for subsequent definitions in that non-Indians determined who was Indian (Tobias 1991).

That the impetus for the first definition of an Indian population emerged from the need to distinguish indigenous and immigrant land holdings reflects European values which tie citizenry to land tenure and ownership of property (Kallen 1982). The 1850 *Lands Act* sought at once to protect Indians so that they might progress toward citizenship without interference, and to formalize and legitimize a procedure for appropriation of Indian lands. As gatekeepers to Indian lands, the Imperial government guarded against the unscrupulous acquisition of such lands by white settlers. In this regard, the Indian definition of 1850 was controversial as it failed to foresee the impact Euro-Canadian males married to Indian females could have on the erosion of Indian land tenure. Therefore, in

1851, the *'Lands Act'* was amended to exclude white males from living among Indians and non-Indian males married to Indian women from legal status as Indians. Non-Indian women married to Indian men did not pose the same threat to Indian lands as Canadian laws of the time recognized only male ownership of land as legitimate. Consequently, non-Indian women were not excluded from status. The 1851 provision was one of the first to differentiate between status and non-status Indians (Leslie and Maguire 1978).

Known as the *'Enfranchisement Act'* of 1857, the *Act to Encourage the Gradual Civilization of the Indian Tribes in the Canadas* revisited the point of distinction between status and non-status Indians. This *Act* was the first to make provision for voluntary surrender of Indian status and band membership (INAC 1991). The Colonial government employed the *'Enfranchisement Act'* as a means of civilizing Indians by individualizing land tenure (Milloy 1991). The provision encouraged Indian males aged 21 and over, who were literate, "of good moral character", and free from debt to apply for enfranchisement (INAC 1991). The government offered various inducements to enfranchisement, including access to voting rights in federal elections (Wherrett 1996). Premised in the notion that `civilization' and `citizenry' were inherently desirable to Indians and non-Indians alike, the intent of the *Act* was to reward those Indians who adopted Euro-Canadian values with the dissolution of legal distinctions between them and their non-Indian counterparts. Although enfranchisement was ostensibly voluntary, the wording of the *Act* ensures only that an adult male would enter into this agreement by his own volition. His wife and children, however, would be automatically enfranchised with him and their names not necessarily listed in the official declaration (INAC 1991).

Early post-Confederation era. In 1867, the British Crown conferred "exclusive Legislative Authority" over "Indians and land reserved for Indians" to the federal government by way of section 91(24) of The *British North America Act* (quoted in Smith, 1975). The *BNA Act* offered no revision of the standing definition of Indian. Rather, it provided an indistinct reference to "Indians" as male persons of Indian blood, their spouses and children (Leslie and Maguire 1978). Thus patrilineal principles embodied in pre-confederation legislation were upheld by the *BNA Act.*

The legal definition of Indian was again addressed by both the *Lands* and *Enfranchisement Acts* of 1868 and 1869; the post-Confederation equivalents of earlier legislation. While the *Lands Act* simply reiterated the 1851 definition, the 1869 *Enfranchisement Act* added a "blood quantum" proviso, which prohibited individuals of less than one-fourth Indian heritage from receiving band annuities upon enfranchisement. Subsequent *Indian Acts* from 1876 through 1927 have contained some reference to "Indian blood", similar to the 1869 statute (Leslie and Maguire 1978).

The *Enfranchisement Act* of 1869 was also the first statute directly governing the status of women after marriage to a non-Indian or non-status Indian male. Such women and the children issuing from the union were not entitled to band membership, to annuities of their natal bands, nor to Indian status. Also, upon marriage to an Indian man from another band, a woman became a member of her husband's band and only paternal band membership could be conferred upon their children (Leslie and Maguire 1978). This legislation represents a controversial turning point in the history of the legal recognition of

Indian status. For aboriginals, it constituted an imposition of Euro-Canadian patriarchal values and an encroachment of the state upon their domestic affairs. As early as 1872, the General Council of Ontario and Quebec Indians petitioned that "Indian women may have the privilege of marrying when and whom they please without subjecting themselves to exclusion or expulsion from the tribe" (quoted in Leslie and Maguire 1978, 54). Such appeals went unheard for over a century before the legitimacy of these claims were recognized in Canadian courts. However, in the intervening years, exclusionary criteria of the discriminatory policy were progressively refined.

The *Indian Act* definition. In 1876, the *Indian Act* consolidated and revised all previous legislation regarding Indians in all existing provinces and territories of Canada. To a far greater degree than in any previous legislation, the *Indian Act* restricted eligibility for Indian status and band membership (INAC 1991). The *Act* provided a succinct definition of the term "Indian" as:

> First. Any male person of Indian blood reputed to belong to a particular band;
>
> Secondly. Any child of such person;
>
> Thirdly. Any woman who is lawfully married to such person. (quoted in Smith, 1975)

Aside from the more parsimonious wording of the definition as compared with those which preceded, the greatest departure made by the 1876 definition was its unequivocal patrilineal bias. Indian status could now only be conferred to a female by virtue of being a daughter or wife of a male status Indian (Leslie and Maguire 1978). Although the *BNA*

Act had already shown a preference for the male line, patrilineal criteria were not firmly entrenched in Canadian legislation until the 1876 *Indian Act* definition. Furthermore, the *Indian Act* retained the controversial 'marriage rule' provision of the 1869 *'Enfranchisement Act',* incorporated in two of five articles which set out the conditions for exclusion of persons from status and band membership (Leslie and Maguire 1978).

In addition to the selective prohibition of Indian women and their children, the 1876 *Act* extended new stipulations barring membership and status to three other categories of persons, including: illegitimate children; Indians residing outside Canada for 5 years; and recipients of half-breed lands or scrip. The exclusion of illegitimate children discouraged Indian women from electing common law unions with non-Indian males in order to retain status for themselves and their children. Foreign residents were targeted in order to prevent individuals from drawing annuities from both the American and Canadian governments. The final article precluded Metis from collecting annuities twice as Manitoba Metis had already been allotted 1,400,000 acres in the 1870 *Manitoba Act* (Leslie and Maguire 1978). Thus, these provisions closed loopholes that had existed in earlier Indian legislation and initiated more stringent regulation of status.

In addition to the restrictions contained in entitlement regulations, a new provision was added to the enfranchisement section of the 1876 *Indian Act* which allowed the government to invoke involuntary enfranchisement under specific circumstances. For example, an Indian could be automatically enfranchised upon his attainment of a university degree or professional credentials of a doctor, lawyer, or Christian minister (INAC 1991).

By 1876, the definition of the Canadian indigenous population had evolved through twenty-five years of legislative activity. What began in early colonial times as an obvious `racial' and ethnic designator had, by the institution of the *Indian Act,* become a somewhat arbitrary designation. At the same time, an increased blurring of cultural and biological categories developed as a result of inter-marriage/mating and social interaction, which added a growing subjective element to the process of defining the Indian population (Frideres 1993). Early legislative definitions addressed an administrative need to define a service population of manageable proportions more so than they reflected changes in the self ascribed identity of Canadian Indians. Despite the opportunity Indians had been given to abrogate their status since 1859, few had actually chosen to do so (Leslie and Maguire 1978). Thus, as early as 1876, a separation had developed in Canadian society between aboriginal cultural associations and the political and legal body defined as Indians by Canadian administrators.

Early revision of the *Indian Act* definition. Early revisions of the *Indian Act* represented mainly administrative refinement rather than changes to the essential structure of Indian legislation (Leslie and Maguire 1978). Several amendments applied to enfranchisement. The preoccupation of the Canadian parliament with enfranchisement near the turn of the century can best be understood in light of high immigration to Canada at that time. Coincident with and complementary to the aims of enfranchisement legislation, an aggressive policy of expropriation of Indian lands was also underway (Bienvenue 1985). In response to reluctance of Indians to withdraw from treaty, the

federal government created further inducements to enfranchisement and removed existing barriers or deterrents (Leslie and Maguire 1978).

Following upon the 1869 defeat of the Riel rebellion, the late 19th century called for the incorporation of Metis into the bureaucratic framework of Indian/non-Indian definitions. Metis had been given the choice of accepting scrip and retaining Metis identity or taking treaty to acquire legal status as Indians (Kallen 1982). Therefore, further amendment of the *Indian Act* was required to allow for 'half-breed' enfranchisement. The 1879 amendment included a provision for withdrawal from treaty of all Metis who had adopted the legal status of Indians, which called for a refund of all money or land scrip received under the treaty. However, a further amendment in 1884 waved this requirement to permit enfranchisement simply on the basis of written intent to do so. This permissive amendment, combined with the Government's decision in 1885 to issue scrip to 'half-breeds' of the Territories, resulted in a flood of applicants for discharge from treaty at the end of the 19th century (Leslie and Maguire 1978).

As further inducement to enfranchisement, the Canadian parliament temporarily suspended tax assessments on the real property of recently enfranchised Indians in 1884. Furthermore, the 1884 amendments granted full authority over enfranchisement to the Superintendent-General of Indian Affairs. This amendment permitted the government to circumvent the authority of the band council which frequently opposed enfranchisement as it led to the erosion of the reserve land base (Leslie and Maguire 1978).

Legislative amendments which followed the 1906 consolidated *Indian Act* achieved greater refinement and extended enfranchisement policy to encompass a wider

range of applicants than ever before. The 1914 amendments provided for the automatic withdrawal of wives of enfranchised half-breed males which brought half-breed policy in line with that which existed for their Indian counterparts (Leslie and Maguire 1978). Amendments in 1918 made provisions for the enfranchisement of persons living away from Indian communities, again including their wives and unmarried minor children. Also, specific provisions were made for the enfranchisement of unmarried women and widows who were previously unaccounted for by male centred legislation. The minor children of widows were automatically enfranchised with her, while those of unmarried women were not necessarily enfranchised, unless named on the enfranchisement order (INAC 1991).

Despite the greater inclusiveness of the *Indian Act's* enfranchisement provisions, by 1920 most Indians still resisted voluntary enfranchisement. In fact, records indicate that only sixty-five families including 102 persons enfranchised between 1876 and 1918 (Nichols 1989). Impatient with the slow rate of Indian assimilation, the Conservative government of the time instituted extreme measures by claiming the right to arbitrarily enfranchise Indians. The 1920 provision gave the Governor in Council power to order any individual over age 21 enfranchised within two years of the Superintendent-General's decision deeming them fit for citizenship. However, compulsory enfranchisement was short lived as, in 1922, the new Liberal government under MacKenzie King revoked this provision. Although a variant of compulsory enfranchisement re-emerged in 1933, greater safeguards of Indians' treaty rights were included in this legislation (Leslie and Maguire 1978).

Development of the new *Indian Act.* In 1938, the Indian Affairs Branch of the Department of Mines and Resources committed to reformulate the *Indian Act* to better address the problems of Indian people. Though delayed by the Second World War, the revision process resumed with greater momentum in 1946, when post-war optimism sparked renewed public and government interest in social issues. This initiative sought a clear departure from earlier legislation which was dominated by policies of assimilation and paternalistic protectionism. Post-war Indian Affairs policy recognized the ethnocentrism of former civilization policy and the importance for Natives of retaining their own values and regaining a voice in the process of their advancement toward citizenship. This new initiative was reflected in the formation of the 1946 Joint Parliamentary Committee to examine the new *Indian Act,* which heard representatives from several Indian groups (Leslie and Maguire 1978).

The 1948 session of the Joint Committee's deliberations heard the opinions of many Indian bands and associations on the topics of band membership and enfranchisement. As a result of this session's hearings, the Joint Committee report recommended a new definition of Indian which better reflected present conditions, the creation of an Indian Register to facilitate determination of Indian status and band membership, and consolidation of several sections of the *Indian Act,* including those concerning enfranchisement (Leslie and Maguire 1978).

Despite the allowance for Indian input, the process which led to the enactment of the 1951 *Indian Act* fell short of its original intentions to advance Indian self determination. The Canadian Parliament did not repeal discriminatory sections of the

Indian Act. Furthermore, the so called "double mother clause" was added to formalize a procedure for excluding "quarter bloods" from band membership and Indian status. Nevertheless, Indian band representatives and members of the government Opposition succeeded in forestalling ratification of the proposed *Indian Act* of 1950 and in eliminating the involuntary enfranchisement provision from the final *Act* (Leslie and Maguire 1978).

The "new" *Indian Act.* The 1951 *Indian Act's* treatment of registration and enfranchisement was the most systematic and bureaucratic to date due to the establishment of the Indian Register (INAC 1991). The Office of the Registrar was also established to maintain the Indian Register and to determine the eligibility of individuals for registration. The Register was established from records such as treaty and interest distribution paylists and census records (INAC 1993a). It provided a centralized record of all persons entitled to registration. Status Indians were listed on one of two lists: the band list if they held membership in a band, or the general list if they were without band affiliation. However, with greater efficiency came greater complexity since the Register facilitated the application of a greater number of eligibility rules and other regulations concerning the administration of entitlement (INAC 1991). The Register also provided a more equitable system for the ascription of status as band and general lists were required by law to be publicly posted and thus subject to scrutiny. Furthermore, a formalized procedure for protest of the Registrar's decisions was put in place (INAC 1991).

Eligibility for status under the 1951 *Indian Act* was determined by several criteria detailed in Section 11 of the *Act.* Firstly, prior entitlement was recognized for those eligible under 1874 legislation on the basis of their use of Indian lands and membership in

bands identified in treaties. Furthermore, members of bands since accorded status by the federal government could also claim Indian status. The *Act* showed continued preference for the male lineage as only males could confer status to their legitimate offspring, spouse, or widow. Although illegitimate children were not categorically denied status, an Indian woman's child could be excluded upon determination of non-Indian paternity. Generally, the addition or deletion of a male Indian from a band or the general list still entailed similar treatment for the names of his wife and minor children (INAC 1991).

Non-eligibility for registration was determined by criteria detailed in Section 12 of the *Act.* Prior enfranchisement, receipt of half-breed lands or money scrip, or descent from a recipient of scrip constituted grounds for ineligibility. In addition, the 1951 *Indian Act* added the so called "double-mother" clause, a vestige of the "quarter blood rule" of 1869. This clause enforced a two generation cut-off where, upon reaching age 21, an individual whose mother and paternal grandmother were both non-Indian would be divested of status (INAC 1991).

The primary criteria which determined eligibility for enfranchisement required voluntary application by an adult male capable of assuming the responsibilities of citizenship and provision for his family. However, women who married non-Indian men and wives and children living with an enfranchised male were still automatically enfranchised. Nevertheless, enfranchisement legislation was somewhat tempered in 1951. The *Act* allowed an Indian male to be enfranchised without his wife and minor children if he did not live with his family and permitted the wife to apply separately for enfranchisement. Women and children could no longer be enfranchised without their

names appearing on the order of enfranchisement. Furthermore, five years foreign residency no longer entailed the loss of status and band membership. In addition, those already enfranchised for this reason were added to the Register and could regain band membership upon the consent of their band council (INAC 1991). Thus, the 1951 legislation became the first to both limit the powers of the government to arbitrarily enfranchise and to reverse the ordinance for a class of individuals.

Further revision to the 1951 *Indian Act.* Few substantive changes to registration and enfranchisement provisions were initiated within thirty years after the passage of the 1951 *Indian Act.* Those revisions which were introduced continued to relax previous regulations. In 1956, registration of illegitimate children was first permitted without an investigation into paternity. However, if the decision were protested and non-Indian paternity was established within 12 months of registration, the child's name would be removed from the Indian Register and band list. The 1956 revisions also added a provision for the enfranchisement of children born to a woman prior to her marriage to a non-Indian, although this was not obligatory (INAC 1991). In 1960, the franchise was extended to status Indians, including those living on reserves (Leslie and Maguire 1978). Finally, a 1970 revision resolved the status of half-breeds who had been inadvertently registered despite their having accepted lands or scrip. If registered on 13 August 1958, these individuals and their descendants were permitted to remain registered (INAC 1991).

When considered in its entirety, the *Indian Act* which emerged from three post war decades of revision largely resembled 19th century legislation, particularly in its

paternalistic philosophy. However, some advances were achieved through the greater inclusion of Indians in the process of *Indian Act* revision. Furthermore, the more discriminatory and repressive entitlement and enfranchisement provisions were dismantled (Leslie and Maguire 1978). Still, changes to the *Act* were largely driven by the government's need to limit the Registered Indian service population which was accomplished according to Euro-Canadian values. Indian Affairs policies discriminatory toward women were among the most resistant to change, as they awaited improved equity for women in other areas of Canadian social and political life (Jamieson 1986).

Bill C-31 Amendments of 1985; Current Legislation

Background to Bill C-31. In 1985, the Bill C-31 amendments to the *Indian Act* became the most extensive revisions involving the determination of Indian status to date. The debate which preceded and ensued from these amendments was the most politically sensitive discussion of the status issue witnessed by Canadians since the White Paper of 1969. Writing in 1984, Sanders described the conflict over Bill C-31 as the "single most contentious issue in Canadian Indian policy" at that time (Sanders 1984, 30). The controversy of Bill C-31 derived from issues of sexual discrimination, aboriginal self determination and cultural integrity provoked by its proposals. Native women and status Indian interest groups polarized over these issues, exacerbating existing schisms in the aboriginal community (Weaver 1973). Women's groups, led by the National Committee on Indian Rights for Indian Women and the Native Women's Association of Canada, advocated a quick legislative solution to the problem of discrimination in the *Indian Act.*

Other Indian groups, in particular the National Indian Brotherhood/Assembly of First Nations (AFN), opposed the discriminatory legislation, yet argued that membership rights should be the prerogative of First Nations. Thus, AFN opposed piecemeal changes to the *Indian Act* in absence of constitutional reform to entrench Indian rights (Dunkley 1982).

Over a century of application of Euro-Canadian patriarchal principles entrenched in the *Indian Act* had institutionalized discrimination among Canada's Indian population. Despite attainment of greater civil liberties for Canadian women, conservative revision of the *Indian Act* forestalled similar progress for Indian women (Jamieson 1978, 1986). The exclusion of women from legal Indian status and from residence on reserves led to increasing dissention among Indian women and, by the 1960s and 70s, organized opposition to discriminatory provisions of the *Indian Act* (Silman 1987, Frideres 1993). In 1971 Jeanette Lavell and Yvonne Bedard, both of whom had lost status upon application of section 12(1)(b), successfully challenged the *Indian Act* in the Canadian courts. In each case, the Federal court's decision charged that the *Indian Act* violated the Canadian Bill of Rights by denying equality before the law by reason of sex. However, in 1973 the Supreme Court reversed the lesser court's judgement in a joint hearing of appeal (Kulchyski 1994, INAC 1993a). Nevertheless, these challenges to the *Indian Act* demonstrated its vulnerability on legal grounds (Jamieson 1978). This prompted status Indians to lobby for government support in blocking alteration to any membership sections of the *Indian Act* pending wholesale revision of the *Act* (Dunkley 1982).

Political posturing by aboriginal factions ended with the decisive manoeuvre by Native women's groups which brought Sandra Lovelace's charge of sexual discrimination

into the international arena. Lovelace appealed to the UN Human Rights Committee to censure the Canadian government for discriminatory treatment levelled against her in the application of section 12(1)(b) which stripped her of status, forced her removal from her community, and prohibited her return upon divorce. In its 1981 ruling, the Committee found Canada in violation of the *International Covenant on Political and Civil Rights,* which guarantees members of ethnic minorities the right to enjoy their own culture (INAC 1993a, Frideres 1993). In response to international pressure, the Canadian government pledged to amend the *Act* in consultation with Native groups. Thus, a parliamentary sub-committee was struck to consider the rights of Indian women and the *Indian Act.* Another committee on self-government was formed which solicited recommendations from status Indians. These consultations led to a variety of proposals for reform (Dunkley 1982, Sanders 1984, INAC 1984). As a further concession, the Canadian government instituted an interim policy in July of 1980 which allowed Indian bands to suspend the 'marriage rule' and 'double mother rule' pending legislative amendments. However, as only 19% of bands chose to suspend the former, whereas 53% suspended the latter, this measure proved insufficient in limiting discrimination (Holmes 1987).

The Canadian government committed to revision of discriminatory provisions within the *Indian Act* upon revision of the *Charter of Rights and Freedoms* in the *Constitution Act* of 1982. The *Charter,* which guaranteed equal rights for women, both in the substance and administration of the law, would have forced resolution of the *Indian Act* by 17 April 1985. The constitution also guaranteed protection of existing aboriginal rights in the application of the *Charter of Rights and Freedoms* (Dunkley 1982, Holmes

1987). Despite AFN denouncement of the revision process and an unsuccessful attempt at passage through Senate, the discriminatory provisions of the *Act* were finally repealed in 1985. Bill C-31, *An Act to amend the Indian Act,* was tabled in the House of Commons on 28 February 1985, passed on 17 June and given Royal Assent on 28 June 1985. The Bill was backdated to 17 April 1985 in order to ensure conformance with international human rights standards and the equality provisions of the *Charter of Rights and Freedoms* (Holmes 1987).

Changes introduced by Bill C-31. The Bill C-31 amendments represent a compromise between the positions of aboriginal women and non-status Indian groups, and the Assembly of First Nations (Moss 1990, 286). The Bill introduced several changes to the *Indian Act* including: the elimination of sexually discriminatory registration criteria; provisions for restoration of status and band membership; provision for first time registration of first generation descendants; the elimination of enfranchisement provisions; and provisions for transfer of control over band membership to band councils (Canada 1985, Penner 1988). These changes significantly affected entitlement to status and created rapid growth in the number of applicants for registration (INAC 1993a). In May of 1986, the Membership and Entitlement Directorate was established to centralize and coordinate registration activities. This office holds responsibility for determining eligibility for status, although it remains the responsibility of individuals to apply for registration. Furthermore, it remains the sole prerogative of the Registrar to add names to or delete names from the Register (INAC 1987).

Eligibility for registration. Bill C-31 significantly altered eligibility criteria for registration. The greatest departure made by the amended *Act* was the elimination of sexually discriminatory criteria. That is, eligibility no longer hinged solely upon the male line of descent (Holmes 1987). The new criteria under subsection 6(1) grant eligibility to those with prior entitlement and to members of newly created bands. Furthermore, entitlement was extended to persons formerly denied status through the sexually discriminatory provisions repealed by Bill C-31. These included the so-called 'double mother' clause under subparagraph 12(1)(a)(iv), the 'marriage rule' stipulated by 12(1)(b), provision 12(1)(a)(iii) which enfranchised children as a result of their mother's marriage to a non-Indian, and provision 12(2) which dictated the removal of children of unmarried Indian women from the Register upon successful protest of non-Indian paternity (Canada 1989, INAC 1991, NWAC 1986). Thus, Bill C-31 ensured that a woman's marital status would no longer determine her entitlement to registration and that marriage of a parent would no longer be a factor in the determination of a child's status (INAC 1989).

The revised *Indian Act* also addressed entitlement of those previously enfranchised. Enfranchisement provisions 109 through 113 were excluded from the new *Act* (Canada 1985). Thus, as of 17 April 1985, an individual could no longer give up or be stripped of status (Holmes 1987). Furthermore, section 10 which stipulated that wives and minor children be added to or deleted from the Register with a male and subparagraph 12(1)(a)(iii) which ordered the removal of enfranchised persons from the Register were also excluded (Hawley 1984). The revised *Act* extended eligibility criteria to include individuals who previously relinquished status as well as wives and children automatically

enfranchised with a husband/father. The latter category includes both those explicitly named on an enfranchisement order and those enfranchised with a husband/father prior to 4 September 1951 without having been named (INAC 1991). Finally, the revised *Act* grants eligibility for registration to those enfranchised prior to 1 July 1920 as a result of their professional or educational credentials and those deleted from a band list prior to 1951 as a result of five or more years foreign residence without authority from the Superintendent General (Canada 1989, INAC 1991).

The final eligibility criteria determine entitlement for registration of subsequent generations. These new criteria make no further gender distinctions. Individuals with two parents registered or entitled to be registered under any of the previously mentioned provisions are also eligible for registration under paragraph 6(1)(f). However, individuals with only one parent entitled under 6(1) are granted entitlement under 6(2) (Canada 1989). Thus, children born to women who had lost status as a result of marrying a non-Indian may only seek entitlement under 6(2). These individuals are unable to confer entitlement to status to their children who would be denied status unless their other parent was entitled to registration under 6(1). In this sense, these criteria perpetuate past discrimination on the basis of sex. Similar restrictions apply to future generations of all Registered Indians as the distinction between 6(1) and 6(2) registrants imposes a two generation 'cut-off' whereby offspring resulting from two successive generations of marriage between status and non-status individuals are denied status (NWAC 1986, Holmes 1987). An added clause under subsection 6(3) grants entitlement to those whose parents died before 17 April 1985 but who would have qualified for registration under

section 6 (Canada 1989). The above provisions apply to Indian children as defined by section 2 of the 1985 *Indian Act.* According to the revised definition, a "child" includes "a child born in or out of wedlock, a legally adopted child and a child adopted in accordance with Indian custom" (Canada 1989, 1). This new definition is more permissive than any adopted by previous legislation and allows for the extension of eligibility to illegitimate and adopted children (INAC 1989).

Non-eligibility. The removal of several discriminatory provisions, as described above, has left few explicit criteria governing ineligibility to status in the revised *Indian Act.* The remaining provisions under section 7 disallow two categories of individuals. Firstly, women who gained status through marriage to an Indian and subsequently lost status are not eligible for registration unless entitled prior to marriage or now entitled in their own right. A child of such a woman is also ineligible if his/her father is not an Indian. However, if the mother at the time of her marriage was eligible for status or now has an entitlement in her own right through her descent from Indians, the child may be eligible for registration (Canada 1989, INAC 1991). Aside from these explicit rules, several other restrictions regarding eligibility remain. For example, the descendants of people who accepted half-breed land or money scrip remain ineligible for registration, unless entitled under another provision. Similarly, descendants of families or entire bands that were left off band lists or were never registered are also ineligible. Furthermore, the limitations of entitlement dictated by subsection 6(2) imposes a tacit system of restricting eligibility as already described (Holmes 1987).

Band membership revisions. Bill C-31 amended sections 8 through 14.3 of the *Indian Act* which determine entitlement to band membership and the administration of band lists (Canada 1985). Until 1985, the Federal Indian Register administered both status and band membership which coincided in virtually all cases. Beginning with the Bill C-31 revisions, status was no longer necessary or sufficient to confer entitlement to band membership. The separation between status and band membership reflected a new division of administrative powers where band councils acquired the option to assume control over band membership and the maintenance of band lists, while the determination of status remained the jurisdiction of the federal government (O'Neil 1988).

Provisions for transfer of control over band membership include several safeguards which strive to maintain equitable rules of entitlement. Firstly, band governments are required to give notice to their membership of the intent to apply for the transfer of control. Secondly, the drafted membership rules require the consent of the majority of electors of the band before submission to the federal government for final approval. Thirdly, the band's membership rules cannot deprive individuals with previously acquired rights to membership or the children of these individuals born on or after 17 April 1985. Furthermore, the rules cannot exclude those who lost membership under sexually discriminatory provisions prior to revision of the *Act* who since acquired rights to status (Canada 1989). These categories of individuals are considered to have "automatic" entitlement to band membership. Others who lost status as a result of enfranchisement and the children of those who directly lost status due to discrimination may claim only "conditional" entitlement to band membership. Conditional entitlement becomes the

jurisdiction of a band where that band has assumed control over membership before 28 June 1987. However, if a band should forego this option, those with conditional membership will be granted automatic membership upon expiry of the deadline. Thereafter, control over membership for that band will revert to the Department of Indian Affairs. Bands may choose to assume control of their membership rules at any time after the June 28 deadline, however, they are obliged to respect the rights of those who acquired membership during the interim (INAC 1989, INAC 1990b).

Despite the above mentioned constraints, Bill C-31 expanded First Nations control over membership rules and community affairs. Band councils may now control access to band membership for the majority of Bill C-31 registrants and future generations. Bands which assumed control over membership rules prior to June of 1987 could adopt rules which differed significantly from Indian Affairs criteria. They may also decide on the admission of transfer applications from members of other bands. Therefore, a woman marrying a man from another band will no longer automatically be ascribed membership in her husband's band. New bylaw powers give bands control over residence of band members and others on reserve and the rights of non-member spouses and children of band members living on reserve (INAC 1989, INAC 1991). As demonstrated by the Sawridge band of Alberta, band councils could pass by-laws to prohibit reinstated persons, entitled to automatic band membership under Bill C-31, from residing on the reserve, thus effectively barring them from band membership (Holmes 1987). Furthermore, where individuals regain membership, band councils may withhold disbursements from band

funds until band monies payed to the individual upon enfranchisement are refunded, where that amount exceeded 1,000 dollars (INAC 1989).

The new role for band councils in the determination of band membership necessitates a changed role for the Indian Registry as well, although several of its former responsibilities continue. The revised *Indian Act* requires the Department of Indian Affairs to continue to maintain a listing of all individuals entitled to status under the *Indian Act*. Thus, individuals registered but excluded from band membership by band rules will continue to be recognized by the federal government as having the legal right to certain benefits granted to Indians (INAC 1991). The Department of Indian Affairs also continues to maintain a band list where a band has declined or not yet assumed control over its own membership. The responsibilities of the Indian Registry change where a band has assumed control over its own membership rules, in which case the Registrar relinquishes power to make additions to or deletions from band lists (INAC 1991). Furthermore, the Indian Registry also ensures that individuals granted automatic and conditional band membership are dealt with in accordance with the rules dictated by the Bill. Further changes can be expected in the future as the administration of the Register will continue to devolve to the band level (INAC 1993b).

Demographic Impact of Bill C-31

Over a decade of application of Bill C-31 has led to significant growth in the Registered Indian population and further questions as to its lasting impacts. A small body of literature has addressed the demographic impact of the Bill to date, projections of

potential impacts, and the general significance of the amendments for the quality of demographic data. Much of the available literature has come out of the Department of Indian Affairs or other government sources, while demographic, health and social science fields have largley ignored the implications of the Bill.

At the time of Bill C-31's inception, approximately 60,000 to 70,000 individuals were expected to seek registration under the revised provisions for registration (Munro 1984, INAC 1995, O'Neil 1988). However, the pace of application for registration in succeeding years proved this estimate to be a gross underestimate of the potential impact of Bill C-31. Initial estimates were dependant upon a base population of enfranchisements recorded by the Department of Indian Affairs, which likely underestimated the number of women and children automatically enfranchised with a husband/father, particularly prior to the 1950's when dependants were not consistently named by the official order. A total of 20,694 enfranchisements are estimated to have occurred between 1876 and 1974, which includes women enfranchised following marriage to non-Indians and minor children enfranchised with adults. Furthermore, statistical evidence indicates that the vast majority of enfranchisements resulted from the application of discriminatory provisions, resulting in a greater number of enfranchised women than men. Between 1955 and 1965, 70% of enfranchisements followed the application of section 12(1)(b). In the following decade, 95% of enfranchisements were attributable to this section (DIAND statistics reproduced in Daniels 1981, 5).

Prior to the enactment of Bill C-31, consultation with Indian band councils uncovered strong concerns over the implications of the amendments for overall growth in

the Registered Indian population and in reserve populations in particular. In response to these concerns, section 22(1) of the amended *Indian Act* committed the Minister of Indian Affairs to table a report in Parliament which examined the implementation of the amendments two years after the Bill's assent (Canada 1985). The Report to Parliament indicated that by 31 May 1987, 90,051 people had applied for registration under the revised *Act*. Of these, 24,708 were granted status. Furthermore, the report indicated 12 bands as having assumed control over their membership in advance of the June 1987 deadline (INAC 1987).

Owing to a large backlog in the processing of applications and few additions to reserves, Indian Affairs committed to undertake further review of demographic and resource impacts in 1990 (O'Neil 1988). The 1990 reports represent the most detailed account of the demographic impacts of Bill C-31 to date. The report documented the registration of 73,554 individuals under Bill C-31, 77% of whom were adults and 58% female. These additions to the Register represented an increase of 19% in the status population over the first five years following the amendments. Bill C-31 registrants constituted 15% of the total Registered Indian population of 1990. A large majority of these individuals (90%) resided off-reserve (INAC 1990).

Since 1990, Indian Affairs has released further information regarding the impact of Bill C-31 upon several demographic indices. In 1992, the department published population projections which addressed growth attributable to the amendments. These estimates placed the Registered Indian population at 700,600 by 2001, representing a 37% increase since the 1991 population. Average annual growth rates were shown to increase

dramatically after 1985, coincident with yearly additions of Bill C-31 registrants to the population. Furthermore, Bill C-31 was implicated in the high rate of growth for the off-reserve population, which showed average annual growth rates in excess of 15% for the 1986 through 1988 yearly intervals. Projections for 2001 estimated the off-reserve population to increase to 44.6% of the total band population. The 1992 demographic assessment was presented together with estimates of mortality rates and life expectancy. Although mortality rates were described as falling sharply since 1988 and life expectancies showed accelerated improvement in the 1980 to 1990 period, no attempt was made to relate these sudden changes to Bill C-31 demographic changes (INAC 1992).

The latest INAC figures on Bill C-31 registration report the addition of 101,428 Bill C-31 registrants from a total of 183,349 applications submitted by 31 August 1995. Of these, another 32,231 were denied eligibility (INAC 1995). Thus, 76% of completed applications resulted in successful registration, which is consistent with proportions drawn from 1988 results (O'Neil 1988). A decade since revision of the *Indian Act* has brought a 27% increase in the Registered Indian population directly attributable to Bill C-31. Furthermore, as of September 1995, 240 of 608 bands have assumed control over their membership rules (Financial Post 1995).

Although short term population increases are evident from the data produced to date, some fear that the 6(2) 'cut off' rule will result in a significant decline in the status Indian population in the future (Holmes 1987, O'Neil 1988, Imai et al. 1993). As the majority of 1990 Bill C-31 registrants were admitted to status under this provision (INAC 1990), its application may well prove significant in the determination of population size for

subsequent generations. According to the projections of Clatworthy and Smith (1992), the Registered Indian population can be expected to increase to approximately 800,000 by 2041, after which time the population will begin to fall, returning to a level of 600,000 by 2091. The same study estimated the impact of the application of various band membership criteria on total band membership. Projections based upon the least restrictive criteria could result in over one million band members by 2061, while more restrictive membership rules could result in fewer than 100,000 by 2091. As the Federal government continues to maintain control over registration, and as funding for government programs remains tied to the number of Registered Indians, bands may have little incentive to broaden their admission criteria to include individuals ascribed conditional band membership (INAC 1993a).

Demographic changes resulting from the application of Bill C-31 have gained little attention in the literature. Nevertheless, the department of Indian Affairs has acknowledged that the reinstatement of Indians through Bill C-31 has added to the already significant problem of late reporting of vital events (INAC 1993a). Finally, Mustard has commented on the inadequacy of MHSC's population registry in covering the Bill C-31 registrant population. As compared with MSB data, an under-count of 4.5% in MHSC registry data is evident in 1986 data, which increases to 12.0% by 1989, and 18.9% by 1990/1991, representing 13,000 to 15,000 individuals (Mustard 1992 communication). Thus, there is a paucity of literature which describes the extent to which Bill C-31 amendments may impact upon the quality of demographic data. The fact that this data is

employed in the calculation of epidemiologic rates which then affect policy decisions, constitutes the rationale for the following analysis.

CHAPTER 3

MATERIALS

Data Sources

Vital statistics data on Manitoba Registered Indians employed in this study were provided by Health and Welfare Canada, Medical Services Branch, Manitoba Region (MSB) with the approval of Dr. Judith Bartlett, Health Programs Director for MSB, and Chief Sydney Garrioch, Chair of the Chiefs Health Committee, Assembly of First Nations.

Population, mortality and fertility data employed in this thesis were compiled by MSB (Manitoba Region) in cooperation with the Department of Indian and Northern Affairs (INAC), the Manitoba Health Services Commission (MHSC), and Manitoba band councils. INAC is mandated under the Indian Act to maintain a registry of status Indians, accounting for births, deaths and legal changes in status among this population. INAC supplies MSB with information from the Canadian Indian Register towards the maintenance of a computerized masterfile of the Registered Indian population in the province. Births and deaths are reported to MSB from a variety of sources, including MHSC, nursing station and band reports. These reports are cross-checked against the masterfile to confirm that these individuals hold Registered Indian status. MSB uses this

information to compile end-year summaries of population, births and deaths for Manitoba Registered Indians.

Postcensal population estimates and death data for the 1992 Manitoba population were derived from publications of the Population Estimates Section of the Demography Division and the Health Statistics Division of Statistics Canada respectively. These data constituted the standard population utilized in comparisons of the Registered Indian population.

Multiple sources of population, fertility and mortality data for Registered Indians in the province can be useful to validation of demographic data. However, the separate development of population data by INAC and birth and death data by other agencies and sources may create a problem of unequal coverage as well. Inconsistencies may arise from the situation where the Manitoba Region of MSB neither serves all reserves in the province, nor all Registered Indians. Consequent to this lack of correspondence between the MSB service population and the total Registered Indian population of Manitoba, some vital events information from the unserviced population may be missed.

Other inaccuracies in this data may reflect the well known problem of late reporting of events. INAC staff indicate that 45-92% of births between 1971 and 1981 in the Indian Register were not reported in the same year as they occurred, with some births recorded up to 11 years late. Deaths were more promptly reported, with about half recorded in the same year as they occurred, and 98% within three years (Piche 1973). Furthermore, due to the high mobility of the Indian population, it is unlikely that the

Register is able to maintain a high degree of accuracy and currency in classifying individuals by residence.

Description of Data

Population, mortality and fertility data for six bands from the Manitoba Registered Indian regional population, 1980-1991, were employed in this thesis. Constituting the largest bands in Manitoba, these include: Cross Lake, Fort Alexander, Nelson House, Norway House, Peguis and Sandy Bay. These bands were selected because: (1) they presented, individually and in the aggregate, manageable population size, (2) were assumed to be representative of Manitoba Indians, and (3) in the aggregate presented sufficient numbers of births and deaths for comparisons of the periods before and after Bill C-31. The combined population of these bands represents approximately 30% of total Registered Indian population of Manitoba throughout the 1980-1991 period. For the purpose of my research, this composite will be taken to represent the Manitoba Registered Indian population as a whole.

The population data depict each of the six selected bands, for each year, 1980 through 1991, represented at end year (December 31). The band specific data is arrayed by age, sex and residence. Residence is assigned according to one of six categories defined by INAC which distinguishes persons living on a reserve administered by their own band; on a reserve administered by a band other than their own; on crown land "own band"; on crown land "other band"; on crown land not administered by any specific band ("no band"); and off-reserve.

MSB birth data consist of year end listings of births, for each of the years 1980-91, among the bands selected for study. Each birth is identified by the code number of the band to which the child was registered; the usual place of residence for the mother; the sex of the child; its date of birth; and the age of the mother at the time of her child's birth. Residence is identified according to MHSC service area codes assigned to 66 Indian Band communities, other Manitoba communities, and nine general service regions (including an out of province region) where individual communities are not assigned separate codes.

The MSB mortality data include deaths which occurred within each year to Indians registered to one of the six selected bands. Each death is described by the code of the band to which the deceased was registered; a MHSC service area residence code which designates usual place of residence at time of death; the sex of the deceased; the age at time of death; and, when applicable, an infant death code. MSB distinguishes between infant deaths which occur within early neonatal (0-6 days old), late neonatal (7-27 days old), and postneonatal (28-365 days old) periods.

The 1992 Manitoba population is aggregated by standard demographic age groupings (<1, 1-4, 5-9...80-84, 85+) and sex. The postcensal estimates are rounded to the nearest hundred population. Manitoba deaths are also aggregated by sex and the same age groups.

Adjustments to Data

A few adjustments to the original data were required in preparation for the analyses. Data was transcribed to Quattro Pro spreadsheet files and minor modifications

made to content and format so as to tailor it to the requirements of data input for the various analytical procedures employed. Restructuring of the data involved a few basic decisions pertaining to the selection of appropriate data categories, comparison groups, and standard definitions of variables. These matters are dealt with in the present section.

Definition of age categories. In anticipation of the intended methodology, it was necessary to adopt the definition of age intervals used in abridged life table analysis. This form requires that age categories be "closed" ended. For example, category 1-4 would include individuals who have attained their first birthday but not yet their 5th birthday.

The age categories selected for restructuring of data (<1, 1-4, 5-9....80-84, 85+) are standard in demographic practice and correspond to those adopted by Statistics Canada in reporting the Manitoba 1992 population. These age categories were applied to fertility and mortality data in preparation for data input. Maternal age by single years was apportioned to the appropriate age category within the fertile period (10-14,...55-59). Similarly, decedents were allocated to one of the 19 age categories on the basis of attained age.

Treatment of unknown age category. There were several individuals included in the population, mortality and particularly fertility data whose age was unknown. Unknowns were treated in a differential manner, mandated by the methodologies and computer programs utilized in this study. Unknowns in the population and mortality data intended for standardized comparisons were grouped together with the 85+ age category.

The rationale for this adjustment was based upon the assumption that it is most likely that individuals who have not reported their age have been unable to do so due to memory loss in old age. In life table and fertility analyses, unknowns were apportioned among categories of known age, for which there were other observations, in proportion to the relative size of that category by the computer programs.

Definition of residence categories. For the purpose of these analyses, the six INAC residence categories described above were collapsed into two categories. These include an "on-reserve" category which subsumed on-reserve own band and on crown land own band categories, and a second category which combined off-reserve, on-reserve other band, on crown land other band and on crown land no band INAC categories. A substantial number of individuals registered with the Nelson House band lived on crown land not administered by any specific band. This group likely belongs to the South Indian Lake community, a derivative community of Nelson House, which historically also included many Metis individuals. Nevertheless, the greatest number of individuals in the second category resided off-reserve. Thus, for the sake of convenience, this category will hereafter be referred to as the "off-reserve" population in contrast with the "on-reserve" population. Comparisons drawn between these two broad residential groups were taken to represent an approximation to differences between band members living on reserve and those living off reserve. The decision to omit "on- reserve other band" and "on crown land other band" residence from the on-reserve category stemmed from the rationale that only own band categories could be taken as an accurate representation of the demographic

characteristics associated with each of the band populations, presumably distinct in terms of social, political, economic, geographical and other environmental influences prevailing. Furthermore, the division of the population necessitated a trade off between maximizing homogeneity and size of comparison groups. By bolstering the size of the off-reserve category, greater comparability may be achieved.

Consistency in residence classification was achieved by allocating the MHSC coded mortality and fertility data to either of the two broad residence groups derived from INAC definitions. Individuals were categorized as on-reserve residents when the MHSC code assigned to them corresponded with a reserve/crown land community administered by their band, identified by a band code. Deaths and births that were assigned other community/region codes were allotted to the off-reserve category. Codes 00008 and 15555, designating out of province and Saskatchewan residence respectively, were interpreted as unknown residence as we were unable to determine whether individuals given these codes live on or off a reserve. These individuals, along with other unknowns lacking residence codes, were assigned to the off-reserve residence category. These represent a small group of individuals and would not appreciably affect the rates in the off-reserve category.

Conversion of end year to mid-year population. It is standard convention in most demographic analyses to employ mid-year population data in combination with birth and death data for the corresponding calendar year. As INAC populations have been recorded at end year, it was necessary to convert these figures into mid-year data. A

standard demographic technique of linear estimation was applied to 1980-1991 age-sex specific end year population data to attain mid-year data for 1981-1991. This procedure is based on the assumption that the mean annual distribution of birth and death processes remains stable over this time period. Linear estimation was employed to derive both band and on-reserve mid-year population data. Estimates for the off-reserve residence category were derived by subtraction.

Data Tables

Based upon preliminary testing and analyses, the materials which resulted from the foregoing preparatory adjustments were aggregated into several data sets from which data input for the analyses were drawn. Data sets employed in preliminary and exploratory stages of the research are not included herein.

Among data sets included, the first (see Appendix A. table 9) consists of three year aggregate mortality and fertility data centred on mid-year populations, arrayed by age category. The data are tabulated separately for males and females by on- and off-reserve residence categories. The three year mortality/fertility data listings are provided for 1980-82, 1983-85, 1986-88 and 1989-91 and are centred on the mid-year populations 1981, 1984, 1987 and 1990 respectively.

The second set of data (see Appendix A, Table 10) consist of five year aggregate mortality and fertility data, again centred on mid-year populations and arrayed by age. On- and off-reserve residence categories are tabulated separately for males and females.

Five year mortality and fertility data are grouped as 1981-1985 and 1986-1990 which are centred on the 1983 and 1988 mid-year populations, respectively.

In addition to the above data tables, Manitoba 1992 population and mortality data compiled by Statistics Canada have been reproduced in part (Appendix A, Table 11) for use in the analyses as a standard.

CHAPTER 4

METHODOLOGY

Data sets were constructed for formatted input with the WATCOM EDITOR according to the specifications of Keyfitz and Flieger (1971) and processed and analyzed with several FORTRAN programs written by these same authors. These programs have been edited to the FORTRAN77 standard, as required for the WATFOR-77 compiler, by Prof. D. Rokala of the Department of Anthropology. Dr Rokala has also supplemented source programs with the addition of routines for the calculation of binomial and nonparametric estimates of variance, standard errors and 95% confidence limits. The modified programs have been run on IBM-compatible microcomputers equipped with DOS Ver. 5.0 and greater.

The methods and procedures here described illustrate variation in compositional variables among the Manitoba Registered Indian population prior to and coincident with Bill C-31 and demonstrate the consequent effects of this variation upon indices of mortality and fertility. Initial analyses included consideration of population growth by residential category and the "error of closure" based upon populations, births, and deaths. Subsequent analyses included direct standardization with decomposition of crude rates, life table analysis of mortality, and deterministic analyses of fertility and reproduction.

Population Growth and Compositional Variables

Preliminary analyses involved manipulations of composite band population data to effect comparisons of differential population growth by residence, sex and age, as well as to estimate what proportion of yearly growth may be attributable to Bill C-31 re-registration. Growth of the total composite band population over time was observed as well as proportional growth by residence category and by sex, with particular interest in any changes associated with the transition between periods before and after Bill C-31. In addition, on-reserve, off-reserve, and total band populations for 1983 and 1988 were compared for age-sex structure to determine whether any further differentials in growth by age were discernable. These simple comparisons of proportional population growth were expanded upon with the calculation of crude annual rates of increase by yearly intervals for the on-reserve, off-reserve, and composite band populations over time.

As the crude annual rate of increase does not differentiate between various processes which contribute to population increase or decrease, an attempt at greater specificity was made by comparing the effects of basic processes of birth and death, contributing to the rate of natural increase, and a third unidentified process estimated by a measure of the "error of closure". The error of closure represents a measure of the proportion of yearly population growth which natural increase fails to account for. It is calculated by adding births and subtracting deaths from the population from the previous year and dividing this by the current population total. The resulting quotient is subtracted from 1 to obtain the proportion of growth not accounted for by natural increase which may then be converted into a percentage. The error of closure represents the combined

effects of several variables which impact upon population size and which may include late registration of births, late registration of deaths, and registration of Bill C-31 applicants. The examination of differential population growth according to compositional variables and the identification of variables contributing to population change provide contextual information important to the interpretation of subsequent analyses of mortality and fertility for the Manitoba status population.

Direct Standardization

Age-specific mortality rates for each of the three-year aggregate populations were standardized by the direct method, using the fortran program DIRECT, described by Keyfitz and Flieger (1971). Direct standardization is a procedure designed to compensate or control for variation due to differences in age structure between populations brought to comparison in the examination of some other variable of interest. Through direct standardization we attempt to ensure that any remaining differences between the comparison groups with respect to mortality, for example, are free of the confounding effects of age. A summary statistic called the directly standardized rate is computed which can be compared to other such statistics for different populations standardized against the same standard population. The directly standardized rate is obtained by applying the age-specific rates for the variable of interest in the study population to the proportional population sizes for the corresponding age categories in the standard population.

Secondary to the calculation of standardized rates, the DIRECT program also computes a decomposition of the difference in crude rates between the standard population and the population of interest which identifies the relative contribution of the discrete effects of age and rate components. In this analysis, decomposition employs weights from the average of given and standard population variables.

As an estimate of variation in standardized death rates, DIRECT computed the binomial variance, according to the method of Armitage (1971). This formula is predicated upon the assumption that the frequency of deaths in the population conforms to the expectations of a binomial distribution of events, where the frequency of an event and that of its alternative sum to unity. The standard error (S.E.) of the estimate of the directly standardized rate was then approximated by the square root of the variance. This statistic represents the average amount of deviation in the data set expressed in standard units. A frequently used approximation to the 95% confidence interval (+/- 1.96 X S.E.) was then applied to the standardized rate obtained. The confidence interval represents a probability statement which tells us that we can be 95% confident that the true standardized rate falls within the interval based upon our estimate.

Carriere and Roos (1994) have presented a descriptive statistic for testing the equality of standardized rates of events which is independent of any underlying distribution of events and robust to departures from the assumptions made by such distributions. The T^2 statistic allows multiple comparison of both rates of events and variation in rates between independent groups. Here the variances for standardized rates are obtained using a simple measure of dispersion that applies to any type of event, with no specific

assumption as to the distribution. This measure reduces to its usual form under a binomial distribution. This nonparametric variance is then incorporated into the formulaic expression of T^2. The T^2 statistic can be further tailored to accommodate either multiple comparisons of independent groups with another population standard or pair-wise comparisons between independent populations. T^2 can be shown to have a chi-squared distribution with H degrees of freedom, where H represents the number of groups being compared.

The Carriere and Roos statistic has been chosen for application in these analyses because it provides a convenient, simultaneous test based upon a non-parametric measure of variance. As such, the T-squared statistic is independent of assumptions about the underlying distribution of rates and subsumes the binomial distribution. With a sufficiently large sample size, the T-squared statistic is, in principle, a generalization of the chi-squared test (Carriere and Roos 1994). The chi-square test has been shown to be relatively powerful and to perform well independently of complicating factors such as the number and size of small populations under comparison, the degree of variation in their size, and the underlying rate being evaluated (Diehr, Cain, and Connell 1990). As the comparison groups employed in this study are relatively small and the distribution of mortality may not hold to restrictive assumptions, the T-squared statistic offers a favourable method of analysis.

The basic output generated by the DIRECT program employed in this analysis includes the crude and standardized rates for the given and standard populations, the ratio of given to standard mortality, and the results of decomposition of differences in crude

rates. In addition, binomial and non-parametric variances, corresponding standard errors, confidence intervals, and the T^2 statistic were computed. The total output generated was brought to comparative analysis with the objective of evaluating the significance of differences in mortality rates over time as well as between various segments of the study population. In addition, on-reserve, off-reserve, and total band data sets were standardized for age by sex to allow further comparison between male and female mortality rates over the study period.

Life Table Analysis

Having gained some understanding of the mortality and age structure differentials within the study population, life table analysis was then employed as further means of analyzing mortality, whereby the mortality of the study population was modeled upon a stationary population structure. Application of this method generates measures of age-specific mortality, life expectancy, and survivorship for the study populations based upon a hypothetical population divorced from the effects of the age distribution of an actual population.

In these analyses, the program LIFE (Keyfitz and Flieger 1971) was used to compute a variety of abridged period life tables. The construction of a period life table is based upon probabilities of death estimated from the age-sex specific mortality rates of the study population. Consequently, the mortality rates represent a cross-sectional view of the aggregate life experience of an entire population rather than the total longitudinal experience of a single age or age-sex cohort as in cohort life tables (Armitage 1971). The

abridged life table permits age intervals which vary in duration and is commonly used in period life table analysis.

Among the variety of analytical approaches subsumed by life table analysis, the interpretive model employed in this study views the life table as a stationary population resulting from an unchanging schedule of age-specific mortality rates, derived from the given population(s), and a constant annual number of births (assumed as 100,000). The result is a stationary population whose total number and distribution by age do not change with time. Based on such assumptions, life table analysis becomes a powerful statistical device in the comparative measurement of mortality and in studies of population structure (Shryock et al. 1976).

The life table generated by LIFE includes several functions, many of which are simply computational while others are essential to the interpretation of our results. Mainly, we are interested in the stationary age distribution, age-specific probabilities of mortality, expectation of life, and survival rates. These measures were generated through several steps which begin with the estimation of Q(x) defined by Keyfitz and Flieger (1971) as the probability of dying in the age interval for individuals alive at the beginning of the interval. In period life tables these probabilities are estimated from the age-specific death rates for the given population which are represented in the life table by MM(x). The Q(x) function is basic to the calculation of all other variables in the life table. A hypothetical population and its expected death frequencies are derived from the application of the Q(x) probabilities to a cohort of newborns, or radix of 100,000. The radix is assumed to experience attrition through mortality according to the probabilities

expressed by the Q(x) values. The resulting values represent firstly the L(x) function, which is simply the number of individuals surviving to the beginning of the interval out of 100,000 born and the D(x) function, which represents the number dying within the interval out of 100,000 born. The LIFE program then calculates the LL(x) function defined as the number of individuals in the hypothetical cohort living within the age interval. This value also represents the life table stationary age distribution. The LL(x) value in turn becomes the denominator in the calculation of the death rate among the hypothetical population, referred to as M(x). The last function in the table is the expectation of life or E(x). This measure represents the average number of years of life remaining for individuals of a given age. Supplemental to the basic functions of the life table, I have also calculated hazard rates based on the method of Selvin (1991). The hazard rate provides a measure of the impact or intensity of mortality on a population at a specific age, relative to the proportion surviving to that age.

In the present study, data brought to life table analysis was restricted to the composite data for five year aggregates. Separate male and female life tables were generated for total band, reserve and other populations for each time interval. As for standardization, population figures represent mid-year estimates for mid-point years within each interval, while mortality and fertility data represent averages over the five year period. The life tables generated were submitted to comparative analysis over time, across residence categories and between sexes. These comparisons afforded an opportunity to observe whether rates of mortality, survivorship and life expectancy changed more

dramatically for any particular comparison group over time and provided corroborative evidence for the results of standardization.

Fertility and Reproduction

The final stage of these analyses involved the deterministic analysis of fertility and reproduction as executed by the LOTKA program (Keyfitz and Flieger 1971). This methodology arrives at several fertility indices by modelling birth rates derived from cross-sectional data upon the life table stationary population previously described. The utility of this form of analysis resides in its ability to compare populations or subsets of populations on the basis of reproductive parameters conditioned by survivorship and to effect such comparisons independent of initial age distributions of the given populations.

Implementation of the analysis of fertility proceeded through several computational steps. In preparation for these calculations, basic population and birth data are arrayed by maternal age from 10 through 55. These data are employed in the calculation of age specific birth rates representing both male and female births. Thereafter, fertility indices are based solely on female births as these are essential to the estimation of reproductive parameters generalized beyond the present generation. An estimate of the total fertility rate (TFR) is then obtained, based upon cross-sectional age-specific rates. The TFR is an estimate of the number of children, male and female, expected to be born to a woman during her reproductive lifetime. Analogous to the TFR, the Gross Reproduction Rate (GRR) represents the number of female children that a female just born may expect to

produce during her reproductive lifetime. Neither the GRR or the TFR measures take into consideration the probability of dying in the reproductive lifetime.

Several other measures are included in these analyses which address birth rate conditioned upon female survivorship. The first of these measures is the net reproduction rate (NRR) derived from the sum of a computational variable called the net maternity function. This variable is the product of age-specific fertility rates for female offspring and the corresponding probabilities of females surviving to that age, as estimated by the life table LL(x) function. The NRR is essentially a replacement ratio. More specifically, it is the number of female children expected to be born to a female just born, on the cross-sectional regimes of mortality and fertility of the given population. A NRR of less than 1.0 is indicative of insufficient age-specific fertility to replace the population, given current levels of mortality by age and sex. The mean age at childbearing (MAC) is a summary statistic derived from the net maternity function which is again contingent upon survivorship. This measure is estimated by weighting the net maternity function by the average age within each interval and dividing the sum of weighted values by the unweighted values. A second measure which addresses the timing of reproduction is the mean length of generation (T), which represents the time in which a population growing at the rate described by the intrinsic rate of natural increase will grow in the ratio of the NRR. The final statistic produced is the intrinsic rate of natural increase (r), an estimate of the rate of growth which would apply if the age-specific fertility and mortality rates of the given population were to persist and a stable age-sex distribution were attained. This

measure represents the single most useful summary statistic describing age specific fertility and mortality rates (Keyfitz and Flieger 1971).

The foregoing statistics are calculated for female centred five year aggregate data. Comparisons focus mainly on differences between residence categories viewed over time. These observations serve to illustrate the magnitude of fertility and population growth which issue from the age-specific rates of birth and death in the study population and differentials among sub-populations in this respect. Of particular interest are the comparisons over time which may afford some conclusions on the effect of re-registration of females of reproductive age on fertility and growth rates.

CHAPTER 5

RESULTS

Population Growth and Compositional Variables

The Manitoba Registered Indian population structure and changes in this structure throughout the 1980-1991 study period are addressed in the present section. We begin by examining the rate and distribution of population growth by residence, sex, and age. In addition to the description of population structure and growth, the "error of closure" is employed to assess the similarity/difference between observed and expected annual population size by residence and the probable determinant(s) of observed differences.

Population growth. The composite band population underwent a dramatic increase in size during the 1980-1991 period, from a total of 14,216 in 1980 to 23,812 in 1991, representing an overall increase of 68%. Table 1 reveals a lack of uniformity in the rate of band population growth over time. Population totals demonstrate small increments from 1980 to 1985, whereas larger yearly increments follow, indicating an abrupt escalation in population size throughout the latter half of the period. Thus, the majority of the overall increase in population occurred during the 1985 to 1991 time interval, amounting to a 46% increase.

Table 1: Proportionate Distribution and Crude Annual Rate of Increase For On-Reserve, Off-Reserve and Band Populations

YEAR	ON-		OFF-		BAND	
	#	%	#	%	#	%
1980	9967	70.11	4249	29.89	14216	100.00
1981	10185	69.59	4450	30.41	14635	100.00
CARI		2.14		4.52		2.86
1982	10259	68.60	4695	31.40	14954	100.00
CARI		0.72		5.22		2.13
1983	10588	68.79	4803	31.21	15391	100.00
CARI		3.11		2.25		2.84
1984	10711	69.04	4803	30.96	15514	100.00
CARI		1.15		0.00		0.79
1985	11299	69.43	4975	30.57	16274	100.00
CARI		5.20		3.46		4.67
1986	11838	67.86	5606	32.14	17444	100.00
CARI		4.55		11.26		6.71
1987	12283	66.00	6328	34.00	18611	100.00
CARI		3.62		11.41		6.27
1988	12614	63.61	7216	36.39	19830	100.00
CARI		2.62		12.31		6.15
1989	12416	59.89	8315	40.11	20731	100.00
CARI		1.59		13.22		4.35
1990	13604	60.51	8877	39.49	22481	100.00
CARI		8.73		6.33		7.78
1991	14437	60.63	9375	39.37	23812	100.00
CARI		5.77		5.31		5.59

Growth rates for the period, measured by the crude annual rate of increase (CARI), verify an escalation in band population size beginning in the 1985-1986 time interval. Annual growth rates over the period fluctuate within a range of 0.79 to 4.67% during the early half of the period and increase substantially after 1985 to a range of 4.35 to 7.78%. These rates average to growth rates of 2.7% in the 1980-1985 interval compared to 6.1% for the 1985-1991 interval, which describe a situation of high and rapidly increasing growth rates for the period. Growth rates calculated for the total band population represent an aggregate of varying rates of change occurring among residential sub-populations, weighted by the changing proportionate contribution of these populations to the total over time. Thus, any generalizations regarding band population growth must give primary consideration to the variable of residence.

Residential differentials in population growth. Residence represents an important variable in revealing differentials in population growth among the composite band population. Changes in the absolute and relative size of on- and off-reserve residential components of the band population are illustrated in table 1. Both on- and off-reserve populations increase in absolute size over the study period, however, an increase in the off-reserve population of 121% far exceeds a 45% increase for the on-reserve population. Consequently, the off- reserve population makes proportionate gains over time from 30% of the total band population in 1980, to nearly 40% by 1991, while the proportion living on-reserve decreases accordingly from approximately 70% to 60%.

Crude annual rates of increase reinforce impressions of the general trend of differential growth by residence over the period. Table 1 reveals obvious differences in annual rates of increase, particularly in the latter half of the period. Between 1985 and 1986, off-reserve growth rates soar to 11.26%, only to climb further to a peak of 13.22% by the 1988-1989 interval. At the same time, on-reserve rates of growth decline from 4.55% to -1.59%, representing an actual decrease in population size in the 1988-1989 interval. Prior to 1985, the rate of increase shows closer correspondence between on- and off-reserve populations and more often higher growth rates on-reserve. Despite highly aberrant rates from 1985 through 1989, by the 1989-1990 interval, this pattern resumes.

Estimation of "error of closure". Table 2 consists of estimates of the error of closure for on-reserve, off-reserve and total band populations for yearly time intervals between 1980 and 1991. Also included are the rates of natural increase, determined by the combined effects of births and deaths, and the differences between end year Indian Affairs population totals for the registered population. For the purpose of these comparisons, Indian Affairs population totals are taken to represent observed annual populations, while natural increase determines expected population size.

Errors of closure calculated for the on-reserve population reveal an overall increase in the difference between observed and expected populations over time despite widely ranging measures from one interval to the next. The highest error of closure calculated appears in the 1989-1990 interval, when natural increase fails to account for 6% of population increase. Measures before 1985 do not exceed 2.7%. Two of the measures

Table 2: Annual Increase/Decrease of End-Year On-Reserve, Off-Reserve and Total Band Populations by Natural Increase and Error of Closure

PERIOD	P(0)	P(1)	P(1)-P(0)	BIRTHS	DEATH	NAT. INCR.	ERROR OF CLOSURE
ON-RESERVE POPULATION							
1980-81	9967	10185	218	269	72	197	0.21%
1981-82	10185	10259	74	261	61	200	-1.23%
1982-83	10259	10588	329	333	61	272	0.54%
1983-84	10588	10711	123	303	58	245	-1.14%
1984-85	10711	11299	588	354	64	290	2.64%
1985-86	11299	11838	539	343	59	284	2.15%
1986-87	11838	12283	445	398	75	323	0.99%
1987-88	12283	12614	331	384	64	320	0.09%
1988-89	12614	12416	-198	394	50	344	-4.37%
1989-90	12416	13604	1188	423	56	367	6.03%
1990-91	13604	14437	833	403	77	326	3.51%
OFF-RESERVE POPULATION							
1980-81	4249	4450	201	175	32	143	1.30%
1981-82	4450	4695	245	173	16	157	1.87%
1982-83	4695	4803	108	200	15	185	-1.60%
1983-84	4803	4803	0	182	25	157	-3.27%
1984-85	4803	4975	172	218	19	199	-0.54%
1985-86	4975	5606	631	186	17	169	8.24%
1986-87	5606	6328	722	200	22	178	8.60%
1987-88	6328	7216	888	174	19	155	10.16%
1988-89	7216	8315	1099	176	18	158	11.32%
1989-90	8315	8877	562	222	18	204	4.03%
1990-91	8877	9375	498	335	8	327	1.82%
TOTAL BAND POPULATION							
1980-81	14216	14635	419	444	104	340	0.54%
1981-82	14635	14954	319	434	77	357	-0.25%
1982-83	14954	15391	437	533	76	457	-0.13%
1983-84	15391	15514	123	485	83	402	-1.80%
1984-85	15514	16274	760	572	83	489	1.67%
1985-86	16274	17444	1170	529	76	453	4.11%
1986-87	17444	18611	1167	598	97	501	3.58%
1987-88	18611	19830	1219	558	83	475	3.75%
1988-89	19830	20731	901	570	68	502	1.92%
1989-90	20731	22481	1750	645	74	571	5.24%
1990-91	22481	23812	1331	738	85	653	2.85%

of error early in the period fall into the negative range to describe a situation where natural increase accounts for more than the observed change in population. However, the largest negative measure is found in the 1988-1989 interval, corresponding to a decrease in the observed population by 198 individuals. Coincident with the overall increase in the error component, natural increase has also grown over the period, mostly attributable to an increase in births. Nevertheless, increases in the observed population are greater than predicted even by these large birth frequencies, particularly in the final two year intervals.

Errors of closure calculated for the off-reserve population by yearly time intervals reveal striking differences between the period preceding 1985 and that following. Prior to 1985, natural increase accounts for nearly all of the apparent change in population indicated by Indian Affairs data. Three of the measures of error fall within the negative range, while none exceed 2%. In contrast, beginning with the 1985-1986 interval, natural increase fails to account for a sizeable proportion of increase, amounting to over 8% in this time interval. Measures of error increase to an excess of 11% in the 1988-1989 interval, corresponding with an observed population increase of 1099, then taper off toward the end of the period. Reduced errors in the final intervals reflect a sudden increase in expected yearly growth due to a simultaneous increase in births and a decrease in deaths, while observed changes in population decreased somewhat. Previous intervals exhibit no consistent pattern of change in either birth or death frequencies, although natural increase shows some overall growth.

In the aggregate, total band errors of closure are small for the yearly intervals preceding 1985. None of the early period percentages exceed 2% and three of these fall

into the negative range. Thus, for the early half of the study period, natural increase accounts for a large and often excessive proportion of the yearly increases in population described by Indian Affairs population data. In contrast, errors of closure for the latter half of the period increase abruptly to indicate substantial proportions of population increase unaccounted for by natural increase. By 1985-1986, a 4% error component is observed and measures for the remainder of the period range from 1.9 to 5.2%, all of which exceed measures for the earlier half of the period. Coincident with the decreasing proportion of change accounted for by natural increase, birth frequencies and, consequently, natural increase exhibit obvious growth during the period. However, large increases in observed population in the latter half of the period still dominate in the calculation of errors of closure for this time interval.

Sex differentials in population growth. Added specificity in comparisons of proportionate changes in residence over time are afforded by an examination of sex differentials in these trends. Figure 1 illustrates the proportionate contribution of male and female components of on- and off-reserve populations over time. Male and female components of the on-reserve population decrease in their proportionate contribution to the overall band population over the study period, the most abrupt changes occurring in the few years immediately after 1985, followed by more stable and lower proportions by 1989. The extent of decline for females on-reserve is similar to that for males, resulting in a constant sex ratio of males to females of 52:48 throughout the period.

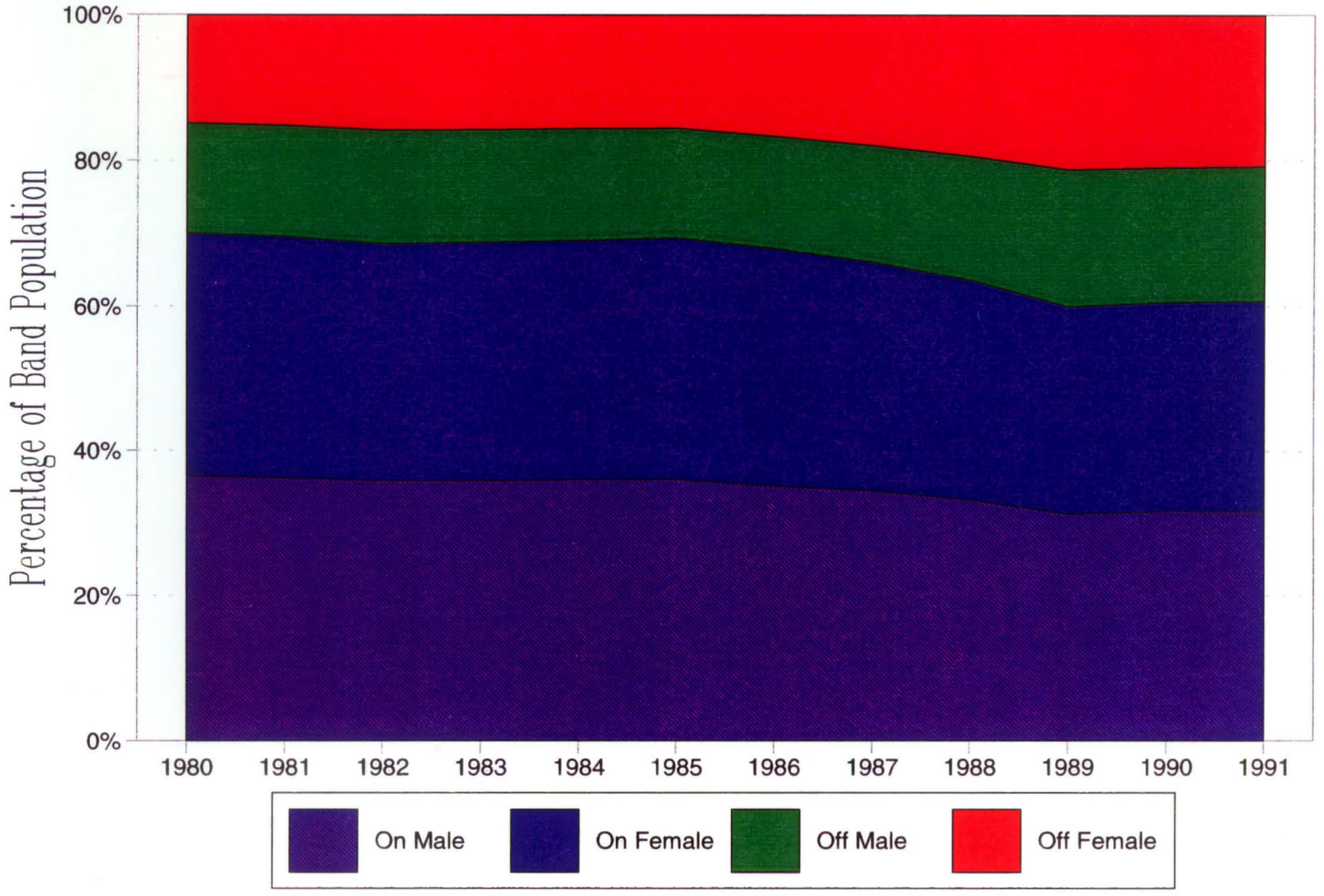

Figure 1: Time Trends in the Proportionate Distribution of the Total Band Population by Residence and Sex

Off-reserve sex differentials in the proportional make-up of the band population over time are more pronounced than for the on-reserve component. Off-reserve females increase by a larger percentage than do males residing off-reserve. Consequently, the size of the female component of the off-reserve population overtakes that of the male component by the end of the period. This fact is reflected by changes in the sex ratio, which declines for males from 50:50 in 1980 to 47:53 in 1987, and remains stable thereafter. Furthermore, females increase in their proportional contribution to the total band population continually throughout the 1985-1989 interval, whereas males increase primarily within the 1987-1989 interval, stabilizing for the final three years, as do females. By 1991, the proportionate distribution by residence and sex depicts the greatest amount of change among the female off-reserve population as compared with the remaining components of the total band population. The impact of the large increase in the off-reserve female population on the total band sex structure is reflected by an increase of band females relative to males recorded by sex ratios of 51:49 in 1980 and 50:50 by 1991.

Age-sex structure changes over time. Comparisons drawn between age-sex structures of on-reserve, off-reserve and total band populations for 1983 and 1988, and across residential groups over time, reveal several interesting trends in differential growth (compare figures 2-7). Comparisons between the on-reserve population by age and sex in 1983 and 1988 (figure 4-5), indicate large additions primarily among adults aged 20 through 39, as well as among children aged 1 through 9. These changes result in a bimodal pattern in the age-sex structure of the later period. The most striking exception

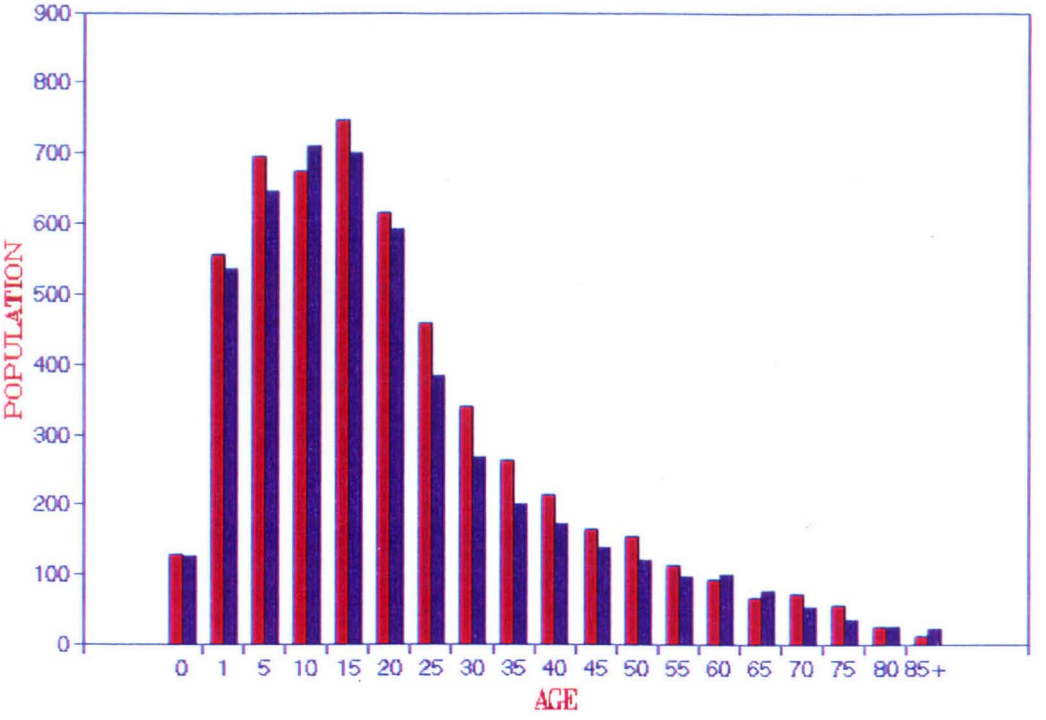

Figure 2. Age-Sex Structure of the On-Reserve Population, 1983.

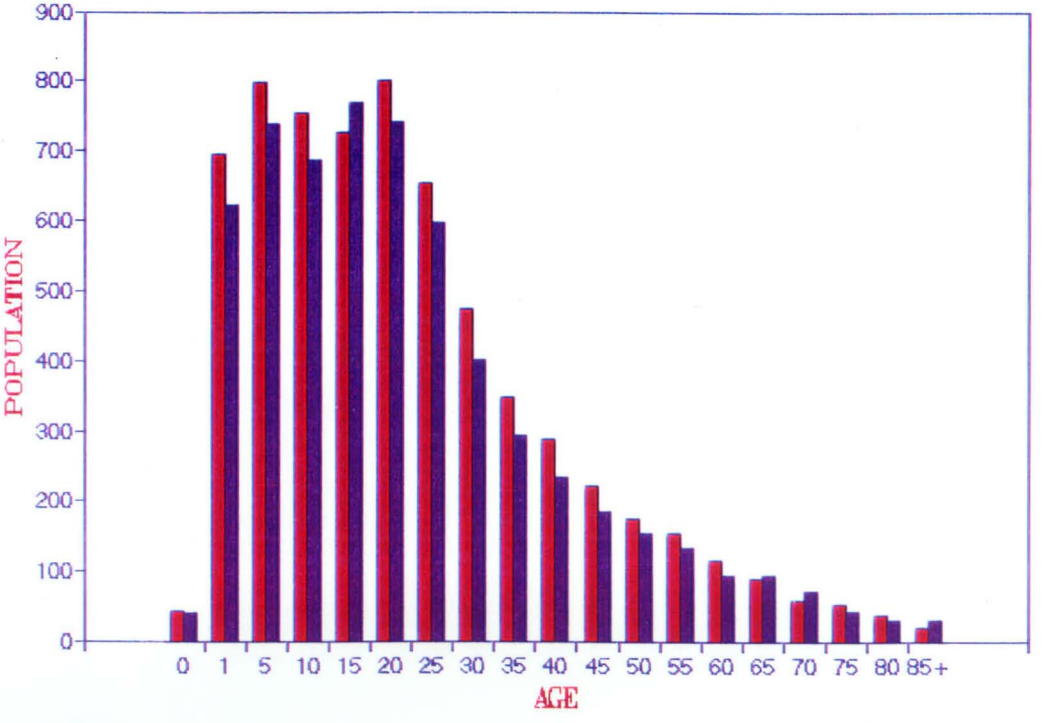

Figure 3. Age-Sex Structure of the On-Reserve Population, 1988.

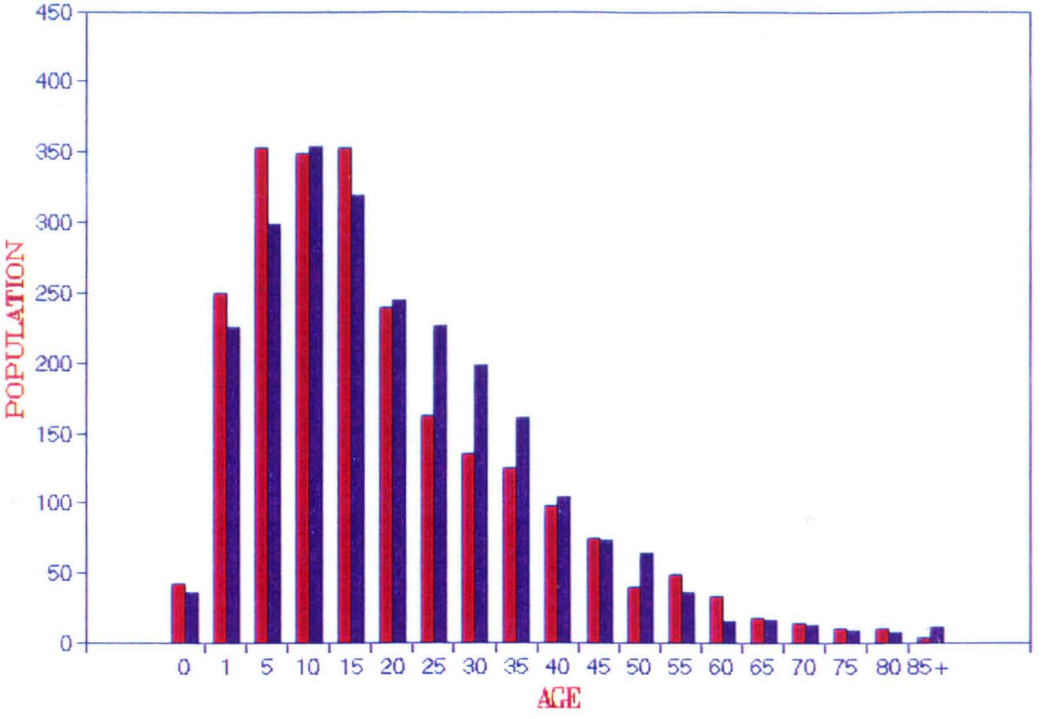

Figure 4. Age-Sex Structure of the Off-Reserve Population, 1983.

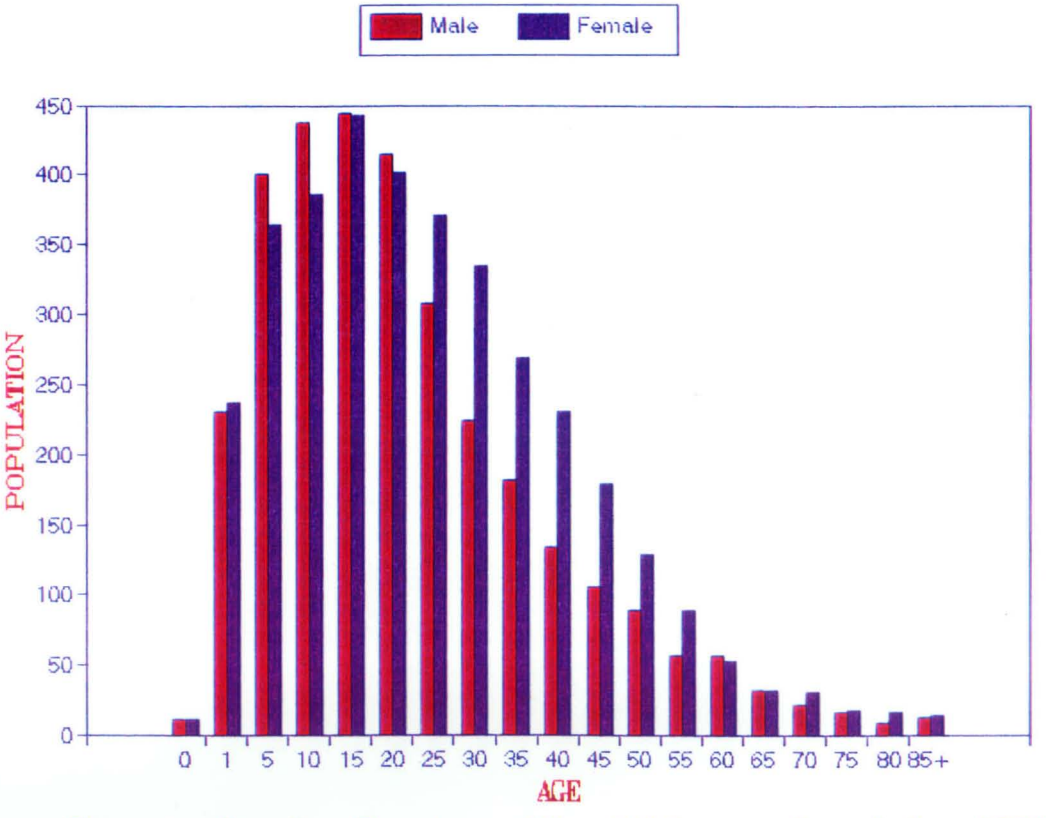

Figure 5. Age-Sex Structure of the Off-Reserve Population, 1988.

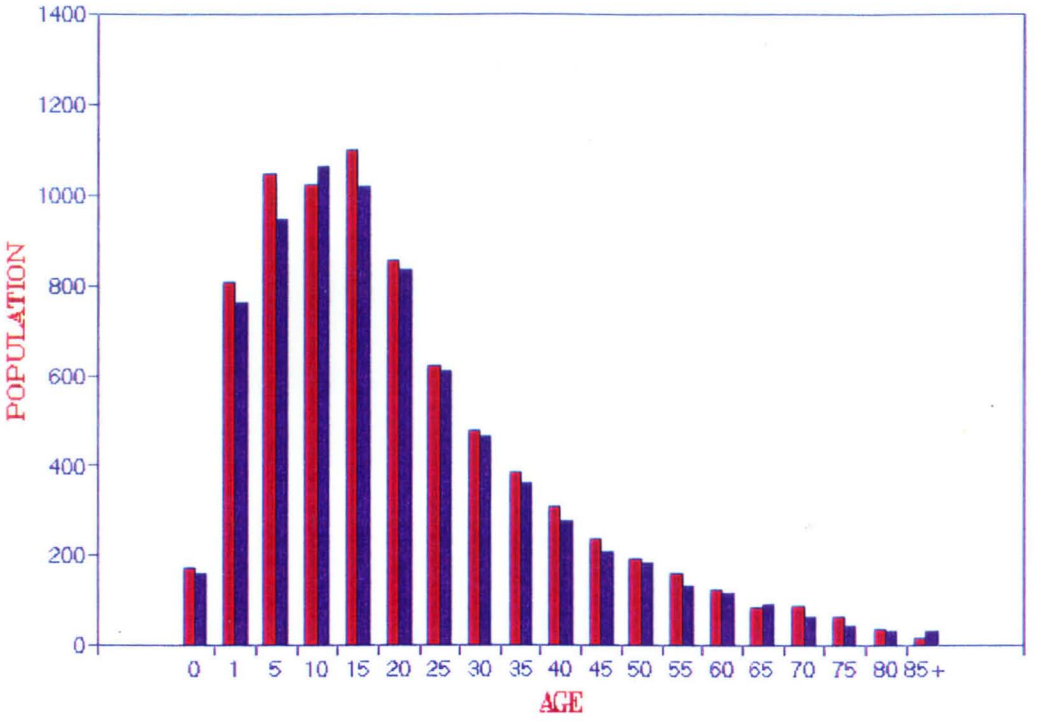

Figure 6. Age-Sex Structure of the Total Band Population, 1983.

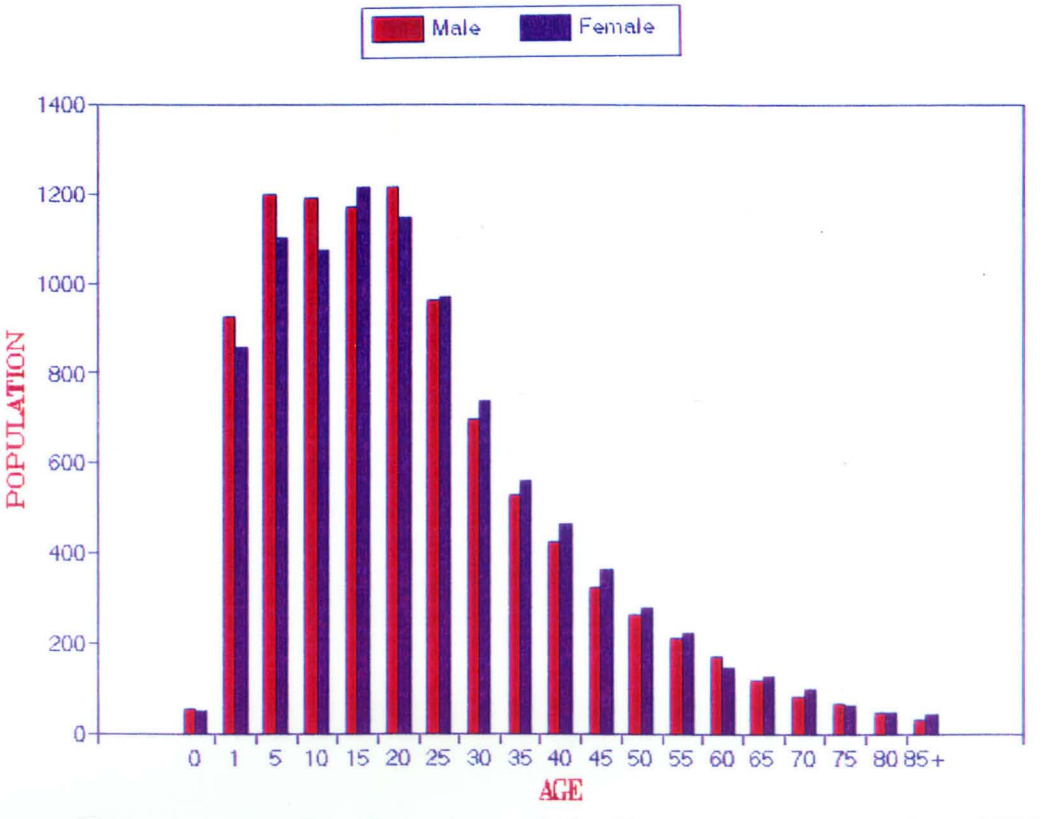

Figure 7. Age-Sex Structure of the Total Band Population, 1988.

to the prevailing trend of growth occurs among the under 1 year age category where a decrease in population is evident. Although among males, larger increases are discernable for ages 1 through 9, male and female patterns of population change in the 20 through 39 age range, show considerable resemblance.

Age-sex distribution changes for the off-reserve population (figure 6-7) exhibit greater increases - proportional to the size of the population - in nearly every age category compared to the on-reserve population. Furthermore, sex differentials in population growth by age are also greater for the off-reserve population. Large increases among off-reserve females in ages 30 through 54, which exceed those for males, result in further exaggeration of existing sex differentials among these ages over the study period. The distribution of increasing population by age also differs by sex as the largest increases for males are concentrated among ages 20 through 29, whereas females show an older and broader age range of large increases in ages 15 through 49. In contrast to the prevailing trend of growth among adult age categories, a substantial decline in the size of the under 1 age group for both males and females is also revealed by these comparisons.

Representing a composite of the foregoing residence specific trends, the total band population exhibits similar patterns of change in age-sex structure. Comparisons drawn between figures 2 and 3 reveal an aging trend, produced through greater increases in adult age categories, particularly those between ages 20 and 49. However, this pattern of growth differs considerably between the sexes as increases among female adults often exceeds those for males and extends into older age categories. Consequently, by 1988, a

reversal of the preponderance of males occurs in ages 25 through 59, where the growth in the female population surpasses that for males.

Direct Standardization

Direct standardization of individual bands. Preliminary analysis involved direct standardization of individual band mortality for the six selected bands in order to establish comparability between bands within the composite band data set. Gross comparisons of these rates show a predominant trend of declining mortality with the exception of Nelson House and Sandy Bay rates which exhibit anomalous trends of increase in the middle of the period. Grouped T-squared comparisons over the six bands, for each interval within the moving five year average results, all fail to achieve significance. As T-squared values are highly dependant upon the variance of the standardized rate, and as variance is in turn a function of population size, the small sizes of the comparison groups used here may preclude our attaining significant results. Regardless, these analyses proceed under the assumption that individual bands do not differ significantly, either in the level of mortality or in mortality trends throughout the period. Thus, the remainder of these results will subsume band specific differentials to the greater purpose of addressing time trends in residence group and male/female differentials among the composite band data.

Composite bands population - standardized rates. Figure 8 illustrates standardized mortality rates for the on-reserve, off-reserve and total band populations for three year aggregate data. Examination of mortality rates for on- and off-reserve

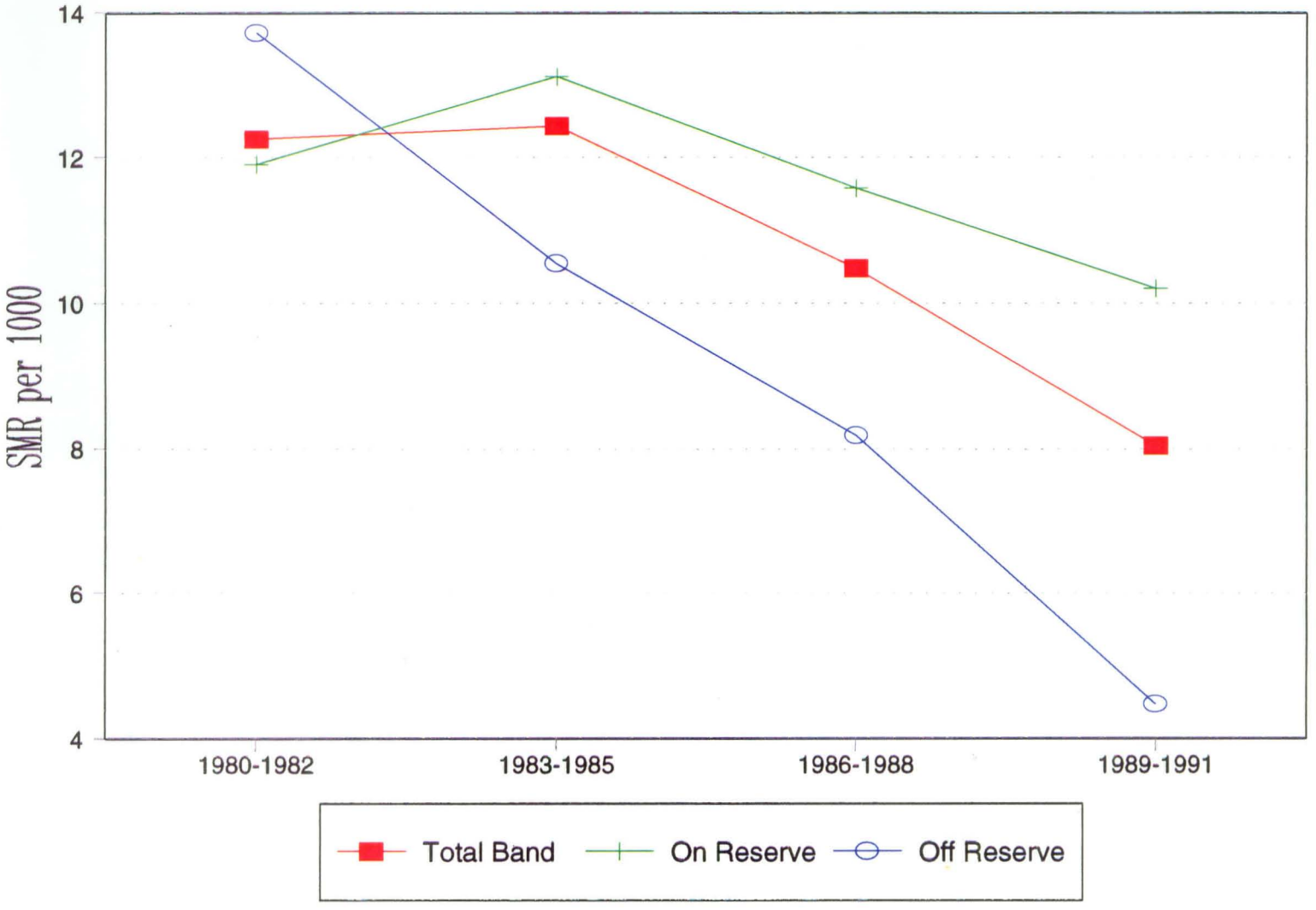

Figure 8. Time Trends in Age Standardized Mortality Rates by Residence; Three Year Average Data

populations over the study period, reveals divergent trends. On-reserve mortality rates actually increase during the first time interval then decrease at a rate of approximately 0.5 deaths per 1000 per year for the duration of the study period. Off-reserve mortality drops steadily and precipitously throughout the entire period from nearly 14 to 4.5 deaths per 1000. This dramatic reduction in mortality is equivalent to a yearly rate of decline of approximately 1 death per 1000. The total band population exhibits moderate levels of mortality relative to residence specific rates. Though stable early in the period at approximately 12 deaths per 1000, the rates begin a steady decline after the 1983-1985 interval, dropping at a rate of nearly 0.8 deaths per 1000 per year to converge with standard population rates of approximately 8/1000 by the final time interval.

Measures of variance, S.E., and confidence intervals reported in table 3 give some indication of the level of variation for corresponding estimates of standardized mortality based upon our data set. Close agreement between binomial and non-parametric variances is observed for on-reserve and total band results, though the off-reserve population is associated with non-parametric measures of up to 16% greater than indicated by binomial variation. Based on more conservative measures of non-parametric variation, confidence limits based on our data place the true mortality rates within 2.8 to 3.6 deaths/1000 of our on-reserve estimate, 2.7 to 8 deaths/1000 of the off-reserve estimate, and 2 to 3 deaths/1000 of the total band estimate. Off-reserve confidence limits appear particularly large at an average of 60% of the size of the estimated rate.

Ratios of given to standard population mortality rates for three year average data, represented in table 3, provide a preliminary means for comparing mortality over time.

Table 3: Age Standardized Mortality Rates, Variability Measures And T-Squared Statistics for Total Band Data by Residence

	A.S.M.R.	Binomial Variance	Non-Parametric Variance	S.E.	C.I.	Ratio	T-sqd*	Grouped T-sqd**
ON-RESERVE								
1980-82	11.90	3.07E-06	3.18E-06	1.78E-03	3.49	1.48	4.62	**18.98**
1983-85	13.11	3.33E-06	3.44E-06	1.85E-03	3.64	1.63	7.40	
1986-88	11.57	2.50E-06	2.56E-06	1.60E-03	3.13	1.43	4.81	
1989-91	10.19	2.05E-06	2.10E-06	1.45E-03	2.84	1.26	2.15	
OFF-RESERVE								
1980-82	13.71	1.42E-05	1.65E-05	4.06E-03	7.97	1.70	1.93	**9.43**
1983-85	10.53	9.62E-06	1.07E-05	3.26E-03	6.40	1.31	0.57	
1986-88	8.18	5.04E-06	5.36E-06	2.32E-03	4.54	1.01	0.00	
1989-91	4.46	1.80E-06	1.88E-06	1.37E-03	2.69	0.55	6.93	
BAND								
1980-82	12.25	2.46E-06	2.52E-06	1.59E-03	3.11	1.52	6.94	**18.07**
1983-85	12.43	2.43E-06	2.48E-06	1.58E-03	3.09	1.54	7.69	
1986-88	10.47	1.65E-06	1.67E-06	1.29E-03	2.54	1.30	3.44	
1989-91	8.04	1.06E-06	1.07E-06	1.04E-03	2.03	1.00	0.00	

* Chi-squared significant value (p = 0.050; 1 d.f.) = 3.84

** Chi-squared significant value (p = 0.050; 4 d.f.) = 9.49

Although standardized rates represent fictitious measures so that ratios cannot be interpreted as truly measurable differences between given and standard population mortality, the use of ratios remains helpful in gauging the extent of decline in rates over time. Examination of ratios over the period indicate considerable narrowing in mortality differentials between given and standard populations. On-reserve ratios reveal a conservative decline of approximately 30 to 40% over the period, though mortality remains somewhat higher than for the standard population. Ratios representing the discrepancy between off-reserve mortality and standard population rates exhibit a precipitous decline of over 100% during the period, from 70% higher to 55% lower than the standard level. Band ratios decline by 50% over the period, arriving at a 1:1 ratio by the 1989-1991 interval, indicating a convergence of band rates with that of the standard population.

T-squared analysis of standardized rates and variation in rates achieves statistical significance in several comparisons of composite population mortality over time. Individual T-squared statistics (see table 3) comparing on-reserve standardized mortality with standard population mortality for each three year interval throughout the period reveal significant differences in mortality for every interval except 1989-1991. Grouped T-squared calculations indicate highly significant differences in on-reserve mortality rates over the entire period. Off-reserve results of individual T-squared comparisons fail to achieve significance until the last interval. The grouped T-squared statistic comparing off-reserve rates over time very nearly reach the significant level, although this is largely attributable to the unusually high 1989-1991 individual T-squared value. It appears that

high variability in mortality rates for this sub-population obscures any trends in off-reserve results. In addition, overall pairwise T-squared comparisons between on- and off-reserve standardized rates reveal significant differences by residence over the study period, although only the last individual paired comparisons achieves significance.

Individual T-squared statistics comparing total band standardized mortality reveal significant differences in mortality for the first two intervals preceding 1985, whereas rates for the latter part of the period no longer indicate true differences between rates. The grouped T-squared statistic identifies highly significant differences among the band population, indicating substantive changes in band mortality rates over the entire period.

Sex differentials in mortality. Three year average mortality, standardized for age by sex, for on-reserve, off-reserve and total band populations are represented in figure 9 (see also tables 4-5). Obvious discrepancies between the sexes can be observed in both the level of mortality and trends over the period. On- and off-reserve mortality rates exhibit, on average, 4.7 and 3.6 deaths per 1000 more for males than for females respectively. These differences between male and female mortality narrow considerably over time among both segments of the population. Declining mortality is apparent for all sex and residence population divisions, although the rate of decline is in all cases greater for males than females. Residence divisions also show this disparate trend. On-reserve rates are relatively stable, particularly for females who show a decline of only .2 deaths per 1000 per year since the 1983-1985 period, while male mortality drops at a rate of approximately .8 deaths per 1000 per year over the same time interval. Off-reserve

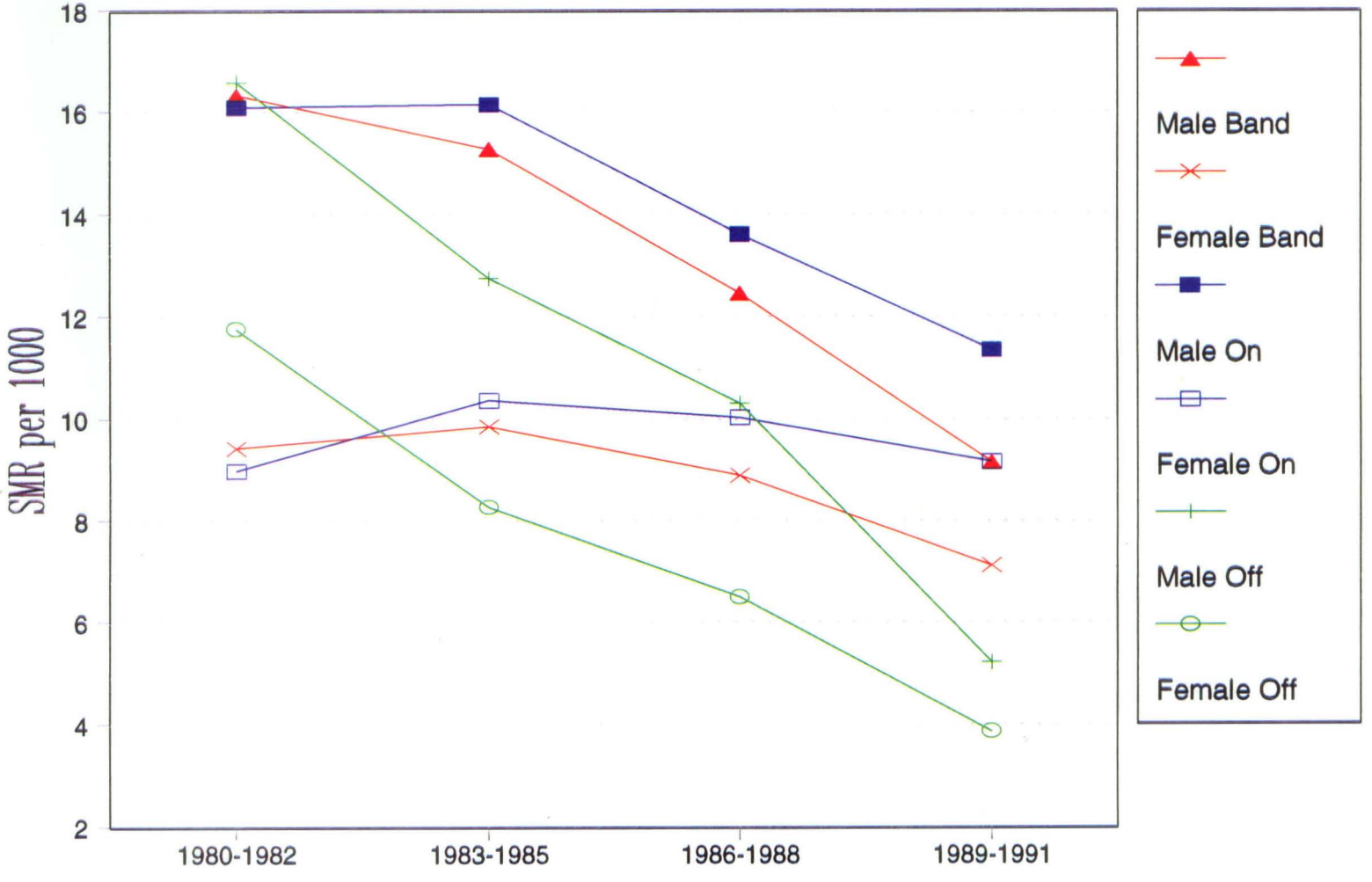

Figure 9. Time Trends in Age Standardized Mortality Rates by Sex and Residence; Three Year Average Data

Table 4: Age Standardized Mortality Rates, Variability Measures
And T-Squared Statistics for Males by Residence

	A.S.M.R.	Binomial Variance	Non-Parametric Variance	S.E.	C.I.	Ratio	T-sqd*	Grouped T-sqd**
ON-RESERVE								
1980-82	16.09	8.37E-06	8.75E-06	2.96E-03	5.80	2.00	7.37	**22.71**
1983-85	16.15	7.97E-06	8.26E-06	2.87E-03	5.63	2.00	7.92	
1986-88	13.60	5.86E-06	6.03E-06	2.46E-03	4.81	1.69	5.08	
1989-91	11.35	4.49E-06	4.59E-06	2.14E-03	4.20	1.41	2.35	
OFF-RESERVE								
1980-82	16.58	3.37E-05	4.26E-05	6.53E-03	12.80	2.06	1.70	**4.86**
1983-85	12.74	2.01E-05	2.16E-05	4.65E-03	9.11	1.58	1.01	
1986-88	10.30	1.46E-05	1.56E-05	3.95E-03	7.74	1.28	0.32	
1989-91	5.20	4.28E-06	4.48E-06	2.12E-03	4.15	0.65	1.83	
BAND								
1980-82	16.33	6.74E-06	6.98E-06	2.64E-03	5.18	2.02	9.77	**23.80**
1983-85	15.27	5.74E-06	5.88E-06	2.42E-03	4.75	1.89	8.82	
1986-88	12.46	4.00E-06	4.08E-06	2.02E-03	3.96	1.54	4.74	
1989-91	9.15	2.46E-06	2.49E-06	1.58E-03	3.09	1.14	0.48	

* Chi-squared significant value (p = 0.050; 1 d.f.) = 3.84

** Chi-squared significant value (p = 0.050; 4 d.f.) = 9.49

Table 5: Age Standardized Mortality Rates, Variability Measures And T-Squared Statistics for Females by Residence

	A.S.M.R.	Binomial Variance	Non-Parametric Variance	S.E.	C.I.	Ratio	T-sqd*	Grouped T-sqd**
ON RESERVE								
1980-82	8.97	4.96E-06	5.11E-06	2.26E-03	4.43	1.11	0.16	**2.28**
1983-85	10.36	5.42E-06	5.58E-06	2.36E-03	4.63	1.28	0.94	
1986-88	10.03	4.45E-06	4.55E-06	2.13E-03	4.18	1.24	0.85	
1989-91	9.16	3.56E-06	3.64E-06	1.91E-03	3.74	1.14	0.33	
OFF RESERVE								
1980-82	11.75	2.69E-05	3.06E-05	5.54E-03	10.85	1.46	0.44	**6.38**
1983-85	8.25	1.65E-05	1.86E-05	4.31E-03	8.45	1.02	0.00	
1986-88	6.48	7.13E-06	7.53E-06	2.74E-03	5.38	0.80	0.33	
1989-91	3.85	3.01E-06	3.16E-06	1.78E-03	3.49	0.48	5.61	
BAND								
1980-82	9.42	4.03E-06	4.12E-06	2.03E-03	3.98	1.17	0.44	**1.97**
1983-85	9.85	4.00E-06	4.09E-06	2.02E-03	3.96	1.22	0.78	
1986-88	8.89	2.81E-06	2.85E-06	1.69E-03	3.31	1.10	0.24	
1989-91	7.11	1.77E-06	1.80E-06	1.34E-03	2.63	0.88	0.51	

* Chi-squared significant value (p = 0.050; 1 d.f.) = 3.84

** Chi-squared significant value (p = 0.050; 4 d.f.) = 9.49

mortality rates decline more precipitously and continually since the beginning of the period, at a rate of approximately 1.3 and .8 deaths per 1000 per year for males and females respectively. The total band population exhibits moderate results for mortality by sex, male mortality decreasing at a rate of approximately .8 deaths per 1000 per year, while female mortality decreases more gradually at .3 deaths per 1000 per year.

Supplementary to the foregoing T-squared analysis of residence group differentials, T-squared statistics were calculated to discern the importance of changes in mortality rates by sex over the study period (tables 4-5). Individual T-squared values calculated for males attain significance for all but the final interval for on-reserve and band results, although off-reserve results fail to achieve significance at any time. Grouped T-squared comparisons indicate significant changes in male mortality on-reserve and for total band males over the study period. Neither individual or grouped T-squared statistics achieve significance for comparisons of female mortality rates over time.

In addition to these comparisons, pairwise T-squared statistics were calculated to provide an interpretive measure of the importance of differences between the sexes within these population divisions over time. T-squared values calculated for total band data ascribe statistical significance to differences in mortality rates by sex over the study period. However, when male and female mortality rates are compared by residence, neither on- or off-reserve results achieve significance. The failure to achieve significant results in these comparisons may, for off-reserve results in particular, reflect a high degree of variation among residence and sex specific results, indicated by confidence limits which are on

average 40% and 80% of the size of standardized rates for on- and off-reserve results by sex, respectively.

Decomposition of crude rates. Having described the trends and differentials in mortality among the composite band population, decomposition in crude rates allows us further insight into the relative effects of age composition and rate differentials in contributing to these results. Decomposition components for total band and residence sub-population results are presented in table 6. Examination of these results reveals that differences in age composition between given and standard populations holds greater influence in determining differences in crude rates than does the rate component, with the exception of the final interval for off-reserve results, where rate differentials prove the greater determinant. Furthermore, the age component shows an overall pattern of increasing relative influence on the difference in crude rates over the study period, particularly for the off-reserve results. The decomposition of sex specific results for the various given populations shows a far greater influence of age composition on crude rate differences relative to rate component effects for females as compared to males. Thus, decomposition results may suggest that the trends and differentials in mortality described above reflect changes in age structure and differentials in age composition more so than actual changes in mortality for our study population(s).

Table 6 : Decomposition of Difference in Crude Rates Between Standard and Given Populations by Residence and Sex

		ON-RESERVE			OFF-RESERVE			BAND		
		Total Dif.	Age	Rate	Total Dif.	Age	Rate	Total Dif.	Age	Rate
TOTAL	1980-82	2.41	5.55	-3.13	3.01	7.19	-4.18	2.59	5.95	-3.35
	1983-85	2.34	6.14	-3.80	3.97	6.44	-2.47	2.85	6.20	-3.35
	1986-88	2.60	5.54	-2.94	4.83	4.94	-0.12	3.34	5.46	-2.12
	1989-91	3.37	5.15	-1.77	6.36	2.75	3.61	4.56	4.77	-0.20
MALE	1980-82	0.95	7.01	-6.06	2.10	8.27	-6.17	1.29	7.42	-6.14
	1983-85	0.85	7.01	-6.15	3.02	6.79	-3.78	1.50	7.01	-5.51
	1986-88	1.63	6.17	-4.54	4.19	6.07	-1.88	2.43	6.08	-3.65
	1989-91	3.01	5.64	-2.63	6.10	4.33	1.77	4.17	5.20	-1.03
FEMALE	1980-82	4.00	4.90	-0.90	3.92	6.61	-2.69	3.98	5.22	-1.24
	1983-85	3.96	5.60	-1.64	4.91	5.45	-0.55	4.26	5.64	-1.37
	1986-88	3.64	5.27	-1.63	5.41	4.66	0.75	4.26	5.11	-0.85
	1989-91	3.77	4.85	-1.08	6.60	3.75	2.85	4.97	4.48	0.49

Life Table Analysis

Selected output derived from life table analysis applied to five year aggregate data sets are presented in tables 12-14 in Appendix B. Life table results are tabulated for on-reserve, off-reserve and band populations by sex and time interval. Output consists of age specific population, averaged death frequencies and mortality rates, addressed by the foregoing analyses, as well as other variables derived from the age specific mortality rates of our study population. The most important of these are the stationary life table population and the summary estimate of life expectancy by age. Measures of the probability of survivorship and hazard rates by age are also calculated from these data. Together, these measures illustrate the effects that changes in population and death frequencies over time have on summary assessments of Registered Indian mortality.

Stationary age distribution. Stationary age distributions modeled on mortality profiles of on-reserve, off-reserve, and total band populations, for pre- and post-1985 data, achieve an isolation of the mortality variable which is useful to these comparative analyses. The stationary age distribution for on-reserve males, predicated upon the mortality rates for five year periods, indicates an expected decline in population for ages 1 through 34 over the study period. The magnitude of this decline decreases with increasing age throughout this age range, from 5% in the 1 through 4 category, to 1% for ages 30 through 34. The middle aged population is expected to remain stable, though by age 40 the reverse trend of increasing population over time is established. The extent of increase escalates with increasing age, first gradually, from 1% in the 40 through 44 age range, to

11% in ages 75 through 79, until after age 80 when very large increases of 58% and 309% are observed.

The pattern of change in the expected female stationary age distribution differs from that for males as decreases are discernable for nearly all ages, with the exception of the final two age categories. Decreases among age categories under 30 are very small. Thereafter, the magnitude of decrease increases to a range of 2 to 8% and shows a subtle trend of larger decreases with age. Only after age 80 does the 1986-1990 stationary population exhibit increases relative to the distribution of the earlier model population. By the final age category the magnitude of increase escalates to 112%.

The stationary age distribution for off-reserve males displays the same overall pattern of change as for males on-reserve, although the extent of change is greater for this population. Comparisons of the later stationary population relative to the earlier reveal decreases in expected population from birth to age 40. The percentage of decrease within this age range lessens from 7% in the 1 through 4 category to 2% for ages 35 through 39. Though the age 40 through 44 age range exhibits little change in size over time, increased population size is observed for each age category thereafter. The magnitude of increasing size escalates with increasing age, at first gradually, from 0.5% in the 40 through 44 age range to 9% in ages 60 through 64, followed by larger increases ranging from 28% to 149% in the senior age categories. Thus, the extent of increase in the expected population size among males is larger for each age category after age 45 in the off-reserve population as compared to the on-reserve population.

Off-reserve females exhibit a different pattern of change in the stationary age distribution from that of on-reserve females, although this pattern generally resembles that for their male counterparts. Small decreases of approximately 2% are observed for the birth to age 30 portion of the stationary age distribution. Middle aged categories show the greatest equivalence, though after age 45, the 1986-1990 stationary age distribution shows increases in expected population with increasing age. This trend escalates suddenly in old age indicated by growth of 58% among ages 80 through 84, and 278% among the over 85 category.

As an amalgam of the foregoing trends and differentials in the stationary age distribution over time, band results display familiar, though moderated, patterns of change. Band males show small decreases in the stationary population size among the birth to 35 year age range, from 5 to 1%. Thereafter, the stationary population increases, the magnitude of the increases growing with increasing age. Again, the largest changes occur in the last two age categories, ages 85 and over showing a 278% increase in the stationary population over the study period. Female stationary age distributions show little change over time among the birth to 55 year age range, though the largest decreases of 2% occur among ages 45 to 54. Increases are observed among senior age categories. Though small until age 75, these increases escalate to 157% in the 85 and over age category.

Life expectancy. Figure 10 illustrates life expectancies predicted for pre- and post-1985 data for the on-reserve population. Life expectancy at birth, commonly employed as a general indicator of the overall level of mortality in a population, increases

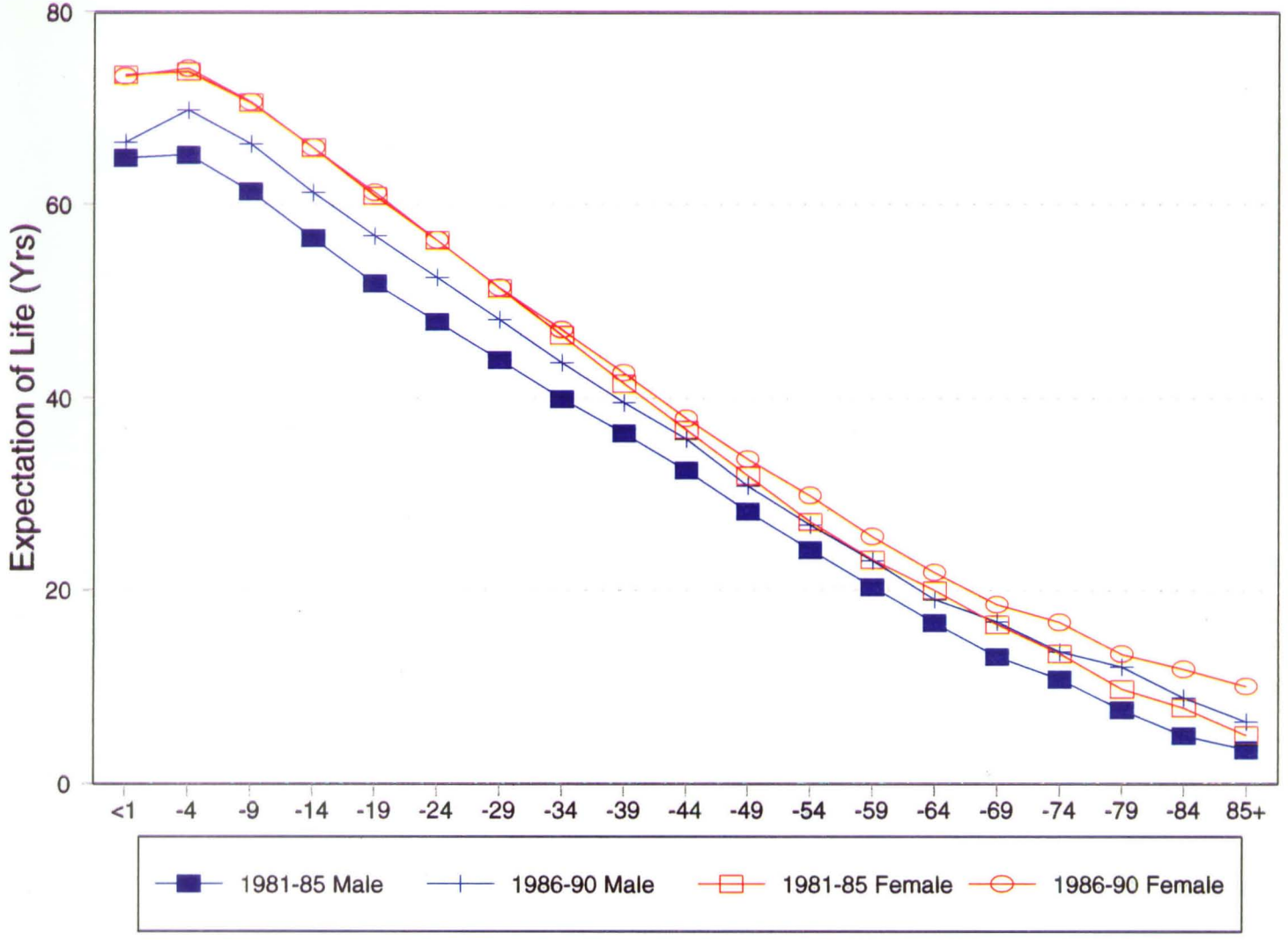

Figure 10. Life Expectancy by Age Estimated for the On-Reserve Population by Sex and Five Year Time Intervals

from 64.8 to 66.4 years for males, while no improvements in a 73 year life expectancy at birth are foreseen for females. Overall improvements for males average to 3.58 more years of life, while female life expectancy increases by an average of 1.58 years. Improvements in life expectancy for males are higher for individuals aged 1 through 24 years while female improvements increase with age, the greatest improvements being observed after age 70. Consequent to these trends, the difference between male and female life expectancies narrows somewhat over the period, from an average of 5.2 years greater life expectancy for females to a difference of 3.4 years.

Off-reserve changes in life expectancy, depicted in figure 11, are greater than that for the on-reserve population. Male life expectancy at birth jumps five years from 66 in the early period to 71 by the later period, while gains in life expectancy among the youth exceed 10 years. Overall, off-reserve males exhibit an average increase in life expectancy of 7.5 years. Although startling increases in life expectancy are predicted for males, the most dramatic increases derive from estimates for off-reserve females. Female life expectancy at birth climbs from 72 years in the 1981-1985 period to 81.6 in the 1986-1990 period. On average, the more recent population can expect to live 11 years longer than their 1981-1985 counterparts. Gains in life expectancy for females appear relatively uniform across age groups, though smaller gains in middle age are discernable. The extreme nature of gains made in estimates of life expectancy based on our off-reserve data set is well illustrated by the example of women over 85 who, in the later period, could expect twice the years of life remaining as in the earlier period, or 20 more years. The greater gains made in female life expectancy off-reserve effect a widening of the gap

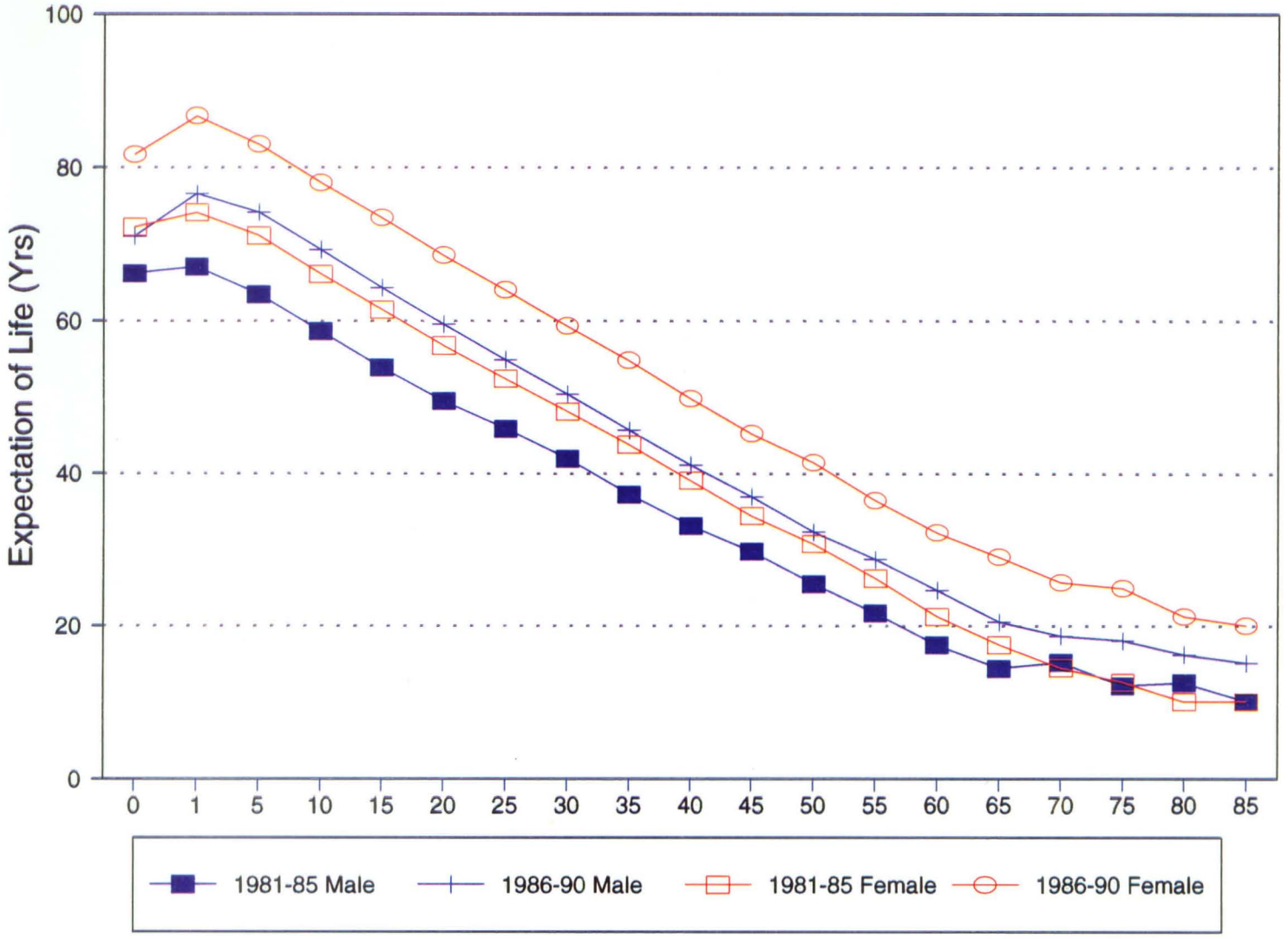

Figure 11. Life Expectancy by Age Estimated for the Off-Reserve Population by Sex and Five Year Time Intervals

between male and female life expectancy over time, from an average difference of 4.6 years greater life expectancy for females early in the period to 8.3 years by the later period. This reversal of the expected trend of reduced differences between the sexes over time adds to the anomalous appearance of these results.

Comparisons of changes in life expectancy differentials between residence categories over time serve to further illustrate the inordinate gains made in off-reserve life expectancy. In the 1981-1985 period, female life expectancy averaged across all age categories is 1.6 years longer for off-reserve residents than for women living on-reserve. However, by the 1986-1990 period, females off-reserve show an average life expectancy 11.2 years longer than on-reserve females. Similarly, male off-reserve life expectancy improves to a greater extent than on-reserve estimates over time, from an average increase of 2.2 to 6.3 years longer life. As increases in on-reserve life expectancy occur over the same period of time, the large increase in differentials by residence attest to enormity of off-reserve increases in life expectancy.

Changes in life expectancy for the total band population over time, illustrated in figure 12, reflect the combined patterns of on- and off-reserve changes. Life expectancy at birth increases from 65 to 68 for males and from 73 to 75 for females over the period. This increase of approximately 2.5 years is modest in comparison with the overall average increase of 4.6 years for males and 3.7 years for females. Among males, the greatest gains in life expectancy over the period are again exhibited among individuals aged 1 through 24 who can expect to live approximately 6 years longer than their counterparts five to ten years ago. The greatest gains among band females were among those aged 75 and over

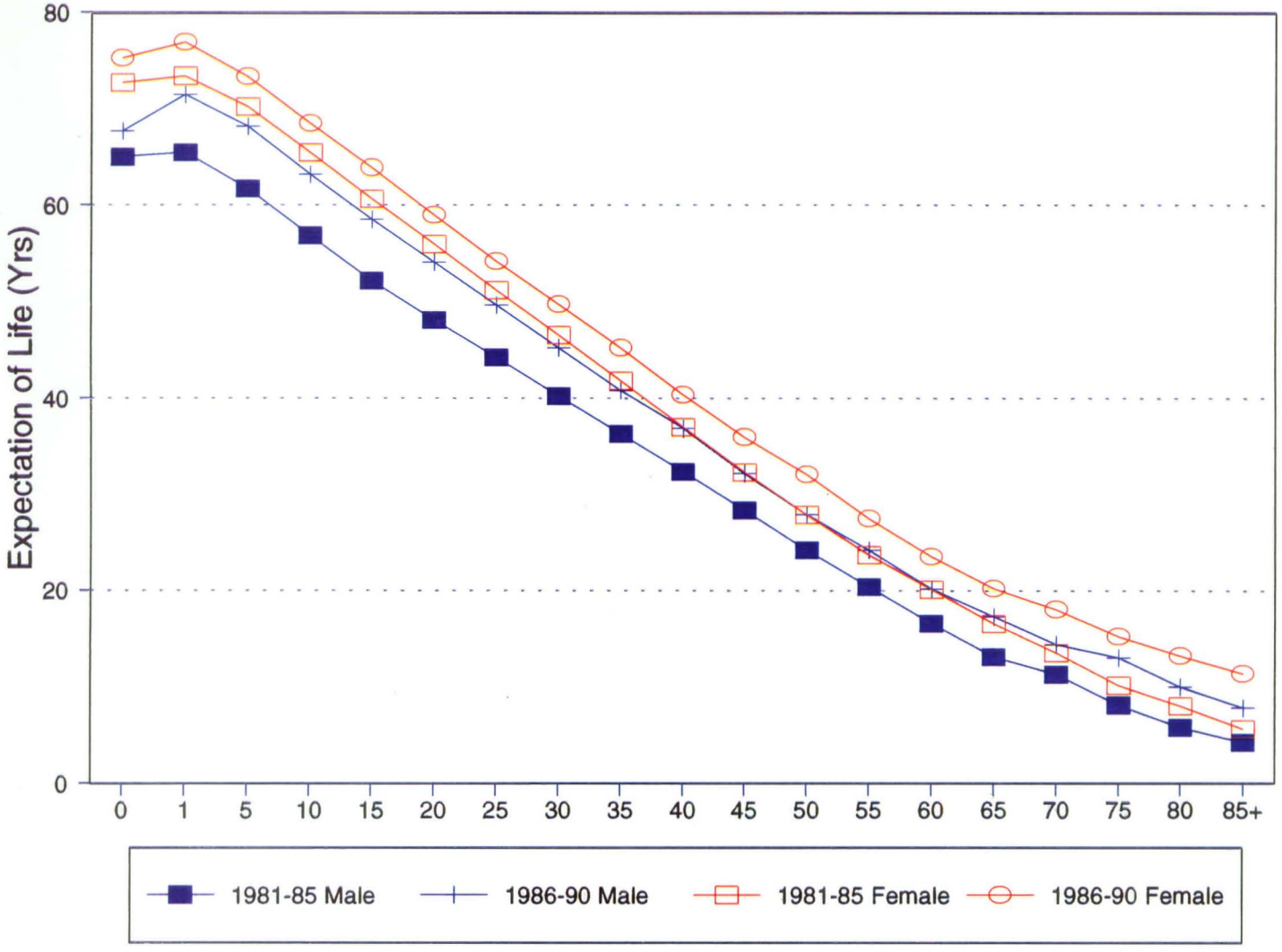

Figure 12. Life Expectancy by Age Estimated for the Total Band Population by Sex and Five Year Time Intervals

who gain 5 to 6 years in life expectancy. The combined effects of these trends among male and female components of the band population result in a narrowing of the gap between male and female expectation of life from an average of 5 years greater life expectancy for females in the 1981-1985 period to a 4.25 year excess by 1986-1990.

Survivorship and hazard rates. Probabilities of survivorship and hazard rates, derived from life table variables, provide additional means for evaluating changing mortality rates. The results of these two measures are described here in tandem as hazard rates can provide complementary information to that of survivorship probabilities by indicating the ages at which the impact of mortality is greatest and where decrements in probabilities of survivorship can be expected.

Survivorship probabilities and hazard rates for on-reserve, off-reserve and total band populations are presented by sex and time period in tables 12-14 (Appendix B.) and supplemented by survival curves for the off-reserve population (figures 13-14). The survival curve is characterized by 100 percent survivorship at birth which thereafter decreases precipitously in the first year of life, simultaneous with high hazard rates in early infancy, then typically plateaus for young ages and begins a downward slope in adulthood, which decreases in greater increments with advancing old age. The nature of survivorship probabilities is cumulative; high death rates early in life are compounded to affect probabilities of surviving to adulthood and old age. Conversely, hazard rates are typically high in early infancy, drop to low levels in childhood and youth and rise throughout

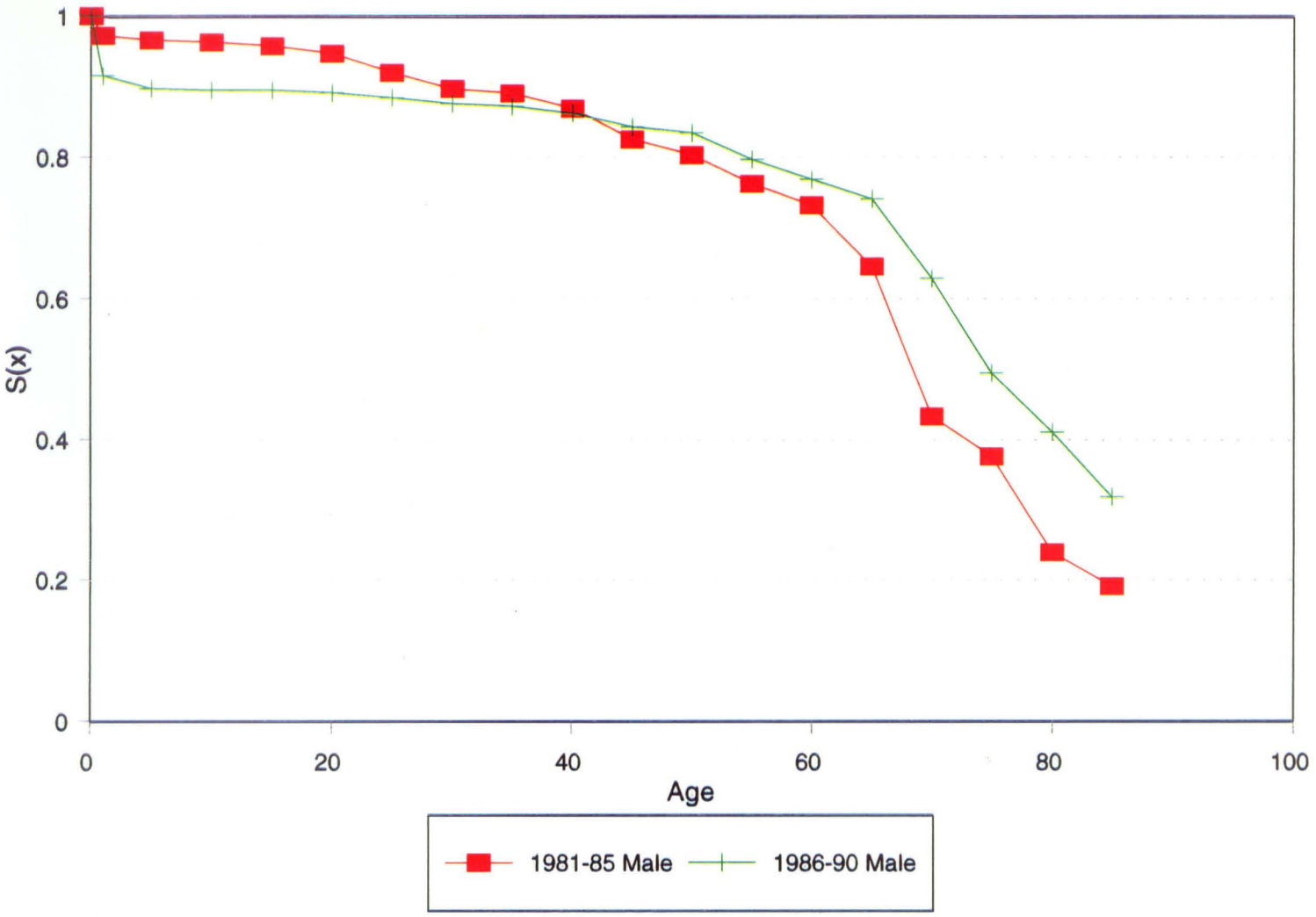

Figure 13. Survivorship Probabilities for Off-Reserve Males by Five Year Time Intervals

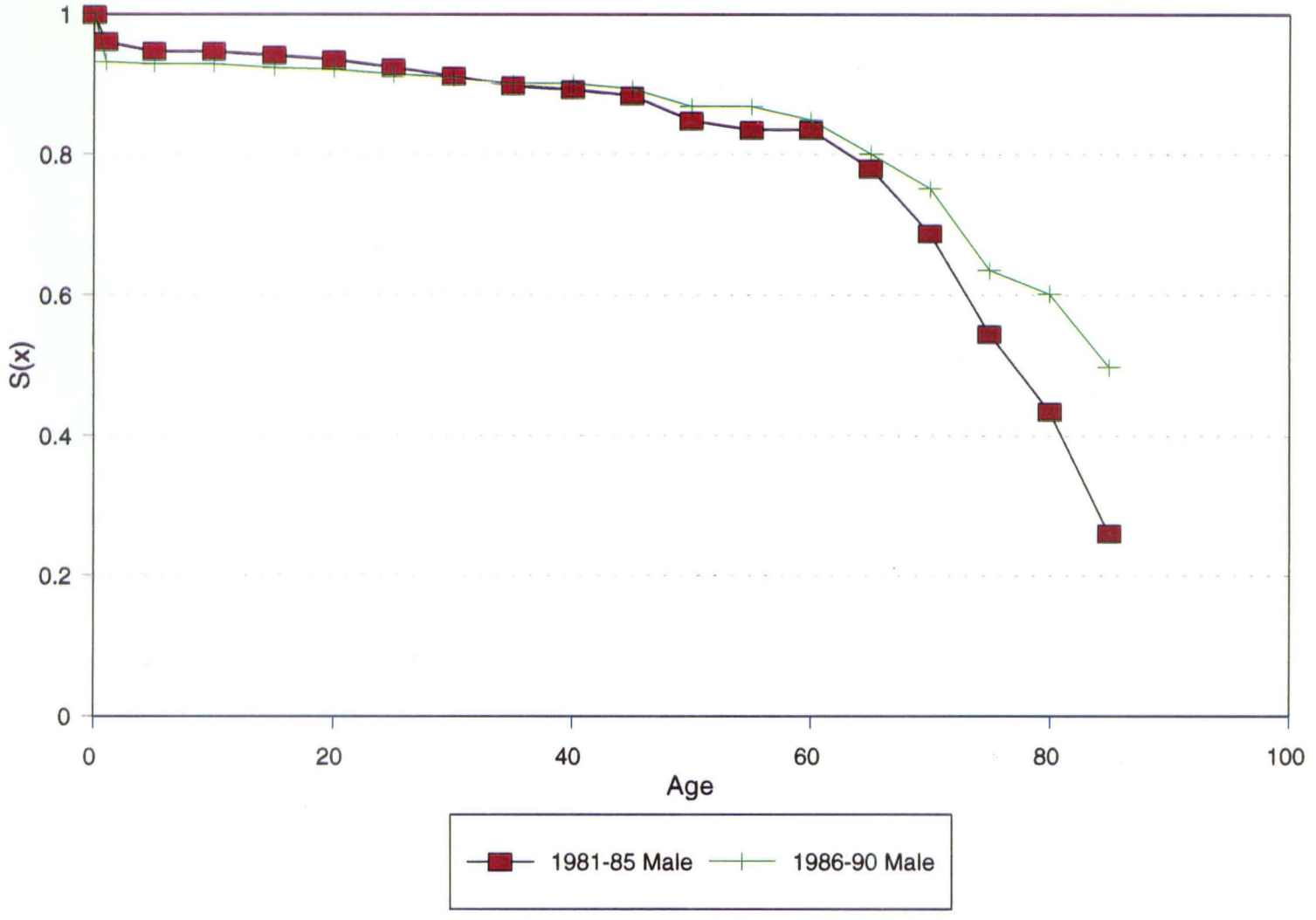

Figure 14. Survivorship Probabilities for Off-Reserve Females by Five Year Time Intervals

adulthood at an increasing rate to peak in the oldest age categories. The general pattern can certainly be observed in these results for the Registered Indian study population. However, minor variations observed over time may be telling.

Comparisons of male on-reserve survivorship probabilities for each half of the study period indicate a changing pattern of survivorship probabilities over time. The first indication of change is the greater decrease in the probability of survivorship observed for the first year of life for the 1986-1990 interval. This reduction is reflected in reduced survivorship probabilities throughout the childhood years until the earlier population sees more rapid declines in probabilities through adulthood than the later period. By age 45, individuals in the later period experience more favourable probabilities, which thereafter remain equal to or greater than probabilities for the previous interval. On-reserve females show little change in probabilities of survivorship until approximately age 35, when the later period begins to show less favourable probabilities of survivorship which continue nearly throughout adulthood. This decline in adult survivorship probabilities is coincident with a few very large increases in hazard rates in adulthood for this segment of the population.

Off-reserve males show more extreme changes in survivorship probabilities than males on-reserve (figure 13). The 1986-1990 time interval data reveal a 9% drop in the probability of survivorship to age 1 compared with a 3% drop earlier in the period. The probability of survivorship remains approximately 7% lower for males in the later period throughout childhood, after which the two trend lines begin to converge, as a result of more rapidly declining probabilities for the early period. By age 45, individuals

represented in the 1986-1990 data experience more favourable probabilities of survivorship compared to their 1981-1985 counterparts. From age 65 onward, survivorship probabilities in the later period are 10-20% higher than they were earlier in the study period. According to 1986-1991 data, nearly a third of the population would survive to age 85. Simultaneous with these increases in survivorship probabilities, hazard rates decrease by 50-70% for most ages.

Females off-reserve (figure 14) again exhibit a greater drop in survivorship probabilities by the first year than in the 1981-1985 interval. This differential is greater than that observed for the on-reserve population compared over time. Higher probabilities of survivorship are again notable for older ages in the later period. This differential is also more profound for off-reserve than on-reserve females. Survivorship probabilities for off-reserve females in the 1986-1990 period predicted that nearly 50% of women in this population would reach 85 years of age compared to only 26% in the previous time interval. Hazard rates for off-reserve females decrease by 90 and 100% for some adult age categories and likely account for this population component having the highest old age survivorship probabilities.

Band males exhibit a moderate pattern of changing survivorship probabilities over time as compared to on- and off-reserve patterns. Again, a sudden decline in the probability of survivorship within the first year of life is observed for the 1986-1990 time interval, reflecting a 210% increase in the hazard rate for this age group compared to the early half of the period. Though survivorship remains lower for the later period throughout childhood and young adult years, these probabilities decline at a slower rate

than for the early half of the period, so that by middle age a cross-over occurs to produce more favourable probabilities of survivorship into adulthood in the later period. This advantage increases with advancing age, from 2 to 14%, as adults in the early interval experience greater reductions in survivorship probabilities with age than do their counterparts in the later period. The extension of higher survivorship probabilities into older ages is accompanied by 40 to 60% improvements in hazard rates for most ages among band males. In contrast, few changes in survivorship probabilities are evident for band females other than 5 to 8% elevated probabilities for the later period in old age and slightly lower probabilities in middle age, reflecting increased hazard rates from ages 25 to 45.

Fertility and Reproduction

The foregoing analysis has focused on the consequences of changes in population and mortality data over the study period in relation to several summary statistics which describe mortality. Likewise, fertility indices may also be examined over time in order to evaluate the effects of changing birth and female population data on these measures, as well as the compound effects of these variables and survivorship probabilities.

Measures of fertility and reproductive success for the on-reserve population display no consistent pattern of decline or increase over the study period. When age-specific fertility rates are observed for the two time intervals (table 7), modest decreases are observed for most age categories, although slight increases are found in the 20 to 29 age range, owing to larger increases in births among these ages than for population.

Table 7: Age Specific Fertility for Total and Female Births, By Residence
1981-1985 and 1986-1991 Time Intervals

	ON-RESERVE				OFF-RESERVE				BAND			
Age	Pop.	Births	Fert.	Fem. Fert.	Pop.	Births	Fert.	Fem. Fert.	Pop.	Births	Fert.	Fem. Fert.
1981-85												
10	710	3	0.0043	0.0036	353	1	0.0017	0.0016	1063	4	0.0034	0.0030
15	699	105	0.1501	0.1278	318	51	0.1616	0.1504	1017	156	0.1538	0.1353
20	591	113	0.1911	0.1627	244	75	0.3083	0.2870	835	188	0.2254	0.1982
25	384	47	0.1235	0.1051	226	38	0.1678	0.1562	610	85	0.1398	0.1230
30	266	23	0.0880	0.0749	197	18	0.0921	0.0857	463	42	0.0897	0.0789
35	200	10	0.0494	0.0421	161	6	0.0355	0.0330	361	16	0.0432	0.0380
40	173	2	0.0128	0.0109	104	1	0.0059	0.0055	277	3	0.0102	0.0090
45	137	0	0.0000	0.0000	0	0	0.0000	0.0000	210	0	0.0000	0.0000
50	120	0	0.0000	0.0000	0	0	0.0000	0.0000	183	0	0.0000	0.0000
55	96	0	0.0021	0.0018	0	0	0.0000	0.0000	131	0	0.0016	0.0014
1986-91												
10	687	2	0.0026	0.0025	386	1	0.0016	0.0015	1073	2	0.0023	0.0021
15	770	106	0.1379	0.1286	442	47	0.1056	0.0992	1212	152	0.1257	0.1175
20	743	153	0.2053	0.1914	401	72	0.1807	0.1697	1144	225	0.1970	0.1841
25	597	82	0.1382	0.1288	370	47	0.1273	0.1195	967	130	0.1342	0.1254
30	402	32	0.0804	0.0750	335	19	0.0582	0.0546	737	52	0.0704	0.0658
35	292	11	0.0392	0.0365	269	5	0.0174	0.0163	561	16	0.0288	0.0269
40	234	2	0.0069	0.0064	230	1	0.0027	0.0025	464	2	0.0048	0.0045
45	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0.0000	0.0000
50	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0.0000	0.0000
55	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0	0.0000	0.0000

Overall, population increases by an average of 10% throughout the reproductive ages for on-reserve women. Nevertheless, these changes are insufficient to effect the total fertility rate (table 8) which exhibits little change over the period, indicating an average of slightly over 3 children born to women in the reproductive ages for both periods. Age and sex specific fertility rates show a similar pattern of modest decline, again with the exception of the 20-29 age group where small increases in fertility are seen. Overall, a small increase of 7% is noted for the GRR, which indicates 2.85 female births per mother by the later time interval.

Table 8.--Indices of Fertility and Reproduction by Residence and Five Year Time Intervals.

	TFR	GRR	NRR	FMU	R	T
ON-						
1981-1985	3.11	2.65	2.54	25.33	0.0381	24.42
1986-1990	3.05	2.85	2.71	24.91	0.0413	24.13
OFF-RESERVE						
1981-1985	3.86	3.60	3.45	24.54	0.0522	23.70
1986-1990	2.47	2.32	2.12	24.47	0.0313	24.00
TOTAL BAND						
1981-1985	3.34	2.93	2.79	24.99	0.0425	24.11
1986-1990	2.82	2.63	2.49	24.67	0.0379	24.03

Reproductive measures conditioned upon female survivorship for the on-reserve population again show little change over the period. A small 7% increase in the net reproduction rate is observed, representing an expectation of 2.71 females to be born to females under a year old in the 1985-1990 period. This estimate, based upon the product of survivorship probabilities and female birth rates for the period, is 5% lower than the GRR measure, which reports female births independent of survivorship. This differential is very similar to the 4% difference between the NRR and GRR for the earlier period. The timing of childbirth on-reserve is stable over the study period, as indicated by the mean age at childbirth, which remains at approximately 25 years of age, and the mean length of generation which is consistent at 24 years of age. However, a small increase is discernable for the intrinsic rate of natural increase, which begins at 0.0381 early in the period and rises by 8% to 0.0413 by the latter half of the period.

In contrast to the situation on-reserve, little change is observed in the actual number of age specific birth frequencies for off-reserve females, although small increases are discernable. At the same time, however, a large increase is apparent in the female population off-reserve, averaging to 52% over all ages in the reproductive age range. Consequently, age specific birth rates decrease considerably over time for this segment of the population, resulting in a 36% decline in the total fertility rate from an average of 3.86 births in the 1981-1985 period, to 2.47 in the 1986-1990 period. The behaviour of age specific fertility rates for female births over time closely mimic the declines observed for total births. As a result, the GRR is again 36% lower than earlier in the period, as an average of 3.6 girls born in 1981-1985 decreases to only 2.32 in 1986-1991.

Reproductive measures conditioned upon survivorship show the same pattern of decreasing fertility over the study period among off-reserve residents. Given the mortality and fertility of the off-reserve population in the 1986-1991 period, we can expect 2.12 female children to be born to females just born in this period, as compared to 3.45 expected in 1981-1985. This represents a 39% decline in the NRR over the study period. The NRR for the 1986-1991 period predicts 9% fewer females to be born to the next generation compared to females born to the present generation, as represented by the GRR described above. This represents a greater discrepancy than the 4% difference between the NRR and the GRR for the 1981-1985 period. Again, negligible differences are observed for measures of mean age at childbirth and mean length of generation over the period, which remain consistent at 24.5 and 24 years respectively. However, the intrinsic rate of natural increase for the off-reserve population decreases by 40%, from 0.0522 in the 1981-1985 period to 0.0313 in the 1986-1991 period. Thus, fertility measures and reproductive indices conditioned upon survivorship consistently indicate declining fertility among the off-reserve population over the study period and predict further declines in subsequent generations.

Examination of fertility indices for the total band population again indicates a trend of declining fertility over time. Age specific fertility rates compared over the two time intervals show reduced fertility for all age categories within the reproductive period, despite increases in births to women aged 20 to 34. As a summary of the age specific fertility rates, the total fertility rate (TFR) indicates that by the later period, we could expect 2.82 children to be born to a women during her reproductive life time. This

represents a 16% decrease from a TFR of 3.34 earlier in the period. When we consider only female births to band women, age specific rates decrease in nearly every age category by similar proportions to those for total births. The gross reproduction rate (GRR) then estimates an average of 2.63 female children born to band women in the later period, compared to a 10% higher rate in the 1981-1985 period.

When we consider other reproductive indices conditioned upon female survivorship, the pattern of decline in band fertility persists. The net reproduction rate derived from 1986-1990 data predicts that 2.49 children will be born to a band female just born, based upon the survivorship probabilities for the period, compared to 2.79 estimated for 1981-1985 data. Despite the 11% decline in the NRR, estimates of the mean age at childbearing show little change over the period from 24.99 to 24.67. Similarly, the mean length of generation remains essentially unchanged over the period. Nevertheless, the intrinsic rate of natural increase exhibits a 11% decrease in the rate of growth over the period. Given this rate of growth, the band population is estimated to increase by the net reproduction rate of 2.49 within the span of one generation.

CHAPTER 6

DISCUSSION

The results of analyses which described changes in population structure and several indices of mortality and fertility have been presented. With these results, we provide an integrated explanation of some of the trends observed for the 1980-1991 study period, using Bill C-31 amendments to contextualize observed changes in population structure. The understanding of changes in population variables, thus gained, is employed in explaining the consequences of C-31 for the calculation and interpretation of epidemiological rates.

Bill C-31 Impact on Population Growth and Structure

Changes in population growth and structure for the composite band study population are consistent with changes in criteria for registration and reregistration imposed by Bill C-31. As well, these results, while revealing some unexpected trends and data quality problems, are largely consistent with national and provincial enumerations and survey results compiled by Indian Affairs, which describe the demographic impact of the 1985 amendments (INAC 1990a).

Population growth concomitant with Bill C-31 changes. The Canadian Registered Indian population is a young and rapidly growing population. Prior to the 1985 amendments, the annual growth rate of this population consistently exceeded 2%, while the general Canadian population grew at a rate of 1% (Frideres 1993). Nevertheless, the composite band population described herein for the 1980-1991 period exhibits an unprecedented rate of increase. In terms of total population growth, national Indian Affairs data indicate a 33% increase from 360,000 enumerated for 1985 to 478,000 in 1990 (INAC 1990a). In comparison, the present study demonstrates a 38% increase in the composite band population for the same period of time. The crude annual rate of increase for these band data averages 2.7% before 1985 and 6.1% in the latter period, which compares well with average Manitoba rates of 2.8% and 5.8% for 1980-84 and 1985-1991 periods respectively. In light of sweeping amendments to the registration entitlement regulations of the Indian Act, introduced in June of 1985, the dramatic increase in the study population within this relatively short time span is understandable. The large population increase observed can be expected to have a considerable impact on the composition of the Indian population, as well as further consequences for the construction of epidemiological rates.

Bill C-31 as a catalyst for compositional change. Biases inherent in past Indian legislation have affected the composition of the Registered Indian population through the selective influence of exclusion criteria contained in registration and enfranchisement sections of the pre-1985 Indian Act. These criteria excluded women upon marriage to

non-status males, their offspring, and illegitimate offspring of Indian or non-Indian women who could not prove the Indian paternity of their children. Others were selectively enfranchised upon request on the basis of their advanced education, professional credentials, foreign residence, or service in the Armed Forces. As a result, enfranchised individuals were assigned non-status Indian identities and relegated, largely, to off-reserve residence.

Superimposed on these gender-specific biases, Bill C-31 amendments have further influenced the composition of the status Indian population, beginning in 1985, through the selective influence of the revised criteria for registration and reregistration. These criteria favoured restoration of status to individuals who had lost status as a result of discriminatory legislation or past enfranchisement practices and permitted the first time registration of their children. However, the enabling legislation also established a second generation cut off rule which largely restricted the eligibility of their grandchildren. For the sake of simplicity, combined reference to those granted restoration of status and their newly registered offspring is subsumed in this text by the term registrants, as registration subsumes reregistration. Thus, an obvious potential for residence, sex and age biases among registrants - and consequently the larger reconstituted Registered Indian population - has been created by a history of legislative changes which have profoundly influenced the lives of Canadian Indians.

Differential impact of Bill C-31 by residence. The changing distribution of the Registered Indian population by residence reflects a long history of legal incursions into

Aboriginal Canadians' rights to determine residence, which have been placed at odds with their rights to self determined identity and to such basic rights as the choice of a spouse. Residence biases result from the observation that most persons applying for reinstatement were largely restricted from reserve residence since the time at which they lost status. Minor children who lost status consequent to a parent's loss of status, would also be more likely to reside off-reserve in the charge of their parents and to remain off-reserve into adulthood. Furthermore, the probability of forced enfranchisement would have been relatively high for status off-reserve residents with greater opportunities to marry non-Indian or non-status males or to be engaged in behaviour leading to application for voluntary enfranchisement.

The bias toward off-reserve residence among Bill C-31 registrants is supported by INAC data for 1990, which shows approximately 90% of successful C-31 registrants living off-reserve where they represent 33% of the off-reserve status population. Conversely, only 10% live on-reserve where they represent 2% of this population. Furthermore, survey results indicate that 62% of C-31 registrants living off-reserve have never lived on-reserve. In addition, registrants who were granted status within the first year and a half after the enactment of Bill C-31 were more likely to live on-reserve than those who were registered since, indicating a decreasing probability of residing on-reserve with greater recency of registration. Although 52% of registrants surveyed indicated an intention to move to a reserve at some future date, the bias toward off-reserve residence is likely resistant to change as perceived and real barriers to on-reserve residence are

prevalent and much smaller percentages report action taken toward realization of the envisioned change in residence (INAC 1990a).

The findings of this study with regard to changes in population by residence over time are consistent with the context described above. The larger increases observed among the off-reserve (121%) as compared to on-reserve (45%) component of the study population reflect constraints imposed upon enfranchised individuals and their descendants which have discouraged on-reserve residence. The Bill C-31 registration of off-reserve residents contributed disproportionate numbers to this population relative to the historically larger proportion on-reserve. Gains in the proportionate contribution off-reserve changed the ratio of off- to on-reserve residence from 30:70 to 40:60 in the pre- and post-1985 periods respectively. These results are highly consistent with national data which report a shift from a ratio of 29:71 before, to 40:60 since Bill C-31 (INAC 1990a). Proportional changes in on- and off-reserve populations are reflected in greater growth off-reserve after 1985, as indicated by crude annual rates of increase. Dramatic changes in off-reserve growth rates begin in the 1985-1986 interval at 11.3% and continue to a maximum of 13.2% through 1989. On-reserve growth rates for this period are high relative to pre-1985 rates (2.6% to 8.7%), with the exception of the anomalous 1988-1989 rate (-1.6%), yet considerably lower than for the off-reserve population. A pattern of higher on-reserve growth rates and greater correspondence between residence groups resumes by 1989, with the completion of the bulk of registration.

Growth differentials attributable to Bill C-31 as determined by the error of closure. The research results have established significant growth in the study population after 1985, particularly off-reserve. Yet, lacking identifiers of C-31 registrants in this data, we are unable to specifically allocate the proportion of growth which is attributable to C-31. Thus, the error of closure is employed as an indirect means of assessing the importance of Bill C-31 registration for on-reserve and off-reserve populations relative to births, deaths, and other variables of population change. As calculated, the error of closure does not enable us to distinguish between variables other than birth and death (e.g., net migration), which contribute to population change. However, by using the pre-1985 level of error as a gauge of baseline error, we may arrive at a crude estimate of the amount of error attributable to Bill C-31 changes after 1985.

The abstract nature of the legally defined Registered Indian population necessitates a broad consideration of variables of population change in the analysis of the error of closure. Firstly, the discrepancy between INAC and MSB data, as previously described, can result in either under-reported births or deaths for the corresponding registered population, which may enlarge error in the former case and reduce it in the latter. Under-reporting of deaths often results from the failure to identify an individual as a Registered Indian on the death certificate. Late reporting and under-registration of births with INAC also present common sources of error. Births for a given year recorded by MSB but not reported to INAC in that year, would escape population data and effect a reduction in the error of closure. However, if births which escape registration in that year are reported in a subsequent year, apparent population growth, unaccounted for by natural increase, would

result. Migration between on- and off-reserve residence would also contribute to changes in error size, immigration accompanied by decreases and emigration by increases in error. Prior to the 1985 amendments, enfranchisement would have reduced the size of the registered population and so the size of error. However, the likelihood of loss of status was considerably reduced by the 1980s, as enfranchisement was phased out by 1982. Furthermore, beginning in 1980, INAC had allowed the suspension of the "marriage rule" and the "double mother rule", although only 103 of 592 bands chose to suspend the former, while 309 suspended the latter (Frideres 1993). Finally, registrations pursuant to Bill C-31 represent an important source of population increase and error after 1985. Thus, the extent to which the error of closure increases at any given time varies in relation to the combined effects of the above variables.

Errors of closure compared for on- and off-reserve populations differ in the pre- and particularly the post-1985 periods, which may reflect dissimilarity in weighting by the above variables. Before 1985, on- and off-reserve errors are both low relative to the later period and often negative, indicating that natural increase accounts for a large and often greater proportion of population increase than indicated by INAC data. However, errors of closure for the off-reserve population assume lower values and a greater percentage range (-3.27 to 1.87%) than for the on-reserve population (1.23 to 2.64%). After 1985, off-reserve errors escalate abruptly to over 10% within a three year period, before returning to pre-1985 levels by 1991. During the same time, on-reserve errors remain under 2.15% for most intervals and make a distinct departure from pre-1985 levels only in the last two year intervals of the period.

Comparisons of error levels against rates of population increase, as well as birth and death frequencies over the period, reveal the underlying differentials between on- and off-reserve data contributive to the summary measures of error. On-reserve data show the combined effects of increasing births and largely unchanged death frequencies, which result in an escalation of natural increase. Coincidentally, population growth remains relatively gradual until the final two time intervals. Although off-reserve population growth is striking after 1985, death frequencies again remain stable, while birth frequencies and thus, natural increase, show no discernable pattern of growth until the final two time intervals. Thus, on-reserve natural increase paces population increase more closely than for off-reserve data, which results in higher errors off-reserve. Off-reserve death and particularly birth frequencies fail to report the same rate of increase as population until sudden increases in the final two years of the period.

Though necessarily speculative, some generalizations can be made regarding the factors contributing to the time trends and on- and off-reserve error differentials described above. Firstly, late reporting and under-reporting of births to INAC are likely the most dominant influences on the level of error prior to 1985, though likely significant throughout the period. Error levels in this early period, which fluctuate between approximately -2 and 2% for the on-reserve population, may reflect alternating effects of late reporting and 'catch up' from previous late reporting of births. The under- or late-reporting of deaths, likely more significant for a less visible off-reserve population, may also depress error levels for this period. Similarly, loss of status as a result of 'marrying out' may also be more significant off-reserve. These factors may account for the lower

values assumed by off-reserve errors of closure. Finally, emigration may also contribute to reduced error levels, particularly on-reserve. The effects of these factors, with the exception of loss of status, are likely to persist throughout the later period. In fact, late reporting of births and the omission of deaths may be further exaggerated in the context of higher work loads for INAC following the 1985 amendments and added opportunity for error owing to the transitory status for many individuals during this time. Nevertheless, the effects of registration associated with Bill C-31 after 1985 would counter the depressant effects of these factors on the error of closure and, particularly for the off-reserve population, produce large measures of error unlikely attributable to other factors.

The additive effects of on- and off-reserve variables contributive to the error of closure produce band results which retain the distinct pattern of increased error after 1985, demonstrated primarily by off-reserve data. By interpreting the average pre- 1985 error level as a baseline level of error, free of the effects of C-31 registration, on-reserve results indicate an average of slightly over 1% error attributable to C-31, off-reserve approximately 7%, and total band results a moderated 3.6%. Though admittedly imprecise, without person level data on C-31 registrants, error of closure provides a convenient means of estimating the extent of population growth attributable to C-31 registration and differentials in this impact by residence.

Differential impact of Bill C-31 by sex. The central mandate for Bill C-31 was to provide redress for inequalities in regulations pertaining to registration which discriminated against women. As such, we may expect these reforms to primarily affect

those disenfranchised native women. In fact, the majority who lost status and who have sought registration under Bill C-31 were those women and their children. National data indicate that 23% (16,702 of 73,554) of those who were registered by April 1990, were reinstated pursuant to article 6(1)(c), the clause which allows for the restoration of women who had lost status as a result of marriage to a non-status male. Another 60% (44,367 of 73,554) of those registered, were newly registered pursuant to article 6(2), which grants entitlement to individuals with one parent registered under 6(1), that is, to offspring of individuals who lost status. Thus, new registrants rather than restorations constitute the bulk of Bill C-31 registrants. This fact has implications for the distribution of the registrant population by sex, as well as the overall Registered Indian population after 1985. Survey data, based on registrants over 18 years of age, shows greater proportions of females to prevail among restorations (approximately 88%). However, new registrants show nearly equal proportions of males (48%) and females (52%). No doubt consequent to the mitigating effects of the greater representation of second generation registrants, national data for 1990 report a modest female majority of 58% among C-31 registrants (INAC 1990a).

The present study reveals sex distribution changes over time, though primarily for the off-reserve population. Male dominated reserve and female dominated off-reserve populations have long been the bi-product of discriminatory legislation. Though Bill C-31 amendments will result in somewhat greater additions of females than males to the Registered Indian population, these changes have neither achieved complete restitution for past discrimination nor are they likely to result in sustained, equivalent sex ratios on- or

off-reserve. In this regard, results of the present study show continued male predominance on-reserve as indicated by a sex ratio of 52:48 throughout the study period, and increased female representation off-reserve revealed by the progression from a 50:50 ratio in 1980 to a 47:53 ratio by 1987. However, these disparate trends are obscured in total band results which indicate a balanced 50:50 sex ratio by 1991. The survey of registrants indicates that a greater proportion of males (59%) currently living off-reserve are more likely to return to reserves in the future than females (48%). Furthermore, males project a shorter time frame for the projected move (INAC 1990a). Thus, in the future, Bill C-31 changes may compound, or at least perpetuate, previously existing sex differentials on- and off-reserve rather than encouraging a greater balance in the distribution by sex.

Age-sex differentials consequent to Bill C-31. As discriminatory legislation has long been in effect, the age distribution of registrants can conceiveably range widely. However, certain biases in legislative criteria, administrative procedures, and registration behaviour by age result in the age structure differentials described in these results. For example, persons who have experienced the injustice of involuntary loss of status within their own life time and those most recently enfranchised likely seek restitution in the greatest numbers. These biases, combined with the greater likelihood that documentation necessary to successful registration is more accurate and attainable for younger applicants than for the elderly, may account for greater population increases among young adult and middle aged categories. These results also indicate substantial increases among children,

except for the under 1 year old age group where large decreases are evident, whereas little growth is discernable for seniors (65+). While large additions among young adults reflect the addition of both reinstated individuals and their children, additions among children reflect only second generation registrants and are limited by the 'second generation cut-off rule' instituted by Bill C-31, which explicitly excludes grandchildren of first generation registrants. A bimodal pattern of population increase illustrates a generational effect on growth on-reserve, which may reflect a greater bias toward registration of parents and young children than off-reserve. This supposition is somewhat supported by INAC survey results which found that among off-reserve registrants, adults with children were more likely to intend to move on-reserve than those without children (INAC 1990a). Old age individuals may be less likely to move to reserves than younger adults with dependent children, who may be more able to relocate to take advantage of social programs offered on-reserve. Despite the small numerical increases among seniors, this addition of population represents a large proportionate increase for these smaller age categories, compared to the 1 through 19 age range where the impact of larger increases is diffused by a large childhood population. Under age 1, population decreases appear to be a function of under-registration of births by INAC which escalates after 1985. When birth frequencies are compared against the under 1 year population, births exceed population during the 1984-1989 period by an average of 70% on-reserve and 86% off-reserve compared to average excesses of 24% and 60% during the remainder of the period for on- and off-reserve populations respectively. That the infant population during this five year period actually decreases to as little as one quarter of its previous size before rebounding

by 1990, suggest that not only are births to Bill C-31 registrants escaping registration by INAC, but births to the original Indian population as well.

Further comparison of age structure by sex reveals important differentials on- and off-reserve. As a point of reference, INAC survey data on registrants 18 and over indicate that 60% of male registrants are aged 18 to 35, compared to only 40% of females. This indicates a younger male than female age structure. The results of the present study for on- and off-reserve populations differ in the extent to which they confirm this distinction. Comparisons of 1983 and 1988 age-sex structures on-reserve show larger increases for males than females among ages 1 through 9, whereas among adults the largest increases uniformly occur in ages 20 through 39 and are similar in magnitude for males and females. Off-reserve age differentials by sex are more pronounced than for on-reserve and show greater increases among females in adult age categories as compared to males. Off-reserve males exhibit population growth concentrated among ages 20 through 29 compared to females, among whom growth of similar magnitude is observed in a broader and older age range of 15 through 49. Total band data reflect the combined effects of these age-sex differentials by residence. Thus, an overall aging trend is revealed in band data, with the greatest additions to population observed among middle aged adults, particularly for females. Population increases for band males exceed those for females among children (1 through 14), whereas larger increases occur among females in ages 25 through 59 as compared with males. The age-sex differentials described herein, particularly for off-reserve females, have implications for changes in fertility and mortality rates as will be further clarified by forthcoming discussion.

The Impact of Bill C-31 on Mortality Rates

Trends and differentials in mortality rates. Standardized mortality rates calculated for the composite band data set indicate a trend of considerable decline in mortality for a relatively constricted time interval. For the on-reserve population, the onset of a decline in mortality is coincident with the enactment of Bill C-31 changes. This correlation implicates the addition of large numbers of Bill C-31 registrants in the decline of standardized mortality rates. Comparisons of standardized rates by on- and off-reserve residence reveal a more precipitous decline in off-reserve mortality (1/1000 per year) than for the on-reserve population (0.5/1000 per year). Furthermore, ratios of given to standard population mortality rates reveal a greater extent of mortality decline off-reserve (100%) than on-reserve (30-40%), reminiscent of the larger off-reserve population increases (121%) compared to on-reserve (43%). As the weighted sum of residence specific mortality, total band mortality declines by 50% during the period to converge with the standard population rate by end of period. Yet convergence of Indian and total Manitoba death rates contradicts not only our expectations regarding the disadvantaged socio-economic environment and limited health care resources of a large proportion of Registered Indians, but the results of other health statistics which describe Indian mortality as remaining higher relative to that for larger Canadian or provincial populations (Foster et al. 1995, Health and Welfare 1990, Postl 1988). Thus, the large decline in mortality and increased residence differentials in rates for this period call for explanations which surpass common interpretations of gradual improvement in mortality and which take Bill C-31 changes into account.

Mortality rates standardized for age by sex reveal a more rapid rate of decline in male mortality for both on- and off-reserve populations. Male mortality on-reserve is, on average 3.6 deaths per 1000 higher than female mortality, and decreases at a rate of 0.8 deaths per 1000 per year over the study period, whereas female mortality decreases at a rate of only 0.2 deaths per 1000 per year. Similarly, male mortality off-reserve exceeds female mortality by an average of 4.7 deaths per 1000 and declines at a rate of 1.3 deaths per 1000 per year, compared to a 0.8 rate of decline among females. Consequent to the residence specific rates of decline by sex, total band mortality rates show a similar pattern of more rapid decline in male mortality. The greater impact of demographic changes on male mortality will be further explored following upon the application of a comparative technique to better assess the significance of the trends described.

Comparisons of standardized mortality rates. Comparison of two or more directly standardized rates may be advanced by a few simple illustrative techniques. Firstly, a ranked ordering of standardized rates according to a ratio of the standardized rate for the given population to the standard population mortality rate can serve as a crude index of how the study populations (here defined according to time interval) compare with respect to the variable of interest (Carriere and Roos 1994). Ratios calculated for composite band data indicate general trends of declining mortality for every segment of the study population over time. In addition, ratios gauge the level of mortality relative to the standard population, the most remarkable result here being off-reserve ratios which

decline from 1.7 to 0.55 to show lower mortality rates (controling for age) than the standard population by the close of the period.

Beyond this basic method of comparison, another useful technique is to examine the confidence intervals associated with a series of standardized rates in order to assess whether a trend represents a true difference between populations rather than merely an artifact of variation (Carriere and Roos 1994). Confidence intervals for the present study exceed the difference between rates for succeeding time intervals in nearly every case, except for the last two intervals for total off-reserve, total band, male off-reserve and male band results. These exceptions likely relate to the gross under-reporting of deaths suspected for the 1991, off-reserve population. The level of variation in these results may then create problems for individual comparisons.

According to Carriere and Roos (1994) the simplistic measures described above are not only impractical in hypothesis testing requiring multiple comparisons but prone to error as well. The authors caution that multiple comparisons of standardized rates can inflate the actual significance level, leading too frequently to an incorrect rejection of the null hypothesis (the null hypothesis being that there are no significant differences between rates compared). The authors recommend a simultaneous test for assessing the overall significance of variation among the standardized rates. The same authors have devised the T-squared hypothesis-testing procedure described in Chapter four. The T-squared statistic allows us to evaluate differences between several standardized mortality rates simultaneously by weighing the importance of changes in the distribution of rates over the period against the amount of variation associated with the estimation of those rates.

T-squared comparisons give us some assurance that trends and differentials in standardized mortality rates do not merely reflect variation. Highly significant grouped T-squared values for on-reserve and total band populations confirm that diminished rates represent substantive changes in mortality over time. Despite a more dramatic decrease in mortality rates off-reserve, comparison over time fails to achieve significance by a narrow margin. This is largely due to high variation early in the period which reduces the T-squared statistic. Individual T-squared statistics for on-reserve and total band populations indicate significant differences until the latter time intervals, which verify the convergence of given and standard population mortality rates by the end of the period. Again, off-reserve results represent the exception, as only the final rate attains significance as a result of the 1991 under-count of deaths. Finally, pair-wise T-squared comparisons also confirm significant differences between on- and off-reserve mortality. Higher individual values toward the end of the period reinforce a trend of increasing differences in mortality between residence groups over time.

T-squared statistics employed in the evaluation of changes in standardized mortality rates by sex provide assurance of significant trends in some instances, yet also warn of high variability in several other comparisons. Overall trends of decline in male mortality rates for both on-reserve and total band populations achieve significance, as do individual comparisons in all but the final time intervals. These results verify a convergence between male mortality rates and standard population mortality rates over time. Neither individual or grouped T-squared statistics attain significance in the comparison of off-reserve male mortality over time. It appears that highly elevated

variances associated with mortality rates for the first three time intervals may prevent T-squared values from reaching significant levels. Female mortality rates appear much more consistent over time and more closely resemble standard population mortality levels than do male rates. Thus, it is not surprising that on-reserve and band results indicate no significant differences with the standard rate at any point in time nor between mortality rates over time. Though individual T-squared statistics calculated for off-reserve females attained significance only for the final mortality rate, this may again reflect under-reporting of mortality for 1991. Pair-wise T-squared statistics show significant differences between the sexes only for band data. Variation in the smaller residence specific comparison group results may preclude significant T-squared results for these comparisons.

Deconstructing standardized rates of mortality - Bill C-31 impact illustrated.

Comparisons of standardized mortality rates over time and between residence and sex group components of the study population reveal some unlikely trends, considering the short time frame involved in this study. However, the use of the T-squared statistic provides some assurance of the authenticity of the trends and differentials indicated, despite high variability among the smallest study population divisions which obscures the results of comparisons. Coincident with changes in mortality rates, Bill C-31 changes in legislation, productive of the demographic changes described in the preceding section, appear correlated with the timing and magnitude of some of these changes in mortality. What remains then, is to explore the influences of Bill C-31 demographic changes on the

calculation of mortality rates and the consequent effects on composite band mortality rates over the study period.

Decomposition of crude mortality rates provides preliminary indication of the importance of changes in age structure in producing observed measures of mortality. Comparisons of age and rate components of differences between crude mortality rates for standard and given populations indicate that age structure differences, rather than actual rate differences, are greater determinants of differences in crude rates. In all such comparisons for on-reserve, off-reserve and total band populations, as well as for male and female divisions among these populations, the age structure component proves dominant, except for the final off-reserve rate differential. In this instance the rate component is the greater determinant of the differential, which can be understood in terms of the unusually low mortality rate produced by the 1991 probable under-count of deaths. What is more significant is the observation that the importance of the age component increases over time, particularly off-reserve. This trend of increasing impact of age-structure can be understood as a product of Bill C-31 changes, most profound off-reserve, which accentuate those age-structure differentials between standard and given populations contributive to crude rate differences. Although decomposition addresses crude rate differences, the importance of age structure effects illustrated by this method may well have carry-over effects for standardized rate differences as well.

Crucial to our understanding of the means by which rate differentials and trends are affected by demographic changes consequent to Bill C-31 is the limited extent to which the process of standardization controls for age-composition differences.

Standardization cannot actually control for all effects of age composition because the preliminary calculation upon which it is based employs age-specific rates of the given population. These rates are weighted by the standard population age structure, but retain the effects of the given population denominator. So it follows that the given population age-structure becomes integrated into the ultimate value of the age standardized rate. Therefore, changes in the given population age structure are reflected in changing standardized mortality rates.

The overall decline in standardized mortality rates for the study population during the 1980-1991 period can be understood as a consequence of increases in the Registered Indian population without commensurate increases in mortality during the same period. These changes in rate follow upon the 1985 amendments to the Indian Act, as Bill C-31 registration contributes to increases in population employed in the denominator of rates, while deaths to this population remain under-reported. In fact, deaths to the population base excluding Bill C-31 registrants also more frequently go unreported after 1985. This imbalance between population and mortality gains produces deflated mortality rates, which create an apparent trend of decreasing mortality over the period. The more precipitous decline in off-reserve mortality rates is the product of greater population increases combined with decreases in mortality among the off-reserve population, compared to more moderate population increases and closer correspondence between added population and deaths for the on-reserve population. Furthermore, sex differentials among each sub-population derive, in general, from fewer deaths reported for males relative to population increases after 1985 than for females.

Further explanation of differentials in the rate of decrease in mortality by sex must account for differences in age-specific rates of mortality coupled with the age distribution of population increases by sex. In general, middle aged categories exhibit the greatest increases in population after 1985 among both males and females. As these are generally the ages at which there is less risk of death, low frequencies of mortality among these ages limit the impact of population changes on mortality rates. This generalization suggests a potential for greater impact of demographic changes on mortality in the future when new registrants pass through age categories characterized by high frequencies of mortality. However, population additions for particular residence, sex, and age groups are presently affecting a decrease in mortality rates. The male on-reserve population exhibits larger increases among children, while population increases among females occur primarily among the middle aged. As middle age mortality is generally low, whereas childhood mortality is relatively high, the greater weighting of the male population among youthful categories results in greater decreases in mortality rates for males than females. Similarly, off-reserve females increase by greater numbers than males among somewhat older ages. Large population increases for off-reserve males among ages 10 through 34, where mortality is commonly high, particularly due to accidental and violent deaths, produces further reductions in mortality as compared with females, among whom changes in mortality are moderated by population increases in ages at which the risk of mortality is lower.

Another age differential, which may partially offset the overall decline in standardized mortality rates described above, relates to the added under-registration of

births in the study population after 1985. The gross deficit in the registration of births, particularly in the 1984 through 1989 period, has already been described. Coupled with relative stability in the frequency of deaths for the infant population over this time period, this sudden decline in population effects a dramatic increase in mortality rates for the under 1 year old age category. As mortality is characteristically high within the first year of life, this decrease in population size represents a substantial impact on infant mortality rates. However, coincident with the inflation in mortality rates incurred by under-registration of births, late registration of these births may also cause greater underestimation of mortality in the post-1985 period as a result of the loss of mortality for births not reported within the period of high mortality. As re-registrant females are largely added part way through, or in the latter part of the reproductive period of life, the children they have had who are added to the population, are likely to have already passed through the period of high infant mortality. Thus, the late registration of births results in a potential loss of infant deaths and introduces the surviving late registrant population into more advanced age categories, producing some compensatory decline in mortality rates.

In sum, Bill C-31 registrants contribute disproportionately to denominators as compared to numerators, or death frequencies, in the calculation of standardized rates after 1985, which produces the observed trends of declining mortality over the 1980-1991 study period. However, when the bulk of C-31 registrants pass through older ages subject to higher mortality rates, we can expect this population to contribute significantly to mortality and perhaps produce increased mortality for the population on the whole. Furthermore, we await the registration of Bill C-31 registrants' births and associated infant

mortality, although these individuals are likely to have already passed through the stage of high mortality in the under 1 category. Therefore, although C-31 registrants are currently deflating mortality rates, we may expect greater impact of demographic changes on mortality rates in the future.

The Impact of Bill C-31 on Life Table Measures of Mortality

Life table methodology employed in the estimation of life expectancy and survivorship probabilities provides supplementary information to that derived from the comparison of standardized mortality rates. The strength of the life table as an analytical tool derives from its interpretation as a stationary population. Life table methodology effectively isolates mortality through the construction of an age distribution unique to the age-specific mortality rates of the study population and isolated from the effects of variability in birth cohort size. According to Shryock and associates (1976), the particular advantage of life tables over other measures of mortality is that "they do not reflect the effects of the age distribution of an actual population and do not require the adoption of a standard population for acceptable comparisons of levels of mortality". The choice of a standard is known to have a significant influence on the results obtained in standardized comparisons (Kitagawa 1964). Resultant values may be comparable, but are ultimately less meaningful in terms of the study population's distribution than life table mortality measures weighted by an age distribution calculated on the basis of the study population's own mortality schedule.

Stationary age distribution changes pursuant to Bill C-31. The characteristic age distribution which results from the methods described above is referred to as the stationary age distribution. It corresponds to the LL(X) column in the life tables described by the foregoing results. The stationary age distribution is employed in calculations of life expectancy and survivorship probabilities, as well as in the deterministic analysis of fertility discussed in the following section. However, the stationary age distribution is itself useful. As a simplified model produced by observed age-specific mortality rates, it mirrors these mortality rates and presents their potential effects on population structure writ large. In this study, the comparison of two such population models generated according to pre- and post-1985 age-specific mortality rates serves to further emphasize differences in mortality rates over time as well as associated changes in population structure resulting from Bill C-31 registration.

A common pattern emerges in the expected changes to age distribution found in comparisons of on-reserve, off-reserve and total band stationary age distributions by sex, across pre- and post-1985 periods. An overall aging process is indicated by decreases to population among age categories under 35 and increases in those over age 40. Furthermore, the magnitude of decrease among the younger categories consistently declines with increasing age, as the magnitude of increase mounts with increasing age, whereas middle aged categories remain relatively stable. However, on-reserve females present an exception to this pattern as decreases to population occur among nearly all age groups until age 80, where large increases are observed. Although very small population decreases occur under age 30, thereafter the extent of decrease slowly escalates. Other

minor variations on the common trend are revealed in comparisons by sex, as more profound changes occur among males than among females both on- and off-reserve. Further differentials by residence show more substantial increases after age 45 among males off-reserve than on-reserve as well as the unique pattern for on-reserve females already described. Consequently, expected changes in model age distributions for the total band population show a moderated version of the common trend, where small changes are observed for female adults as a result of opposing trends for these ages by residence.

The common trend in stationary age distributions can be understood in terms of the changes in age-specific mortality rates observed between the pre- and post-1985 study populations, upon which the model distributions are based. Decreases in stationary population size among the young may be a product of large increases in mortality rates for the under 1 age category. As already described, these increases in mortality rates are largely the consequence of substantial decreases in population for this category, due to more frequent under-registration of births after 1985. Owing to the cumulative nature of the life table calculations productive of the stationary age distribution, the large increases in mortality rates for the first age category reduce population size in several subsequent age categories. The depressive effect on population gradually subsides, as decreases in mortality for children and young adults produce compensatory increases in stationary population size. Commonly, these increases are first discernable after age 40, when large decreases in mortality rates have occurred as a result of increases in the study populations. The cumulative effects of these changes produce larger increases in population with age, which peak in the highest age groups.

The anomalous pattern of change in the stationary population for on-reserve females, as well as other variations on the common trend, can similarly be explained by deviations in the pattern of changing age-specific mortality rates. Small increases in mortality early in the age distribution followed by relatively large increases among several adult age categories produce mounting decreases for nearly the full age range within the stationary age distribution. A greater number of age categories after age 50 exhibit mortality decreases which eventually effect increases in the stationary population for the final age intervals. In contrast, among on-reserve males, mortality increases under 1 are much more substantial than for females and extend into the 1 through 4 age category as well. Although mortality increases are also observed among adult males, these occur among fewer age categories and are of lesser magnitude than for on-reserve females. Despite parallel trends in off-reserve male and female stationary age distributions, more profound changes in the male population appear to be a product of larger initial increases in mortality and somewhat larger decreases in adult mortality for males than females. Similar age-specific mortality differentials produce a more profound aging trend in the stationary population off-reserve compared to on-reserve. Thus, stationary age distributions viewed over the study period reflect the same mortality rate trends and differentials described by the results of standardized mortality rate comparisons and allude to the changes in population size and structure which followed upon the Bill C-31 amendments.

The impact of Bill C-31 changes on life expectancy. Measures of life expectancy represent important summary measures of mortality. The expectation of life at birth is the life table function most frequently used as an index of the overall level of mortality in a population as it represents a summary of the whole series of mortality rates for all ages combined, as weighted by the life table stationary population (Shryock et al. 1976). In this study, the life expectancy function affords an opportunity for comparison of the potential impact of changes in mortality from the pre-1985 period to the post-1985 period for individual age categories. These comparisons reveal some very large increases in life expectancy over a relatively small study period, as well as substantial differentials in the extent of increased life expectancy by residence, sex and age. As will be further detailed, the changes modeled by the life table for the study population in this period appear consistent with gross changes in mortality rates, age-specific differentials in these rates, and changes in population structure consequent to the Bill C-31 amendments.

Comparisons of life expectancies over the study period show the least improvements for the on-reserve female population as indicated by overall measures, as well as most other age-specific measures of life expectancy. Although a life expectancy at birth of 73 represents the highest measure compared to other segments of the study population, no improvement in this life expectancy is anticipated for the post-1985 period. In fact, little improvement in life expectancy is indicated by age-specific results until age 70 for this population, while the average gain for all age categories combined is 1.58 years. In contrast, males on-reserve can expect gains in life expectancy at birth of 1.6 years, to a 66.4 year expectation of life in the post-1985 period and an overall average

gain of 3.58 years. Furthermore, the distribution of increases in life expectancy by age is concentrated among males aged 1 through 24, a considerably younger age set than for females. These differentials in life expectancy by sex are consistent with the results of mortality and population structure comparisons previously described. In general, on-reserve female mortality remains quite stable over the study period, due to relatively small population increases, which are balanced by the addition of death frequencies more commensurate with population increases than found among males. Therefore, measures of life expectancy at birth, which summarize overall mortality, show no discernable improvements. The appearance of considerable gains in life expectancy only in old age for females may reflect the frequent and widespread increases in age-specific mortality rates over time prior to age 70. With advancing age, the cumulative measure of remaining years of life records greater gains as the increased age-specific mortality rates of middle aged categories are less represented than the decreasing age-specific mortality rates observed for the old age categories of the remaining life span. However, among males, gains in life expectancy among the young reflect improvements in mortality rates early within the life span. As increases in mortality rates among advanced adult categories are not as large or widespread as for females, these changes have only a small depressant effect on life expectancies. Males also exhibit some improved life expectancies among old age categories which reflect improved mortality rates for these ages.

Off-reserve life expectancies exhibit greater improvements over the study period than indicated for the on-reserve population. Life expectancies at birth show a 5 year improvement for males, elevating the expectation of life from 66 to 71 years by the latter

period. For the same constricted time period, female life expectancy at birth can expect nearly a ten year improvement, from 72 to 82 years of life remaining. Overall average gains in life expectancy mount to 7.5 years for males and 11 years for females, the latter showing a great deal of consistency over the age distribution. By any standards, these gains are enormous and cannot be accounted for by changes in environmental risks or health care benefits. However, the very large overall increases in life expectancy can be understood in relation to large population increases in the off-reserve population, coincident with under-reporting of deaths for this period. Consequent to these trends, mortality rates decline over time for a wide range of age categories among male and female components of this population. Simply in terms of changes to population structure, large gains in off-reserve life expectancy can be understood as a product of large increases in population after 1985, which add to the total person years of life lived within the life table model for the latter half of the period. Greater population increases for females than for males among a broader age range result in more widespread and somewhat larger decreases in female age-specific mortality rates. These differentials are reflected in the greater gains in life expectancies for females among a larger distribution of age categories. Male and female life expectancies off-reserve again exhibit a differential distribution of greater male gains among the young and greater female gains in old age. This can be explained by somewhat greater decreases in age-specific mortality rates for males early in the age distribution in contrast with greater decreases in female mortality rates in the latter years of the distribution.

Band life expectancy results indicate moderated gains compared to improvements exhibited by on- and off-reserve models. Males gain three years of life expectancy at birth, from 65 to 68 years, compared to two year gains for females, from 73 to 75 years. Thus, males expect greater gains than females, resulting in a narrowed gap between male and female life expectancies. Despite the increased proportional contribution of the off-reserve population toward the total band population over the course of the study period, these results reflect the greater influence of on-reserve than off-reserve changes as a consequence of the larger on-reserve population.

Survivorship changes consequent to Bill C-31. A second fundamental summary statistic derived from the life table is the survival curve. As previously described, the survival curve represents estimated probabilities of surviving beyond any given age. The survival curve has a geometric interpretation related to the expectation of life, the latter being approximately equal to the area under the survival curve (Selvin 1991). The hazard rate also relates to survivorship. Derived from the slope of the survival curve, the hazard rate describes the instantaneous rate of death relative to the probability of being alive at a given age. Thus, higher rates of mortality imply lower probabilities of survival (Shryock et al. 1976). In the present study, survivorship probabilities and hazard rates are employed as a further means for comparing the mortality profile and population structure characteristic of pre- and post- 1985 data. These results provide added confirmation of the substantial impact of Bill C-31 changes on demographic and epidemiological measures.

Survivorship also has applications in the study of fertility and reproductivity as will be further explored in the next section.

A common pattern emerges in the changes which occur in survivorship probabilities over the study period. This pattern clearly parallels previously described changes in the stationary age distribution of the life table model populations. In general, survivorship probabilities over time show reduced survivorship from birth through ages 30 or 40 and increased survivorship in all age categories thereafter. The exception to this pattern again arises in the female portion of the on-reserve population. Survivorship probabilities for females on-reserve indicate no discernable changes until age 35, when the later period begins to show less favourable probabilities of survivorship until age 80, where greater correspondence resumes. The lack of any improvement in survivorship over the study period, despite Bill C-31 demographic changes, likely reflects the lesser addition of Bill C-31 registrants as well as greater reporting of mortality for this segment of the study population. Decreases in survivorship among adult age categories in the later period show the effects of a few very large increases in mortality in ages 25 through 50 as indicated by hazard rates, the cumulative effects of which are retained nearly throughout the remainder of adulthood.

The on-reserve male population generally conforms to the normative pattern described above. Survivorship probabilities for the later period are reduced among ages 1 through 35 and thereafter are either equal to or greater than the pre-1985 probabilities. Greater improvements in survivorship among males than among females on-reserve can be understood as a consequence of the larger extent of under-reporting of deaths for males.

Though population increases show close resemblance at 19% and 20% for females and males respectively, reported deaths for females increase by 14% while those for males actually decrease 13% over the study period. A reduced frequency of death effects improved mortality rates and so improved survivorship as well. Differential survivorship over the age distribution by time period reflects changes in hazard rates for particular ages. These mainly represent greater decreases in mortality rates for the later period owing to increases in population and stable death frequencies for most age categories following upon Bill C-31 amendments. However, large increases in hazard rates arise in the first two age categories which are produced by decreased registration of births coincident with stable death frequencies over time. This has a depressant effect upon survivorship probabilities in the later period until middle age, when the buoyant effects of population additions on survivorship first become apparent.

Off-reserve males and females conform to the same pattern of change in survivorship probabilities as described above, although differences of degree are apparent. Both sexes exhibit more profound changes than their on-reserve counterparts. In general, this may be understood as a product of greater additions of population off-reserve, five year data showing a 35% increase in male and 50% increase in female population, as well as reductions in death frequencies for both males and females of 15% and 9% respectively. Off-reserve males show the most extreme changes over the period, both in terms of reduced survivorship among the young and increased survivorship among adults over age 40. Hazard rates for the first two age categories are the highest for males, reflecting a greater extent of under-reporting of births over the study period than for females.

Mortality in the young adult ages for the early period diminish survivorship probabilities at an increased rate compared to that for the latter period where probabilities remain bolstered by population additions among young adults. Though population additions are somewhat greater for females than males, a greater impact of change is exhibited among males for most age categories owing to higher original mortality for the earlier period. However, females exhibit greater increases in survivorship in old age as illustrated by probabilities of survival to age 85 which double to a 50% probability by the latter half of the period, whereas male survivorship to this age increases from 20 to 30% over the same time period.

Consequent to the residence specific changes in survivorship probabilities over the study period, total band data exhibit a conservative pattern of change. Males exhibit a moderate extent of change, presenting the common pattern of reduced survivorship among the young and more favourable probabilities among senior age categories in the latter half of the study period. Females exhibit little change in survivorship probabilities except for a 5 to 8% elevated survivorship in old age and slightly lower probabilities in middle age for the later period, reflecting increased hazard rates for ages 25 through 45. Apparently the greater weighting by the on-reserve population has obscured the greater differentials revealed in the off-reserve results.

Bill C-31 Impacts on Fertility and Reproductive Success

The deterministic analysis of fertility and reproduction employs age-specific fertility rates and, for reproductive measures, mortality rates derived from cross-sectional

data in estimating indices of average family size, distribution of births, replacement ratios, and growth rates for a given study population. Fertility measures are simple, synthetic estimates of the number of offspring born to women derived from cross-sectional data, which assume no mortality during the reproductive period. However, reproductive measures model age-specific rates of the given population on the life table stationary population, to arrive at measures conditioned upon female survivorship. Thus, the measurement of net reproduction focuses upon the replacement of the female population in the subsequent generation, based upon present levels of mortality. To proceed from this measure of replacement per generation to an annual rate we must account for the ages at which women in the population have their children (Keyfitz and Flieger 1971). To these ends, the mean length of generation or the mean age at childbirth, a close approximation to the former, are employed in the calculation of the intrinsic rate of natural increase. This statistic represents the rate of growth that would be obtained if the present age-specific rates in the given population continued and a stable age distribution was attained. The utility of this measure derives from its independence from the initial age distribution of the given population.

On-reserve impacts. Comparisons of on-reserve fertility and reproductive indices indicate some small increases though considerable stability over time. In general, these increases may be understood in terms of an overall 28% increase in the birth frequency which exceeds the 24% increase in the female population in reproductive ages over the study period. Thus it appears that the addition of Bill C-31 registrants to the reproductive

age range among females was adequately matched by an increase in births to the on-reserve population. Although population increased in nearly every age category, particularly in the older ages, larger birth frequency increases occurred in ages 20 through 29 which resulted in increased age-specific birth rates in this age range. Overall, changes in age-specific rates appear to balance as average family size, represented by the TFR, is maintained at approximately 3 children born to on-reserve women over the course of the reproductive life span. However, when female births are considered alone, the GRR indicates a 7% increase over the study period. The small extent of this increase may be insignificant and merely reflect random variability in the frequency of either sex among offspring within this small subdivision of the total population.

Reproductive measures conditioned upon the survivorship of on-reserve females again show little appreciable change over the study period. The female replacement ratio (NRR), subject to survivorship for on-reserve females of reproductive age, increases by only 7% over the study period. Comparison of this measure of the NRR and the GRR as described above, which differ only with respect to the consideration of survivorship by the former, reveals no greater effect on female replacement of reduced survivorship observed for the latter half of the study period. Furthermore, the timing of fertility within the reproductive period shows stability over the study period, as indicated by both the mean age at childbirth and the mean length of generation, which remain at approximately age 25 and 24 respectively. The intrinsic rate of natural increase, as a summary measure of age-specific fertility and mortality rates, indicates a small 8% increase from a growth rate of 0.0381 to 0.0413. The relative stability of these reproduction measures over time can be

understood in relation to the absence of reduced survivorship probabilities in early childhood for on-reserve females, found among other segments of the study population, as well as delayed reductions in adult survivorship. Although the latter period exhibits reduced female survivorship beginning at age 30, these reductions are small and occur after the peak reproductive ages so as to present a limited influence on reproductive success.

Off-reserve impacts. In contrast to the relative stability represented by on-reserve measures of fertility and reproduction, most off-reserve measures indicate a substantial decline in these indices over time. Whereas the on-reserve population showed greater increases in total births than population, birth frequencies off-reserve remain nearly constant, while the female population in the reproductive age range increases by 52% over the study period. Thus it appears that the greater addition of population off-reserve coupled with a lack of commensurate increases in births to this population contribute to the clear trend of decline in fertility and reproductive indices over the study period. These changes are likely the outcome of Bill C-31 registration after 1985. Age-specific comparisons reveal population increases in every age category, which after age 20 escalate from approximately 60% to 120%, while the most substantial change in birth frequency amounts to less than 25% for the 25 through 29 age category. Consequent to the greater extent of population increase than birth frequency changes, age-specific birth rates decrease over the study period. As a synthesis of these age-specific rates, the TFR exhibits a 36% decline in average family size from 3.86 to 2.47 offspring over the period.

The same extent of decline is exhibited by female births, which decrease from an expectation of 3.6 to 2.32 female offspring. The decline in fertility exhibited by these measures represents a profound change within a short time frame and can only be accounted for by the large increases to birth rate denominators attributable to the addition of Bill C-31 registrants.

Reproductive measures conditioned upon survivorship for the off-reserve population show a similar though slightly increased magnitude of decline over the study period as compared to fertility measures. Comparison of the NRR reveals a 39% decline in the rate of replacement for females from 3.45 to 2.12 female offspring resulting from pre- and post- 1985 schedules of fertility and mortality rates. An additional decline in this measure of replacement is attributable to survivorship differentials over time and is illustrated by comparison of the NRR and GRR at early and latter halves of the study period. Although the GRR exceeds the NRR by only 4% before 1985, by the latter period this difference grows to 9%, indicating that reduced survivorship hampers the ability of the female population to replace itself. As previously demonstrated, off-reserve females exhibit reduced survivorship in the under 1 age category, which affects subsequent probabilities of survivorship in the young adult age ranges until age 30. Thus, reduced survivorship in the ages at which fertility rates are highest produces a substantial reduction in overall reproductive success. Although increased survivorship after 1985 is indicated for women over age 40, changes at these advanced ages is unlikely to significantly affect reproductive success. Despite the reduction in both measures of fertility and reproduction, the mean age at childbearing and the mean length of generation both remain

essentially unchanged at 24.5 and 24 respectively. The stability of these measures is somewhat unexpected as decreases in fertility are most often accompanied by a decrease in the average age at reproduction as women truncate fertility in the older age categories (Keyfitz and Flieger 1971). Furthermore, if the observed reductions in fertility were due to delayed childbearing, these measures would show increases over time. Therefore, these results provide added confirmation that reductions in fertility and reproduction are unlikely to be the product of usual variables of change in these indices, which adds credence to their relationship to population changes resulting from Bill C-31 amendments. Final evidence of a decline in reproductive success off-reserve is provided by the observed 40% decline in the intrinsic rate of natural increase from 0.0522 to 0.0313 which summarizes the effects of both age-specific birth and death rates for the off-reserve population over the study period.

Consequent impact for total band. Comparisons of fertility and reproductive indices for the total band population reflect the greater stability of the on-reserve results to a larger extent than off-reserve changes, owing to the larger proportionate contribution of this residence group to the total band population. Small changes in total band fertility can be understood in relation to an overall increase in total births of 17%, which is nearly matched by a 20% population increase over the period. Thus, the greater addition of population than births over the study period effects a decline in both overall and age-specific rates. The TFR exhibits a 16% decline from an average family size of 3.34 in the pre-1985 period to 2.82 offspring in the post-1985 period. Similarly, the GRR shows a

10% decline in female fertility over the period. Reproductive measures conditioned upon female survivorship show no additional decrease in reproductive measures. Both the NRR and the intrinsic rate of natural increase decline by 11% over the study period. Comparison of the GRR and the NRR measure of female replacement indicates equivalent differences between these measures in the pre- and post- 1985 period, which confirms a lack of survivorship effects on fertility. This of course relates to the previously described absence of any sizeable change in survivorship probabilities within the reproductive age range for the total female population. Again the mean age at childbearing and the mean length of generation remain essentially unchanged at approximately 25 and 24 years respectively. Thus the small decline in fertility and reproductive success for the total band population largely reflects the greater addition of population than births over the period. However, we may expect that sizeable additions of population, which amount to 60% in some highly fertile age categories, may bring further increases in fertility indices when births are adequately registered for the added Bill C-31 population.

CHAPTER 7

SUMMARY AND CONCLUSIONS

The concept of "Indian" in Canadian society is a mutable, socially defined concept, as is any concept which defines an ethnic group. Yet, the term Indian is distinct from other ethnic identifiers as it was unilaterally imposed upon an indigenous population by a politically dominant Euro-Canadian population and defined in legislation. Despite frequent indiscriminate use of the term to refer to aboriginal Canadians as a whole, Indian has a very precise meaning as defined in the *Indian Act*. This definition stipulates who is entitled to recognition as a status Indian under federal law which grants certain rights to lands, government funded social development programs, non-insured health care benefits etc. The legal definition of Indian guides the Department of Indian Affairs in the maintenance of a list of persons who are eligible for services. This list is referred to as the Indian Register and persons included on the list are Registered Indians. Thus, Registered Indians are the administrative counterparts to legally defined status Indians.

"Indian" represents merely one abstraction drawn from the diverse aboriginal population of Canada. Nevertheless, the term has gained validity as it has come to define an increasingly distinct population, the members of which identify themselves as Indian. Although often denigrated as an imposed, arbitrarily defined category, "Indian" has

arguably transcended its literal form as a legal entity and come to resemble an actual social division in Canadian society. That is, the shared history among Indians of control by legislators and administrators may have shaped Indian social institutions and culture in such a way as to distinguish them from their non-status Indian counterparts. Furthermore, Indians have defended their designation as such, if only to protect the legality of their treaty rights in relationship with the federal government. Regardless of its origins or its correspondence with cultural parameters, the designation continues to hold importance for those entitled to the rights and services it entails and for those mandated to provide these services. In addition, the existence of a comprehensive listing of Indians has made the Indian population a convenient study population from which generalizations on the larger aboriginal population are often derived.

In order to draw useful inferences from Registered Indian data and apply them appropriately, it is necessary to understand how the Indian population has been and is currently defined. A review of the history of the Indian definition demonstrates a progression from a generalized and inclusive definition to a more complex and precise definition. In 1850, the first definition allowed for a considerable extent of self determination by Indians. However, the following year a restriction was added to bar non-Indian males married to Indian females from status, whereas non-Indian female spouses were not excluded. The first provision for voluntary enfranchisement was made in 1857, which also provided for the automatic removal of the names of wives and children from the Indian Register. In 1869, individuals with less than one quarter Indian ancestry were barred from receiving band annuities. Furthermore, women who married

non-Indian males were first excluded from status and band membership. Thereafter, Indian status was determined according to patrilineal criteria. Thus, the 1876 *Indian Act* specified that females gained status only as a wife or daughter of a male status Indian. The *Indian Act* also restricted illegitimate children, foreign residents, recipients of half-breed lands or scrip, and permitted the involuntary enfranchisement of professionals. Subsequent amendments to the *Act* added inducements to enfranchisement and refined this legislation to expedite assimilation. Amendment initiatives in the post-war period were the first to seek Indian directives in the revision of the *Indian Act*. Although Indians successfully lobbied for the removal of involuntary enfranchisement, the *Indian Act* of 1951 retained discriminatory provisions such as the 'marriage rule', and restrictions regarding illegitimate children, as well as adding the 'double mother rule'. Thus, sexually discriminatory legislation remained resistant to change well into the latter 20th century.

The Indian population has been created and re-created throughout history since European contact, largely without allowance for input by aboriginals. However, since the late 1960s, aboriginals have made significant advances in self-determination. The amendments of 1985 represent the culmination of the efforts of non-status women to gain restitution for discrimination levelled against them in the application of *Indian Act* provisions governing entitlement to status. Bill C-31 introduced significant changes to the definition of Indian, including the elimination of sexually discriminatory registration criteria, addition of provisions for restoration of status and band membership as well as first time registration of first generation descendants, elimination of enfranchisement provisions, and addition of provisions for transfer of control over band membership to

band councils. In addition, the amendments made further concessions to status Indian interests by instituting a second generation 'cut-off' rule which generally limited new entitlements to status to women who had lost status as a result of discriminatory legislation, enfranchised persons and the offspring of both categories of individuals.

Over a decade of application of Bill C-31 has led to significant growth in the Registered Indian population. Population growth has exceeded original estimates of the number of individuals likely to seek registration under the Bill. A few government studies committed to quantifying the impacts of Bill C-31 for status Indians have documented the growth in population attributable to Bill C-31 as well as changes in the age, sex and residential composition of the Indian population. Considerable attention has been given to the second generation 'cut-off' rule as it may affect the size of the status Indian population in the future. One projection which accounts for the 'cut-off' rule anticipates half a century of growth, bringing the Indian population up to approximately 800,000, followed by a second half-century of decline and return to a population of 600,000. The literature which addresses demographic impacts of Bill C-31 is dominated by Indian Affairs sources. Furthermore, few studies have considered the implications of demographic changes associated with Bill C-31 for epidemiologic rates. One review of departmental data juxtaposed demographic changes and recent anomalies in epidemiological rates but did not suggest any relationship between the two. The lack of attention brought to these data possibly derives from the administrative data source and the tendency to view INAC data quality as an internal issue, having limited statistical significance or broader interest. However, in the present climate of fiscal restraint, granting agencies increasingly require

researchers to employ existing administrative data sources. Thus, in employing the Indian Register 'service frame' as a sampling frame, researchers must be aware of inconsistencies in the definition of Indian over time and the particular affects these changes may have in the calculation of summary statistics based upon this data.

The present study attempted to provide an integrated explanation of the way in which Bill C-31 legislative changes which redefined "Indian" have created changes in the demographic composition of the Registered Indian population, and further changes in epidemiological rates and indices. A composite of six Manitoba band populations were employed in an examination of trends in age standardized mortality rates, life table estimates of life expectancy and survivorship, and fertility rates and reproductive indices over the 1980 to 1991 study period. The findings related some significant changes in epidemiologic rates to inconsistencies in population, fertility and mortality data following upon the 1985 changes, in addition to demographic changes provoked by the legislative amendments.

The results of demographic analyses found that Bill C-31 added substantial numbers of individuals to the Registered Indian population, the majority of which belonged to the off-reserve population. Furthermore, off-reserve population growth was characterized by greater numbers of females than males and a relatively broad age range of the greatest increases. In contrast, on-reserve growth showed greater equivalence for males and females and exhibited a more restricted, bimodal pattern of increase. This pattern may reflect a bias toward greater relocation of parent and child registrants to reserves. Both on- and off-reserve populations showed a substantial decrease in the size

of the under 1 year age category after 1985, which indicates an increase in under-reporting of births to INAC following the amendments. Aside from this final observation, the demographic changes observed are highly consistent with the types of changes to registration criteria introduced by Bill C-31, which favour the registration of females excluded from status and relegated to off-reserve residence by discriminatory legislation in the past.

Comparisons of age-standardized mortality rates indicated substantial declines in mortality over a constricted time period. Off-reserve mortality declined more precipitously than on-reserve mortality. Furthermore, male mortality rates both on- and off-reserve declined to a greater extent than did female rates. Calculation of the T-squared statistic provided assurance of the authenticity of these trends and differentials, despite high variability among the smallest study population divisions which obscured the results of comparisons. However, these trends are remarkable in their unexpected convergence with overall Manitoba mortality rates and, for the off-reserve population, their substantial improvements over these rates. Thus, the results of these comparisons demand further explanation. That the onset of mortality decline corresponds with the 1985 amendments, and the magnitude of decline for on- and off-reserve populations resembles their respective population growth over the period, seems to implicate Bill C-31 demographic changes as contributive to mortality trends. The specific means by which Bill C-31 demographic changes influence mortality trends is revealed by an examination of the age-specific mortality rates employed in the construction of the standardized rates. An overall decline in mortality may be explained by the addition of Bill C-31 registrants to the

study population, which constitutes the denominators of age-specific rates, without commensurate increases in deaths, or the numerators of rates, during the same period. More specifically, the age and sex categories in which Bill C-31 registrants are added tend to be those where the risk of mortality is low so that mortality does not increase to the same extent as population. Furthermore, the greater under-registration of births after 1985 reduces the potential for added mortality in the under 1 age range where deaths are typically high. Sex differentials may then be understood in terms of the greater addition of middle aged population among females, while male population is added to a greater extent among young age categories, where higher risks of mortality increase the impacts of the population changes on mortality rates.

Changes in life table stationary populations, life expectancies, and survivorship probabilities over time are contingent upon the same relationships between population and mortality additions productive of the age-specific mortality rates described above. Expected changes in stationary populations over the study period follow a common pattern of decreases in population size under age 35 and increases over age 45. Decreases among the young reflect increased mortality rates in the under 1 age category, the cumulative effects of which are maintained until middle age when reductions in mortality rates due to large additions of population in these ages begins to effect increases in the expected population. The same pattern applies in the calculation of survivorship probabilities, survivorship being reduced through the effects of increased mortality rates in the first year of life which affects survival to all subsequent ages. The exception to this pattern is observed for on-reserve females, among whom relative stability is observed for

ages under 35 and decreases in survivorship thereafter. This pattern relates to smaller additions of C-31 population and more complete death data relative to the addition of population for this category. More extreme changes in survivorship over the period for off-reserve males as compared to on-reserve males relate to the greater under reporting of births observed for the former.

Life expectancies over the period show some very large increases over time as well as substantial differences in the extent of increase by residence, sex and age. The least improvements are again observed for on-reserve females, where life expectancy at birth show no improvement, overall average gains amount to only 1.58 years, and little age-specific improvement is observed until age 70. In contrast, on-reserve males gain 1.6 years of life expectancy at birth, experience average gains of 3.58 years, and benefit from the greatest improvements in ages 1 through 24. Sex differentials can be understood in terms of small population increases balanced by commensurate increases in deaths for females. More dramatic improvements are noted for the off-reserve population, particularly for females, whose 10 year greater life expectancy at birth and 11 year average gains can be understood in terms of the large population additions in this population combined with greater under-reporting of deaths after 1985.

Measures of fertility and reproductive indices combine information on births and previously derived measures of survivorship. Thus, the changing balance between population data and vital events data which resulted from the addition of the Bill C-31 population extends its influence upon these results as well. This influence is limited in the case of the on-reserve population which shows only small increases in fertility rates over

time and little change between these measures and reproductive measures conditioned upon survivorship. The stability in fertility rates can be explained in terms of increases in birth frequencies commensurate with gains in the female population in the reproductive age range. The stability observed for reproductive indices reflects the absence of the normal pattern of reduced survivorship probabilities in early childhood for on-reserve females as well as the delay of reduced adult survivorship until after the peak reproductive period. In contrast, substantial declines (>30%) are observed in off-reserve fertility as well as in reproductive measures. The decline in fertility rates result from stable birth frequencies combined with a 52% increase in the female population in the reproductive age range. An increased decline in reproductive measures can be attributed to reduced survivorship under age 1, the effects of which continue through the peak years of reproduction.

The foregoing results of the step-wise application of Indian mortality and population data in common methods of epidemiologic analyses, indicate substantial effects of demographic changes resulting from Bill C-31 amendments for the off-reserve population. The impact of Bill C-31 demographic changes is less noteworthy for the on-reserve population, particularly for females. Total band results moderate the two findings, although they reflect off-reserve rates to a greater extent after Bill C-31 revisions as a result of the increased proportionate contribution of this population to the total band population. Furthermore, these findings indicate that not only did the Bill C-31 registrant population present a skewed distribution of age-sex variables upon introduction to the Registered Indian data set, but there also seemed to be greater under-registration of deaths

and particularly births secondary to the registration process. Data inconsistencies may have arisen as a consequence of increased work loads for INAC which may have lacked sufficient resources to adequately attend to both the registration of Bill C-31 applicants and to births. The results suggest that caution should be exercised in the interpretation of rates based on a rapidly growing population and birth and death data which do not reflect the same pace of increase. Thus, inconsistencies in population and vital events data as well as Bill C-31 demographic changes impact upon epidemiologic rates calculated herein.

APPENDIX A.

DEMOGRAPHIC DATA TABLES

Table 9. Mid-Year Population Totals and Three Year Mortality and Fertility Data for On- and Off-Reserve Populations by Sex

ON-RESERVE

AGE	MID-YEAR POPULATION				THREE YEAR DEATHS				THREE YEAR BIRTHS				MOTH.
Male	1981	1984	1987	1990	'80-82	'83-85	'86-88	'89-91	'80-82	'83-85	'86-88	'89-91	AGE
<1	108	101	60	70	7	7	11	3	0	0	0	0	<1
1-4	591	573	749	668	5	0	6	4	0	0	0	0	1-4
5-9	698	699	762	884	1	1	0	1	0	0	0	0	5-9
10-14	690	688	730	758	3	1	4	2	5	8	3	3	10-14
15-19	726	716	709	732	9	7	5	7	169	170	177	149	15-19
20-24	570	661	775	758	3	12	9	4	144	207	235	246	20-24
25-29	405	488	604	734	8	4	5	5	59	86	112	142	25-29
30-34	303	361	433	520	5	8	8	2	27	37	46	54	30-34
35-39	244	267	322	373	5	4	9	6	8	22	19	15	35-39
40-44	195	219	269	303	3	4	1	0	6	2	2	2	40-44
45-49	166	169	208	234	3	3	5	4	0	0	0	0	45-49
50-54	129	160	163	194	7	4	5	5	0	0	0	0	50-54
55-59	107	114	140	176	1	7	5	6	1	0	0	0	55-59
60-64	86	100	110	114	5	5	10	11	0	0	0	0	60-64
65-69	64	68	75	98	6	9	8	5	0	0	0	0	65-69
70-74	77	68	60	64	10	10	8	14	0	0	0	0	70-74
75-79	46	58	52	50	9	15	6	6	0	0	0	0	75-79
80-84	27	23	34	41	10	13	7	9	0	0	0	0	80-84
85+	13	14	17	24	11	6	9	9	0	0	0	0	85+
Unk.	0	0	0	0	1	0	0	0	8	7	6	2	Unk.
TOTAL	5245	5547	6272	6795	112	120	121	103	427	539	600	613	TOTAL

Table 9 cont'd

ON-RESERVE

AGE	MID-YEAR POPULATION				THREE YEAR DEATHS				THREE YEAR BIRTHS				MOTH.
Female	1981	1984	1987	1990	'80-82	'83-85	'86-88	'89-91	'80-82	'83-85	'86-88	'89-91	AGE
<1	110	86	74	70	7	4	0	12	0	0	0	0	<1
1-4	538	559	657	616	4	4	2	3	0	0	0	0	1-4
5-9	669	649	711	792	3	0	3	0	0	0	0	0	5-9
10-14	730	692	674	670	0	1	3	1	1	3	4	2	10-14
15-19	682	713	767	728	1	3	1	4	115	159	144	155	15-19
20-24	532	634	723	748	2	0	1	0	159	155	204	222	20-24
25-29	346	414	557	656	0	1	4	5	50	75	105	152	25-29
30-34	241	291	376	449	0	0	3	3	25	44	51	46	30-34
35-39	192	209	261	334	1	0	2	0	18	11	14	20	35-39
40-44	157	182	216	257	2	0	5	2	4	3	2	3	40-44
45-49	131	143	169	212	3	0	4	4	0	0	0	0	45-49
50-54	110	123	146	159	4	2	3	1	0	0	0	0	50-54
55-59	104	100	120	141	1	7	5	3	0	0	0	0	55-59
60-64	91	104	92	105	5	4	6	4	0	0	0	0	60-64
65-69	71	73	90	98	4	6	10	10	0	0	0	0	65-69
70-74	61	54	67	63	4	4	5	5	0	0	0	0	70-74
75-79	31	41	48	45	5	9	10	3	0	0	0	0	75-79
80-84	24	24	25	41	4	4	4	8	0	0	0	0	80-84
85+	19	21	25	26	8	14	6	12	0	0	0	0	85+
Unk.	2	0	0	0	1	0	0	0	0	1	1	7	Unk.
TOTAL	4841	5112	5798	6210	59	63	77	80	372	451	525	607	TOTAL

Table 9 cont'd

OFF-RESERVE

AGE	MID-YEAR POPULATION				THREE YEAR DEATHS				THREE YEAR BIRTHS				MOTH.
Male	1981	1984	1987	1990	'80-82	'83-85	'86-88	'89-91	'80-82	'83-85	'86-88	'89-91	AGE
<1	40	25	17	19	4	4	2	3	0	0	0	0	<1
1-4	215	248	237	241	1	1	4	2	0	0	0	0	1-4
5-9	347	349	376	473	0	1	0	1	0	0	0	0	5-9
10-14	356	343	406	512	3	1	0	0	2	0	1	0	10-14
15-19	305	366	406	519	1	3	2	0	86	80	65	91	15-19
20-24	196	254	362	492	3	4	3	1	87	132	112	130	20-24
25-29	146	168	248	448	4	1	2	2	62	49	72	94	25-29
30-34	139	136	179	355	0	1	0	1	25	28	28	43	30-34
35-39	104	132	164	264	2	1	2	0	10	12	7	16	35-39
40-44	102	99	106	205	4	2	2	1	2	1	2	0	40-44
45-49	65	79	96	140	2	1	1	0	0	0	0	0	45-49
50-54	39	46	76	122	1	1	2	2	0	0	0	0	50-54
55-59	44	42	43	84	1	2	1	1	0	0	0	0	55-59
60-64	28	34	49	72	3	2	2	0	0	0	0	0	60-64
65-69	20	20	24	41	4	5	1	5	0	0	0	0	65-69
70-74	15	12	17	31	1	1	4	1	0	0	0	0	70-74
75-79	8	11	13	20	2	3	3	0	0	0	0	0	75-79
80-84	7	9	9	14	0	2	1	1	0	0	0	0	80-84
85+	3	4	8	14	3	0	1	3	0	0	0	0	85+
Unk.	0	0	0	0	0	0	0	0	10	5	6	7	Unk.
TOTAL	2179	2377	2836	4066	39	36	33	24	284	307	293	381	TOTAL

Table 9 cont'd

OFF-RESERVE

AGE	MID-YEAR POPULATION				THREE YEAR DEATHS				THREE YEAR BIRTHS				MOTH.
Female	1981	1984	1987	1990	'80-82	'83-85	'86-88	'89-91	'80-82	'83-85	'86-88	'89-91	AGE
<1	34	26	20	14	5	3	2	2	0	0	0	0	<1
1-4	212	212	242	236	1	3	1	0	0	0	0	0	1-4
5-9	305	302	336	422	0	0	0	0	0	0	0	0	5-9
10-14	343	353	360	443	2	1	2	0	3	0	1	1	10-14
15-19	266	320	399	507	1	1	0	1	84	59	62	102	15-19
20-24	194	263	348	497	2	1	1	2	86	117	99	120	20-24
25-29	205	210	303	505	1	2	1	1	43	71	61	77	25-29
30-34	175	209	276	439	0	3	2	1	16	33	27	35	30-34
35-39	134	171	229	362	1	0	0	0	5	6	8	7	35-39
40-44	94	109	184	313	1	0	2	0	0	1	1	0	40-44
45-49	68	80	147	233	2	1	3	3	0	0	0	0	45-49
50-54	46	62	95	197	1	1	0	0	0	0	0	0	50-54
55-59	29	41	69	138	0	0	1	1	0	0	0	0	55-59
60-64	15	17	40	88	1	0	2	1	0	0	0	0	60-64
65-69	14	15	21	56	2	0	1	2	0	0	0	0	65-69
70-74	13	12	27	37	0	3	4	2	0	0	0	0	70-74
75-79	6	10	19	26	2	1	1	0	0	0	0	0	75-79
80-84	8	5	11	17	3	1	1	2	0	0	0	0	80-84
85+	5	9	9	16	2	2	1	2	0	0	0	0	85+
Unk.	5	0	0	0	0	0	0	0	2	6	8	10	Unk.
TOTAL	2171	2426	3135	4546	27	23	25	20	239	293	267	352	TOTAL

Table 10. Mid-Year Population Totals and Five Year Mortality and Fertility Data for On- and Off-Reserve Populations by Sex

ON-RESERVE

AGE	MID-YR. POPULATION		FIVE YEAR DEATHS		FIVE YEAR BIRTHS		MOTH.
Male	1983	1988	1981-85	1986-90	1981-85	1986-90	AGE
<1	128	43	13	14	0	0	<1
1-4	556	695	2	6	0	0	1-4
5-9	694	799	2	0	0	0	5-9
10-14	673	754	4	6	11	4	10-14
15-19	747	726	16	10	282	278	15-19
20-24	615	801	14	10	305	405	20-24
25-29	457	653	10	8	124	200	25-29
30-34	341	473	13	9	54	80	30-34
35-39	263	347	9	12	27	28	35-39
40-44	211	288	5	1	5	4	40-44
45-49	164	220	6	7	0	0	45-49
50-54	153	174	8	9	0	0	50-54
55-59	113	154	8	7	1	0	55-59
60-64	92	115	9	17	0	0	60-64
65-69	66	88	15	11	0	0	65-69
70-74	71	59	14	16	0	0	70-74
75-79	56	53	21	9	0	0	75-79
80-84	26	39	22	13	0	0	80-84
85+	11	19	16	15	0	0	85+
Unk.	0	0	0	0	12	6	Unk.
TOTALS	5437	6500	207	180	821	1005	TOTALS

Table 10 cont'd

ON-RESERVE

AGE	MID-YR. POPULATION		FIVE YEAR DEATHS		FIVE YEAR BIRTHS		MOTH.
Female	1983	1988	1981-85	1986-90	1981-85	1986-90	AGE
<1	125	40	11	5	0	0	<1
1-4	535	622	7	5	0	0	1-4
5-9	647	739	3	3	0	0	5-9
10-14	710	687	1	4	4	5	10-14
15-19	699	770	4	1	238	251	15-19
20-24	591	743	1	1	255	355	20-24
25-29	384	597	1	8	111	211	25-29
30-34	266	402	0	5	62	81	30-34
35-39	200	292	1	2	22	29	35-39
40-44	173	234	1	5	6	4	40-44
45-49	137	184	1	7	0	0	45-49
50-54	120	152	5	4	0	0	50-54
55-59	96	133	8	7	0	0	55-59
60-64	99	95	8	8	0	0	60-64
65-69	76	95	10	17	0	0	65-69
70-74	53	70	6	8	0	0	70-74
75-79	35	44	12	12	0	0	75-79
80-84	24	31	8	9	0	0	80-84
85+	20	26	20	13	0	0	85+
Unk.	2	3	1	0	1	1	Unk.
TOTALS	4992	5959	109	124	699	937	TOTALS

Table 10 cont'd

OFF-RESERVE

AGE	MID-YR. POPULATION		FIVE YEAR DEATHS		FIVE YEAR BIRTHS		MOTH.
Male	1983	1988	1981-85	1986-90	1981-85	1986-90	AGE
<1	42	11	6	5	0	0	<1
1-4	249	230	2	6	0	0	1-4
5-9	353	400	1	1	0	0	5-9
10-14	349	437	2	0	1	1	10-14
15-19	352	444	4	2	135	112	15-19
20-24	239	414	7	3	194	186	20-24
25-29	161	307	4	3	86	123	25-29
30-34	135	224	1	1	44	52	30-34
35-39	124	181	3	2	18	12	35-39
40-44	98	133	5	3	2	2	40-44
45-49	74	105	2	1	0	0	45-49
50-54	39	88	2	4	0	0	50-54
55-59	48	55	2	2	0	0	55-59
60-64	33	56	4	2	0	0	60-64
65-69	18	31	7	5	0	0	65-69
70-74	14	21	2	5	0	0	70-74
75-79	9	16	4	3	0	0	75-79
80-84	9	8	2	2	0	0	80-84
85+	4	9	2	3	0	0	85+
Unk.	0	2	0	0	11	6	Unk.
TOTALS	2350	3172	62	53	491	494	TOTALS

Table 10 cont'd

OFF-RESERVE

AGE	MID-YR. POPULATION		FIVE YEAR DEATHS		FIVE YEAR BIRTHS		MOTH.
Female	1983	1988	1981-85	1986-90	1981-85	1986-90	AGE
<1	35	11	7	4	0	0	<1
1-4	225	236	4	1	0	0	1-4
5-9	299	363	0	0	0	0	5-9
10-14	353	386	2	2	2	2	10-14
15-19	318	442	2	1	117	118	15-19
20-24	244	401	3	3	175	171	20-24
25-29	226	370	3	2	100	109	25-29
30-34	197	335	3	3	45	44	30-34
35-39	161	269	1	0	10	11	35-39
40-44	104	230	1	2	1	1	40-44
45-49	73	178	3	5	0	0	45-49
50-54	63	128	1	0	0	0	50-54
55-59	35	89	0	2	0	0	55-59
60-64	15	52	1	3	0	0	60-64
65-69	16	32	2	2	0	0	65-69
70-74	13	30	3	5	0	0	70-74
75-79	9	18	2	1	0	0	75-79
80-84	8	16	4	3	0	0	80-84
85+	6	8	3	2	0	0	85+
Unk.	5	5	0	0	7	8	Unk.
TOTALS	2405	3599	45	41	457	464	TOTALS

Table 11 : Manitoba Postcencal Population Estimates and Mortality by Age and Sex, 1992

	POPULATION*		DEATHS**	
AGE	MALE	FEMALE	MALE	FEMALE
<1	8400	8200	68	45
1-4	34200	32700	10	13
5-9	42000	39900	11	5
10-14	40300	38200	10	4
15-19	41600	39200	39	15
20-24	42500	40400	54	13
25-29	46400	44600	56	22
30-34	49400	47000	68	22
35-39	44600	44000	69	33
40-44	39500	38900	78	43
45-49	32700	31900	113	84
50-54	25300	25400	132	86
55-59	23000	22900	217	101
60-64	22300	23600	337	205
65-69	20700	24100	508	317
70-74	17000	21800	679	447
75-79	12700	17700	753	586
80-84	7600	12000	716	688
85+	5000	10800	888	1444
TOTALS	**555200**	**563300**	**4806**	**4173**

SOURCES:

* Demography Division, Population Estimates Section,

** Health Statistics Division, Statistics Canada

NOTES:

* Adjusted for net census undercoverage and includes non-permanent residents

Estimates rounded to nearest 100

APPENDIX B.

ABRIDGED LIFE TABLES

Table 12. Abridged Life Tables Generated for On-Reserve Five Year Aggregate Data by Age and Sex

ON-RESERVE MALES 1981-1985

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	128	2.60	0.020313	0.019950	100000	1995	98213	0.020312	64.825	1.0000	0.0202
1-4	556	0.40	0.000719	0.002872	98005	282	391316	0.000719	65.143	0.9801	0.0007
5-9	694	0.40	0.000576	0.002878	97723	281	487914	0.000576	61.326	0.9772	0.0006
10-14	673	0.80	0.001189	0.005930	97442	578	486136	0.001189	56.496	0.9744	0.0012
15-19	747	3.20	0.004284	0.021206	96864	2054	479511	0.004284	51.814	0.9686	0.0043
20-24	615	2.80	0.004553	0.022512	94810	2134	468707	0.004554	47.879	0.9481	0.0046
25-29	457	2.00	0.004376	0.021731	92675	2014	458610	0.004391	43.924	0.9268	0.0044
30-34	341	2.60	0.007625	0.037587	90662	3408	444980	0.007658	39.841	0.9066	0.0077
35-39	263	1.80	0.006844	0.033505	87254	2923	428663	0.006820	36.298	0.8725	0.0068
40-44	211	1.00	0.004739	0.023361	84330	1970	416739	0.004727	32.473	0.8433	0.0047
45-49	164	1.20	0.007317	0.036128	82360	2976	404801	0.007351	28.190	0.8236	0.0074
50-54	153	1.60	0.010458	0.051177	79385	4063	387228	0.010492	24.147	0.7939	0.0105
55-59	113	1.60	0.014159	0.068755	75322	5179	364199	0.014220	20.309	0.7532	0.0142
60-64	92	1.80	0.019565	0.094473	70143	6627	335777	0.019735	16.616	0.7014	0.0198
65-69	66	3.00	0.045455	0.204409	63517	12983	285635	0.045455	13.063	0.6352	0.0455
70-74	71	2.80	0.039437	0.179526	50533	9072	230041	0.039437	10.767	0.5053	0.0394
75-79	56	4.20	0.075000	0.319426	41461	13244	175784	0.075341	7.574	0.4146	0.0760
80-84	26	4.40	0.169231	0.591489	28217	16690	98625	0.169231	4.899	0.2822	0.1680
85+	11	3.20	0.290909	1.000000	11527	11527	39624	0.244956	3.438	0.1153	0.4000

Table 12 cont'd

ON-RESERVE MALES 1986-1990

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	43	2.80	0.065116	0.061818	100000	6182	94935	0.065116	66.409	1.0000	0.0638
1-4	695	1.20	0.001727	0.006877	93818	645	373659	0.001727	69.772	0.9382	0.0017
5-9	799	0.00	0.000000	0.000000	93173	0	465865	0.000000	66.245	0.9317	0.0000
10-14	754	1.20	0.001592	0.007954	93173	741	464275	0.001596	61.245	0.9317	0.0016
15-19	726	2.00	0.002755	0.013682	92431	1265	459079	0.002755	56.713	0.9243	0.0028
20-24	801	2.00	0.002497	0.012406	91167	1131	452974	0.002497	52.465	0.9117	0.0025
25-29	653	1.60	0.002450	0.012211	90036	1099	447549	0.002457	48.093	0.9004	0.0025
30-34	473	1.80	0.003805	0.019024	88936	1692	440842	0.003838	43.655	0.8894	0.0038
35-39	347	2.40	0.006916	0.033974	87244	2964	428519	0.006917	39.449	0.8724	0.0069
40-44	288	0.20	0.000694	0.003275	84280	276	420653	0.000656	35.751	0.8428	0.0007
45-49	220	1.40	0.006364	0.031814	84004	2672	414142	0.006453	30.861	0.8400	0.0065
50-54	174	1.80	0.010345	0.050578	81332	4114	396543	0.010374	26.784	0.8133	0.0104
55-59	154	1.40	0.009091	0.044922	77218	3469	378698	0.009160	23.075	0.7722	0.0092
60-64	115	3.40	0.029565	0.138879	73749	10242	343982	0.029776	19.025	0.7375	0.0298
65-69	88	2.20	0.025000	0.118009	63507	7494	299461	0.025026	16.677	0.6351	0.0251
70-74	59	3.20	0.054237	0.239389	56013	13409	246367	0.054427	13.563	0.5601	0.0544
75-79	53	1.80	0.033962	0.156056	42604	6649	195765	0.033962	12.048	0.4260	0.0339
80-84	39	2.60	0.066667	0.288298	35955	10366	155479	0.066671	8.832	0.3596	0.0674
85+	19	3.00	0.157895	1.000000	25589	25590	162067	0.088901	6.333	0.2559	0.4000

Table 12 cont'd

ON-RESERVE FEMALES 1981-1985

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	125	2.22	0.017763	0.017484	100000	1748	98426	0.017763	73.445	1.0000	0.0176
1-4	535	1.41	0.002641	0.010495	98251	1031	390428	0.002641	73.751	0.9825	0.0026
5-9	647	0.61	0.000936	0.004669	97220	454	484967	0.000936	70.517	0.9722	0.0009
10-14	710	0.20	0.000284	0.001420	96766	137	483510	0.000284	65.836	0.9677	0.0003
15-19	699	0.81	0.001155	0.005760	96629	557	481758	0.001155	60.926	0.9663	0.0012
20-24	591	0.20	0.000342	0.001660	96072	160	479900	0.000332	56.264	0.9607	0.0003
25-29	384	0.20	0.000526	0.002614	95913	251	478905	0.000524	51.354	0.9591	0.0005
30-34	266	0.00	0.000000	0.000000	95662	0	478360	0.000000	46.483	0.9566	0.0000
35-39	200	0.20	0.001009	0.005091	95662	487	477209	0.001021	41.482	0.9566	0.0010
40-44	173	0.20	0.001167	0.005831	95175	555	474536	0.001169	36.681	0.9518	0.0012
45-49	137	0.20	0.001473	0.007547	94620	714	472018	0.001513	31.881	0.9462	0.0015
50-54	120	1.01	0.008410	0.041801	93906	3925	461085	0.008513	27.096	0.9391	0.0085
55-59	96	1.61	0.016821	0.080939	89980	7283	432230	0.016850	23.154	0.8998	0.0169
60-64	99	1.61	0.016311	0.078449	82697	6488	397737	0.016311	19.967	0.8270	0.0163
65-69	76	2.02	0.026559	0.125004	76210	9527	357399	0.026655	16.448	0.7621	0.0267
70-74	53	1.21	0.022851	0.109131	66683	7277	316938	0.022961	13.438	0.6668	0.0231
75-79	35	2.42	0.069206	0.298770	59406	17749	253648	0.069974	9.749	0.5941	0.0702
80-84	24	1.61	0.067284	0.288567	41657	12021	178660	0.067284	7.813	0.4166	0.0674
85+	20	4.04	0.201852	1.000000	29636	29637	146823	0.134787	4.954	0.2964	0.4000

Table 12 cont'd

ON-RESERVE FEMALES 1986-1990

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	40	1.00	0.025000	0.024457	100000	2446	97829	0.025000	73.266	1.0000	0.0248
1-4	622	1.00	0.001608	0.006405	97554	625	388655	0.001608	74.100	0.9755	0.0016
5-9	739	0.60	0.000812	0.004051	96929	393	483665	0.000812	70.568	0.9693	0.0008
10-14	687	0.80	0.001164	0.005805	96536	560	481227	0.001164	65.845	0.9654	0.0012
15-19	770	0.20	0.000260	0.001298	95976	125	479481	0.000260	61.215	0.9598	0.0003
20-24	743	0.20	0.000269	0.001379	95851	132	479170	0.000276	56.292	0.9585	0.0003
25-29	597	1.60	0.002680	0.013443	95719	1287	475596	0.002705	51.364	0.9572	0.0027
30-34	402	1.00	0.002488	0.012305	94432	1162	469124	0.002477	47.028	0.9443	0.0025
35-39	292	0.40	0.001370	0.006848	93270	639	464929	0.001374	42.584	0.9327	0.0014
40-44	234	1.00	0.004274	0.021423	92632	1984	458774	0.004326	37.858	0.9263	0.0043
45-49	184	1.40	0.007609	0.037454	90647	3395	444810	0.007633	33.626	0.9065	0.0076
50-54	152	0.80	0.005263	0.026009	87252	2269	430800	0.005268	29.837	0.8725	0.0053
55-59	133	1.40	0.010526	0.051827	84983	4404	414801	0.010618	25.564	0.8498	0.0106
60-64	95	1.60	0.016842	0.081570	80578	6573	388077	0.016937	21.814	0.8058	0.0170
65-69	95	3.40	0.035789	0.164261	74006	12156	339660	0.035789	18.507	0.7401	0.0358
70-74	70	1.60	0.022857	0.107917	61849	6675	292824	0.022794	16.653	0.6185	0.0228
75-79	44	2.40	0.054545	0.243107	55175	13413	243154	0.055164	13.360	0.5518	0.0553
80-84	31	1.80	0.058065	0.253257	41761	10576	182149	0.058065	11.829	0.4176	0.0580
85+	26	2.60	1.000000	1.000000	31185	31185	311852	0.039668	10.000	0.3119	0.4000

Table 13. Abridged Life Tables Generated for Off-Reserve Five Year Data by Age and Sex

OFF-RESERVE MALES 1981-1985

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	42	1.20	0.028571	0.027869	100000	2787	97543	0.028571	66.011	1.0000	0.0283
1-4	249	0.40	0.001606	0.006400	97213	622	387296	0.001606	66.900	0.9721	0.0016
5-9	353	0.20	0.000567	0.002829	96590	273	482271	0.000567	63.321	0.9659	0.0006
10-14	349	0.40	0.001146	0.005716	96317	551	480382	0.001146	58.493	0.9632	0.0011
15-19	352	0.80	0.002273	0.011421	95767	1094	476559	0.002950	53.814	0.9577	0.0023
20-24	239	1.40	0.005858	0.029056	94673	2751	466728	0.005894	49.401	0.9467	0.0059
25-29	161	0.80	0.004969	0.024355	91922	2239	453579	0.004936	45.802	0.9192	0.0049
30-34	135	0.20	0.001481	0.007332	89683	658	446756	0.001472	41.888	0.8968	0.0015
35-39	124	0.60	0.004839	0.024149	89026	2150	440523	0.004880	37.179	0.8903	0.0049
40-44	98	1.00	0.010204	0.049938	86876	4338	423543	0.010243	33.029	0.8688	0.0102
45-49	74	0.40	0.005405	0.026497	82537	2187	407159	0.005371	29.633	0.8254	0.0054
50-54	39	0.40	0.010256	0.050261	80350	4039	391854	0.010306	25.373	0.8035	0.0103
55-59	48	0.40	0.008333	0.040972	76312	3127	374693	0.008345	21.580	0.7631	0.0084
60-64	33	0.80	0.024242	0.117364	73185	8589	348224	0.024666	17.383	0.7319	0.0249
65-69	18	1.40	0.077778	0.328456	64596	21217	269333	0.078776	14.303	0.6460	0.0786
70-74	14	0.40	0.028571	0.130969	43379	5681	201125	0.028248	15.090	0.4338	0.0280
75-79	9	0.80	0.088889	0.363262	37697	13694	154060	0.088889	12.029	0.3770	0.0888
80-84	9	0.40	0.044444	0.197909	24003	4751	106887	0.044444	12.474	0.2400	0.0439
85+	4	0.40	0.100000	1.000000	19253	19253	192531	0.039842	10.000	0.1925	0.4000

Table 13 cont'd

OFF-RESERVE MALES 1986-1990

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	11	1.00	0.090909	0.084922	100000	8492	93414	0.090909	70.827	1.0000	0.0887
1-4	230	1.20	0.005217	0.020601	91507	1885	361318	0.005217	76.380	0.9151	0.0052
5-9	400	0.20	0.000500	0.002497	89622	224	447553	0.000500	73.955	0.8962	0.0005
10-14	437	0.00	0.000000	0.000000	89398	0	447031	0.000000	69.133	0.8940	0.0000
15-19	444	0.40	0.000901	0.004496	89398	402	446123	0.000901	64.133	0.8940	0.0009
20-24	414	0.60	0.001449	0.007250	88996	645	443466	0.001455	59.410	0.8900	0.0015
25-29	307	0.60	0.001954	0.009714	88351	858	439559	0.001953	54.824	0.8835	0.0020
30-34	224	0.20	0.000893	0.004429	87493	388	436521	0.000888	50.338	0.8749	0.0009
35-39	181	0.40	0.002210	0.011135	87105	970	433425	0.002238	45.551	0.8711	0.0022
40-44	133	0.60	0.004511	0.022354	86136	1926	425832	0.004522	41.032	0.8614	0.0045
45-49	105	0.20	0.001905	0.009547	84210	804	419421	0.001917	36.913	0.8421	0.0019
50-54	88	0.80	0.009091	0.044861	83406	3742	408101	0.009169	32.240	0.8341	0.0092
55-59	55	0.40	0.007273	0.035582	79664	2835	391032	0.007249	28.632	0.7966	0.0072
60-64	56	0.40	0.007143	0.035876	76830	2756	379016	0.007272	24.599	0.7683	0.0073
65-69	31	1.00	0.032258	0.152048	74073	11263	344423	0.032700	20.397	0.7407	0.0329
70-74	21	1.00	0.047619	0.212852	62811	13370	280037	0.047742	18.571	0.6281	0.0476
75-79	16	0.60	0.037500	0.170038	49441	8407	225306	0.037314	17.929	0.4944	0.0372
80-84	8	0.40	0.050000	0.222365	41034	9125	182493	0.050000	16.112	0.4103	0.0500
85+	9	0.60	0.066667	1.000000	31909	31910	478649	0.018891	15.000	0.3191	0.4000

Table 13 cont'd

OFF-RESERVE FEMALES 1981-1985

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	35	1.40	0.039917	0.038589	100000	3859	96673	0.039917	72.083	1.0000	0.0394
1-4	225	0.80	0.003548	0.014068	96141	1353	381183	0.003548	73.971	0.9613	0.0035
5-9	300	0.00	0.000000	0.000000	94788	0	473943	0.000000	71.005	0.9478	0.0000
10-14	354	0.40	0.001131	0.005639	94788	535	472730	0.001131	66.005	0.9478	0.0011
15-19	319	0.40	0.001255	0.006289	94254	593	469916	0.001261	61.364	0.9424	0.0013
20-24	245	0.60	0.002454	0.012259	93661	1148	465566	0.002466	56.735	0.9365	0.0025
25-29	226	0.60	0.002649	0.013172	92513	1219	459565	0.002652	52.407	0.9250	0.0027
30-34	197	0.60	0.003039	0.015050	91294	1374	452897	0.003034	48.073	0.9128	0.0030
35-39	161	0.20	0.001240	0.006091	89920	548	448129	0.001222	43.771	0.8990	0.0012
40-44	104	0.20	0.001919	0.009782	89372	874	445309	0.001963	39.025	0.8935	0.0020
45-49	73	0.60	0.008202	0.040421	88498	3577	433638	0.008249	34.378	0.8848	0.0083
50-54	63	0.20	0.003168	0.015289	84921	1298	420615	0.003087	30.720	0.8489	0.0031
55-59	35	0.00	0.000000	0.000000	83622	0	418989	0.000000	26.167	0.8359	0.0000
60-64	15	0.20	0.013306	0.065748	83622	5498	406289	0.013532	21.157	0.8359	0.0136
65-69	16	0.40	0.024948	0.117967	78124	9216	369414	0.024948	17.445	0.7808	0.0251
70-74	13	0.60	0.046058	0.207297	68908	14285	309189	0.046200	14.417	0.6886	0.0463
75-79	9	0.40	0.044352	0.200106	54624	10931	246451	0.044352	12.527	0.5456	0.0446
80-84	8	0.80	0.099792	0.399144	43693	17440	174763	0.099792	10.021	0.4362	0.0999
85+	6	0.60	0.099792	1.000000	26253	26254	263082	0.039647	10.021	0.2618	0.4000

Table 13 cont'd

OFF-RESERVE FEMALES 1986-1990

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	11	0.80	0.072727	0.068699	100000	6870	94460	0.072727	81.567	1.0000	0.0711
1-4	236	0.20	0.000847	0.003383	93130	315	371733	0.000847	86.570	0.9313	0.0008
5-9	363	0.00	0.000000	0.000000	92815	0	464075	0.000000	82.859	0.9282	0.0000
10-14	386	0.40	0.001036	0.005168	92815	480	462919	0.001036	77.859	0.9282	0.0010
15-19	442	0.20	0.000452	0.002260	92335	209	461198	0.000452	73.250	0.9234	0.0005
20-24	401	0.60	0.001496	0.007466	92126	688	458973	0.001499	68.410	0.9213	0.0015
25-29	370	0.40	0.001081	0.005393	91438	493	455987	0.001082	63.905	0.9144	0.0011
30-34	335	0.60	0.001791	0.008898	90945	809	452603	0.001788	59.237	0.9095	0.0018
35-39	269	0.00	0.000000	0.000000	90136	0	450680	0.000000	54.748	0.9014	0.0000
40-44	230	0.40	0.001739	0.008865	90136	799	449201	0.001779	49.748	0.9014	0.0018
45-49	178	1.00	0.005618	0.027750	89337	2479	440323	0.005630	45.165	0.8934	0.0056
50-54	128	0.00	0.000000	0.000000	86858	0	434186	0.000000	41.384	0.8686	0.0000
55-59	89	0.40	0.004494	0.022724	86858	1974	430358	0.004586	36.386	0.8686	0.0046
60-64	52	0.60	0.011538	0.056593	84884	4804	413025	0.011631	32.162	0.8488	0.0116
65-69	32	0.40	0.012500	0.061323	80080	4911	389546	0.012606	28.934	0.8008	0.0127
70-74	30	1.00	0.033333	0.154542	75169	11617	346487	0.033528	25.642	0.7517	0.0335
75-79	18	0.20	0.011111	0.053126	63552	3376	309071	0.010924	24.877	0.6355	0.0109
80-84	16	0.60	0.037500	0.172880	60176	10403	276446	0.037633	21.136	0.6018	0.0378
85+	8	0.40	0.050000	1.000000	49773	49773	995465	0.010968	20.000	0.4977	0.4000

Table 14. Abridged Life Tables Generated for Total Band Five Year Aggregate Data by Age and Sex

BAND MALES 1981-1985

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	170	3.80	0.022353	0.021916	100000	2192	98045	0.022353	64.979	1.0000	0.0222
1-4	805	0.80	0.000994	0.003965	97808	388	390264	0.000994	65.432	0.9781	0.0010
5-9	1047	0.60	0.000573	0.002861	97420	279	486406	0.000573	61.687	0.9742	0.0006
10-14	1022	1.20	0.001174	0.005857	97141	569	484592	0.001174	56.857	0.9714	0.0012
15-19	1099	4.00	0.003640	0.018067	96572	1745	478864	0.003643	52.174	0.9657	0.0036
20-24	854	4.20	0.004918	0.024351	94828	2309	468436	0.004929	48.084	0.9483	0.0049
25-29	618	2.80	0.004531	0.022410	92518	2073	457478	0.004532	44.221	0.9252	0.0045
30-34	476	2.80	0.005882	0.029073	90445	2630	445781	0.005899	40.176	0.9045	0.0059
35-39	387	2.40	0.006202	0.030552	87816	2683	432390	0.006205	36.303	0.8782	0.0062
40-44	309	2.00	0.006472	0.031861	85133	2712	418895	0.006475	32.368	0.8513	0.0065
45-49	238	1.60	0.006723	0.033185	82420	2735	405547	0.006744	28.351	0.8242	0.0067
50-54	192	2.00	0.010417	0.051016	79685	4065	388649	0.010460	24.235	0.7969	0.0105
55-59	161	2.00	0.012422	0.060566	75620	4580	367293	0.012470	20.398	0.7562	0.0125
60-64	125	2.60	0.020800	0.100553	71040	7143	339478	0.021042	16.543	0.7104	0.0212
65-69	84	4.40	0.052381	0.232068	63897	14828	282682	0.052456	13.079	0.6390	0.0525
70-74	85	3.20	0.037647	0.171807	49068	8430	223931	0.037647	11.271	0.4907	0.0376
75-79	65	5.00	0.076923	0.325172	40638	13214	171302	0.077141	8.099	0.4064	0.0777
80-84	35	4.80	0.137143	0.508228	27423	13938	101628	0.137143	5.755	0.2742	0.1363
85+	15	3.60	0.240000	1.000000	13486	13486	56192	0.179872	4.167	0.1349	0.4000

Table 14 cont'd

BAND MALES 1986-1990

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	54	3.80	0.070370	0.066574	100000	6657	94605	0.070370	67.615	1.0000	0.0689
1-4	925	2.40	0.002595	0.010311	93342	963	370964	0.002595	71.424	0.9334	0.0026
5-9	1199	0.20	0.000167	0.000834	92380	77	461708	0.000167	68.153	0.9238	0.0002
10-14	1191	1.20	0.001008	0.005030	92303	464	460534	0.001008	63.208	0.9230	0.0010
15-19	1170	2.40	0.002051	0.010206	91838	937	456955	0.002051	58.512	0.9184	0.0021
20-24	1215	2.60	0.002140	0.010645	90901	968	452106	0.002140	54.089	0.9090	0.0021
25-29	960	2.20	0.002292	0.011415	89933	1027	447167	0.002296	49.644	0.8993	0.0023
30-34	697	2.00	0.002869	0.014351	88907	1276	441611	0.002889	45.187	0.8891	0.0029
35-39	528	2.80	0.005303	0.026200	87631	2296	432317	0.005311	40.806	0.8763	0.0053
40-44	421	0.80	0.001900	0.009343	85335	797	424640	0.001878	36.838	0.8534	0.0019
45-49	325	1.60	0.004923	0.024664	84538	2085	418148	0.004986	32.162	0.8454	0.0050
50-54	262	2.60	0.009924	0.048688	82453	4014	402489	0.009974	27.904	0.8245	0.0100
55-59	209	1.80	0.008612	0.042467	78438	3331	384693	0.008659	24.201	0.7844	0.0087
60-64	171	3.80	0.022222	0.106367	75107	7989	356649	0.022400	20.152	0.7511	0.0225
65-69	119	3.20	0.026891	0.127099	67118	8531	315440	0.027044	17.237	0.6712	0.0271
70-74	80	4.20	0.052500	0.232512	58587	13622	258599	0.052678	14.363	0.5859	0.0526
75-79	69	2.40	0.034783	0.159322	44965	7164	206261	0.034733	12.963	0.4497	0.0346
80-84	47	3.00	0.063830	0.277064	37801	10473	164084	0.063830	9.964	0.3780	0.0643
85+	28	3.60	0.128571	1.000000	27328	27328	212551	0.062159	7.778	0.2733	0.4000

Table 14 cont'd

BAND FEMALES 1981-1985

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	160	3.62	0.022647	0.022199	100000	2220	98020	0.022647	72.728	1.0000	0.0224
1-4	760	2.21	0.002914	0.011570	97780	1131	388292	0.002914	73.376	0.9778	0.0029
5-9	946	0.60	0.000638	0.003187	96648	308	482473	0.000638	70.218	0.9665	0.0006
10-14	1064	0.60	0.000568	0.002834	96340	273	481075	0.000568	65.434	0.9634	0.0006
15-19	1017	1.21	0.001188	0.005928	96067	570	478953	0.001189	60.612	0.9607	0.0012
20-24	835	0.81	0.000964	0.004803	95498	459	476356	0.000963	55.959	0.9550	0.0010
25-29	610	0.81	0.001320	0.006593	95039	627	473663	0.001323	51.216	0.9504	0.0013
30-34	463	0.60	0.001304	0.006488	94412	613	470511	0.001302	46.539	0.9441	0.0013
35-39	361	0.40	0.001115	0.005556	93800	521	467714	0.001114	41.827	0.9380	0.0011
40-44	277	0.40	0.001453	0.007331	93279	684	464948	0.001471	37.047	0.9328	0.0015
45-49	210	0.81	0.003834	0.019208	92595	1779	459009	0.003875	32.299	0.9260	0.0039
50-54	183	1.21	0.006600	0.032819	90816	2981	447363	0.006662	27.877	0.9082	0.0067
55-59	131	1.61	0.012294	0.060149	87836	5283	426673	0.012382	23.730	0.8784	0.0124
60-64	114	1.81	0.015893	0.076818	82553	6342	397776	0.015943	20.080	0.8255	0.0160
65-69	92	2.42	0.026257	0.123773	76211	9433	357956	0.026352	16.532	0.7621	0.0264
70-74	66	1.81	0.027451	0.129573	66778	8653	313670	0.027585	13.507	0.6678	0.0277
75-79	44	2.82	0.064052	0.278659	58125	16197	251110	0.064503	10.121	0.5813	0.0648
80-84	32	2.42	0.075490	0.317947	41928	13331	176593	0.075490	8.042	0.4193	0.0756
85+	26	4.63	0.178079	1.000000	28597	28598	160588	0.109179	5.615	0.2860	0.4000

Table 14 cont'd

BAND FEMALES 1986-1990

AGE	PP	DD	MM(X)	Q(X)	L(X)	D(X)	LL(X)	M(X)	E(X)	S(X)	H(X)
<1	51	1.80	0.035294	0.034243	100000	3424	97020	0.035294	75.221	1.0000	0.0348
1-4	858	1.20	0.001399	0.005575	96575	538	384956	0.001399	76.884	0.9658	0.0014
5-9	1102	0.60	0.000544	0.002719	96037	261	479534	0.000544	73.306	0.9604	0.0005
10-14	1073	1.20	0.001118	0.005576	95776	534	477524	0.001118	68.499	0.9578	0.0011
15-19	1213	0.40	0.000330	0.001647	95242	157	475777	0.000330	63.870	0.9524	0.0003
20-24	1144	0.80	0.000699	0.003512	95085	334	474763	0.000703	58.971	0.9509	0.0007
25-29	967	2.00	0.002068	0.010357	94751	981	471443	0.002082	54.169	0.9475	0.0021
30-34	737	1.60	0.002171	0.010749	93770	1008	466194	0.002162	49.708	0.9377	0.0022
35-39	561	0.40	0.000713	0.003543	92762	329	463072	0.000710	45.222	0.9276	0.0007
40-44	464	1.40	0.003017	0.015222	92433	1407	459201	0.003064	40.373	0.9243	0.0031
45-49	362	2.40	0.006630	0.032705	91026	2977	447655	0.006650	35.953	0.9103	0.0066
50-54	280	0.80	0.002857	0.014114	88049	1243	437249	0.002842	32.084	0.8805	0.0028
55-59	222	1.80	0.008108	0.040313	86806	3499	426295	0.008209	27.506	0.8681	0.0082
60-64	147	2.20	0.014966	0.073125	83307	6092	402823	0.015123	23.545	0.8331	0.0152
65-69	127	3.80	0.029921	0.139593	77215	10779	359551	0.029978	20.185	0.7722	0.0300
70-74	100	2.60	0.026000	0.122068	66436	8110	311988	0.025994	18.048	0.6644	0.0260
75-79	62	2.60	0.041935	0.191341	58326	11160	264272	0.042230	15.209	0.5833	0.0423
80-84	47	2.40	0.051064	0.226797	47166	10697	209487	0.051064	13.204	0.4717	0.0512
85+	34	3.00	0.088235	1.000000	36469	36469	413319	0.031617	11.333	0.3647	0.4000

REFERENCES CITED

Armitage, P.
1971 *Statistical Methods in Medical Research.* Oxford and Edinburgh: Blackwell Scientific Publications.

Barth, Frederick
1969 *Ethnic Groups and Boundaries.* London: George Allen and Unwin.

Bienvenue, Rita M.
1985 Colonial Status: The Case of Canadian Indians. In *Ethnicity and Ethnic Relations in Canada*, ed. R. M. Bienvenue and J. E. Goldstein, 199-214. Toronto: Butterworth & Co.

Boldt, Menno
1993 *Surviving as Indians: The Challenge of Self-Government.* Toronto: University of Toronto Press.

Canada, Statutes of
1985 *Bill C-31: An Act to Amend the Indian Act.* First Session, Thirty-third Parliament. 33-34 Elizabeth II, 1984-85. February 28, 1985. Ottawa: The Minister of Indian Affairs and Northern Development.

Canada
1989 *Indian Act* R.S., 1985, c. I-5, amended by R.S., 1985, c.32 (1st Supp.), R.S., 1985, c.27 (2nd Supp.) R.S., 1985, c.17, 43, 48 (4th Supp.). Ottawa: Minister of Supply and Services Canada.

Cardinal, Harold
1961 *The Unjust Society.* Edmonton: M. G. Hurtig.

Carriere, K. C. and Leslie L. Roos
1994 Comparing Standardized Rates of Events. *American Journal of Epidemiology* 140(5): 472-482.

Clatworthy, Stewart and Anthony H. Smith.
1992 *Population Implications of the 1985 Amendments to the Indian Act*: Final Report, Prepared for the Assembly of First Nations, December 1992.

Daniels, H. W.
1981 *Native People and the Constitution of Canada*, The Report of the Metis and Non-Status Indian Constitutional Review Commission. Ottawa: Mutual Press.

Darnell, Regna
1986 A Linguistic Classification of Canadian Native Peoples: Issues, Problems, and Theoreticl Implications. In *Native Peoples: The Canadian Experience*, ed. R. B. Morrison and C. R. Wilson, 22-44. Toronto: McClelland and Stewart Limited.

Diehr, P., K. Cain, and F. Connell
1990 What is Too Much Variation? The Null Hypothesis in Small-Area Analysis. *Health Services Research* 24:741-771.

Dunkley, K.
1982 *Women and the Indian Act*, Background Paper 16E. Ottawa: Library of Parliament, Research Branch.

Dyck, N.
1980 Indian, Metis, Native: Some Implications of Special Status. *Canadian Ethnic Studies* 12(1): 34-46.

1991 *What is the Indian 'Problem.' Tutelage and Resistance in Canadian Indian Administration*. St. John's, Newfoundland: Memorial University, The Institute of Social and Economic Research.

Elliott, David W., ed.
1992 *Law and Aboriginal Peoples of Canada*. North York, Ontario: Captus Press.

Financial Post.
1992 Act Amendments Remove Discrimination. 7 October 1995. Letter from Gregor MacIntosh, Director General, Revenues and Band Governance Branch, DIAND.

Foster, L. T., J. Macdonald, T. A. Tuk, S. H. Uh, and D. Talbot
1995 Native Health in British Columbia: A Vital Statistics Perspective. In *A Persistent Spirit: Towards Understanding Aboriginal Health in British Columbia*, ed. P. H. Stephenson, S. J. Elliott, L. T. Foster, J. Harris. Canadian Western Geographical Series, no. 31, 43-93. Victoria, B.C.: University of Victoria.

Frideres, J. S.
1993 *Native Peoples in Canada: Contemporary Conflicts*. Scarborough, Ontario: Prentice-Hall of Canada.

Guillemin, J.
1978 The Politics of National Integration: A Comparison of United States and Canadian Indian Administration. *Social Problems* (December): 320-332.

Halli S. S., F. Trovato, and L. Driedger
1990 The Social Demography of Ethnic Groups. In *Ethnic Demography: Canadian Immigrant, Racial and Cultural Variations*, ed. S. S. Halli, F. Trovato, and L. Driedger, 1-12. Ottawa: Carleton University Press.

Hawley, D. L.
1984 *The Indian Act Annotated*. Calgary: The Carswell Company Limited.

Health and Welfare Canada
1990 *Health Status of Canadian Indians and Inuit - 1990*. Ottawa: Health and Welfare Canada, Medical Services Branch.

Holmes, J.
1987 *Bill C-31 Equality or Disparity? The Effects of the New Indian Act on Native Women*. Ottawa: Canadian Advisory Council on the Status of Women.

Imai, S., K. Logan, and G. Stein.
1993 *Aboriginal Law Handbook*, Scarborough, Ontario: Carswell.

Indian and Northern Affairs Canada
1984 *Bill C-47; Amendments to the Indian Act to End Discrimination Based on Sex*. Notes Prepared for the Honourable John C. Munro P.C., M.P., Minister of Indian Affairs and Northern Development, June 26, 1984.

Indian and Northern Affairs Canada
1987 *Report to Parliament; Implementation of the 1985 Changes to the Indian Act*. Ottawa: Minister of Supply and Services.

Indian and Northern Affairs Canada
1989 *Bill C-31*, Information Sheet no.2. Department of Indian Affairs and Northern Development, Communications Branch.

Indian and Northern Affairs Canada
1990a *Impacts of the 1985 Amendments to the Indian Act (Bill C-31)*. (Modules 1 through 4 and summary report). Ottawa: Minister of Supply and Services Canada.

Indian and Northern Affairs Canada
1990b *Indian Band Membership*. An Information Booklet Concerning New Indian Band Membership Laws and the Preparation of Indian Band Membership Codes. Ottawa: Minister of Supply and Services Canada.

Indian and Northern Affairs Canada
1991 *The Indian Act Past and Present: A Manual on Registration and Entitlement Legislation*. Indian Registration and Band Lists Directorate. Ottawa: Minister of Supply and Services Canada.

Indian and Northern Affairs Canada
1992 *Basic Departmental Data, 1992*. Quantitative Analysis and Socio-demographic Research, Management Information and Analysis, Finance and Professional Services. Ottawa: Minister of Supply and Services Canada.

Indian and Northern Affairs Canada
1993a *Identification and Registration of Indian and Inuit People*. Indian Registration and Band Lists Directorate. Ottawa: Indian and Northern Affairs Canada.

Indian and Northern Affairs Canada
1993b *The Indian Register*. Information Sheet No. 44. Ottawa: Department of Indian Affairs and Northern Development, Communications Branch.

Indian and Northern Affairs Canada
1995 *1995-96 Estimates, Part III*, Ottawa: Ministry of Supply and Services

Inglis, G. B.
1971 Canadian Indian Reserve Populations: Some Problems of Concept. *Northwest Anthropological Research Notes* 5(1): 23-36.

Isajiw, W.
1985 Definitions of Ethnicity. In *Ethnicity and Ethnic Relations in Canada*, ed. R. M. Bienvenue and J. E. Goldstein, 5-17. Toronto: Butterworth & Co.

Jamieson, K.
1978 *Indian Women and the Law in Canada: Citizens Minus*. Ottawa: Minister of Supply and Services.

1986 Sex Discrimination and the *Indian Act*. In *Arduous Journey: Canadian Indians and Decolonization*, ed. J. R. Ponting, 112-136. Toronto: McClelland and Stewart.

Kallen, E.
1982 *Ethnicity and Human Rights in Canada*. Toronto: Gage Publishing Limited.

Keyfitz, N. and W. Flieger
1971 *Population; Facts and Methods of Demography*. San Francisco, California: W.H. Freeman and Company.

Kitagawa, Evelyn M.
1964 Standardized Comparisons in Population Research. *Demography* 1:296-315.

Kulchyski, P.
1994 *Unjust Relations: Aboriginal Rights in Canadian Courts*. Toronto: Oxford University Press.

Larsen, Kenneth
1977 *Negotiating Identity: Ethnic Incorporation Among the Nova Scotia Micmacs*. Unpublished M. A. Thesis in Social Anthropology. University of Oslo, Norway.

Leslie, J., and R. Maguire, eds.
1978 *The Historical Development of the Indian Act*. Treaties and Historical Research Centre, P.R.E. Group, Indian Indian and Northern Affairs Canada. Unpublished, internal working paper.

Mao, Y., B. W. Moloughney, R. M. Semenciw, and H. I. Morrison
1992 Indian Reserve and Registered Indian Mortality in Canada. *Canadian Journal of Public Health* 83(5): 350-353.

Mawhiney, Anne-Marie
1993 *Towards Aboriginal Self-Government: Relations between Status Indian Peoples and the Government of Canada 1969-1984.* New York and London: Garland.

Milloy, J. S.
1991 The Early Indian Acts: Developmental Strategy and Constitutional Change. In *Sweet Promises: A Reader on Indian - White Relations*, ed. J. R. Miller, 145-154. Toronto: University of Toronto Press.

Moffatt, M. E. K., D. Gray, and B. D. Postl
1988 Sudden Infant Death Syndrome in Manitoba. *Arctic Medical Research* 47(Supp.1):526-528.

Morse, B. W.
1985 *Aboriginal Peoples and the Law: Indian, Metis and Inuit Rights in Canada.* Ottawa: Carleton University Press.

Moss, W.
1990 Indigenous Self-Government in Canada and Sexual Equality Under the Indian Act: Resolving Conflicts between Collective and Individual Rights, *Queen's Law Journal* 15:286.

Mustard, Cam
1992 Manitoba Centre for Health Policy and Evaluation. Communication.

Native Women's Association of Canada
1986 *Guide to Bill C-31: Explanation of the 1985 Amendments to the Indian Act.* Ottawa: Native Women's Association of Canada.

Nichols, R. L.
1989 The United States, Canada, and the Indians 1865-1876. *The Social Science Journal* 26(3): 249-263.

O'Neil L. (Chairman)
1988 *Fifth Report of the Standing Committee on Aboriginal Affairs and Northern Development*; on consideration of the implementation of the *Act to Amend the Indian Act* as passed by the House of Commons on June 12, 1985. Ottawa: Queen's Printer for Canada.

Owl, F. M.
1962 Who and What is an American Indian? *Ethnohistory* 9: 265-284.

Penner, H.
1988 *Bill C-31; An Act to Amend the Indian Act*, Background Paper. Ottawa: National Association of Women and the Law.

Piche, V. and M. V. George
1973 Estimates of Vital Rates for the Canadian Indians, 1960-1970. *Demography* 10(3): 367-382.

Postl, B. and M. Moffatt
1988 The Health of Canada's Native People: An Overview. *Canadian Family Physician* 34: 2413-2419, 2580.

Sanders, D.
1984 Indian Status: A Woman's Issue or an Indian Issue. *Canadian Native Law Reporter* 3:30-39.

Sawchuk, J.
1985 The Metis, Non-status Indians and the New Aboriginality: Government Influence on Native Political Alliances and Identity. *Canadian Ethnic Studies* 17(2): 135-146.

Selvin, Steve
1991 *Statistical Analysis of Epidemiologic Data*. Monographs in Epidemiology and Biostatistics, Vol. 17. New York: Oxford University Press.

Schryock, H. S., J. S. Siegel and Associates
1976 *The Methods and Materials of Demography*. New York: Academic Press.

Silman, J. ed.
1987 *Enough is Enough: Aboriginal Women Speak Out*. Toronto: The Women's Press.

Slobodin, Richard
1971 The Indians of Canada Today: Questions of Identity. In *Canada: A Sociological Profile*, Second Edition, ed. W. E. Mann, 286-292. Toronto: Copp-Clark.

Smith, D. G., ed.
1975 *Canadian Indians and the Law: Selected Documents, 1663-1972.* Ottawa: McClelland and Stewart Limited.

Stymeist, D. H.
1975 *Ethnics and Indians: Social Realtions in a Northwestern Ontario Town.* Toronto: Peter Martin Associates Limited.

Tobias, J. L.
1991 Protection, Civilization, Assimilation: An Outline History of Canada's Indian Policy. In *Sweet Promises: A Reader on Indian - White Relations*, ed. J. R. Miller, 127-144. Toronto: University of Toronto Press.

Upton, L. F. S.
1973 The Origins of Canadian Indian Policy. *Journal of Canadian Studies* 8: 51-61.

Weaver, S. M.
1973 *Proposed Changes in the Legal Status of Canadian Indian Women. The Collision of Two Social Movements*, Paper Presented at the 1973 Annual Meeting of the American Anthropological Association, New Orleans, November 30, 1973.

1977 Segregation and the Indian Act: The Dialogue of Equality vs Special Status. In *Identities: The Impact of Ethnicity on Canadian Society*, ed. W. Isajiw, 154-61. Toronto: Peter Martin Associates Ltd.

1984 Struggles of the Nation-State to Define Aboriginal Ethnicity: Canada and Australia. In *Minorities and Mother Country Imagery*, ed. G. L. Gold, 182-210. Social and Economic Papers, No. 13. St. John's, Newfoundland: Memorial University of Newfoundland, Institute of Social and Economic Research.

Wherrett, Jill
1996 *Indian Status and Band Membership Issues*, Background Paper (BP-410E). Ottawa: Library of Parliament, Research Branch, Political and Social Affairs Division.