

A B S T R A C T

Objective: To describe regional trends in premature mortality in Manitoba

Design: Comparison of all-cause and cause-specific mortality of persons less than age 75 in 11 Regional Health Authority populations over two time periods: 1985-89 and 1990-94.

Results: The provincial premature mortality rate declined over the two time periods (4.00/1,000 to 3.72/1,000). Declines were also observed in 9 of 11 regional populations. Premature mortality increased, however, in the 2 regional populations with the highest mortality rates in the first observation period.

Conclusion: Declining premature mortality in low mortality populations and rising premature mortality in high mortality populations has resulted in a widening of regional mortality rates in Manitoba. Recent policy initiatives in many provinces, including the devolution of authority for the management and delivery of health services and the implementation of population need-based funding formulas to share health care resources among regional health authorities, if implemented, have the potential to partially mitigate the processes producing these widening regional health inequalities.

A B R É G É

Objectif: décrire les tendances régionales de la mortalité prématurée au Manitoba.

Conception : comparaison de toutes les causes et des causes spécifiques de mortalité chez les personnes de moins de 75 ans dans onze populations d'autorités sanitaires régionales au cours de deux périodes, soit de 1985 à 1989 et de 1990 à 1994.

Résultats : le taux de mortalité prématurée provinciale a baissé au cours des deux périodes (de 4 pour 1 000 à 3,72 pour 1 000). Des baisses ont également été observées chez neuf des onze populations régionales. La mortalité prématurée a toutefois augmenté chez les deux populations régionales qui avaient les plus hauts taux de mortalité au cours de la première période d'observation.

Conclusion : la baisse de la mortalité prématurée chez les populations présentant un faible taux et la hausse de la mortalité prématurée chez les populations présentant un taux élevé ont eu pour effet d'augmenter les taux de mortalité au Manitoba. De récentes initiatives de politique dans de nombreuses provinces – y compris le transfert du pouvoir pour la gestion et la prestation des services de santé, ainsi que la mise en place de formules de financement basées sur les besoins de la population pour partager les ressources de soins de santé entre les autorités sanitaires régionales – si elles sont mises en application – ont le potentiel de limiter les processus qui produisent ces inégalités croissantes dans la santé au niveau régional.

Widening Regional Inequality in Premature Mortality Rates in Manitoba

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Sustained improvement in Canadian mortality over the past two decades has been well documented, with male and female life expectancy at birth increasing 3.2 years and 2.0 years, respectively, in the period 1971 to 1986.¹ Provincial mortality trends have mirrored this national pattern. In addition, there have been important reductions in regional disparities in life expectancy, declining from approximately 5 years in 1941 to approximately 1.5 years in 1986.² The specific factors which account for this reduction in inter-provincial mortality differences are not well understood.

The description of mortality trends at the national and provincial levels can overlook important dynamics within provincial populations. In this report we document an increase in the disparity in premature mortality for Regional Health Authority populations in Manitoba over the period 1985-94, a widening of inequality which occurred despite an overall decline in provincial mortality.

METHODS

Two sources of information were combined in this study. For the 11 Regional Health Authority populations described, population denominators were obtained

for 10 consecutive years from the Manitoba Health Services Insurance Plan registry file, which contains a record for each resident of the province eligible to receive insured health care services. The eligible registrant population was defined as of December in each observation year. Computerized death records from the Vital Statistics Branch of Manitoba Health were the source of mortality information. These death records contain information on cause of death, recorded in ICD-9. Deaths occurring to residents of Manitoba while out of the province and deaths occurring in Manitoba to residents of other provinces were excluded.

For the purpose of this study, we excluded deaths occurring to individuals 75 years of age or older. Deaths to persons under the age of 75 were defined as premature mortality. Crude and age-adjusted premature mortality rates for each Regional Health Authority population were calculated for two consecutive five-year periods: 1985-89 and 1990-94. Due to the very small size of the Regional Health Authority population of Churchill, this region was excluded from the results reported here.

Analysis

Crude and age- and sex-adjusted premature mortality rates are reported for the two consecutive five-year observation periods. Age and sex adjustment was performed on all-cause premature mortality and cause-specific premature mortality by the direct method, using the provincial population as the reference. Standard errors of both the crude and age-/sex-adjusted mortality rates were computed under the assumption of a chi-square distribution and are based on a person-year denominator. Statistical inference was

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TABLE I
Premature Mortality Rates, 1985-89 and 1990-94
Regional Health Authorities, Manitoba

RHA	Premature Mortality 1985-89					Premature Mortality 1990-94					Test for Difference
	Population (person years)	Crude Mortality /1,000	Adjusted Mortality /1,000	95% Confidence Limit Lower Upper		Population (person years)	Crude Mortality /1,000	Adjusted Mortality /1,000	95% Confidence Limit Lower Upper		
South Eastman	223,953	2.885	3.256	3.005	3.507	237,303	2.752	3.123	2.884	3.363	NS
South Westman	178,945	4.448	3.519	3.271	3.767	166,261	3.910	3.023	2.786	3.260	-
Central	438,058	3.655	3.557	3.384	3.731	434,263	3.539	3.497	3.323	3.671	NS
Marquette	185,045	4.999	3.919	3.661	4.176	172,128	4.532	3.502	3.251	3.752	-
Winnipeg	3,031,795	3.999	4.030	3.959	4.101	3,079,995	3.695	3.712	3.645	3.780	-
Parkland	201,468	5.217	4.095	3.843	4.348	202,819	4.758	3.713	3.475	3.950	-
North Eastman	160,953	4.032	4.156	3.837	4.475	173,432	3.771	3.801	3.509	4.093	-
Interlake	333,441	4.427	4.163	3.952	4.375	340,870	4.304	4.031	3.826	4.237	NS
Brandon	216,618	4.169	4.286	4.010	4.563	218,347	3.366	3.430	3.184	3.676	-
Burntwood	237,979	2.874	4.809	4.378	5.240	216,853	3.080	5.429	4.915	5.943	+
Norman	116,066	3.972	5.189	4.708	5.669	119,382	4.180	5.604	5.105	6.103	NS
Total	5,331,244	4.004	4.004	3.950	4.057	5,367,599	3.728	3.728	3.677	3.780	-

Deaths to persons under the age of 75 are defined as premature mortality

In the column labelled 'Test for Difference', '+' indicates a significant increase in the age-adjusted mortality rate between 1985-89 and 1990-94, '-' indicates a significant decline in the age-adjusted mortality rate.

based on a T^2 statistic, testing the null hypothesis that mortality rates were equivalent in all regions or equivalent within regions across time periods.³ A critical value of 0.05 was used, and no Bonferroni adjustment for multiple comparisons was applied.

RESULTS

In the two consecutive five-year time periods compared in this report, the provincial premature mortality rate declined from 4.00/1,000 to 3.72/1,000 ($p < 0.001$). Mortality declines were observed in 9 of 11 Regional Health Authority populations: in 6 of these populations, the declines were greater than would be expected by chance (Table I, Figure 1). Two Regional Health Authority populations experienced increases in premature mortality; between 1985-89 and 1990-94, age-adjusted rates of premature mortality per 1,000 person years (with 95% confidence intervals shown in parentheses) increased from 4.8 (4.4-5.2) to 5.4 (4.9-6.1) in Burntwood and from 5.2 (4.7-5.7) to 5.6 (5.1-6.1) in Norman. Both populations experiencing increased rates of premature mortality between 1985-89 and 1990-94 had the highest premature mortality rates in the first observation period.

When classified by cause of death, significant declines in premature mortality in the overall provincial population were observed for diseases of the circulatory sys-

tem (ICD9 390-459), diseases of the respiratory system (ICD9 460-519), conditions arising in the perinatal period (ICD9 760-779) and injuries and poisonings (ICD9 800-999) (Table II). In addition, a decline was observed over the two periods in the numbers of deaths which were not classified by cause. Increased premature mortality rates were seen in four categories: infectious diseases (ICD9 001-139), endocrine, nutritional and metabolic disorders (ICD9 240-279), mental disorders (ICD9 290-319) and diseases of the genitourinary system (ICD9 580-629).

To identify cause-specific mortality dynamics associated with the increasing inequality in regional premature mortality between 1985-89 and 1990-94, adjusted premature mortality rates for the six leading causes of death in Burntwood and Norman regions were compared to provincial mortality rates (data not shown). In the 1985-89 period, cause-specific premature mortality was elevated relative to the provincial mortality rate for residents of Burntwood in the single category of injury and poisonings. In the subsequent period 1990-94, cause-specific premature mortality in Burntwood region was elevated in three categories: injury and poisoning (age-adjusted rates per 1,000 person years with 95% confidence intervals) 0.91 (0.76-1.06) vs 0.38, respiratory disease 0.41 (0.24-0.58) vs 0.20 and deaths classified by symptoms, signs and ill-defined conditions 0.24 (0.13-0.35) vs 0.12.

In the 1985-89 period, cause-specific premature mortality was elevated relative to the provincial mortality rate for residents of Norman in the categories of circulatory diseases and injury and poisonings. In the subsequent period 1990-94, cause-specific premature mortality in Norman region was elevated in four categories relative to the provincial cause-specific mortality rate: neoplasms 1.71 (1.42-2.00) vs 1.26, circulatory diseases 1.64 (1.36-1.93) vs 1.10, injury and poisoning 0.60 (0.44-0.76) vs 0.38 and respiratory diseases 0.42 (0.26-0.58) vs 0.20.

In Burntwood region, there were no statistically significant differences between the two time periods in any of the six leading causes of deaths. In Norman region, the premature mortality rate for neoplasms increased significantly (1.44/1,000 to 1.71/1,000) and the premature mortality rate for injury and poisoning declined significantly from 0.80/1,000 to 0.60/1,000.

DISCUSSION

Declining premature mortality in low mortality populations and rising premature mortality in high mortality populations has resulted in an increase in the disparity in regional mortality rates in Manitoba over this 10-year period. Declines in premature mortality were observed in 9 of 11 regional populations, representing 97% of the provincial population, while increases were observed in 2 regional populations, repre-

senting 3% of the provincial population. In analyses conducted concurrent with the results reported here, premature mortality rates in Winnipeg also grew more unequal over this period. Between 1986 and 1996, the ratio of premature mortality rates between the 20% of the population in the most highly educated neighbourhoods and the 20% of the population in neighbourhoods with the lowest levels of education increased from 1.4 to 1.8.⁴ These results are consistent with a number of reports from other developed country settings which have both documented the persistence of regional health inequalities over time^{1,5,6} and provided evidence that the magnitude of inequality in many settings has increased over time.⁷⁻¹²

The increase in health inequality in the Manitoba population indicated by these premature mortality data draws attention to two issues. The first issue focusses on explanatory mechanisms: what are the principal processes which result in increasing mortality in some populations, and declining mortality in others? At least four primary explanations can be considered: 1) selection due to inter-regional migration, 2) region-specific changes in health behaviours, 3) the consequences to health of differential economic growth, and 4) the consequences to health resulting from differences in the allocation of public investments in health, social and educational infrastructure.

The health status profile of inter-regional migrants is poorly understood. Inter-regional migration may be in part determined by health status, with persons migrating from high mortality regions to regions with lower premature mortality rates being healthier than persons who remain behind. If inter-regional migration is in part determined by health status differences such as this, over time inter-regional premature mortality rates will widen.

In both time periods, injury and poisoning figure prominently as a cause of death in the two high mortality regions, reflecting in part the more challenging geographic environments in which these regions are located. The widening of the regional disparity in mortality may also be marking region-specific changes in health-related behaviours in the areas of injury control,

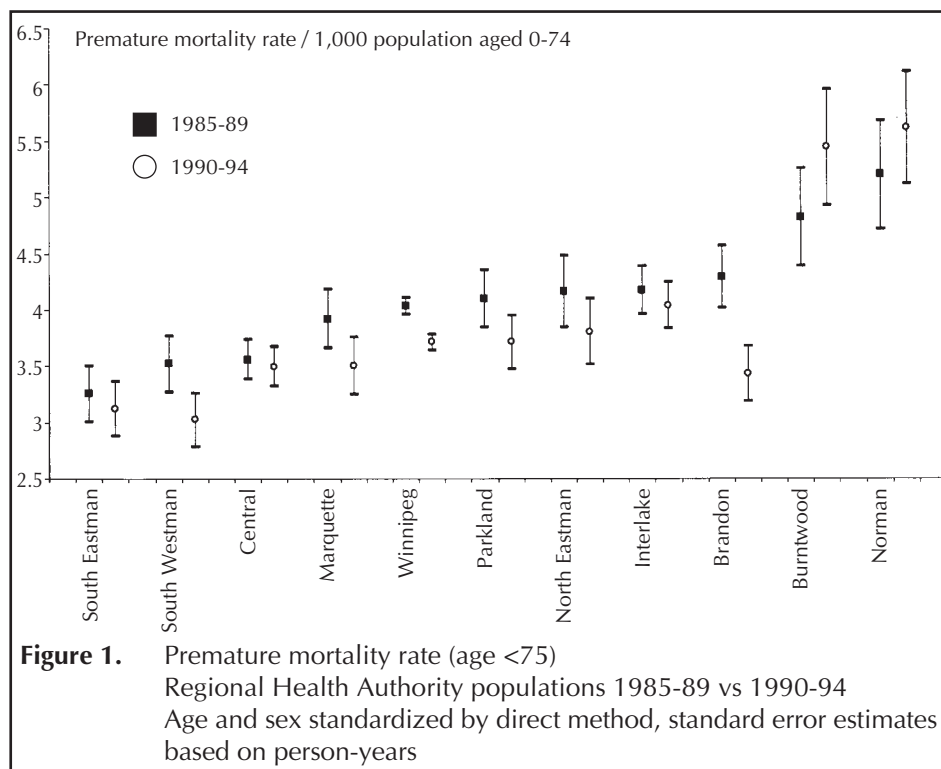


Figure 1. Premature mortality rate (age <75) Regional Health Authority populations 1985-89 vs 1990-94 Age and sex standardized by direct method, standard error estimates based on person-years

nutrition and alcohol use, all of which are potentially amenable to primary prevention intervention.

Although far from a sufficient explanation,^{13,14} the relative degree of economic prosperity enjoyed by a population is an important determinant of the health status potential of a population. The relative standards of socio-economic development do differ across the regions described in this report and the ranking of regions on premature mortality rates is strongly correlated with the geographic distribution of economic and human capital resources across these areas.¹⁵ In this setting, regions with the most favourable premature mortality rates are in the rural south of the province, and those regions with the least favourable and deteriorating premature mortality rates are in the north of the province. Additional work is underway to determine if the patterns of change over time in regional premature mortality are correlated with changes in the geographic distribution of socio-economic resources.

Finally, there may be differences in the allocation of public expenditures in health care, social services, educational and physical infrastructure and differences in the organization and delivery of health care services, which if sustained over time, may

contribute to widening inequalities in health. While there is very limited information in Canada on the allocation of health care resources to sub-provincial populations, it is clear in the province of Manitoba that regional per capita resource use in the hospital sector (summing in-region and out-of-region use) is positively correlated with the premature mortality profile documented in this report.¹⁶

The second issue raised by this comparison of regional premature mortality focusses on the policy implications of increasing health disparities in the province of Manitoba. Increasing mortality is, potentially, an indicator of deterioration in the composite of economic and social resources at the household and collective level which protect and promote population health. As national and provincial health policies have evolved from a focus on the financing, organization and delivery of health services to more broadly focus on the health of populations, the policy prominence of the principle of equity has increased substantially.¹⁷⁻¹⁹ This evolution has led to an amplification of the original principle of reasonable access to equal levels of health care services defined in the Canada Health Act to incorporate the idea of providing equal access to health services

TABLE II
Premature Mortality by Cause of Death
Manitoba, 1985-89 vs 1990-94

Cause of Death	Premature Mortality 1985-89					Premature Mortality 1990-94					Test for Difference
	Number of Deaths	Percent of Deaths	Crude Mortality /1,000	95% Confidence Limit Lower	95% Confidence Limit Upper	Number of Deaths	Percent of Deaths	Crude Mortality /1,000	95% Confidence Limit Lower	95% Confidence Limit Upper	
Infectious and Parasitic Diseases	124	0.58%	0.023	0.019	0.027	229	1.10%	0.043	0.037	0.048	+
Neoplasms	6,824	32.00%	1.280	1.251	1.309	6,764	34.00%	1.260	1.230	1.290	
Endocrine,Nutritnal, Metabolic,Immunity	451	2.10%	0.085	0.077	0.092	532	2.70%	0.099	0.091	0.108	+
Dis: Blood, Blood-Forming Organs	60	0.28%	0.011	0.007	0.015	58	0.29%	0.011	0.008	0.014	
Mental Disorders	185	0.87%	0.035	0.029	0.041	241	1.20%	0.045	0.039	0.051	+
Diseases: Nervous Sys & Sense Organs	426	2.00%	0.080	0.072	0.088	363	1.80%	0.068	0.061	0.075	
Diseases: Circulatory System	6,683	31.00%	1.254	1.224	1.283	5,879	29.00%	1.095	1.067	1.123	-
Diseases: Respiratory System	1,166	5.50%	0.219	0.207	0.230	1,086	5.40%	0.202	0.190	0.214	-
Diseases: Digestive System	765	3.60%	0.143	0.134	0.153	729	3.60%	0.136	0.126	0.146	
Diseases: Genitourinary System	165	0.77%	0.031	0.027	0.035	213	1.10%	0.040	0.034	0.045	+
Comp of Preg, Childbirth & Puerperium	4	0.02%	0.001	-0.001	0.003	3	0.01%	0.001	-0.002	0.003	
Dis: Skin & Subcutaneous Tissue	10	0.05%	0.002	0.000	0.004	13	0.06%	0.002	0.000	0.005	
Dis: Muscul System and Connect Tissue	74	0.35%	0.014	0.010	0.018	55	0.27%	0.010	0.007	0.013	
Congenital Anomalies	218	1.00%	0.041	0.035	0.047	234	1.20%	0.044	0.038	0.049	
Condtns Origin. Perinatal Period	259	1.20%	0.049	0.043	0.054	211	1.10%	0.039	0.034	0.045	-
Symptoms, Signs and Ill-Defn. Condtns	692	3.20%	0.130	0.120	0.140	670	3.30%	0.125	0.115	0.134	
Injury and Poisoning	2,333	11.00%	0.438	0.420	0.455	2,047	10.00%	0.381	0.365	0.398	-
Unclassified	905	4.20%	0.170	0.158	0.182	685	3.40%	0.128	0.118	0.137	-
Total	21,344	100.00%	4.004	3.951	4.056	20,012	100.00%	3.728	3.677	3.780	-

In period 1985-89, 5,331,244 person years of observation; in period 1990-94 5,367,599 person years of observation
 In the column labelled 'Test for Difference', '+' indicates a significant increase in the cause-specific mortality rate between 1985-89 and 1990-94, '-' indicates a significant decline in the cause-specific mortality rate.
 Deaths to persons under the age of 75 are defined as premature mortality

for equal need. The corollary of this framework is that populations with greater need, indicated by poorer health status, should have access to a greater share of publicly funded health services.

One example of this increased policy focus on equity are the mechanisms adopted or proposed in many provinces for allocating health care resources to Regional Health Authority populations. These methodologies for sharing and allocating the resources of the central treasury allocated to health care among regional populations rely in whole or in part on mortality measures to indicate relative need for health care.²⁰⁻²⁴ Many provinces specifically apply measures of premature mortality. Mortality measures have been adopted in these resource allocation methodologies for a number of reasons: mortality data are readily available and are understood to be relatively accurate. Relative mortality has

been demonstrated to be a valid marker of regional differences in need for health care.²⁵⁻²⁹ In addition, as the data reported in this paper and elsewhere indicate,³⁰ regional mortality patterns are dynamic, and would appear to mark important changes in the health of populations over relatively short time intervals. Over the two time periods described in this report, the funding methodologies adopted in Saskatchewan and proposed in British Columbia and Manitoba (all of which use mortality indices in computing components of need measures) would have increased the relative share of health resources allocated to the two RHA populations exhibiting deteriorating health status.

The devolution of authority for the management and delivery of health services to Regional Health Authorities in most Canadian provinces promises to improve

the monitoring and surveillance of population health for geographic areas below the provincial level, a level of surveillance which with some exceptions³¹⁻³³ has not received consistent attention in Canada. Simultaneously, the implementation of funding formulas to share health care resources among regional health authorities based on need measures defined in part by premature mortality would embed a specific commitment to equity in health across populations. While neither the devolution of health system governance to regional authorities nor the implementation of population need-based funding methodologies for health system resources are necessarily sufficient to mitigate the processes which are producing the widening regional health inequalities observed in this setting, they are policy initiatives which provide new and fundamental mechanisms for responding to inequalities in health.

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