ABSTRACT

Health in the northern territories does not reach that of national standards. Investigations in these areas are hampered by small population size, which limits both the identification of local health problems as well as the planning and prioritizing of prevention and interventions. We report on health deficiencies of the northern territories and illustrate how our analytic applications supplement traditional approaches to benefit public health objectives. We reveal that life expectancy in Northern Canada has increased such that health deficiencies between the North and South have decreased substantially, although they still persist at a high level. The current health status of Northwest Territories residents approximates that of Canadians 15 to 25 years ago. In addition, while chronic diseases were previously less of a concern for Northwest Territories residents, they show increasing trends in importance. This is of particular significance in light of an aging population in the northern territories.

ABRÉGÉ

L'état de santé des résidents du Nord n'égale pas celui des Canadiens en général. Les enquêtes sur les problèmes locaux de santé sont entravées par la petite taille de la population, qui nuit à la fois au recensement des problèmes, à la planification de la prévention et des interventions et à la détermination des priorités. Notre étude rend compte des lacunes des territoires du Nord sur le plan de la santé et illustre la façon dont nos applications analytiques peuvent compléter les méthodes traditionnelles et contribuer à l'atteinte des objectifs de santé publique. Nous démontrons que l'espérance de vie dans le Nord du Canada a augmenté dans une proportion telle que les écarts entre le Nord et le Sud sur le plan de la santé ont considérablement diminué, bien qu'ils soient encore importants. L'état de santé actuel des résidents des Territoires du Nord-Ouest (T.N.-O.) s'apparente à celui des Canadiens il y a 15 ou 25 ans. Par ailleurs, les maladies chroniques, qui étaient auparavant un problème mineur chez les résidents des T.N.-O., gagnent en importance. Cela pose un problème particulier, étant donné le vieillissement de la population dans les territoires nordiques.

The North-South Gradient in Health: Analytic Applications for Public Health

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Residents of western Canada fare better than those of eastern Canada in their health status.¹ This east-west gradient in health is observed in both cancer and cardiovascular disease incidence and mortality rates; the gradient reflects lifestyle and socio-economic risk factors, health services utilization, and screening participation rates.^{2,3} Health statistics such as the east-west gradient in health are important to public health in that they provide clues and direction for prevention and interventions.⁴

North-south discrepancies in health have been less intensively reported than other regional comparisons in Canada. Life expectancy of the Inuit in the Northwest Territories (NWT)* in the early 1980s was reported to be 66 years, compared with 75 years for Canadians in general.^{5,6} More recently, in 1997, life expectancy was reported to be 77 years for women and 72 years for men in the NWT, as compared to 82 years and 76 years for Canadian women and men respectively.⁷ While mortality rates declined dramatically in the NWT, they remained substantially higher than

the national rates with the exception of ischemic heart disease mortality.⁸ Mortality rates for motor vehicle accidents have been on the rise since the early 1970s, while those for the nation have been decreasing over the same period. Suicide and homicide have increased and mortality from injuries were consistently higher in the NWT than in all of Canada. Injuries were particularly higher among Inuit and Indian people.⁹ In contrast, a recent study concluded that the self-reported health of Northern residents did not differ significantly from that of provincial residents.¹⁰ The authors, however, acknowledged limitations in the study design.

The use of life expectancy over mortality rates and ratios is generally appreciated and preferred in health policy.⁴ A general health policy objective is reduction of health inequalities, which in operational terms means that one invests in the health of areas and subgroups that are not meeting a particular standard. And as a public health standard, one most practically takes the national average. We recently proposed a measure of health status based on life expectancy.^{11,12} This measure, "health deficiency", quantifies the difference between local and national life expectancies and can be broken down into disease-specific components. Public health workers and health policy makers may wish to interpret this measure as the expected increase in life expectancy if a public health intervention were successful in reducing local mortality to that of the concurrent national level. This *a priori* knowledge of the potential health benefits provides good guidance for health policy makers in priority-setting and planning of prevention and interventions as part of their efforts to diminish inequalities in health.

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* Throughout this paper, we refer to the Northwest Territories as it existed prior to April 1, 1999, which included Nunavut, as the data analyzed and previous studies cited for comparison covered the entire region.

A general limitation acknowledged in most comparisons of health status between northern territorial residents and southern provincial residents is the small population size for the former.² This limits inferences regarding the magnitude and nature of the health concerns and, in turn, hampers the activities of health policy makers. We made the abovementioned measure of health deficiencies suitable for comparisons of small populations by integrating time trends and applying smoothing procedures.¹³

In the present study, we report on the health deficiencies of the northern territories and illustrate how the analytic applications can facilitate the work of health policy makers in priority setting and planning.

METHODS

Health deficiencies are defined as the differences in life expectancy between Canadians and residents of the NWT and Yukon in the concurrent calendar year. Health deficiencies are decomposed into age- and disease-specific components. The estimation of these quantities is based on life table methods, cause elimination, smoothing, and Monte Carlo procedures, the details of which are described elsewhere.^{11,13} We depict time trends with confidence bounds to facilitate judgement of the significance of the health deficiencies.

We obtained annual disease-specific mortality counts by gender, age, and geographic location from Statistics Canada for the years 1950 to 1995. During these years the International Classification of Diseases (ICD) has been revised four times. Table I presents the ICD codes of diseases included in the present contribution. We also obtained census data on population size by gender, age, and geographic location from Statistics Canada for the years that the census was held – once every five years. We estimated intercensal population sizes using cubic splines,¹⁴ as described and applied elsewhere.¹¹

RESULTS

The population in the NWT has increased from approximately 18,000 in the 1950s to 57,000 in the early 1990s.

TABLE I
The International Classification of Diseases Coding, 1950-1995

Disease Entity	ICD 6 & 7 1950-1968	ICD 8 1969-1978	ICD 9 1979-1995
Malignant Neoplasms			
All sites	140-205	140-207	140-208
Lung, trachea, bronchus, pleura	162, 163	162, 163	162, 163
Breast	170	174	174
Colon, rectum	153, 154	153, 154	153, 154
Cardiovascular Diseases	330-339 400-468	390-458	390-459

Figure 1. Life expectancy at birth of women and men in the Northwest Territories and the Yukon. Bold lines indicate smoothed estimates of local life expectancy and thin lines the 95% confidence limits. Dotted lines represent annual estimates of local life expectancy. Annual estimates of life expectancy of Canadian women and men are provided as a reference in each plot.

For the Yukon this increase was from approximately 11,000 to 27,000. Figure 1 presents annual estimates and smoothed estimates with 95% confidence limits of life expectancy for women and men in the NWT and Yukon. Life expectancies for Canadian women and men are presented for reference. Health deficiency of the NWT, as the difference between local life expectancy and that of Canadians, decreased from approximately 25 years in 1950 to approximately 4 years for women and 5 years for men in 1995. In the Yukon in the 1990s, health deficiencies are approximately 2 years for women and 3 years for men.

Figure 2 presents the extent to which the health deficiencies can be attributed to different age groups. In the NWT, health

deficiency from infant and childhood mortality combined decreased from more than 10 years in the early 1950s to approximately 1 year in the mid-1990s. Public health workers should interpret this health deficiency of 1 year as the increase in life expectancy of NWT residents if interventions were successful in reducing infant and childhood mortality to that at the national level. Health deficiencies in all age groups in the Northern regions are diminishing with the exception of the oldest age category in the NWT, suggesting an increase in the importance of chronic diseases. This is confirmed by the increasing trends of health deficiencies resulting from cancer and cardiovascular diseases as presented in Figure 3. For example, whereas in the 1960s and 1970s cardiovascular

Figure 2. Health deficiencies by age group for women and men in the Northwest Territories and the Yukon. Health deficiency for a specific age group is represented by the area between the lines, while each curve represents the cumulative health deficiency for all age groups falling below that curve.

Figure 3. Health deficiencies resulting from cancer and cardiovascular disease for women and men in the Northwest Territories. Bold lines indicate smoothed estimates of health deficiencies and thin lines the 95% confidence limits. Dotted lines represent annual estimates of health deficiencies. Negative values indicate that mortality from these conditions is lower in the local population than nationally.

mortality was less of a concern for men in the NWT than for Canadian men, in the 1990s men in the NWT were no longer at an advantage. Cancer and in particular lung cancer (Figure 4) seem important and

increasing concerns for women in the NWT. This is in contrast to cancers that are subject to screening or potential future screening, namely breast, cervical and colorectal cancer (latter not shown).

DISCUSSION

Life expectancy in Northern Canada has increased such that health deficiencies between the North and South have decreased substantially, although they still persist at a high level. Discrepancies between provincial and national life expectancies are generally less than 1 year.² Here we provided robust estimates of deficiencies of 4 years for women in the NWT and 5 years for men in the NWT. Hence the current health status of NWT residents approximates that of Canadians 15 to 25 years ago.

While the health of infants, children, and adults has dramatically improved over the past five decades, it continues to be at a level substantially lower than the national average. Health concerns among older Northern Canadians, in contrast, are growing as a result of an increase in the importance of chronic diseases, including cardiovascular disease and cancer. We also observed very distinct temporal trends of life expectancies in the NWT and Yukon. This may be attributable to differential proportions of Aboriginal people, 20% in the Yukon and 54% in the NWT.¹⁰ The growing concerns regarding chronic diseases seem to agree with reports on the rapid changes in lifestyle and dietary habits among the Aboriginal people.¹⁵⁻¹⁷ The increase in smoking in the Canadian Arctic is now evidenced in a reduction in life expectancy due to lung cancer. This trend is expected to continue given the persistently higher smoking rates.^{10,18} Although some have reported higher incidence of cervical cancer,^{15,19-21} it is not reflected in a reduced life expectancy, suggesting that health service delivery is adequate. Breast and colorectal cancer seem less of a concern for NWT residents than for Canadians, which is in agreement with various studies reporting an inverse relation between these cancers and socio-economic status.^{22,23}

Our applications supplement traditional approaches and reveal the shift in health concerns from premature mortality to health concerns for older residents as a result of an increase in the importance of chronic diseases. This becomes particularly important in light of an aging population in the Northern regions. In terms of health

policy, this should be reflected in further emphasis on prevention and planning of health services capacity.

Health, as defined by the World Health Organization, is the overall physical, mental, and social well-being of individuals.^{24,25} These health dimensions should also be considered in health comparisons of populations and subpopulations. Information on these dimensions, however, is not as readily available and inter-group comparisons are not straightforward. We are currently active in developing new measures based on risk factor prevalence and disease incidence that are as easy to comprehend but that provide a broader health picture than that of health deficiencies alone. In the current contribution, we focussed on inter-territorial comparisons. Since our methods allow further decompositions, our future focus will include comparisons within the territories, such as ethnic differences, and conditions typical for the North, such as the high injury rates.

In summary, life expectancy in Northern Canada has increased such that health deficiencies between the North and South have decreased substantially, although they still persist at a high level. While the health of youth and adults has improved over the past five decades, health concerns among older Northern Canadians are growing as a result of an increase in the importance of chronic diseases, including cardiovascular disease and cancer. These findings should be considered when planning and prioritizing prevention and interventions.

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Figure 4. Health deficiencies resulting from specific cancers for women and men in the Northwest Territories.

Bold lines indicate smoothed estimates of health deficiencies and thin lines the 95% confidence limits. Dotted lines represent annual estimates of health deficiencies.