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Identifying and Predicting Chronic Care Need in the Inuvik Region,

Northwest Territories

by

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A thesis submitted to the Faculty of Graduate Studies and Research in partial

fulfilment of the requirements for the degree of Master of Health Services

Administration

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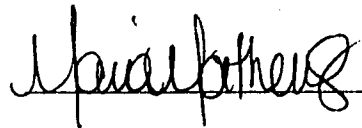
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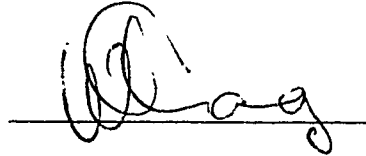
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The undersigned certify that they have read, and recommend to the Faculty of
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degree of Master of Health Services Administration.

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Abstract

The study examined previously collected data in the Inuvik Region about individuals requiring chronic care (I.R.C.C.). The study described the characteristics of I.R.C.C. and developed and evaluated two models to forecast need. The first model used a multivariate linear regression, whereas the second used a Markov Chain. The findings can be used to support evidence-based decision making in planning and policy-making.

The study found that need increased with age. Additional investigation may clarify whether aboriginal people have higher levels of need than non-aboriginal people. Both models produced reasonable estimates of need but additional study with larger samples is needed to refine the models and ensure they are statistically appropriate. Modification to the data collection and classification procedures will address a number of limitations to the study.

ACKNOWLEDGEMENT

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List of Abbreviations

A.D.C.I.A.	Aged, Disabled, and Chronically Ill Assessment
D.O.H.S.S.	Department of Health and Social Services
I.R.C.C.	Individuals requiring chronic care
I.R.H.B.	Inuvik Regional Health Board
F.A.E.	Fetal Alcohol Effects
F.A.S.	Fetal Alcohol Syndrome
G.N.W.T.	Government of the Northwest Territories
H.C.P.	Health Care Plan
N.W.T.	Northwest Territories
N.W.T.A.P.G.	Northwest Territories Assessment and Placement Guide
pop	population

1.0 INTRODUCTION

1.1 Thesis Format

The thesis is written in six chapters. Chapter one introduces the problem and outlines the goal, scope and significance of the study. It defines important terms, provides background information about health services in the Inuvik Region, and describes policies which influence the organization and provision of chronic care services. Chapter two is a review of literature relating to need and the predisposing factors of chronic care. Chapter three describes the methodology used in the study. The results are presented in chapter four and discussed in chapter five. Conclusions and recommendations are presented in chapter six. Following the thesis are the bibliography and six appendices.

Appendix A contains the Northwest Territories Assessment and Placement Guide which was used to identify individuals requiring chronic care (I.R.C.C.) and classify their level of need. Appendix B is the data entry form which was used to create an electronic database of client records. Appendix C and Appendix D contain calculations from Model A and Model B respectively. Appendix E is a description of the calculations used to create a Leslie Matrix for population projections. Appendix F contains additional tables referred to in chapters four and five.

1.2 Identification of the Problem

The lack of appropriate and reliable information about health care needs

has placed considerable stress on the decision making process in the health care

sector (Angus, 1995). Past decisions about the allocation of chronic care

resources in the Inuvik Region were believed to have been directed by political

influence rather than demonstrated need. Because administrators and

policy-makers are forced to make difficult choices, particularly in light of shrinking

health care budgets, "evidence based decisions are required to ensure that policies

and programs focus on the right issues, take effective action, and produce sound

results" (Hamilton and Bhatti, 1996, 8). An essential element of evidence-based

decision making is the examination of past need in order to analyse trends and

identify emerging issues (Hamilton and Bhatti, 1996).

One of the first examples of data collection to assist decision making in

chronic care services in the Northwest Territories was the 1985 Aged, Disabled

and Chronically Ill Assessment (A.D.C.I.A.). The study identified all I.R.C.C. due

to age, disability or chronic illness. According to Miles Tapping (1989), one of the

coordinators of the project, the A.D.C.I.A was organized because "in the context

of transfer of responsibilities from the Government of Canada to the territorial

governments... it [was] important to know just what responsibilities [were] being

transferred, for what services, and for how many people" (145). A complete

survey of all communities in the Inuvik Region was repeated in 1988, 1991, and

1995. The results from each A.D.C.I.A were used to keep record of the

individuals who required ongoing assisted living or chronic care services. The data from each A.D.C.I.A. were entered into client summary charts. These charts provided an opportunity to examine and predict chronic care needs of this population.

1.3 Objectives of the Study

The goal of this study was to analyse the client summary charts and develop a better understanding of disability and chronic care needs in the Inuvik Region to facilitate the planning of services. Particular attention was given to the factors which predispose individuals to chronic care need. The objective was to describe the characteristics of the I.R.C.C., and to develop and evaluate two forecasting methods to predict chronic care needs to the year 2005.

1.4 Significance of the Study

This study was the first detailed analysis of chronic care needs in the Inuvik Region. It was a response to the need to provide administrators and care providers with information to support evidence-based decision making in the chronic care sector. The information can also serve as the first step in a planning process for chronic care and prevention programs. The results can be used for comparison with other regions in the Northwest Territories. Lastly, problems encountered in using the Northwest Territories Assessment and Placement Guide

(N.W.T.A.P.G.) for describing and predicting need may lead to useful modification of the instrument and assessment methodology.

1.5 Limitations of the Study

The study relied exclusively on the data gathered during each A.D.C.I.A. Both the analysis conducted and the models developed were limited by the type and scope of the information gathered about each I.R.C.C. Moreover, the data collection methodology used in the A.D.C.I.A. may have introduced limitations to this study with regard to the reliability and accuracy of the number of identified I.R.C.C. These potential limitations are discussed in chapter five.

Although the Inuvik Region is geographically large, it has a very small population compared to other health regions in southern Canada. The total population of the Region during the period studied was less than 10 000 people, of whom, two to three percent required chronic care. Because of the small sample size, it was difficult to determine whether the forecasting models were statistically appropriate, and as such, the findings of the study were largely exploratory in nature.

1.6 Definition of Terms

1.6.1 Individuals Requiring Chronic Care (I.R.C.C)

I.R.C.C. includes exclusively those individuals who are identified by the N.W.T.A.P.G. as requiring ongoing assistance (Appendix A). The levels of need

defined by the N.W.T.A.P.G may differ from the definitions of need and of disability used by other assessment tools and disability surveys. The Department of Health and Social Services (D.O.H.S.S.) classifies degree of chronic need into four levels for adults (individuals age 18 years and over) and three levels for children (G.N.W.T., 1987).

1.6.1.1 Adult - Level One An adult at level one is essentially independent but may require guidance or supervision with some activities of daily living. Care is generally provided in the home by family or, when required, by community support programmes.

1.6.1.2 Adult - Level Two An adult at level two is able to get around safely with or without aides, is able to assist in dressing and feeding and is usually continent. Care may be provided in the home by family and community support programmes, or in a residential setting such as a personal care home or multi-level care home.

1.6.1.3 Adult - Level Three An adult at level three requires more than assistance and supervision with activities of daily living and is usually not continent. Care may be provided in the home by family and community support programmes, or in a residential setting such as a personal care home or multi-level care home.

1.6.1.4 Adult - Level Four An adult at level four requires regular and continuous medical attention, and highly skilled technical nursing supervision on a 24 hour basis. Care is provided in a hospital extended care unit.

1.6.1.5 Child - Level One A child at level one requires more assistance with activities of daily living and life skills than is within the normal range for children of

the same age because of developmental delay, cognitive, or physical impairment.

The child is expected to become independent in activities of daily living as an adult.

1.6.1.6 Child - Level Two A child at level two is not expected to become

independent in all activities of daily living as an adult because of a physical or

cognitive impairment.

1.6.1.7 Child - Level Three A child at level three has a severe physical or

cognitive impairment and is expected to remain physically dependent for activities

of daily living.

1.6.2 Chronic Care Services

Chronic care services include homemaking (also known as home support),

homecare, institutional long term care, and respite care.

1.6.2.1 Homemaking Homemaking is provided by home support workers who

clean houses, prepare meals, launder clothes, assist in shopping and errands, aid in

personal grooming and hygiene, and perform basic nursing skills. Homemaking is

provided in clients' homes.

1.6.2.2 Homecare Homecare is provided by nursing staff who deliver nursing

care to patients. The service is provided in the clients' home.

1.6.2.3 Institutional Care Individuals who require institutional long term care are

dependent upon ongoing supervision or nursing care which is only available (unless

privately funded) in public institutions such as nursing homes (also referred to as

seniors homes or old folks homes), group homes, or hospitals.

1.6.2.4 Respite Care Respite care is the temporary lodging of an I.R.C.C. in a

long term care institution. Respite care is usually used to relieve primary care

givers of their duties for short periods of time (a few days to two months).

1.7 Background Information

1.7.1 Inuvik Region

The Inuvik Region extends from the south shore of Great Bear Lake to

Banks Island in the Beaufort Sea (Figure 1). It includes twelve communities.
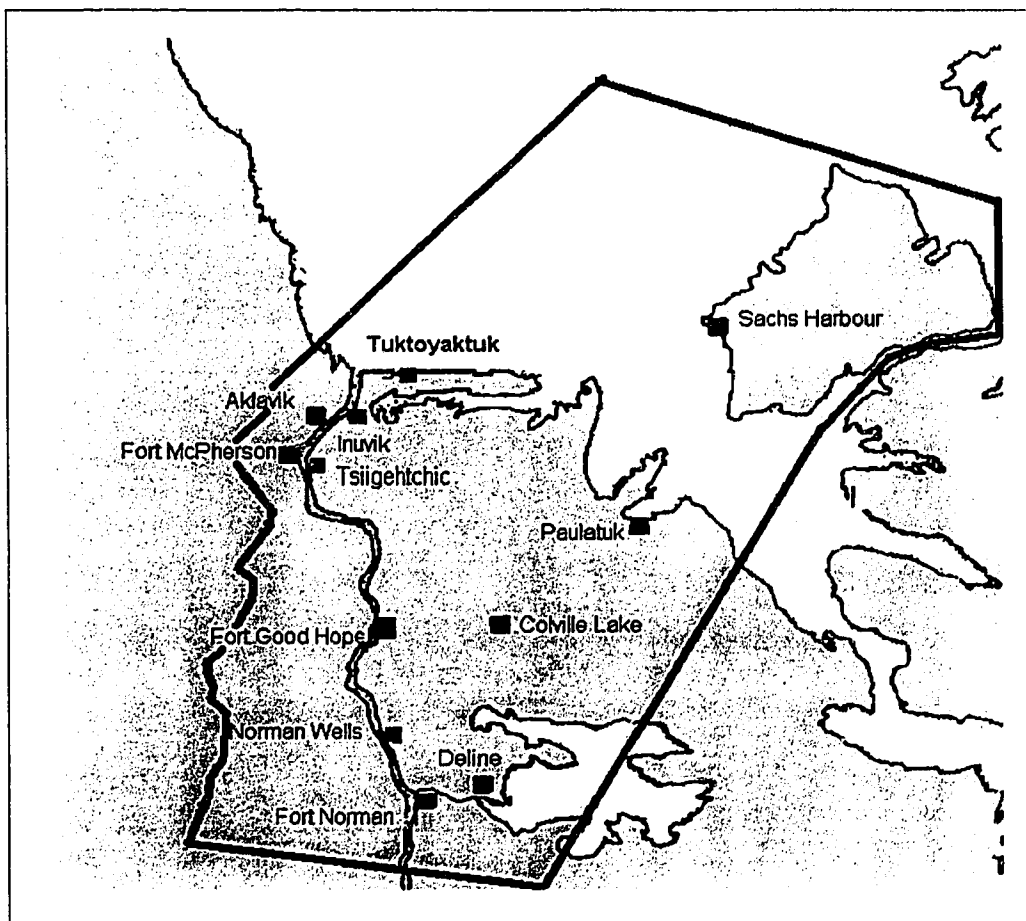
Figure 1. Map of the Inuvik Region.

The seven northernmost communities are collectively known as the Beaufort-Delta communities: Sachs Harbour, Tuktoyaktuk, Paulatuk, Inuvik, Aklavik, Fort McPherson, and Tsiigehtchic (formerly known as Arctic Red River). The five southernmost communities are collectively known as the Sahtu communities: Fort Good Hope, Colville Lake, Norman Wells, Tulita (formerly known as Fort Norman) and Deline (formerly known as Fort Franklin).

Between 1985 and 1995, Inuvialuit (a cultural group of the Inuit), Gwich'in, Sahtu Dene, Metis and non-aboriginal people lived in the Region. Most Inuvialuit people lived in Sachs Harbour, Tuktoyaktuk, Paulatuk, Inuvik, and Aklavik. Most Gwich'in resided in Inuvik, Aklavik, Tsiigehtchic, and Fort McPherson; and the Sahtu Dene in Fort Good Hope, Colville Lake, Norman Wells, Tulita, and Deline. Metis lived in almost all of the communities. Non-native people resided in all communities, although their numbers were highest in Inuvik and Norman Wells (I.R.H.B., 1996a).

1.7.2 Delivery of Health and Social Services

Prior to 1988, the Medical Services Branch of Health and Welfare Canada administered and delivered health services in the Northwest Territories. In 1988, responsibility for health services was transferred to the Department of Health of the Northwest Territories, which established six[1] regional health boards to deliver and administer services.

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[1] A health board was not established in the MacKenzie/ Deh Cho Region. Health services were delivered by the Northwest Territories Department of Health.

Health services in the Inuvik Region are delivered through health centres or health stations located in each community and the Inuvik Regional Hospital located in Inuvik. Health centres are found in communities with populations greater than 200 people[2]: Sachs Harbour, Tuktoyaktuk, Paulatuk, Aklavik, Fort McPherson, Fort Good Hope, Norman Wells, Tulita, and, Deline. Community health stations are located in communities with populations less than 200 people (Colville Lake and Tsiigehtchic).

Health centres are staffed by nurses, community health representatives, support staff, and, in some communities, dental therapists. Health centres are open daily for sick clinics, routine public health clinics, educational workshops and community development programs. Nursing staff are on call after regular hours to provide 24 hour emergency coverage. Each community health station is staffed by a lay dispenser who, during emergencies, assesses patients and provides treatment according to directions given by physicians or nurses. Each week, nurses from Fort Good Hope visit Colville Lake and nurses from the Inuvik Regional Hospital visit Tsiigehtchic. Physicians visit each community either once a month or once every six weeks (depending on the population of the community).

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[2] Although Sachs Harbour has a population of approximately 130 people, it has a health centre because of the its geographical isolation. Located on Banks Island, Sachs Harbour is often inaccessible because of adverse weather conditions.

Patients are transferred to the Inuvik Regional Hospital to access specialist and inpatient services[3]. The hospital operates 26 acute care beds and 16 long term care beds. The hospital provides diagnostic, therapeutic, rehabilitation and prevention services for both the hospital and the community health centres. Unlike most hospitals in the south, the Inuvik Regional Hospital has a hostel (called the Transient Centre) for out of town patients who do not require inpatient services. Patients requiring additional health services are transferred to Stanton Yellowknife Hospital in Yellowknife or the Capital Health Authority in Edmonton.

1.7.3 Chronic Care Services

Between 1985 and 1995 responsibility for assisted living services for the disabled and chronically ill were shared between the Department of Health and the Department of Social Services. In 1985, Inuvik was the only community in the Region with homecare and homemaking programs. In 1995, Inuvik was the only community with designated staff for the homecare programme. In the other communities, health centre nurses provided limited homecare services. The I.R.H.B. employed two homemakers in Inuvik. In the other communities, Social Services awarded contracts to band and hamlet councils to provide homemaking services in their community. In 1995, six communities were awarded homemaking contracts.

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[3] As of April 1, 1995, residents of Deline, Fort Norman, and Norman Wells accessed hospital and specialist services from the Stanton Yellowknife Hospital in Yellowknife.

In 1985, there was one long term care facility in the Region. In 1995, there were four. All four institutions offered respite care.

1.7.3.1 Joe Greenland Centre The Joe Greenland Centre in Aklavik was the only long term care facility in the Region which was in operation in both 1985 and 1995. In 1995, it had eight level two beds. The centre also included seven level one apartments for seniors who required minimal assistance (such as homemaking).

1.7.3.2 Long Term Care Ward at the Inuvik Regional Hospital A designated long term care ward was added to the Inuvik Regional Hospital between 1985 and 1988 (Personal Communication, Holly Fletcher-Best, February 19, 1996) Prior to its construction, I.R.C.C. were admitted to either the acute care ward or the maternity and surgery ward.

In 1995, the long term care ward had 14 resident and two respite beds for chronically disabled young adult and geriatric patients who required ongoing supervisory and nursing care (level three and four). Residents in the ward could not be cared for in their homes or in the other long term care facilities in the Region because of the severity of their conditions and the lack of appropriate medical services in the communities.

1.7.3.3 Kw'iy Aota' Ko Elders' Facility The facility, located in Deline opened in 1993. In 1995, it had six level two beds and ten level one apartments for clients over the age of 50.

1.7.3.4 Inuvik Disabled Adult Group Home. Located in Inuvik, the Inuvik

Disabled Adult Group Home opened in 1995. It had 6 resident and 2 respite beds.

Eligible clients were level two I.R.C.C between the ages of 18 to 40 years.

1.7.4 Service Requirements Relative to Need .

Adults at levels one and two may be able to remain independent and in their own

homes with homemaking and, if necessary, homecare. Generally, adults at levels

three and four require long term care. Children at levels one and two can be cared

for in their own homes by their parents. Depending on the nature of their disability

and the willingness of their parents, children at level three can be cared for in their

own homes or in a long term care institution. Respite care is usually provided for

adults at levels two, three, and four, or children at levels two and three.

1.7.5 Factors Affecting Chronic Care Services

The creation and organization of chronic care services in the Region is

influenced by a number of Territorial government policies and objectives (such as

the Community Wellness strategy) as well as community concerns. However,

underlying all government initiatives is fiscal restraint.

1.7.5.1 Fiscal Restraint Since 1992, the Department of Health and Social Services

has seen significant growth in expenditures, and has adopted measures to reduce

spending. One major initiative is the development of population based funding

formulas to provide regional and community agencies with block funding for

programs. A second major cost cutting initiative was the amalgamation of the

Department of Health and the Department of Social Services in June 1994. The

consolidation of health and social services at regional and community levels is presently underway.

1.7.5.2 Community Wellness The Community Wellness policy calls for less control by government and greater involvement by communities through prevention, healing and treatment programs; education and training of local people; inter-agency collaboration; and community empowerment through more control of local services (Benoit, 1995). The policy promotes the concept of a healthy community which is characterised by a strong sense of community and family life, a state of personal and community well-being, the preservation of culture and tradition, and integrated services provided by community members and care givers working cooperatively (Benoit, 1995). In the context of chronic care services, the Community Wellness policy encourages communities to care for their own people wherever possible by means of the Community Transfer Initiative, the Repatriation policy, and changes in care delivery.

1.7.5.2.1 Community Transfer Initiative. The Community Transfer Initiative is geared toward increasing community responsibility for services and programs by transferring program funding from the Territorial government to a local band or hamlet council. The goal of the initiative is to provide communities with the opportunity to restore local responsibility and self-sufficiency; to address economic and social problems by establishing local priorities; and to produce an efficient, responsive, and cost-effective system of government (Department of Health, 1993). Under the initiative, communities will increasingly assume the

responsibility for planning, administration, and delivery of programs and services. Regional agencies will support the communities through programme development, and manpower training. An example of the Community Transfer Initiative in the chronic care sector is the transfer of responsibility for the Joe Greenland Centre from the Department of Health and Social Services to the Aklavik Aboriginal Committee.

1.7.5.2.2 Repatriation. Previously, when adequate services and facilities were unavailable in the North, individuals with mental and physical disabilities were placed in the South. Under the repatriation policy, individuals placed in southern institutions will be relocated to facilities in the North. The policy is part of broader objectives to develop northern resources for individuals with special needs, to preserve northern culture, to strengthen family bonds, to promote community wellness, and to reduce government expenditures (The Repatriation Task Group, 1996).

1.7.5.2.3 Change in Service Delivery. Throughout North America, the emphasis of social and health services has shifted towards ambulatory care, provided in home-like settings, by a team of care providers (I.R.H.B., 1996c). The change in service delivery de-emphasizes institutionalized programmes, especially for physically and mentally disabled individuals who require ongoing care. The approach in the Inuvik Region was to provide services by local care providers and family members, in home-like environments, as close to the home community as possible (I.R.H.B., 1996c).

1.7.5.3 Community Concerns The planning and provision of chronic care services in the Inuvik Region was a growing concern for both residents and health administrators (I.R.H.B., 1996). In a recent needs assessment, seven communities expressed a desire to have a facility like the Joe Greenland Centre.. Residents in these communities said that "elders are a valuable resource ... [they] would like to keep elders in the community rather than see them leave because appropriate facilities or services [were] not available" (I.R.H.B., 1995, 35). Elders play a leading role in the political and social activities in the community. They are a link to the past and are seen as a valuable resource for preserving traditional lifestyles and values. Moreover, communities in the Region are separated by considerable distances, and some are only accessible by air travel. Removing individuals from their home community in order to access chronic care services breaks up families and removes social support networks.

The creation of chronic care programs can also play a role in the economic and social development of a community. It provides the opportunity to train local (aboriginal) care providers and to boost the local economy.

Nonetheless, funding for chronic care programs is limited. Seniors' facilities are expensive to construct and operate. Since opening in 1993 and 1995 respectively, both the Kw'iy Aota' Ko Elders Facility and the Inuvik Disabled Adult Group Home have operated at half their capacities. Reducing operations is not economically advantageous because most expenses are fixed costs (given the small size of the facilities). When planning chronic care programs, administrators must

not only consider funding, government policies, and community concerns, but also

the need for chronic care services.

1.8 Chapter Summary

Chapter one identified the problem and outlined the context in which the

problem will be considered. The next chapter examines a review of selected

literature to develop an understanding of chronic care need in Canada.

2.0 LITERATURE REVIEW

2.1 Need

According to Donabedian (1973), a planning process must consider three elements: need, service, and resources. Need is a "service requiring potential" (Donabedian, 1973, 65). Service is the required care procedure, and resource is the supply or source of the service. These three elements are inter-related. Identifying and describing need allows planners to determine required services as well as the resources required to produce them.

Need in this study referred to the requirement for chronic care services. Service referred to the types of chronic care services, and resource referred to the various elements required to provide the service (for example, human resources, finances, capital, and policies). In a complete planning exercise, all three elements and factors which influence them are considered. This study however, focused on needs and the factors which affect them.

2.2 Predisposing Factors

Need for health services is not uniform in a population; some individuals are more likely than others to have greater need. Wolinsky, Stump, and Johnson (1995) suggested that need is a function of an individual's predisposing characteristics (individual traits which exist prior to the onset of illness and disability). Predisposing factors such as demographic features, social structures,

beliefs, and attitudes can be used to predict the differential propensity of need between groups (Starrett, Rogers, and Walters, 1988; Ward, 1977; Anderson and Newman, 1978). Age, gender, and marital status, to name a few, are predisposing factors which have been studied in relation to use of chronic care services (Starrett et al., 1988; Wolinsky, 1978).

This study examined both demographic and socio-economic predisposing factors. The demographic factors included the gender, age, and ethnic composition of a community. The socio-economic factors included (on a community level) unemployment rate, mean annual income, educational attainment, and number of individuals per household.

A number of studies and surveys have described the extent and causes of chronic illness and disability in Canada in relation to demographic and socio-economic predisposing characteristics. Less, however, is known specifically about the chronic illness and disability among different ethnic groups in Canada, particularly aboriginal people.

2.2.1 Age

The 1983 -1984 Canadian Health and Disability Survey described disability (limitation in normal daily activity) among people age 15 and over[4] and the 1986 - 1987 Health and Activity Limitation Survey described both children and adults

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[4] The Canadian Disability Survey did not include "residents of the Yukon, Northwest Territories, persons living on Indian reserves, full-time members of the armed forces and persons living in institutions" (Statistics Canada, 1985, 12).

who reported a limitation in the "kind or amount of activity they could undertake because of a health problem or condition" (Statistics Canada, 1990, xix). Both surveys, as well as 1986 census data, found that a greater proportion of Canadians age 65 years or older were disabled than Canadians under the age of 65 (Statistics Canada, 1985; Statistics Canada, 1990; Nessner, 1994). Moreover, Nessner reported that 82% of people aged 85 years or greater were disabled.

The A.D.C.I.A., conducted by the N.W.T. Department of Health in 1985 -1986, was the first extensive study of chronic care needs among N.W.T. residents (G.N.W.T., 1987). A comparison of the results of the A.D.C.I.A. and the Canadian Disability Survey, showed that similar disability rates existed among people over the age of 65, although N.W.T. elderly more often reported milder disabilities (Miles-Tapping, 1989). In the Inuvik Region, the 1985/86 assessment found that 61% of all I.R.C.C. were 65 years of age or more (G.N.W.T., 1987). Furthermore, I.R.C.C. in this age group had higher levels of need than I.R.C.C. between 15 and 64 years of age. The 1995 A.D.C.I.A. update in the Inuvik Region identified a total of 284 I.R.C.C., of whom 246 (86.6%) were 18 years of age or more (I.R.H.B., 1996b). However, a greater proportion of I.R.C.C. under the age of 18 years (42%) were at a higher level of need (level three) than those I.R.C.C age 18 years or more (12% at level three and four) (I.R.H.B., 1996b).

2.2.2 Gender

The Canadian Disability Survey found that a greater proportion of females than males, in all age groups, were disabled (Statistics Canada, 1985; Nessner,

1994). However, the Health and Activity Limitation Survey found that under the

age of 55, disabled males outnumbered disabled females, whereas age 55 years or

more, disabled females outnumbered disabled males (Statistics Canada, 1990).

Cassou, Derriennic, Iwatsubo, and Amphoux (1992) argued that when the longer

life expectancy of females was taken into consideration, that disability rates

between the genders did not differ significantly.

<u>2.2.3 Ethnicity</u>

Little information was available on disability rates among different ethnic

groups. However, in examining the data from the 1985-86 A.D.C.I.A.,

Miles-Tapping (1989) found that communities with greater concentrations of

non-aboriginal people appeared to have a lower prevalence of disability.

Miles-Tapping attributed this finding to the "healthy worker effect"; good health is

required for initial and continuing employment; mortality rates are lower among

employed persons than the general population (Monson, 1986). Most

non-aboriginal people moved to the Region for employment opportunities and

generally returned to the South when employment ceases or when long term

medical care is required (Personal Communication, Margaret Marshall, February 1,

1995).

<u>2.2.4 Cause of Disability</u>

According to a number of Canadian studies, the leading causes of disability among

all age groups (residing in their own homes and in institutions) were: (a) diseases

of the musculoskeletal system and connective tissue (including limb and joint

disorders), (b) diseases of the circulatory system, (c) diseases of the nervous system (including vision and sense disorders), (d) mental disorders, (e) trauma, (f) diseases of the respiratory system, (g) congenital anomalies and perinatal defects, and (h) diseases of the digestive system (Peron and Strohmenger, 1985; Statistics Canada, 1985; Statistics Canada, 1990, Alberta Health 1991). The causes of disability vary according to region and age. A 1991 study profiling the residents of long term care facilities in Alberta found that the most common medical diagnoses of residents under the age of 65 were: (a) multiple sclerosis, (b) epilepsy, (c) depression, (d) mental retardation, and (e) paralysis; whereas, among residents over the age of 65, the most common medical diagnoses were (a) osteoarthritis, (b) dementia (not including Alzheimer's), (c) hypertension, (d) diabetes, (e) heart failure, (f) Alzheimer's disease, and (g) Chronic Obstructive Pulmonary Disease (Alberta Health, 1991). Cerebrovascular accidents were a cause of disability in both age groups. Most disabled individuals report more than one cause of disability (Peron and Strohmenger, 1985; Statistics Canada, 1985; Statistics Canada, 1990, Alberta Health 1991).

Among aboriginal people, diabetes is the most commonly reported chronic condition (McClure et al., 1991), especially in the Western provinces (Bobet, 1994). Native people are also more likely than other Canadians to report respiratory diseases (McClure et al., 1992; Bobet, 1994; I.R.H.B., 1996a). Tuberculosis rates among natives also exceeded the Canadian rate (Bobet, 1994; Territorial Health Insurance Services Board and The Department of Health, 1990).

Little information was available about disabilities arising from accidents or chronic

diseases in the Northwest Territories (Territorial Health Insurance Services Board

and The Department of Health, 1990).

2.2.5 Socio-economic Factors

Four socio-economic indicators were of interest in this study: (a)

unemployment, (b) income, (c) education, and (d) housing. A number of studies

have documented the correlation between disability, unemployment, and income in

Canada. Unemployed individuals had greater rates and severity of disability and

report more health problems (D'arcy and Siddique, 1985; Ross and Shillington,

1990), especially musculoskeletal disorders (Badley and Ibanez, 1994) than the

general population. Disabled people also had lower incomes than the general

population, especially disabled women (Ross and Shillington, 1990). Disabled

people also had lower levels of formal education than the general population (Ross

and Shillington, 1990; Social Trends Analysis Directorate, 1986). Moreover,

Badley and Ibanez (1994) found that lower educational attainment was associated

with increased risk of disability. The association between unemployment, low

income, low educational attainment and disability was not surprising because the

three characteristics are interrelated (Badley and Ibanez, 1994); lower levels of

education results in lower employability resulting in lower annual income. Finally,

with regard to housing, a greater proportion of non-institutionalized disabled

people live either alone or with non-relatives than the general population (Ross and

Shillington, 1990; Social Trends Analysis Directorate, 1986).

Although significant associations between unemployment, income, education and housing have been found, these factors may not have been accurate indicators of disability in the Northwest Territories. In the Inuvik Region, as with the rest of the N.W.T., unemployment rates exceeded the national average (I.R.H.B., 1996a), and hence may not have been a sensitive indicator for disability; unemployment rates for native people were twice as high as unemployment rates among non-native people, and four times higher among natives aged 15 - 24[5] (Territorial Health Insurance Services Board and The Department of Health, 1990). Educational attainment, on average, was lower in the Region (and in the rest of the Northwest Territories) than in the rest of Canada (I.R.H.B., 1996a). Aboriginal residents in the Region may not have had access to more than the minimal educational resources. Finally, housing statistics in the Region may not have reflected housing trends in the rest of Canada because many extended families continue to live together, and because available public housing was limited in most communities in the Region (I.R.H.B., 1996a). The number of individuals per household, therefore, may not have been a reliable indicator of disability.

2.3 Chapter Summary

Chapter two summarized the literature relating to need and predisposing factors of chronic care need and provided information about the indicators which

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[5] The high unemployment rate was not due to native people choosing to pursue traditional activities (Territorial Health Insurance Services Board and The Department of Health, 1990).

can be used to predict chronic care need. The next chapter outlines the method

used to collect data, to describe the I.R.C.C., and to develop and evaluate two

forecasting models.

3.0 METHOD

3.1 Data Collection

The purpose of the A.D.C.I.A. was to identify each individual who required some form of chronic assistance according to the levels of need described in the N.W.T.A.P.G. The A.D.C.I.A. was conducted in each of the 12 communities in the Inuvik Region in 1985, 1988, and 1995. Records were available for all communities except Sachs Harbour, Paulatuk, and Tsiigehtchic in 1991. Similar methods were used to identify and classify I.R.C.C. during each A.D.C.I.A.

Project staff for each A.D.C.I.A. consisted of placement assessors and project coordinators. Assessors were care providers such as nurses, occupational and physical therapists, and social services workers who had some previous experience with chronic care. Assessors visited communities, identified I.R.C.C., classified them according to level of need, and gathered supporting documentation. Project coordinators were responsible for administrative matters and reviewing client summary charts for completion and accuracy. Prior to each A.D.C.I.A., resource personnel from the Department of Health and Social Services trained all project staff on the N.W.T.A.P.G. and its application. In each A.D.C.I.A., the project staff consisted of different people.

In each community, assessors conducted interviews with care providers such as community health centre personnel, community social services workers,

teachers, band or hamlet officials and, in some places, members of the elders'

committee. Respondents were asked to identify individuals who they felt required

chronic assistance and why. Because of the relatively small size of the

communities, care providers and community officials know community members

well, and thus were believed to be able to provide a complete list of I.R.C.C.

Assessors also reviewed patient lists from the chronic illness clinic[8] and

prescription lists[9] in order to complete a preliminary list of I.R.C.C.

Project staff then reviewed the medical charts of each individual to

document their level of need. These charts included age, health care plan number

(H.C.P.), medical diagnosis and treatments, family and social history as well as

other pertinent information. Those I.R.C.C. who were believed to be at level two

or greater were personally visited by project staff and assessed according to the

N.W.T.A.P.G. During personal assessments, each individual was briefed on the

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[8] Each community health centre organizes a weekly chronic illness clinic

during which time health centre staff monitor patients with chronic illnesses. The

chronic illness clinic is a part of the community health centres public health

programme.

[9] In all communities in the Region except for Inuvik, prescriptions are filled

by the community health centre. Medications which are not on the health centre

formulary are mailed to the health centre from the Inuvik Regional Hospital or

from a privately owned pharmacy located in Inuvik. Health centre nurses sort and

distribute medications on a weekly basis.

purpose of the study. Signed consent was obtained before assessments were conducted and translators were provided where necessary. Records from the 1995 A.D.C.I.A. indicated that two people refused a personal assessment and that another three were unavailable for personal assessment. Records did not indicate the number of individuals who refused personal assessment in the other years of the study, but these were also believed to be small.

Assessors then categorized each individual's level of need according to the criteria set out in the N.W.T.A.P.G., and information was summarized onto the client summary charts. Each record was independently reviewed by another project staff member, either another assessor or the project coordinator, all of whom had received training on the use of the N.W.T.A.P.G. Disagreements over classification were discussed between the reviewer and the assessor, and levels of need were reclassified by consensus of both raters.

The methodology used to collect data relied on a network of community care providers and health records in order to identify I.R.C.C. Potential weaknesses in the methodology, which may threaten the validity of the A.D.C.I.A. results, are discussed in chapter five.

3.2 Instrumentation

The N.W.T.A.P.G. was used to categorize level of need (G.N.W.T., 1987). The tool measured an individual's ability to perform activities of daily living, ability to travel, ability to perform household activities, medical-biological status, and

psycho-social status (Personal Communication, Margaret Marshall, February 1,1995). Medical diagnoses (supported by a medical chart review), although recorded, did not form the basis for categorization of need, as they were not accurate indicators of care requirements. Moreover, the levels of need provide information regarding the types of assistance required and provide information useful for planning (Miles-Tapping, 1989). During the 10 year period covered in the analysis the guide has not been significantly altered.

The Department of Health and Social Services classifies level of chronic need into four levels for adults (individuals 18 years of age and over) and three levels for children (G.N.W.T., 1987). Each level is described in chapter one.

3.3 Data Management

The data from the client summary charts were entered into an electronic data base using the Data Entry Form (Appendix B). The year of study (1985, 1988, 1991, 1995) was entered into the field labelled "YEAR". The individual's home community and N.W.T. health care plan number was entered into the field labelled "COMMUNITY" and "HCP" respectively. The individual's ethnicity, year of birth and gender were entered into the fields labelled "ETHNICITY", "BIRTH", and "SEX" respectively. Ethnicity was determined by the first letter of the H.C.P. number which distinguishes individuals by ethnicity, namely: (a) T for Inuit (specifically the Inuvialuit in the Inuvik Region), (b) D for Dene (specifically the Sahtu and Gwich'in people), (c) M for Metis, and (d) N for non-native.

Each disease condition for each individual was entered into one of 14

categories. Within some of these categories, specific conditions were also entered:

(a) diseases of the circulatory system (with specific note of heart disease, and

hypertension), (b) diseases of the musculoskeletal system (with specific note of

arthritis and rheumatism), (c) diseases of the respiratory system (with specific note

of asthma, and chronic obstructive respiratory disease), (d) mental disorders (with

specific note of Alzheimer's disease), (e) congenital anomalies (with specific note

of Down's syndrome and fetal alcohol syndrome), (f) diseases of the digestive

system, (g) diabetes, (h) multiple sclerosis, (i) epilepsy, (j) paralysis, (k) cerebral

palsy, (l) blindness, (m) deafness, and (n) other. The individual's level of need was

entered into the field labelled "LEVEL OF NEED". Mental retardation and mental

illness were included under the "mental disorders" category. The "blindness" and

"deafness" categories included all types of vision and hearing problems. The

categories used in this study were similar to the categories used in the Canadian

Health and Disability Survey (1983-84) and the Health and Activity Limitations

Survey (1986-87).

Two measures were taken to ensure the database was complete and

accurate. First, the H.C.P. number (an unique identifier) was used to verify that

duplicate records were not entered. Second, during each A.D.C.I.A., project staff

recorded the date when clients no longer required chronic care (because of death;

improvement in health; or for non-native clients, emigration from the Region).

These dates were used to verify whether records should have been included or removed from each A.D.C.I.A list.

Annual income statistics for the communities in the Region were available from 1986 to 1992, and unemployment rates were available for selected years between 1986 and 1994. Because the mean annual income and unemployment rate fluctuate considerably, 1995 values were not estimated. Income and unemployment statistics were calculated by Statistics Canada and the N.W.T. Bureau of Statistics. The percentage of individuals with less than a grade twelve education, and the percentage of households with one individual and more than six individuals was taken from the 1991 Aboriginal Peoples Survey (as presented in the Inuvik Region Profile) (I.R.H.B., 1996a).

3.4 Defined Population

The population for the study included all residents of the surveyed communities. I.R.C.C. outside of their home community at institutions[8] were included in the population of their home community (assuming that, if appropriate services were available, they would continue to reside in their home community). Home community was identified on the client summary charts. Community populations were adjusted to account for the addition or loss of individuals in each community.

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[8] I.R.C.C. outside the Region generally live in Yellowknife or Edmonton.

3.5 Description of I.R.C.C.

Once data were entered, the I.R.C.C. for each A.D.C.I.A. year was described according to age group, gender, and ethnicity relative to the total number of I.R.C.C. and the total Regional population. Category specific rates (number of I.R.C.C. per 100 people) were calculated for age, gender and ethnic groups. Age-gender group specific rates were also tabulated. However, age-gender specific rates were not calculated for each ethnic group because population composition by age, gender and ethnic group was not available.

Separate rates by age, by gender and by ethnic group were not calculated for the causes of disability and chronic illness. The number of cases in each category were too small to produce stable rates.

Socio-economic factors were described for each community rather than I.R.C.C. because this information was not collected for each I.R.C.C. Potential correlation between each indicator and the percentage of I.R.C.C. in the population were examined.

3.6 Model A

The first forecasting model developed was an ecological model which used multivariate linear regression to calculate the percentage of I.R.C.C. in the community population. Multivariate linear regression has been previously used to study the relationship between predisposing factors and health services utilization. In 1978, Wolinsky studied the relationship between an individual's predisposing

characteristics and health services utilization. Wolinsky et al. (1993) used data on predisposing, enabling, and need factors to examine the volume and consistency of hospital utilization. This study applied similar statistical models to health status needs rather than service utilization.

Initially, a multivariate linear regression was to be developed for each level of need for each A.D.C.I.A. year. However, because of the small number of adults at level three and level four, and the small number of children requiring chronic care, none of the independent variables achieved statistical significance. The original model was then slightly modified.

A single multivariate linear regression model was developed to predict the percentage of the community population which required chronic care at any level (the dependent variable) using independent variables which described the predisposing factors for each community. A model was developed for each A.D.C.I.A. year. Table 1 shows the independent variables entered into each regression.

Table 1.

Independent variables used in each regression in Model A

Independent Variable	1985	1988	1991	1995
% males in the population	x	x	x	x
% Dene in the population	x	x	x	x
% Inuit in the population	x	x	x	x
% non-aboriginals in the population	x	x	x	x
% of population between 20 and 39	x	x	x	x
% of population between 40 and 59	x	x	x	x
% of population between 60 and 79	x	x	x	x
% of population 80 and over	x	x	x	x
Unemployment rate	x	x	x	
Mean annual income		x	x	
% of population with less than high school			x	
% of population with 1 person/house			x	
% of population with 6 or more people/house			x	

x = entered into regression model

Bivariate linear regression analysis was used to assess the degree of association of each independent variable with the dependent variable, and to screen for

potentially significant associations for subsequent multivariate analysis. The

criteria for removal was $p \leq 0.40$. Category specific rates were also considered to

judge whether variables should be removed from the regression equation (i.e.

category specific rates were used to intuitively evaluate potential significance).

Backward stepwise regression was then used to determine the significant variables

in each regression equation.

The regression model produced coefficients which were used to determine

the percentage I.R.C.C. in the population. To calculate the number of I.R.C.C.,

this value was multiplied by the total population. The number of people at each

level of care was estimated by multiplying the calculated number of I.R.C.C within

each community by the overall proportions of individuals at each level of care.

Appendix C contains a sample calculation for a forecast using Model A.

3.7 Model B

The second forecasting model used a Markov chain which is useful for

studying the progression of disease (Jain, 1986) and for forecasting the state of a

system at some future time (Swain, 1981). The model determines, for longitudinal

data, the probabilities of change in disease/need from various starting points.

The probabilities are used to predict future outcomes. The Markov chain

has been applied in the long term care sector to examine the progression of clients

requiring chronic care services. Boult, Kane, Louis, and Ibrahim (1991) used

Markov chains to project transition rates to and from levels of functional ability, as

well as mortality rates. Norton (19??) examined the relationship between nursing

home funding schedules and change in health status of nursing home patients.

The Markov chain describes the progression of I.R.C.C. through various

levels of need. Each element in the transition matrix, P, defines the probability of

an individual moving from one state to another within a given time period. Figure

2 is an example of a three state transition matrix.

$$
P = \begin{bmatrix} P_{11} & P_{12} & P_{13} \\ P_{21} & P_{22} & P_{23} \\ P_{31} & P_{32} & P_{33} \end{bmatrix} = \begin{bmatrix} 0.5 & 0.2 & 0.3 \\ 0.1 & 0.2 & 0.7 \\ 0.4 & 0.4 & 0.2 \end{bmatrix}
$$

<u>Figure 2.</u> A Markov chain transition matrix.

The first digit in the subscript represents the row position (i.e. classification

at the beginning of the transition period [t_1]). The second digit in the subscript

represents the column position (i.e. the classification at the end of the transition

period [t_2]). P_{11} (0.5) describes the probability of an individual from state one

remaining in state one. P_{12} (0.2) describes the probability of an individual from

state one moving to state two (0.2) Note that the sum of the probabilities in each

row of the matrix is one.

To develop the Markov chain, the levels of care of I.R.C.C. were recorded

at the beginning and end of the transition period. At the beginning of the transition

period, all individuals in the population were classified into one of seven levels of

care or as not requiring care. At the end of the transition period, they were

counted in one of nine categories: (a) adult - level one, (b) adult - level two, (c) adult - level three, (d) adult - level four, (e) child - level one, (f) child - level two, (g) child - level three (h) alive and no longer requiring chronic care services, or (i) dead. Calculations for a three year projection are shown in Appendix D.

3.8 Model Evaluation

In order to evaluate Model A, the regression equation from each A.D.C.I.A. year was used to predict the I.R.C.C. in another year. In order to evaluate Model B, data from 1985 and 1988 were used to develop a transition probability matrix and predict the number of I.R.C.C in 1991.

This study used the evaluation measures described by Lane, Uyeno, Stark, Kliewer, and Gutman (1985) in their study of forecasting models. Five measures were used: (a) mean absolute deviation, (b) bias, (c) weighted absolute deviation, (d) weighted bias, and (e) X^2. For each of the measures, the closer the value was to zero, the closer the projections were to actual values. Mean absolute deviation described the mean size of error by summing the absolute values of the difference between the predicted and actual values and then calculating the mean. Because absolute values were used, the direction of error was not measured. Bias is the sum of the difference between the predicted and actual values. Bias measured the direction of error. Weighted absolute deviation is the sum of the absolute values of the differences between the predicted and actual values for each level of care, divided by the actual total number of I.R.C.C. It is expressed as a percentage.

Weighted bias is the sum of the differences between the predicted and actual

values for each level of care, divided by the actual total number of I.R.C.C. The

X^2 test statistic was used to test the significance of the null (H_0) and alternative

(H_A) hypotheses:

H_0 : the difference between the predicted and actual values was not

statistically significant; the actual values can be predicted by the model

H_A: the difference between the predicted and actual values was statistically

significant; the actual values can not be predicted by the model.

Because of the small size of the sample, the hypotheses was tested at $\alpha = 0.10$.

3.9 Need Forecasts

A Leslie matrix was used to estimate the population for 2005. The

advantage of the Leslie matrix is that it projects the size of each age group rather

than a total population size (Brown, 1993). Calculation used to predict the Leslie

matrix and the population projection are shown in Appendix E. The projected

population was then used in each of the forecasting models.

3.10 Chapter Summary

Chapter three described the method used to collect and process A.D.C.I.A. data

and outlined the methods used to describe the characteristics of the I.R.C.C. and to

develop and evaluate two forecasting models. The next chapter presents the results of the investigation.

4.0 RESULTS

4.1 Description of Regional Population

The Regional population was greater in 1995 than it was in 1985. In 1988 and 1991, the population was less than in 1985. In general, the population was quite young; over 75% of the population was under the age of 40 (Table F1). Between 1985 and 1995, males made up between 50% and 54% of the Regional population (Table F2). Table F3 shows the Regional population composition by age group and gender. The Dene, Inuit and non-native people were the three largest ethnic groups in the Region, accounting for over 90% of the total population (Table F4). Compared to 1985, in 1995, the proportion of Inuit and Dene increased, whereas the proportion of non-natives decreased.

4.2 Description of I.R.C.C.

The A.D.C.I.A. identified 211 I.R.C.C. in 1985, 205 in 1988, 162 in 1992, and 284 in 1995. Adults (individuals aged 18 years or greater) made up the majority of I.R.C.C. in each year (with a high of 91% in 1991 and a low of 86% in 1995). I.R.C.C. at either level one or two accounted for a minimum of 75% of the total number of I.R.C.C. in each year. Table 2 shows the relative proportion of the levels of need.

Table 2.

Levels of Care of I.R.C.C (1985 - 1995)

Level of Care	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
Adults				
One	104 (49.3)	105 (51.2)	98 (60.5)	141 (49.6)
Two	58 (27.5)	55 (26.8)	42 (25.9)	79 (27.8)
Three	21 (10.0)	25 (12.2)	12 (7.4)	18 (6.4)
Four	4 (1.9)	2 (1.0)	1 (0.6)	8 (2.8)
Children				
One	13 (6.1)	7 (3.4)	4 (2.5)	23 (8.1)
Two	4 (1.9)	4 (2.0)	2 (1.2)	10 (3.5)
Three	7 (3.3)	7 (3.4)	3 (1.9)	5 (1.8)
Total	211 (100)	205 (100)	162 (100)	284 (100)

4.2.1 Age

In general, chronic care need increased with age. Between 1985 and

1995, individuals over the aged 60 and over made up between 5% and 7% of the

Regional population. During the same period, however, they accounted for at

least 60% of the I.R.C.C. (Table 3).

Table 3.

I.R.C.C. by age group (1985-1995)

Age Group	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
0-19	25 (11.8)	26 (12.7)	16 (9.9)	44 (15.5)
20-39	27 (12.8)	24 (11.7)	19 (11.7)	39 (13.7)
40-59	26 (12.3)	32 (15.6)	23 (14.2)	26 (9.2)
60-79	90 (42.7)	76 (37.1)	66 (40.7)	112 (39.4)
80+	43 (20.4)	47 (22.9)	38 (23.7)	63 (22.2)
Total	211 (100)	205 (100)	162 (100)	284 (100)

Table 4 shows that the number of I.R.C.C per 100 people varied in all age groups between 1985 and 1995. The highest rate was in the 80 years or more age group. The rate also increased over time; the rate was higher in 1995 than it was in 1985 in all age groups except for the 40 to 59 years cohort.

Table 4.

Age Group Specific Rate (number of I.R.C.C. per 100 people)

Age Group	1985	1988	1991	1995
0-19	0.70	0.64	0.54	0.54
20-39	0.76	0.81	0.62	1.16
40-59	1.96	2.25	1.61	1.54
60-79	21.13	15.38	15.42	21.71
80+	55.13	71.79	55.88	75.90

4.2.2 Gender

Table 5 shows the I.R.C.C. by gender. Between 1985 and 1995 the proportion of

male I.R.C.C. decreased and the proportion of female I.R.C.C. increased.

Table 5.

I.R.C.C. by gender (1985 - 1995)

Age Group	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
Male	111 (52.6)	102 (49.8)	75 (46.3)	128 (45.1)
Female	100 (47.4)	104 (50.2)	87 (53.7)	156 (54.9)
Total	211 (100)	205 (100)	162 (100)	284 (100)

Although males outnumbered females in the general population between

1985 and 1995, females had a higher rate of requiring chronic care (Table 6). The

difference between the two rates has grown since 1985.

Table 6.

Gender specific rate (number of I.R.C.C. per 100 people)

Gender	1985	1988	1991	1995
Males	2.34	2.17	1.87	2.60
Females	2.39	2.43	2.17	3.53

Variability in the total number of I.R.C.C. for each gender can be

explained, to a large degree, by the variability of the rates in the 60 to 79 and 80

and over age groups. Table 7 shows that the largest differences in rates occurred in these two age groups.

Table 7.

Gender-age group specific rates (number of I.R.C.C. per 100)

Age Group	1985	1988	1991	1995
Male				
0-19	0.74	0.59	0.50	1.27
20-39	1.02	0.88	0.63	0.94
40-59	1.91	2.22	1.51	1.60
60-79	15.93	11.06	11.01	18.73
80+	62.79	78.57	62.50	64.71
Female				
0-19	0.65	0.69	0.57	1.15
20-39	0.48	0.74	0.60	1.41
40-59	2.06	2.28	1.74	1.46
60-79	27.00	19.91	20.0	24.90
80+	45.71	72.22	50.0	83.67

4.2.3 Ethnicity

Although the Dene, Inuit and non-native groups made up approximately equal proportions of the Regional population, the Dene and Inuit made up considerably larger proportions of I.R.C.C. (Table 8). The rate for non-natives was three times greater in 1995 than it was in 1985. The rate for the Metis was almost four times as greater in 1995 than in 1985 (this calculation, however, is based on a very small number of I.R.C.C. and may not represent a stable rate).

Table 8

I.R.C.C. by ethnicity (1985 - 1995)

Age Group	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
Dene	144 (68.2)	126 (61.5)	89 (54.9)	155 (54.6)
Inuit	57 (27.0)	63 (30.7)	52 (32.1)	93 (32.7)
Non-native	9 (4.3)	15 (7.3)	20 (12.4)	32 (11.3)
Metis	1 (0.5)	1 (0.5)	1 (0.6)	4 (1.4)
Total	211 (100)	205 (100)	162 (100)	284 (100)

The Dene had the highest group specific rate (Table 9). The rates increased for all groups. Age-gender group rates for each ethnic group was not calculated because, population composition by age, ethnicity and gender was not available, and further analysis was not possible.

Table 9.

Ethnic groups specific rate (number of I.R.C.C per 100 people)

Ethnic Group	1985	1988	1991	1995
Dene	5.15	4.58	3.14	5.21
Inuit	2.34	2.22	2.09	3.26
Non-native	0.29	0.59	0.85	0.88
Metis	0.16	0.12	0.13	0.58

4.2.4 Cause of Disability or Chronic Illness

Table 10 shows the number and proportion of I.R.C.C. reporting each cause of disability or chronic illness. Note in each A.D.C.I.A. year, the

percentages do not add to 100 because more than one cause of disability or

chronic illness may have been reported for each I.R.C.C.

Table 10.

Causes of disability and chronic illness reported by I.R.C.C.

Cause	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
Diseases of the circulatory system	24 (11.4)	28 (13.7)	25 (15.4)	61 (22.5)
Diseases of the musculoskeletal system	32 (15.2)	39 (19.0)	47 (29.0)	105 (37.0)
Diseases of the respiratory system	19 (9.0)	18 (8.8)	24 (14.8)	53 (18.7)
Mental disorders	47 (22.3)	45 (22.0)	29 (17.9)	54 (19.0)
Congenital abnormalities	11 (5.2)	12 (5.9)	11 (6.8)	36 (12.7)
Diseases of the digestive system	5 (2.4)	5 (2.4)	4 (2.5)	17 (6.0)
Diabetes	8 (3.8)	6 (2.9)	3 (1.9)	13 (4.6)
Paralysis	14 (6.6)	13 (6.3)	9 (5.6)	18 (6.3)
Multiple sclerosis	0	1 (0.5)	0	0
Cerebral palsy	2 (0.9)	3 (1.5)	3 (1.9)	8 (2.8)
Seizure disorders	9 (4.3)	11 (5.4)	10 (6.2)	18 (6.3)
Hearing problems	17 (8.1)	15 (7.3)	12 (7.4)	32 (11.3)
Vision problems	14 (6.6)	15 (7.3)	17 (10.5)	41 (14.4)
Other	100 (47.4)	89 (43.4)	66 (40.7)	72 (25.4)
Frailty	76 (36.0)	67 (32.7)	43 (26.5)	28 (9.6)

Frailty due to age was the most common entry in the "Other" category.

Between 1985 and 1995, the leading causes of disability were: (a) frailty - reported

for a mean of 26.2% of the I.R.C.C., (b) diseases of the musculoskeletal system -

reported for a mean of 25.1% of the I.R.C.C., (c) mental disorders - reported for a

mean of 20.3% of the I.R.C.C., (d) diseases of the circulatory system - reported

for 15.8% of the I.R.C.C., and e) diseases of the respiratory system - reported for

a mean of 12.8% of the I.R.C.C.

The most commonly reported diseases of the circulatory system was heart

disease (Table F5). Chronic obstructive pulmonary disease (C.O.P.D.) was the

most commonly reported disorder of the respiratory system, and arthritis was the

most commonly reported disease of the musculoskeletal system. Between 1985

and 1995, only three cases of Alzheimer's disease were reported (all three cases

were reported in 1995). The number of F.A.S.[9] cases in 1995 was seven times

greater than the number of cases in 1985. Between 1985 and 1995, the proportion

of I.R.C.C reporting more than one cause of disability increased (Table F6).

<u>4.2.5 Socio-economic Factors</u>

Tables F7, F8 and F9 show the values of the four indicators included in the

model and the percentage of I.R.C.C. in the total population for each community.

Between 1985 and 1991, the percentage of I.R.C.C. in each population remained

fairly constant regardless of the unemployment rate. Norman Wells and Inuvik

showed a smaller percentage of I.R.C.C. and lower unemployment rates, but both

these communities have comparatively high proportions of non-aboriginal people.

Moreover, the unemployment rate included only those people who were in the

labour force (individuals over the age of 15 who were either employed or seeking

employment). Many of the I.R.C.C. in the Region may not have been part of the

labour force because of their age or disability.

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[9] Fetal Alcohol Effects (F.A.E.) was counted in the same category as F.A.S.

The percentage of I.R.C.C. decreased as mean annual income increased but

when Inuvik and Norman Wells were not considered, the trend was not as clear.

Moreover, because this statistic is based on income stated on tax returns, it may

not reflect actual income, and thus may not be a reliable indicator of actual income.

In communities with predominantly aboriginal populations, between 60%

and 71% of the population had less than a grade 12 education, far more than

communities with large non-aboriginal populations. Even when Inuvik and

Norman Wells were not included in the analysis, there was not a clear trend

between educational attainment and the percentage of I.R.C.C in the population.

With regard to housing, previous studies indicated that

non-institutionalized disabled individuals were more likely to ..ve alone than other

Canadians (Ross and Shillington, 1990; Social Trends Directorate, 1986).

Although there was a positive correlation between the percentage of I.R.C.C. in

the population and the percentage of the population with only one person per

household, the same trend is seen with the percentage of I.R C C. in the

population, and the percentage of the population with six or more people per

household.

4.3 Model A

Table 11 contains the results of the multivariate linear regression for each

A.D.C.I.A year[10]. The table shows which independent variables were initially

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[10] Calculations used to develop Model A are described in Appendix C.

included in each year, the variables which were removed after bivariate analysis, as

well as the variables in the final regression equation.

The 1991 regression equation posed an additional challenge because there

were more variables than there were communities. Because of the poor

relationship between socio-economic variables and the percentage of I.R.C.C. in

the population, the socio-economic variables were removed from the model to

decrease the number of independent variables.

Table 11.

Regression Coefficients and Model Statistics for Model A

Independent Variables	1985	1988	1991	1995
Age				
% pop. 0-19	2.7060*	+	+	+
% pop. 20-39	+	-	-	-
% pop. 40-59	+	-	-	+
% pop 60-79	+	-	-	-
% pop. 80+	+	-	1.1890*	1.4352*
Gender				
% pop. male	-	-	+	-
Ethnicity				
% pop. Dene	-	-	-	-
% pop. Inuit	-0.3834*	+	-	-
% pop. Non-native	+	-	-	-
Economic				
Mean annual income	x	-	-	x
Unemployment rate	+	0.0301	-	x
Education				
% pop. < grade 12	x	x	-	x
Housing				
% pop. 1/house	x	x	+	x
% pop. 6+/house	x	x	-	x
Model Statistics				
Intercept	-0.9206*	-0.0086	0.0109	0.0191
R^2	0.4988	0.2962	0.751	0.7303
Adjusted R^2	0.3874	0.2258	0.7154	0.7034

*$p \leq 0.05$
x - not entered into model
+ - removed after bivariate analysis
- not significant

The most consistent predictor was age, particularly the percentage of the population aged 80 years and over. Gender was not a significant predictor in any of the models, and ethnicity was significant in only the 1985 model. Of the socio-economic factors, only unemployment was a significant predictor, but only in the 1988 model.

Each regression equation was evaluated in two ways: how well it fit the data for a given year and how close the predicted values were to actual values of I.R.C.C. The square of the correlation coefficient (R^2) describes the proportion of the variability in the dependent variable which is "explained" by the regression. It evaluates how well the model fits the data for a given year. The adjusted R^2 takes into consideration that a regression model fits the particular data better than it will fit the population. Both measures are indications about the goodness of the fit of the regressions. The R^2 value for 1985 and 1988 models are low, indicating that the models do not fit the data well. For the 1991 and 1995 equations, the R^2 and the adjusted R^2 values were very reasonable, suggesting that the model fit the data well.

In order to evaluate how well the model predicts need, the regression equation from each year was used to estimate the I.R.C.C. for the other A.D.C.I.A. years (Table 12).

Table 12.

Predicted I.R.C.C. values using Model A regression equations

Regression Equation	Estimate Year			
	1985 (n)	1988 (n)	1991 (n)	1995 (n)
1985	-	194	-192	164
1988	-29	-	-25	-
1991	193	190	-	200
1995	263	259	235	-

The regression equation from 1985 underestimated the total number of I.R.C.C. in 1988 and 1995 and produced a negative number for 1991. The 1988 regression equation produced negative values for both 1985 and 1991 estimates. The poor predictions and the and the low R^2 values indicate that these two regression equations are poor forecasting tools.

The 1991 equation underestimated need and the 1995 equation overestimated it. The data from these two years were pooled to produce another regression equation (Table F10). An additional regression was developed using data from all four years. The regression included only the age variables because of the clear differences in age group specific rates, and because age was the most consistent predictor from the first four regression equations. Because the results of the regression analysis were consistent with the results of the 91/95 pooled regression, and used a larger number of data points, the pooled data equation was used in the Model A predictions (shown in Table 13).

Table 13.

Regression Coefficients and Model Statistics for Pooled Data

Independent Variables	Pooled
Age	
% pop. 0-19	-
% pop. 20-39	-
% pop. 40-59	-
% pop 60-79	0.2966*
% pop. 80+	1.3127*
Model Statistics	
Intercept	-0.0016*
R^2	0.7023
Adjusted R^2	0.6882
*$p \leq 0.05$ - not significant	

The R^2 value for the pooled data indicated that the model fits the data

reasonably well. Table 14 shows the I.R.C.C. estimates for each year. To

determine the number of I.R.C.C. at each level, the mean proportion of I.R.C.C.

was calculated using the proportions from each of the four years.

Table 14.

Forecasted number of I.R.C.C using Pooled Data Regression Equations

Level of Care	1985	1988	1991	1995
Adult - One	114	115	111	131
Adult - Two	59	59	56	67
Adult Three	20	20	19	22
Adult Four	3	4	3	4
Child One	11	11	10	12
Child Two	5	5	5	6
Child Three	5	5	5	6
Total	217	219	209	248

In general, the regression model overestimated for 1985, 1988 and 1991 whereas it underestimated for 1995. The I.R.C.C. estimates were evaluated using the five measures shown in Table 15.

Table 15.

Evaluation of Model A estimates

Measure	1985	1988	1991	1995
Mean Absolute Deviation	2.57	4.00	6.71	6.57
Bias	0.86	2.00	6.71	-4.57
Weighted Deviation	0.08	0.13	0.22	0.18
Weighted Bias	0.03	0.06	0.22	0.12
χ^2	2.63	5.89	15.13	20.55
degrees of freedom	6	6	6	6
$\chi^2 critical$	10.64	10.64	10.64	10.64

The table shows that, although slightly overestimated, the predictions for

the 1985 and 1988 values are quite close to actual values. The Chi square analysis

for each of the years showed that the difference between actual and predicted

values was not statistically significant. The model overestimated 1991 values

whereas it underestimated 1995 values. The difference between predicted and

actual values for 1991 and 1995, however, were statistically significant.

4.4 Model B

Model B was used to forecast the number of I.R.C.C. in 1991, given the

1988 data. Calculations used to develop the three year forecast are shown in

Appendix D. Table 16 shows the estimate of I.R.C.C. in 1991 as well as the actual

1991 data.

Table 16.

Model B estimate of 1991 I.R.C.C.

Level of Care	1991 estimate	Actual 1991 data
Adult One	94	98
Adult Two	49	42
Adult Three	24	12
Adult Four	1	1
Child One	4	4
Child Two	3	2
Child Three	7	3
Total	182	162

The estimate was evaluated using five measures shown in Table 17. Model B overestimated chronic care need, however, the X^2 test found that the difference between the actual and forecasted values was not statistically significant.

Table 17.

Evaluation of Model B estimate

Measure	Model B 1991 estimate
Mean Absolute Deviation	4.00
Bias	2.86
Weighted Deviation	0.15
Weighted Bias	0.11
χ^2	9.79
degrees of freedom	6
$\chi^2 critical$	10.64

4.5 Need Forecasts

Both Model A and Model B were used to forecast the number of I.R.C.C. in 2005. The pooled regression equation was used for Model A. Similar to the method used to develop a three year matrix, a ten year matrix was tabulated using collected A.D.C.I.A. data. An alternative method of estimating the transition matrix is to multiply the three year transition matrix three times (P^3), to estimate a ten year matrix. The transition matrix used in the 2005 need prediction is shown below:

$$\begin{bmatrix} 0.3173 & 0.1154 & 0.0288 & 0 & 0 & 0 & 0 & 0.1731 & 0.3354 \\ 0.1900 & 0.2758 & 0.0344 & 0 & 0 & 0 & 0 & 0.1033 & 0.3695 \\ 0 & 0.0477 & 0.1904 & 0.0477 & 0 & 0 & 0 & 0.0952 & 0.6190 \\ 0.2500 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0.7500 \\ 0.3846 & 0.0769 & 0 & 0 & 0.0769 & 0 & 0 & 0.4615 & 0 \\ 0 & 0.2500 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.1429 & 0.2857 & 0.5714 & 0 & 0 & 0 & 0 & 0 \\ 0.0107 & 0.0055 & 0.0008 & 0.0003 & 0.0024 & 0.0011 & 0.006 & 0.9447 & 0.0339 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

Figure 3. Ten year transition probability matrix.

Using a Leslie Matrix, the 2005 population was projected at 9506, an

increase of 224 from 1995 (calculations are explained in Appendix E). Table 18

shows the forecast for I.R.C.C. in 2005 using both Model A and B.

Table 18.

I.R.C.C. forecasts for 2005

Level of Care	Model A n	Model B n
Adult One	265	169
Adult Two	72	95
Adult Three	24	19
Adult Four	4	6
Child One	13	24
Child Two	6	10
Child Three	7	6
Total	265	329

4.6 Chapter Summary

Chapter four presented the results of the study. The next chapter discusses the findings, considers their implication in resource and service planning, and examines limitations of the investigation.

5.0 DISCUSSION

5.1 Description of I.R.C.C.

The description of I.R.C.C. revealed a number of trends about chronic care needs in the Inuvik Region. In general, need increased with age. The highest rate of need was in the 80 or more age group, a finding which is supported by previous studies (Statistics Canada, 1985; Statistics Canada, 1990; Nessner, 1994). Each gender had roughly equal rates of need when differences in age in the cohorts were considered.

The smaller relative proportion of non-native I.R.C.C. and the lower group specific rate confirm suspicions that non-natives collectively had lower chronic care need than Dene and Inuit people. Miles-Tapping (1989) accredited this trend to the "healthy worker effect"; most non-native people resided in the Region because of employment opportunities, and returned to the South once employment ended or chronic illness or disability occurred.

The lower rate among Metis was more difficult to explain. The lower rates among Metis, as well as the relatively small number of Metis in the Regional population may be due to a small number of people claiming Metis status. Between 1985 and 1995, each of the three aboriginal groups (the Inuvialuit, Gwich'in, and Sahtu Dene) had completed or were negotiating land claims. In order to benefit from the land claim (as well as to increase the amount of the settlement) residents may have been more inclined to claim Dene or Inuit status

than Metis. Moreover, status Dene and Inuit enjoyed non-insured health benefits[11] and affirmative action policies whereas Metis did not[12].

The disparity in rates between the Inuit and Dene was a potentially important finding. However, further research is required to determine if the higher need in these ethnic groups was due to the age and gender composition of the population.

The overall increase in chronic care need also warrants further examination. The increase may have been due to ageing within each age group which may not have been detected in 20 year age group divisions. The increase in the number of I.R.C.C. (and hence need) may have been due to weaknesses in the data collection methodology or instrumentation (N.W.T.A.P.G.). These potential limitations to the validity of the results are discussed in greater detail later in this chapter.

The causes of disability or chronic illness in the Inuvik Region were somewhat similar to the rest of Canada. Previous Canadian studies found that the leading causes of disability and chronic illness in Canada were (a) diseases of the musculoskeletal system and connective tissue (including limb and joint disorders), (b) diseases of the circulatory system, (c) diseases of the nervous system (including vision and sense disorders), (d) mental disorders, (e) trauma, and (f) diseases of the

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[11] Non-insured health benefits are health services provided free of charge to status (treaty) Indians, Dene, and Inuit by the Federal Government.

[12] The Territorial Government extended non-insured health benefits to Metis in the fall of 1995.

respiratory system, (g) congenital anomalies and perinatal defects, and (h) diseases of the digestive system (Peron and Strohmenger, 1985; Statistics Canada, 1985; Statistics Canada, 1990, Alberta Health 1991)[13]. Frailty, which was the leading cause of disability and illness in the Inuvik Region, was not listed as a specific cause in the surveys used in the other studies and was not reported as a specific cause of disability or chronic illness.

The increase in the number of I.R.C.C. reporting circulatory and musculoskeletal diseases and the decrease in the reporting of frailty may imply that project staff may have better documented cases in 1995 than in 1985. Moreover, increased awareness of some diseases, such as Fetal Alcohol Syndrome (F.A.S.), among key informants and project staff may explain its sudden increase in 1995. This increase also raised questions. F.A.S. results from maternal consumption of alcohol during pregnancy producing multiple features in offspring, including

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[13] When vision and hearing problems are counted in one category (diseases of the nervous system - including sense disorders, the leading causes of disability and chronic illness in the Inuvik region between 1985 and 1995 were: (a) frailty - reported for a mean of 26.2% of the I.R.C.C., (b) diseases of the musculoskeletal system - reported for a mean of 25.1% of the I.R.C.C., (c) mental disorders - reported for a mean of 20.3% of the I.R.C.C., (d) diseases of the nervous system - reported for a mean of 18.2% of the I.R.C.C., (e) diseases of the circulatory system - reported for a mean of 15.8% of the I.R.C.C., and (f) diseases of the respiratory system - reported for a mean of 12.8% of the I.R.C.C.

"microcephaly, pre-natal and post-natal growth deficiencies mental retardation, and facial defects" (Morrison, 1982, 9). A patient afflicted with F.A.S. may demonstrate any combination of the anomalies in varying degrees. F.A.S. is difficult to diagnose conclusively, and reports of F.A.S. in I.R.C.C. may be suspicions rather than confirmed diagnosis (Personal Communication, Margaret Marshall, February 1, 1995), especially in children who reported a milder form of F.A.S., termed Fetal Alcohol Effects (F.A.E.). Children with F.A.E. may exhibit growth deficiency, behavioural problems, and/ or learning disabilities. Children who were "poorly behaved and slow learners" in 1985 may have been be suspected of suffering from F.A.S. or F.A.E. in 1995[14].

5.2 Model A

The regression equation used in Model A was based on data from each A.D.C.I.A. year and built upon the information gained from the description of the I.R.C.C. The model fit the data well and produced reasonable estimates for each A.D.C.I.A year.

Further research, particularly about need in each ethnic group, may produce a more reliable model which uses more specific independent variables. Rather than use the percentage of the population over the age of 80, a refined

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[14] In addition to the children identified as requiring care, the 1995 A.D.C.I.A project staff compiled a list of 208 children who did not meet level one (child) criteria, but were suspected of having F.A.E (I.R.H.B., 1996b).

model may distinguish the ethnicity of the age group, e.g. the percentage of the population which is Dene <u>and</u> over the age of 80, the percentage of the population which is Inuit <u>and</u> over the age of 80, etc. Moreover, if non-natives and Metis do not contribute significantly to the number of I.R.C.C., forecasts based on the Inuvialuit and Dene population, rather than the total population, may produce more accurate estimates of need.

5.3 Model B

The Markov Chain is a method of forecasting which was readily adaptable to the information available from the A.D.C.I.A. The model was realistic in that it included the possibilities that individuals could be discharged from the system due to improvement in health status or death. However, the model was restricted by a number of assumptions. First, it assumed that the transition probability for all I.R.C.C. was homogeneous; all individuals progressed from state to state at identical rates. It did not account for characteristics which may predispose some individuals to deteriorate at a greater rate than other individuals. Boult et al. (1991) found that the transitions probabilities change depending upon the age, gender and cause of disability of the individuals considered, and recommended developing transition matrices for different groups of I.R.C.C. Further study is required to determine which predisposing factors influence transition probabilities.

Second, the study considered a small sample size, particularly of children and of adults at level three and four in the transition matrix. Additional research

with the data from the other regions in the Northwest Territories may produce

more accurate transition probabilities.

Again, additional study about the relationship between ethnicity and need

may improve the model. Probabilities for the eighth row (new cases from the

population) may be more accurate if they are based on the Inuvialuit and Dene

population rather than the total population

5.4 Need Forecasts

Both models depended on population projections in its need forecast.

Estimates for future Regional population are variable because the size of the

population is highly dependent on economic activities in the Region. The majority

on non-native residents would leave the Region if employment opportunities

ceased. On the other hand, if oil and gas exploration or mining ventures were

further developed, more people (of all ethnic groups) would likely reside in the

Region. Finally, estimates for shorter periods of time (e.g. under five years) may

provide more reliable, and hence, useful forecasts.

5.5 Implications for Service and Resource Planning

The findings of this study, particularly the description of the I.R.C.C.,

provide information which may be useful in the planning of services and resources.

The majority of the I.R.C.C. were at levels one and two and required homemaking

or homecare. Both these services can be organized and provided by community

organizations (in accordance with the Community Wellness policy and the

Community Transfer Initiative). However, given the small number of I.R.C.C. that

were at level three and four care, institutional and respite care should remain

regionally administered programs.

The causes of disability and illness in the Region provide some indication of

the types of prevention, therapeutic, and rehabilitation programs required. For

example, the increase in the number of suspected F.A.S. cases suggested a need

for appropriate assessment and prevention programs. Administrators also need to

consider whether there are sufficient resources to prevent and treat diseases of the

circulatory, musculoskeletal and respiratory system, as well as mental disorders.

Better understanding the distribution of need in the population can assist in

resource allocation. For example, funding formulas can be based on the segments

of the population which display need rather than the total population. In the

Inuvik Region, the findings suggest that the formulas should consider the number

of elderly and the number of Dene and Inuvialuit in the population rather than the

total population size without consideration of its composition..

5.6 Potential Limitations to Validity

The validity of the findings of the study depended upon the data collection

methodology, the classification instrument, and the statistical models.

5.6.1 Data Collection

A.D.C.I.A. project staff compiled preliminary lists of I.R.C.C. through key informant interviews in each community. Relying on community based informants presents two threats to the validity of the number of I.R.C.C. First, because of familiarity with complaints, health centre staff may have dismissed individuals with minor ailments or minor disabilities, producing false-negative results (Miles-Tapping, 1989). Second, because the A.D.C.I.A. was potentially tied to increased community resources with proven need, some community members may have overstated disability in order to increase community resources, producing false-positives results (Miles-Tapping, 1989). In 1985, homecare and homemaking services were available only in Inuvik. Between 1985 and 1995, the homecare program was expanded in Inuvik and funding was available from the D.O.H.S.S. to contract community based agencies to provide homemaking services, and build long term care facilities in Deline and Inuvik. In 1985, project staff and key informants may have understated need because services (or funding) were not available. In 1995 however, they may have overstated need in order to gain more services and funding. In 1985, project staff were D.O.H.S.S. personnel. In 1995, the project staff were I.R.H.B. personnel, specifically staff from the Homecare department who may have been motivated to justify or increase departmental funding.

Controlling the for variation in key informants over a ten year period may not have been possible as informants may have changed positions or left the

Region. Moreover, research guidelines in the Northwest Territories stipulate that community members should be involved and consulted in all research (Aurora Research Institute, 1996). This is particularly true for research gathered by government agencies (Personal Communication, Drew Lockhart, April 28, 1994).

5.6.2 Instrumentation

Similar methods were not used to classify all I.R.C.C. Those at level two or greater were personally assessed. Individuals at level one (or those considered not disabled by the classification criteria) were assessed by information gathered from care providers and medical charts. The assessor's interpretation of information relating to level of need may vary depending on the source.

Although all assessors used the N.W.T.A.P.G. and identical classification criteria, each assessor may have interpreted the guide differently. Because of the small number of descriptors for each level of care, there was a potential for variability in each assessor's interpretation of the criteria for each level (Personal Communication, Barbara Bracko, January 31, 1996). Although the review by a second party may have reduced the variation in interpretation, individual judgement and assessing styles may have influenced the documentation gathered to support a classification (as well as information which was omitted). The reviewer had access to only the information provided on the client summary charts, and not other information which may have refuted the classification of need.

Additional study is needed to verify if the N.W.T.A.P.G. was a reliable tool for classifications. Modifications to the instrument may be required to reduce potential misinterpretations and to increase the accuracy of the tool.

In its defence however, the data was useful in its original purpose which was to identify and keep record of I.R.C.C. The limitations described above extend from using data which was not collected purposely for this investigation. Future study must specify more rigid data collection protocol to address the limitations outlined above.

5.6.3 Forecasting Models

Both models used small samples which may not have provided stable statistical information. Pooling the data (as in Model A) may have produced more stable coefficients since more data points were used in the regression analysis. Further investigation is required to determine whether the model satisfied the five assumptions of any regression model: linearity[15], normality, homogeneity of variance, independence dependent and independent variables, and elimination of outliers.

For future studies, two alternative models, probit and logit analysis should also be considered. These models are less well-known, but may be more appropriate than the linear model, particularly when the dependent variables are

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[15] In order to test for colinearity, forward stepwise regression was performed on Model A (pooled data) and the exact same results were obtained.

proportions as was the case in this study. In 1985 and 1995, the A.D.C.I.A. was

carried out in most N.W.T. communities. This provides an excellent opportunity

to re-evaluate the models using a larger sample size.

5.7 Chapter Summary

Chapter five discussed the results, their application, and limitations. Final

conclusions and recommendations are presented in the next chapter.

6.0 CONCLUSIONS AND RECOMMENDATIONS FOR POLICY MAKERS AND RESEARCHERS

Any planning effort begins with an assessment of need, both present and future. Understanding the needs of a population allows administrators and care providers to plan appropriate services and to allocate resources. Predisposing factors have been used to better understand and forecast needs. The purpose of this study was to gain a better understanding of chronic care need, and to develop and evaluate two forecasting models. The findings of this study provide the basis of a rational planning process.

The findings show that different segments of the population have higher rates of chronic care need than others. Need increased with age and may be more prevalent in Inuvialuit and Dene populations than Metis and non-native populations. Further study is needed to examine the relationship between ethnicity and chronic care need. Trends between chronic care need and socio-economic factors, which have been documented in other Canadian populations, were not found in this population because of the vast difference in socio-economic climates in northern and southern Canada. Additional research is needed to identify appropriate socio-economic indicators in the North.

The study also found that some causes of disability and chronic illness may be more common in the Region than in the rest of Canada. Additional

investigation is required to understand the epidemiology of certain conditions, such as F.A.S.

Both of the models were promising forecasting tools. Replication of the study, with larger samples and greater control over potential limitations will improve the models and increase the reliability of the forecasts. Additional research may also determine if the two models are statistically appropriate. A.D.C.I.A. data were collected for most communities in the Northwest Territories in 1985 and again between 1993 and 1995. This provides an excellent opportunity to test the models using similar chronic care assessment and classification methods.

Future research about chronic care need must develop more rigid guidelines for data collection and classification to gather accurate and reliable assessments of need. Moreover, modifications to the N.W.T.A.P.G. may reduce ambiguity in its application and produce uniform interpretation among its users.

Many of the limitations described in the study resulted from using data which was not originally intended for this investigation. In order to support the evidence-based decision making process, researchers and policy makers must contemplate and clarify the types of information required and how the information can be used. Better information about need will support sound service planning, resource allocation, and policy-making.

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APPENDIX A

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NORTHWEST TERRITORIES ASSESSMENT AND PLACEMENT GUIDE

Northwest Territories

ASSESSMENT AND PLACEMENT RECORD

Department of Health and Department of Social Services

AGENCY COMPLETING ASSESSMENT:

LOCATION:

DATE:

CLIENT PROFILE

NAME
- Surname
- Given Name(s)

ADDRESS

DATE OF BIRTH: Day Month Year

PHONE NO:

MARITAL STATUS: ○ Single ○ Married ○ Other (specify) —

LANGUAGE(S) SPOKEN

LANGUAGE(S) WRITTEN

OCCUPATION

HEALTH CARE NO:

FAMILY MEMBERS/CLOSE FRIENDS — Check (✓) person responsible for client.
Note — If none, enter "NONE" in space.

✓	NAME ADDRESS/PHONE NO.	DISTANCE/ CONTACT FREQUENCY	SUPPORTIVENESS OF CLIENT AND HOW
	NAME		
	ADDRESS/PHONE NO		
	NAME		
	ADDRESS/PHONE NO		
	NAME		
	ADDRESS/PHONE NO		
	NAME		
	ADDRESS/PHONE NO		

Comments

SUMMARY OF CLIENT PLACEMENT — Complete after assessment

☐ **LEVEL 1** SUPERVISORY CARE — Client is essentially independent and shows only a slight impairment (physical frailty and or minor mental deterioration).
Care required — mainly guidance or supervision with activities of daily living.

☐ **LEVEL 2** PERSONAL CARE — Client shows impairment of physical and or mental facilities.
Care required — supervision and assistance with activities of daily living (eg. hygiene and grooming, meals, laundry, and housekeeping services).
— Client gets around safely with or without aids, is able to feed him/ herself and is usually continent.
— This is 24 hour custodial care and may be provided in an extended family/foster home with support services adult residential care facility, or personal care home.

☐ **LEVEL 3** NURSING HOME — Client has advanced physical and or mental illness that is reasonably stabilized and not expected to deteriorate in the near future (barring an accident or additional disease)
Care required — Nursing home facility.

☐ **LEVEL 4** EXTENDED/CHRONIC CARE — Client who requires regular and continuous medical attention, highly skilled technical nursing supervision on a 24 hour basis, and special techniques for improvement and/or maintenance of function.
Care required — Chronic care facility with access to diagnostic treatment facilities.

☐ **LEVEL 5** INTENSIVE REHABILITATION CARE — Client with physical disabilities who requires intensive therapy.
Care required — Special rehabilitation team
— Maximum benefit should probably occur within 3 months, at which time the client is transferred home or to another facility for a more appropriate level of care.

☐ **LEVEL 6** ACUTE CARE — Client (all ages) who requires short term diagnosis and treatment.
Care required — 24 hour medical nursing supervision in specialized hospitals.
— Outpatient services and day hospitals for mental illness are also included.

SERVICE SUGGESTED:

○ Home Independently ○ Home with Family Support ○ Home with Community Service ○ Appropriate Care Facility

○ Other (specify) —

IMPORTANT — enter "x" beside the applicable assessment.

A. ACTIVITIES OF DAILY LIVING

Columns: Initial Assessment | Final Goal | REASSESSMENT DATES - Day/Month/Year

1. LOCOMOTION
- Climbs stairs
- Climbs stairs with assistance
- Walks independently
- Walks with an aid
- Walks with assistance
- Wheelchair
- Wheelchair with assistance
- Bedridden

2. TRANSFERS (bed-chair, chair-toilet, etc.)
- Fully independent
- Independent with devices
- Requires assistance
- Totally dependent

3. FEEDING
- Fully independent
- Independent with modifications
- Requires supervision only
- Requires assistance
- Totally dependent

4. DRESSING
- Fully independent
- Independent with modifications
- Requires supervision
- Requires assistance
- Totally dependent

5. GROOMING (Wash face, shave, makeup, hair, etc.)
- Fully independent
- Independent with devices
- Requires supervision only
- Requires assistance
- Totally dependent

6. NAIL CARE
- Can cut nails
- Requires assistance

7. BATHING
- Fully independent
- Independent with devices
- Requires supervision only
- Requires assistance
- Totally dependent

8. TOILET USE (transfer, clothes, wipe, etc.)
- Fully independent
- Independent with modifications
- Requires supervision only
- Requires assistance
- Totally dependent

9. HAND USE (grasp, strength, dexterity)
- Fully independent
- Independent with tremor
- Independent with adaptations
- Requires assistance
- Totally dependent

B. TRAVEL

1. ABILITY TO TRAVEL
- Fully independent
- Requires transfer assistance
- Uses public transport alone
- Uses public transport with assistance
- Needs special transport (wheelchair, cab, etc.)

TRAVEL COMMENTS - Indicate any special transportation requirements.

ACTIVITIES OF DAILY LIVING COMMENTS

C. HOUSEHOLD ACTIVITIES

REASSESSMENT DATES - Day/Month/Year

Initial Assessment | Final Goal

1. PREPARING MEALS
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

2. DISHES (Wash/dry)
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

3. LIGHT HOUSEWORK (dust, vacuum, etc.)
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

4. MAKING BEDS
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

5. LAUNDRY
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

6. YARD WORK
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

7. HOME REPAIRS
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

8. HEATING (handle coal, wood, oil, etc.)
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

9. SHOPPING
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

10. BUDGETING, BANKING
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

11. ERRANDS
- Fully independent
- Independent with modifications
- Required assistance available
- Assistance required
- Not applicable

12. ABLE TO USE
- Light switches
- Faucets
- Telephone
- T.V. radio channels
- Thermostats

HOUSEHOLD ACTIVITIES COMMENTS

D. MEDICAL-BIOLOGICAL

REASSESSMENT DATES - Day/Month/Year

	Initial Assessment	Final Goal								

1. VISION
- Normal
- Normal with glasses/lenses
- Limited vision
- Totally blind

2. HEARING
- Normal
- Normal with aid
- Partially impaired
- Deaf

3. ABILITY TO COMMUNICATE
- Speech normal
- Speech impaired but intelligible
- Speech barely intelligible
- Speech unintelligible, uses gestures
- Does not communicate at all

4. COMPREHENSION
- Normal
- Partial comprehension of speech
- Unable to comprehend speech
- Unable to comprehend speech/gesture
- Unable to assess

5. DENTITION
- Adequate
- Some problem
- Major problem

6. DIET
- Normal
- Soft
- Therapeutic

7. SKIN CONDITION
- Skin intact
- Skin intact but dry or itchy
- Skin intact but poor sensation or circulation (eg. diabetic)
- Persistent redness or rash
- Skin broken
- Ulcer

8. BLADDER CONTROL
- Totally continent
- Continent with device (eg. catheter, ostomy)
- Occasionally incontinent
- Frequently incontinent
- Totally incontinent

9. BOWEL CONTROL
- Totally continent
- Continent with routine (laxative, enema)
- Occasionally incontinent
- Frequently incontinent
- Totally incontinent

10. MEDICATIONS
- No medications
- Takes medication independently
- Requires supervision
- Oral medications administered
- Parenteral medications administered

11. NURSING TREATMENTS
- No treatments
- Can do independently
- Requires supervision
- Treatments must be done

12. SPECIAL PROCEDURE
- Catheter care
- Bladder irrigation
- Special skin care
- Respiratory therapy
- Rehabilitation therapy
- I.V.
- Ostomy care
- Other — specify

MEDICAL-BIOLOGICAL COMMENTS (indicate any past or present medical problems, treatments, medications, etc.)

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E. PSYCHO-SOCIAL
*NOTE

S - Day/Month/Year

1. MEMORY & ORIENTATION
- Normal
- Periods of forgetfulness, confusion, diso-
- Constantly confused & disoriented

2. MOOD/STATUS
- Depressed — no problem
- Depressed — moderate problem
- Depressed — extreme problem
- Anxious — no problem
- Anxious — moderate problem
- Anxious — extreme problem
- Uncooperative — no problem
- Uncooperative — moderate problem
- Uncooperative — extreme problem

3. ABILITY TO BE REALISTIC IN JUDGEMENT
- Normal
- Limited ability
- Unable to make any judgement

4. ATTITUDE TO DISABILITY & LIMITATIONS
- Accepts, participates in planning care
- Accepts, but poor motivation to improve
- Denies limitations
- Unable to cope

5. FAMILY RELATIONSHIPS — EMOTIONAL SUPPORT (Observe)
- Adequate support from family
- Some support from family
- No support from family
- Family a negative factor
- No family

6. SOCIAL RELATIONSHIPS OUTSIDE FAMILY
- Attends outside social functions
- Participates socially at home
- One or two close friends
- Infrequent contact with outsiders
- No friends or social activities

7. INITIATIVE IN PARTICIPATING IN SOCIAL ACTIVITIES
- High
- Moderate
- Low
- None

8. USE OF LEISURE
- Takes initiative, makes good use
- Engages in leisure only with persuasion
- No active use of leisure

9. BEREAVEMENT
- No recent bereavement
- None within last year
- Occurred within last month

PSYCHO-SOCIAL COMMENTS: (Specify date)

*Obtain PSYCHO-SOCIAL assessment from observation, patient, and family if possible. If there is not
adequate time to evaluate at the initial assessment, complete on a subsequent visit, stating the date.

CLIENT INFORMATION

CLIENT UNDERSTANDS THE SITUATION:
☐ Fully ☐ Partly ☐ Poorly ☐ Not at all

CLIENT PERSONALLY PROVIDED THE INFORMATION RECORDED ON THIS FORM
○ YES ○ NO (If NO, specify)

CLIENT PRESENTLY RECEIVES HOME CARE OR SUPPORT SERVICES
○ YES ○ NO (If YES, specify)

CLIENT AGREES WITH INFORMATION RECORDED ON THIS FORM
○ YES ○ NO (If NO, specify)

CLIENT AGREES TO MOVE TO APPROPRIATE CARE FACILITY IF NECESSARY
○ Totally Accepting ○ Fairly Accepting ○ Indecisive ○ Unaccepting

CLIENT ASSESSED AGREES WITH RECOMMENDED SERVICES
IF NOT, EXPLAIN:

ASSESSMENT COMPLETED BY:

NAME | Surname | Given Names

ADDRESS

PHONE NO | Business | Residence

OCCUPATION

LIVING ARRANGEMENT OF CLIENT

○ Alone ○ with Spouse ○ with Relatives ○ with Children ○ Other — (specify)

NO OF ADULTS	NO OF CHILDREN

TYPE OF ACCOMMODATION
○ House ○ Apt ○ Room ○ Other — (specify)

FACILITIES - HEAT
○ Oil ○ Gas ○ Wood ○ Other — (specify)

FACILITIES - WATER
○ Running ○ Hot ○ Cold ○ Storage Tank ○ Truck ○ Self- Supply ○ Others — (specify)

FACILITIES — BATH/SHOWER
○ Bath - Yes ○ Bath - No ○ Shower - Yes ○ Shower - No

FACILITIES — TOILET
○ Indoors ○ Outdoors ○ None

RATING OF LIVING ACCOMMODATION

☐ Satisfactory ☐ Structural Improvement Needed ☐ Crowded ☐ Need alternate Accommodation

COMMENTS (specify date)

APPENDIX B

DATA ENTRY FORM.

Data Entry Form

YEAR COMMUNITY HCP   ETHNICITY BIRTH SEX

CIRCULATORY MUSCULOSKELETAL RESPIRATORY MENTAL   CONGENITAL

HEART DISEASE ARTHRITIS   ASTHMA   ALZHEIMERS DOWNS

HYPERTENSION RHEUMATISM COPD   FAS

DIGESTIVE DIABETES MS EPILEPSY PARALYSIS CP BLIND DEAF

OTHER

LEVEL OF NEED

APPENDIX C

.

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MODEL A: CALCULATIONS

Model A used multivariate linear regression to forecast the percentage of

I.R.C.C. in the community population. The regression coefficients are displayed in

Table 13. The regression equation for Model A is:

$$\hat{y} = \beta_1 x_1 + \beta_2 x_2 + \ldots + c$$

where

$\hat{y}$ = estimate of percentage of I.R.C.C. (dependent variable)

β_1 = coefficient of the first independent variable

x_1 = first independent variable

β_2 = coefficient of the second independent variable

x_2 = second independent variable

c = constant.

The pooled data coefficients were used to predict the percentage of

I.R.C.C. in each year. The values for the independent variables are shown in Table

3, Table 5, and Table 8. A sample calculation for 1985 was:

$$\hat{y} = 0.2966 \,(\% \text{ pop. } 60\text{-}79) + 1.3127 \,(\% \text{ pop. } 80) - 0.0016$$

$$\hat{y} = 0.0243$$

To calculate the predicted number of I.R.C.C in 1985, this number was multiplied by the total 1985 population:

0.0243 x 8933 = 217 I.R.C.C.

To calculate the number of I.R.C.C. at each level of care, this number was multiplied by the mean proportion of I.R.C.C. at each level in between 1988 and 1995 (shown in Table 2). For example, to calculate the number of I.R.C.C at level one

217 x mean % I.R.C.C. at level one =

217 x 0.538 = 117.

APPENDIX D

MODEL B: CALCULATIONS

Model B used a Markov Chain transition matrix to forecast need. The A.D.C.I.A. data from 1985 and 1988 were used to predict the I.R.C.C for 1991. To develop the Markov Chain, the levels of care of I.R.C.C. were recorded in 1985 and 1988. In 1985, each person in the population was classified into one of seven levels of care, or as not requiring care. In 1988, they were counted in one of nine categories: (a) adult - level one, (b) adult - level two, (c) adult - level three, (d) adult - level four, (e) child - level one, (f) child - level two, (g) child - level three (h) alive and no longer requiring chronic care services, or (i) dead. Table D1 shows level of care of the 1985 population 1988.

Table D1.

Levels of Care of 1985 Population in 1988

		1988								
	Level of Care	Adult One	Adult Two	Adult Three	Adult Four	Child One	Child Two	Child Three	Alive - No Care	Dead
		n	n	n	n	n	n	n	n	n
	Adult One	73	5	1	0	0	0	0	13	12
	Adult Two	9	38	1	0	0	0	0	4	6
	Adult Three	0	3	9	0	0	0	0	1	6
1985	Adult Four	1	1	0	1	0	0	0	0	1
	Child One	5	0	0	0	6	1	0	1	0
	Child Two	0	1	0	0	0	2	0	1	0
	Child Three	0	0	2	0	0	0	5	0	0
	No Care	17	7	10	1	1	1	2	8608	75

The probability of transferring from one state to another were calculated and entered into the matrix shown below:

$$
\begin{bmatrix}
0.7019 & 0.0481 & 0.0096 & 0 & 0 & 0 & 0 & 0.1250 & 0.1154 \\
0.1552 & 0.6552 & 0.0172 & 0 & 0 & 0 & 0 & 0.0690 & 0.1034 \\
0 & 0.1429 & 0.5238 & 0 & 0 & 0 & 0 & 0.0476 & 0.2857 \\
0.2500 & 0.2500 & 0 & 0.2500 & 0 & 0 & 0 & 0 & 0.2500 \\
0.3846 & 0 & 0 & 0 & 0.4615 & 0.0769 & 0 & 0.0769 & 0 \\
0 & 0.2500 & 0 & 0 & 0 & 0.5000 & 0 & 02500 & 0 \\
0 & 0 & 0.2857 & 0 & 0 & 0 & 0.7143 & 0 & 0 \\
0.0019 & 0.0008 & 0.0011 & 0.0001 & 0.0001 & 0.0001 & 0.0002 & 0.9869 & 0.0088 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
\end{bmatrix}
$$

The ninth row, death, is an absorbing state; once individuals transfer to the state, they remain there.

Matrix A is a nine by one matrix. The first seven elements are the number of I.R.C.C. at each level of care in 1985. The eighth element is the number of people who did not require chronic care and the ninth element is the number of dead at the beginning of the transition period.

$$
A = \begin{bmatrix}
97 \\
52 \\
22 \\
2 \\
7 \\
3 \\
7 \\
7802 \\
0
\end{bmatrix}
$$

Because Sachs Harbour, Tsiigehtchic, and Paulatuk were not included in the 1991

data, they were not include in this calculation, hence the discrepancy between these

figures and the figures reported elsewhere.

The two matrices are multiplied according to the formula A^T x P to

produce Matrix B:

$$A^T \times P = B = \begin{bmatrix} 94 \\ 49 \\ 24 \\ 1 \\ 4 \\ 3 \\ 7 \\ 7718 \\ 92 \end{bmatrix}$$

The entries in Matrix B describe the level of care of the 1988

I.R.C.C in 1991. The first entry is the number of I.R.C.C. in level one, the second

the number of people at level two, etc. The eighth entry is the number of 1988

people who do no require chronic care services. The ninth entry is the number of

people who died.

APPENDIX E

LESLIE MATRIX: CALCULATIONS

To project the population, two matrices, K and M, were multiplied

together according to the formula $M^z K$, where

$z = \dfrac{\text{number of years ahead}}{\text{interval limit}}$.

The subscript in each matrix represents the interval number.

Matrix K is the population vector

$$K = \begin{bmatrix} k_1 \\ k_2 \\ k_3 \\ \vdots \\ k_{nj} \end{bmatrix}$$

where i is the interval and each entry in the number of people in each interval.

Matrix M is the Leslie matrix.

$$M = \begin{bmatrix} a_1 & a_2 & \cdots & a_{n-1} & a_n \\ b_1 & 0 & \cdots & 0 & 0 \\ 0 & b_2 & \cdots & 0 & 0 \\ \vdots & \vdots & \ddots & 0 & \vdots \\ 0 & 0 & \cdots & b_n & 0 \end{bmatrix}$$

where

$$a_i = \frac{L_i}{l_i}\left[\tfrac{1}{2}f_i + \tfrac{1}{2}(b_i)\left(f_i\right) \right]$$

L_i = number of people in interval (males and females)

l_i = number of females in interval

f_i = interval specific birth rate of females

$b_i = \frac{L_{i+1}}{L_i}$.

In order to calculate 10 years into the future, from 1995 to 2005, the Regional

population was divided into ten year intervals. In order to calculate the ten year

interval specific birth rate of female offspring, a mean of the 1988 to 1992 birth
rates was calculated and projected for a ten year period. Table E1 shows the
values used to calculate the population in 2005, shown in table E2.

Table E1.

Values for Population Projection

Interval i (age group)	L_i	l_i	f_i	a_i	b_i
1 ((0-9)	2112	1019	0	0	0.72
2 (10-19)	1514	721	0.02	0.04	1.08
3 (20-29)	1628	780	0.03	0.07	1.11
4 (30-39)	1820	857	0.02	0.03	0.59
5 (40-49)	1065	462	0	0	0.59
6 (50-59)	625	289	0	0	0.56
7 (60-69)	352	159	0	0	0.45
8 (70-79)	157	83	0	0	0.4
9 (80-89)	63	37	0	0	0.32
10(90-99)	20	11	0	0	0.05
11 (100-109)	1	1	0	0	0

Table E2.

Projected 2005 Population for the Inuvik Region

Age Group	Estimated population	Per cent of population
0-19	3823	40.2
20-39	3410	35.7
40-59	1674	17.6
60-79	527	5.5
80+	92	1.0
Total	9506	100

Table F1.

Age group composition of the Inuvik Region population, 1985 - 1995.

Age Group	1985 n (%)	1988 n (%)	1991* n (%)	1995 n (%)
0-19	3572 (40.0)	3461 (39.3)	2982 (37.3)	3623 (39.0)
20-39	3541 (39.6)	3444 (39.1)	3086 (38.6)	3370 (36.3)
40-59	1316 (14.7)	1379 (15.7)	1428 (17.8)	1690 (18.2)
60-79	426 (4.8)	442 (5.0)	428 (5.4)	516 (5.6)
80+	78 (0.9)	78 (0.9)	68 (0.9)	83 (0.9)
Total	8933 (100)	8804 (100)	7992 (100)	9282 (100)

* Does not include Paulatuk, Sachs Harbour, and Tsiigehtchic

Table F2.

Gender composition of the Inuvik Region population, 1985-1995.

Gender	1985 n (%)	1988 n (%)	1991* n (%)	1995 n (%)
Male	4753 (53.2)	4719 (53.6)	4031 (50.4)	4934 (53.2)
Female	4180 (46.8)	4085 (46.4)	3961 (49.6)	4348 (46.8)
Total	8933 (100)	8804 (100)	7992 (100)	9282 (100)

* Does not include Paulatuk, Sachs Harbour, and Tsiigehtchic

Table F3.

Population composition of the Inuvik Region by age an gender, 1985-1995

Female	1985	1988	1991*	1995
0-19	1690	1591	1576	1740
20-39	1673	1629	1508	1559
40-59	582	613	631	751
60-79	200	216	210	249
80+	35	36	36	49
Sub-total	4180	4085	3961	4348
Male				
0-19	1882	1870	1406	1883
20-39	1868	1815	1578	1811
40-59	734	766	797	939
60-79	226	226	218	267
80+	43	42	32	34
Sub-total	4753	4719	4031	4934
Total	8933	8804	7992	9282

* Does not include Paulatuk, Sachs Harbour, and Tsiigehtchic.

Table F4.

Ethnic composition of Inuvik Region Population, 1985-1995

Ethnic Group	1985 n (%)	1988 n (%)	1991* n (%)	1995 n (%)
Dene	2751 (30.8)	2700 (30.6)	2673 (33.4)	2955 (31.8)
Inuit	2423 (27.1)	2785 (31.6)	2347 (29.4)	2834 (30.5)
Non-native	3140 (35.2)	2483 (28.2)	2234 (28.0)	2810 (30.3)
Metis	619 (6.9)	836 (9.6)	738 (9.2)	683 (7.4)
Total	8933 (100)	8804 (100)	7992 (100)	9282 (100)

* Does not include Paulatuk, Sachs Harbour, and Tsiigehtchic

Table F5.

Specific causes of disability and chronic illness

Cause	1985	1988	1991	1995
Circulatory Disease	24	28	25	64
Heart Disease	13	8	6	· 26
Hypertension	5	4	3	22
Musculoskeletal Disease	32	39	47	105
Arthritis	17		31	74
Rheumatism	1	0	3	3
Respiratory Disease	19	18	24	53
C.O.P.D.	16	16	22	42
Asthma	0	1	1	1
Mental Disorders	47	45	29	54
Alzheimer's Disease	0	0	0	3
Congenital Disorders	11	12	11	36
Down's Syndrome	3	4	4	6
F.A.S.	4	3	2	21

Table F6.

Number of reported causes of disability and chronic illness

Number of reported causes of disability or chronic illness	1985 n (%)	1988 n (%)	1991 n (%)	1995 n (%)
One	138 (65.4)	134 (65.4)	90 (55.6)	129 (45.4)
More than one	73 (34.6)	71 (34.6)	72 (44.4)	155 (54.6)
Total	211 (100)	205 (100)	162 (100)	284 (100)

Table F7.

Unemployment and Percentage of I.R.C.C. in the population, 1985

Community	I.R.C.C. in population (%)	Unemployment Rate (%)*
Aklavik	3.5	39
Colville Lake	16.0	34
Deline	7.0	20
Fort Good Hope	5.4	24
Fort McPherson	1.9	31
Inuvik	0.8	11
Norman Wells	0.8	8
Paulatuk	0.4	29
Sachs Harbour	2.5	17
Tsiigehtchic	4.4	-
Tuktoyaktuk	2.0	33
Tulita	5.5	8

* % of the labour force

Table F8.

Socio-economic Indicators and Percentage of I.R.C.C. in the population, 1988

Community	I.R.C.C. in the population (%)	Unemployment Rate (%)*	Mean Annual Income ($)
Aklavik	2.4	42	16 239
Colville Lake	14.2	20	8 050
Deline	6.6	22	14 000
Fort Good Hope	4.1	17	14 374
Fort McPherson	1.2	35	14 828
Inuvik	1.1	6	27 983
Norman Wells	0.7	7	36 106
Paulatuk	0.9	18	11 386
Sachs Harbour	1.9	16	21 200
Tsiigehtchic	8.2	40	12 360
Tuktoyaktuk	2.5	31	19 158
Tulita	5.1	13	19 158

* % of the labour force

Table F9.

Socio-economic Indicators and Percentage of I.R.C.C. in the population, 1991

Community	I.R.C.C. in the population (%)	Unemployment Rate (%)*	Mean Annual Income ($)	Less than grade 12**	1/house**	6+/house**
Aklavik	2.1	37	19 690	61.5	16.7	16.7
Colville Lake	8.5	40	12 333	67.7	25	25
Deline	4.5	21	18 044	71.2	18.5	29.6
Fort Good Hope	3.3	26	16 789	61.1	14.3	32.6
Fort McPherson	1.3	22	15 905	63.5	13.5	24.3
Inuvik	1.1	11	32 426	33.6	26	7.3
Norman Wells	0.1	5	42 369	23	27.3	2.3
Paulatuk	-	-	-	-	-	-
Sachs Harbour	-	-	-	-	-	-
Tsiigehtchic	-	-	-	-	-	-
Tuktoyaktuk	2.1	34	21 670	65.3	22.5	16.3
Tulita	3.5	26	21 673	62.8	26.1	17.4

* % of the labour force   ** % total population

Table F 10.

Regression Coefficients and Model Statistics for 1991/95 Pooled Data

Independent Variables	1991/95
Age	
% pop. 0-19	-
% pop. 20-39	-
% pop. 40-59	-
% pop 60-79	0.3685*
% pop. 80+	1.0567*
Model Statistics	
Intercept	-0.0025
R^2	0.7580
Adjusted R^2	0.7312
*$p \leq 0.05$ - not significant	