

A Matter of Life and Death for Manitoba's Children

An Overview of Birth Rates and Mortality Rates

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ABSTRACT

Objective: To determine the fertility and child mortality rates for Manitoba.

Methods: Fertility and mortality rates were derived from the Population Health Research Data Repository and Vital Statistics, for 1994 through 1998. Data are presented by 12 Regional Health Authorities (RHAs), 12 Winnipeg Community Areas (CAs) and by income quintile. Each indicator is correlated with PMR (the age- and sex-adjusted premature mortality rate, i.e., death before age 75) and SEFI (Socioeconomic Factor Index, a standardized composite index), both considered proxies for overall health and socioeconomic well-being of populations.

Results: Manitoba's total fertility rate was 1.77 children per woman, ranging from 1.62 to 3.15 by RHA, and 1.21 to 2.30 by Winnipeg CA. Manitoba's infant mortality rate was 6.6/1000 (or 5.5/1000 excluding <500 g or <20 weeks gestation), ranging from 4.5 to 10.2 by RHA (4.2 to 9.8 exclusive), and 3.7 to 8.4 by Winnipeg CA (2.7 to 6.7). There was a gradient of infant mortality by income quintile ($p < 0.001$), with double the rate comparing lowest to highest. Child mortality rates varied geographically and by gender, with northern children at greatest risk. Injury was the leading cause of death (52% for ages 1 through 9, 75% for ages 15 to 19).

Conclusion: Fertility rates, as well as infant and child mortality rates, were positively associated with PMR and SEFI, with substantial geographical variation.

La traduction du résumé se trouve à la fin de l'article.

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Responding in part to a growing body of evidence indicating that child health is a strong predictor of adult health, Manitoba Health, the provincial health department, asked the Manitoba Centre for Health Policy (MCHP) to develop a report on child health in Manitoba. The most basic indicators of child health revolve around issues of birth and death – fertility and mortality rates. This includes mortality rates for children ages 0 to 19 years, as well as causes of death. It was hypothesized that variations in fertility and mortality rates within Manitoba would be highly variable by geographical area. As well, these would be related to variations in income, and in the health and socioeconomic well-being of the community as measured by the premature mortality rate (PMR) and the socioeconomic factor index (SEFI) of a region.

The Canadian total fertility rate was 1.5 children per woman in 1997.¹ This is lower than the 1998 rate for USA at 1.97 children per woman, calculated from a general fertility rate of 65.6/1000.² Canada experienced a 5% drop in the annual number of births reported from 1996 to 1997. In the USA, births dropped successively from 1990 to 1997, with 1998 showing a modest increase of 1.6%. Who is giving birth? Canadian and USA statistics are quite similar. The percentages of Canadian 1997 births by maternal age were: 11% to women less than 20 years old; 58% to women ages 20-29 years old; and 31% to women age 30 and older. In the USA during 1998, 12.5% of the births were to women less than 20 years old, 52% to women 20 to 29 years old, and 35.5% to women 30 years or older.

Infant mortality rate (number of deaths among children less than one year old, per 1000 live births, per year) is considered an indicator of the level of health within a community.³ Distinction is made between infant mortality rates calculated as either a) a percentage of all live births, or b) a percentage of all live births excluding infants born weighing less than 500 grams and those born before 20 weeks of gestation. The usefulness of distinguishing between these two rates has been noted by Joseph and Kramer,⁴ due to the lower survival rate in babies less than 500 grams or born before 20 weeks gestation. The Canadian Perinatal Surveillance System Committee also recommends adjustment

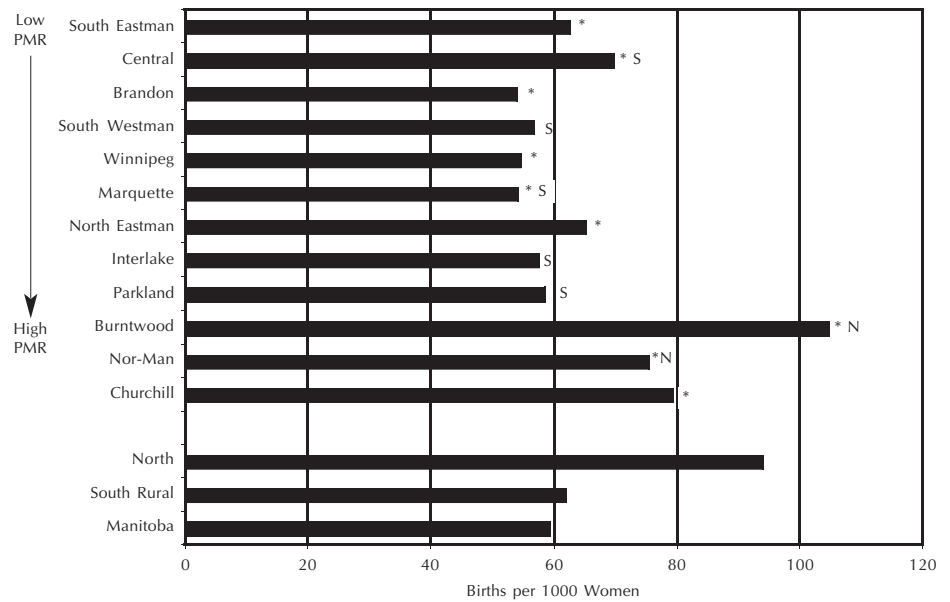
for birthweight, although it is sometimes difficult to obtain the necessary data.⁵ Different regions, provinces, as well as countries may have very different proportions of infants weighing less than 500 g. Of Canada's 10 provinces, Manitoba had the fourth highest infant mortality rate in 1994, with Newfoundland, Saskatchewan and Alberta having higher rates. Using the exclusive infant mortality rate, Manitoba drops to the fourth lowest with Saskatchewan, Newfoundland, Prince Edward Island, Alberta, British Columbia, and Ontario all being higher.

In the analysis of causes of death, this paper separates infant mortality rates into neonatal (28 days and under) and post-neonatal (29 days to less than 1 year) mortality rates. Neonatal mortality is more sensitive to advances in medical care, whereas post-neonatal mortality is more related to both medical care and socioeconomic conditions of the infant.⁶

METHODS

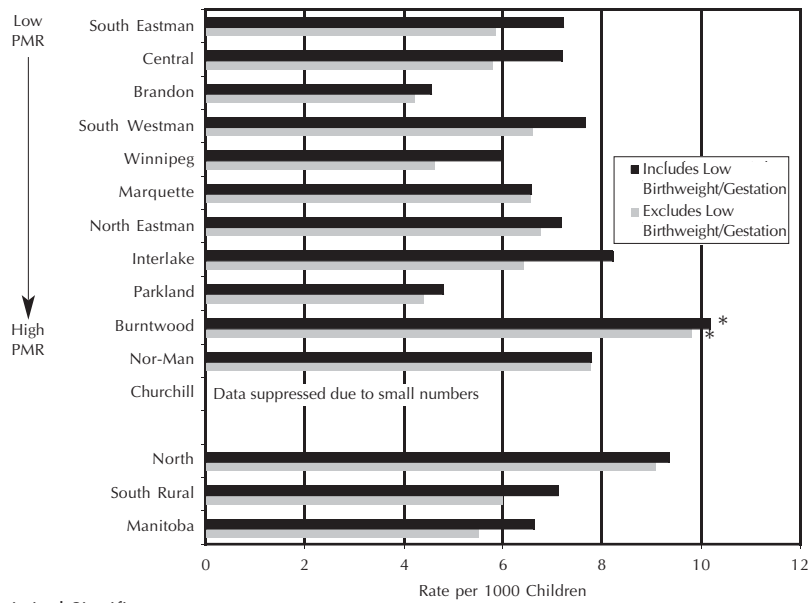
This is a cross-sectional study of children ages 0 to 19 years residing in the province of Manitoba from 1994 to 1998 inclusive. The "general fertility rate" calculates the number of births per 1000 women age 15 to 44 years old. A commonly used measure of fertility is the "total fertility rate",⁷ interpreted as "the number of children who would be born to an average woman who experiences each of the age-specific fertility rates of a population in a given year as she progresses through her reproductive lifetime."

Infant mortality rates are reported in two ways: a) as a percentage of all live births, and b) as a percentage of all live births minus infants born weighing less than 500 grams and those born before 20 weeks of gestation. For the sake of brevity, this paper will refer to the former rate as the "inclusive infant mortality rate" and the latter rate as the "exclusive rate." For infant and child mortality, the calendar years (January 1 through to December 31) were used. Mortality data were available for the years 1994 to 1998 inclusive, but cause of death was only available for the 1994 to 1997 data. Birth, mortality, and cause-of-death data were derived from the Population Health Research Data Repository and Vital Statistics (see



Statistical Significance:
 * - Rate significantly different from Manitoba mean at p<0.05
 N - Rate significantly different from mean for Northern Manitoba at p<0.05
 S - Rate significantly different from mean for Rural South Manitoba at p<0.05

Figure 1. General fertility rate for women aged 15-44 years by RHA, 1994-98



Statistical Significance:
 * Rate significantly different from Manitoba mean at p<0.05

Figure 2. Infant mortality rates for children aged <1 year at December 31, by RHA, 1994-98

Brownell et al.⁸ for more details on the methods and the databases).

Geographical data are presented by 12 geographical regions of Manitoba called "Regional Health Authorities" (RHAs), and also by 12 sub-regions of Winnipeg, Manitoba's largest city, called "Winnipeg Community Areas" (Winnipeg CAs). Comparisons of each RHA and Winnipeg

CA were made to the overall provincial rate as well as to the North (a combined rate of Burntwood, Nor-Man, and Churchill RHAs) and to the South Rural (seven southern RHAs excluding Winnipeg and Brandon). Residents of Manitoba were placed into either urban or rural income quintiles based on their postal codes. "Urban" referred to location within

TABLE I
Causes of Mortality by Age, 1994 through 1997 *

Cause of Death	Infant Mortality		Child Mortality			
	Ages 0 through 1 Year		Ages 1 through 19 Years			
	Neonate (< 28 days)	Post-Neonate (29 days to 364 days)	1 to 4 Years	5 to 9 Years	10 to 14 Years	15 to 19 Years
SIDS	2%	29%	—	—	—	—
Congenital anomalies	26%	14%	13%	5%	1%	2%
Injury	1%	9%	52%	52%	69%	75%
Respiratory system	10%	11%	7%	6%	3%	2%
Digestive system	2%	1%	3%	5%	3%	1%
Circulatory system	4%	6%	5%	6%	3%	3%
Nervous system	—	9%	5%	5%	4%	10%
Endocrine/metabolic	2%	2%	—	—	—	—
Neoplasm	1%	1%	6%	12%	14%	9%
Infectious/parasitic	2%	8%	4%	3%	$< 0.5\%$	3%
Ill-defined/unknown	10%	9%	—	—	—	—
Fetal haemorrhage	2%	—	—	—	—	—
Short gestational age/low birthweight	18%	—	—	—	—	—
Complications of labour	10%	—	—	—	—	—
Maternal conditions or complications	7%	—	—	—	—	—
Other	12%	1%	5%	6%	3%	4%

* Note: a dash in the cell indicates that this cause of death was not separated out for that specific age category

the two major urban cities of Manitoba – Brandon and Winnipeg – each of which constitutes an RHA. “Rural” referred to all other RHAs. Each postal code income grouping, and hence the quintile grouping, is reflecting an average income for the population within that group, not an individual income by household.

To determine the relationship between fertility/mortality rates and the health and socioeconomic well-being of the community, two regional measures were used: the premature mortality rate (PMR) and the socioeconomic factor index (SEFI). The PMR is an age- and sex-standardized death rate of persons less than 75 years old. It is considered the best single measure to reflect the healthiness of a group of people and their need for health care services.⁹⁻¹¹ Socioeconomic status is another indicator of overall population health and well-being.^{12,13} MCHP uses the SEFI as a composite measure of socioeconomic status. SEFI is based upon census measures of environmental, household and individual conditions associated with poor health, and hence a greater need for health care. PMR is highly correlated with SEFI and could be considered a surrogate for both physical health and socioeconomic health of the population within which the child resides (see Martens et al.¹⁴ for a detailed explanation of PMR and SEFI).

All indicator graphs are ordered by a five-year average 1994/95 to 1998/99 PMR, from the region with the lowest

PMR – the region with the healthiest population – on the top of the y-axis to the region with the highest PMR – the region with the least healthy population – on the bottom. For example, graphs displaying RHA data place South Eastman RHA at the top of the y-axis because South Eastman has the lowest PMR. This construction embeds the child health indicator in a framework of the healthiness of the region’s population, thereby giving a pictorial sense of whether one is associated with the other.

RESULTS

Fertility rates

Figure 1 shows the general fertility rate by RHA, calculated as the number of births per 1000 women ages 15 to 44 years old. Rates for the Winnipeg CAs are available in the child health report on our website at www.umanitoba.ca/centres/mchp. The two main urban areas of Manitoba – Winnipeg and Brandon – have lower fertility rates (54/1000) compared to the Manitoba average (59/1000), but the North has a much higher rate (94/1000), 1.6 times the provincial average. Within Winnipeg, the range of the Winnipeg CA rates is from 41/1000 (Assiniboine South) to 76/1000 (Point Douglas).

To translate these general fertility rates into the average number of children born to each woman during her lifetime, one can use the “total fertility rate.” Manitoba’s

total fertility rate was 1.77 children per woman for 1994 to 1998, higher than the Canadian rate (1.5) but lower than the USA rate (1.97). The Manitoba rate varies tremendously by region, ranging from 1.62 (Marquette) to 3.15 (Burntwood) at the RHA level, and 1.21 (Assiniboine South) to 2.30 (Point Douglas) at the Winnipeg CA level.

There was a significant decline in the general fertility rate in Manitoba from 1994 to 1998 ($p < 0.001$), but this mainly reflects declines in urban and South Rural Manitoba ($p < 0.001$). The North’s fertility rates stayed relatively stable ($p = 0.09$, NS). The annual number of live births in Manitoba dropped by 13% from 1994 to 1998. Actual numbers of live births within Manitoba for the years 1994 to 1998 were: 16,164; 15,833; 15,161; 14,361; and 14,143 respectively. The decline from the previous year was 2.1% (1994 to 1995), 4.2% (1995 to 1996), 5.3% (1996 to 1997) and 1.5% (1997 to 1998). In Manitoba for the year 1997, 18% of births were to women less than 20 years old; 55% to women 20 to 29 years old; and 27% to women 30 years old or more.

Infant mortality

Figure 2 presents the inclusive and exclusive infant mortality rate (the latter excluding babies weighing less than 500 g, or of less than 20 weeks gestational age). Rates for the Winnipeg CAs are available in the child health report on our website at www.umanitoba.ca/centres/mchp. For the years 1994-1998, the Manitoba inclusive infant mortality rate was 6.6/1000 (or 5.5/1000 exclusive), but rates varied by region from a low of 4.5/1000 (4.2/1000 exclusive) in Brandon RHA to a high of 10.2/1000 (9.8/1000 exclusive) in Burntwood RHA. Since infant mortality is a relatively rare event, thus fluctuating widely from year to year, the only region with a rate statistically different from the Manitoba rate was Burntwood. Infant mortality rates in Winnipeg CAs were lower, with the lowest inclusive rates being 3.7 (2.7 exclusive) for Transcona and St. Boniface, and the highest in Downtown at 8.4/1000 (6.7/1000 exclusive).

Causes of death for neonates and post-neonates are given in Table I. The leading causes of death for neonates in Manitoba

from 1994 to 1997 were congenital anomalies (26%), followed by short gestational age/low birthweight (18%). For post-neonates, SIDS (Sudden Infant Death Syndrome) was the leading cause of death at 29%, followed by congenital anomalies at 14%. Respiratory, infectious, and parasitic diseases made up a total of 19% of the causes of death for post-neonates.

There was a strong gradient ($p < 0.001$) in infant mortality by both rural and urban income quintiles within Manitoba (Figure 3). Comparing the lowest income quintile to the highest, there was twice the infant mortality rate both in urban (8.12/1000 vs. 4.15/1000, inclusive; or 6.24 vs. 2.72 exclusive) and rural settings (10.18 vs. 4.75 inclusive; or 8.83 vs. 4.05 exclusive).

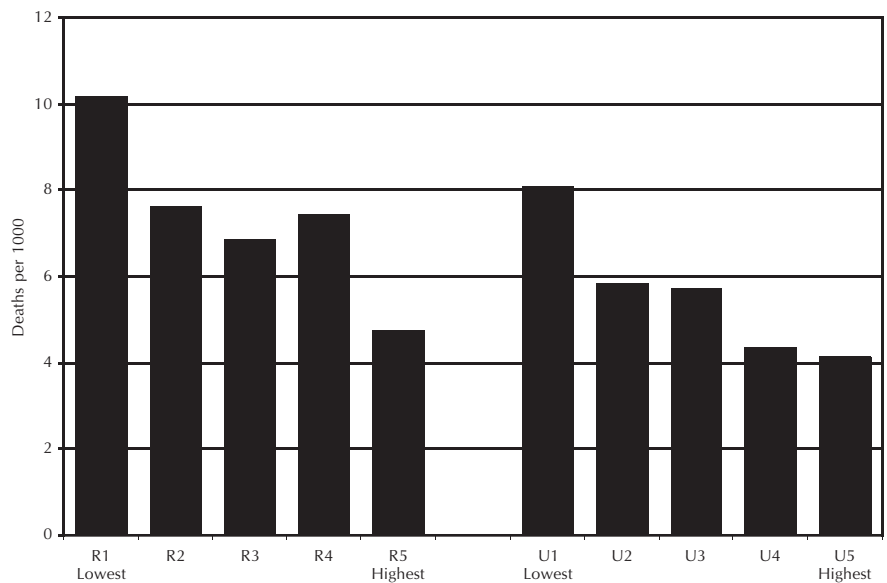
Child mortality

Age-specific mortality rates for 1-19 year olds are presented in Figures 4 and 5 by gender, age category and geographical location. Because child death is a rare event, child mortality rates are presented by larger geographical regions – North, South Rural, Winnipeg and Manitoba.

Winnipeg generally has lower child mortality rates than the Manitoba average, especially for male children ages 5 to 19 years. For males ages 5 to 19 years living in south rural areas, the rates are 26% to 47% higher than the average Manitoba male. In contrast, northern Manitoba shows an elevated pattern of mortality for both genders and nearly all age categories, especially for children ages 1 to 9 years. Females living in northern Manitoba have double the Manitoba female mortality rate at ages 5 to 9 years, almost triple the rate at ages 1 to 4 and 15 to 19 years, but about the same rate in the middle years of 10 to 14 years. Northern Manitoba males have almost triple the Manitoba male mortality rate at ages 1 to 9, double the rate at ages 10 to 14, and 1.6 times the rate at ages 15 to 19 years.

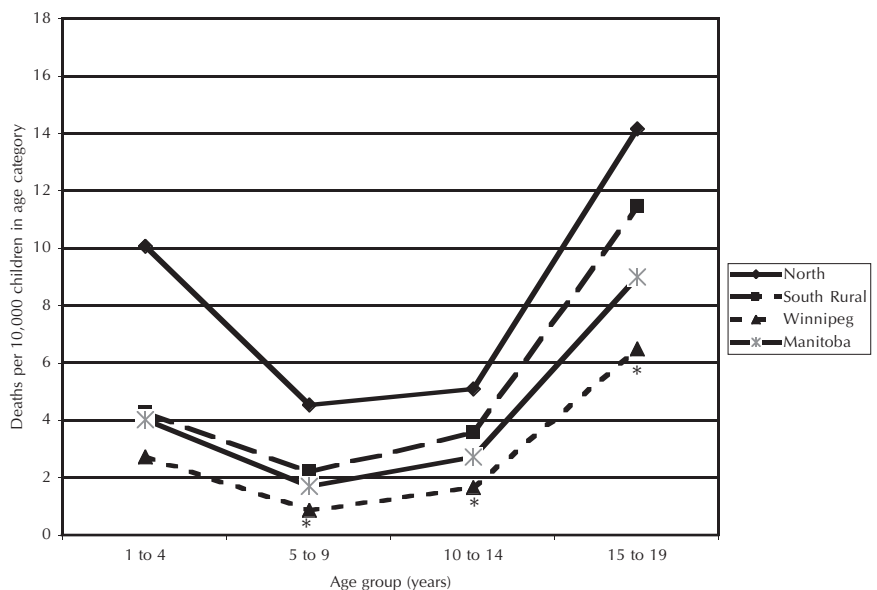
There was no statistically significant change in Manitoba's overall child mortality over the period 1994 to 1997, and no change by gender or by age category. Using three-year running average rates, the overall child mortality rates per 10,000 for ages 1 to 19 years were: 3.87 for 1994 to 1996; 3.86 for 1995 to 1997; and 3.82 for 1996 to 1998.

The causes of child mortality vary by age grouping (Table I). Death due to injury



R represents rural income quintiles, with R1 being the lowest and R5 being the highest income quintile; U represents urban income quintiles, with U1 being the lowest and U5 being the highest income quintile. Statistically significant trends in both rural and urban ($p < 0.0001$), using two-tailed Cochran-Armitage trend test.

Figure 3. Infant mortality (inclusive rate) by rural and urban income quintiles, 1994-98



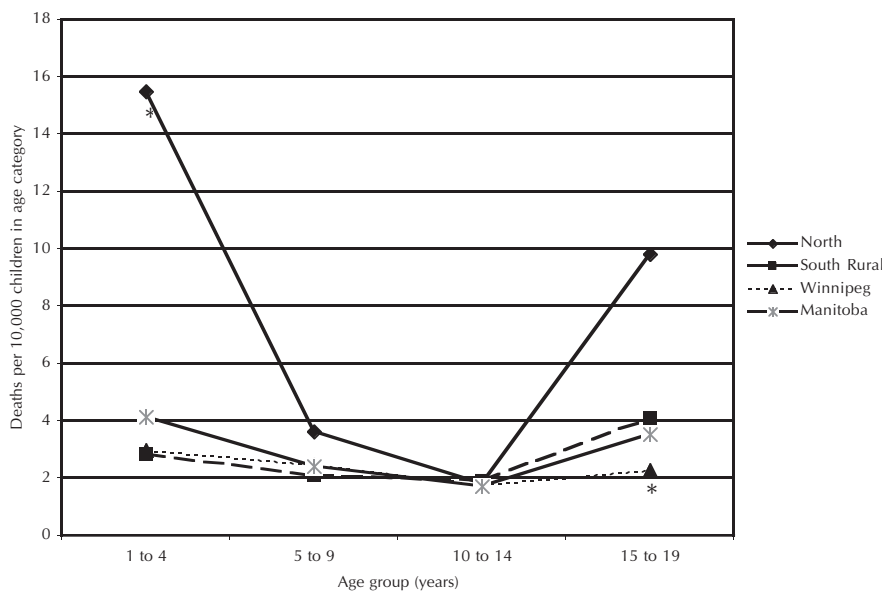
* Statistically different from Manitoba males in age group

Figure 4. Child mortality: males, 1994-98

was the leading cause for ages 1 through 19, ranging from 52% for ages 1 to 9 years, 69% for ages 10 to 14, and 75% for ages 15 to 19 (for detailed information on injury, see Brownell et al., this issue).¹⁵ Other leading causes include congenital anomalies and respiratory diseases for the youngest, and neoplasms for ages 5 to 19 years.

Correlations of fertility and mortality rates with regional population health indicators

Table II details the correlation of fertility and mortality rates with the two indicators of the healthiness and socioeconomic well-being of regional populations – PMR and SEFI. The greater the PMR (that is, the poorer the overall population health sta-



* Statistically different from Manitoba females in age group

Figure 5. Child mortality: females, 1994-98

TABLE II

Association of Child Indicators with Population Health/Socioeconomic Indicators

Health indicator‡	Correlation of Indicator with Premature Mortality Rate (PMR)	Correlation of Indicator with the Socioeconomic Factor Index (SEFI)
General fertility rate (n=23)	0.74***	0.70***
RHAs (Non-Winnipeg)	0.55†	0.67*
Winnipeg CAs	0.80**	0.69*
Infant mortality rate (n=22)	0.42†	0.39†
RHAs (Non-Winnipeg)	0.39	0.31
Winnipeg CAs	0.38	0.51†
Infant mortality rate excluding <500g and <20 weeks gestation (n=22)	0.63**	0.52*
RHAs (Non-Winnipeg)	0.58†	0.33
Winnipeg CAs	0.61*	0.76*
Child mortality rate ages 1 to 4 years (n=21)	0.81***	0.69***
RHAs (Non-Winnipeg)	0.86***	0.92***
Winnipeg CAs	0.67*	0.40
Child mortality rate ages 5 to 9 years (n=23)	0.27	0.16
RHAs (Non-Winnipeg)	0.18	0.19
Winnipeg CAs	0.10	0.02
Child mortality rate ages 10 to 14 years (n=22)	0.60**	0.59*
RHAs (Non-Winnipeg)	0.56†	0.67*
Winnipeg CAs	0.57†	0.42
Child mortality rate ages 15 to 19 years (n=22)	0.47*	0.47*
RHAs (Non-Winnipeg)	0.33	0.25
Winnipeg CAs	0.19	0.54†

‡ Each of the 11 Non-Winnipeg regional health authority regions (RHAs) and the 12 Winnipeg community areas (Winnipeg CAs) was included in the Spearman's correlations with PMR and SEFI. In some regions, there was suppression of the rate due to small numbers. The level of significance of the correlation coefficient is indicated by the following: * $p < 0.05$; ** $p < 0.002$; *** $p < 0.0001$; † $p < 0.10$, not statistically significant

tus), the greater a region's fertility rate, exclusive infant mortality rate, and child mortality rate in the age groups of 1 to 4, 10 to 14, and 15 to 19 years. In contrast,

there was no relationship between child mortality rate of children ages 5 to 9 years and PMR ($r = 0.27$, $p = 0.23$) or SEFI ($r = 0.16$, $p = 0.48$), even when analyzing

Winnipeg CAs and Non-Winnipeg RHAs separately.

When Winnipeg CA and Non-Winnipeg RHA rates were analyzed separately, the exclusive infant mortality was related to both PMR and SEFI within Winnipeg, but not outside of Winnipeg. In contrast, the inclusive infant mortality was not associated with PMR or SEFI. This may underscore the importance of using the exclusive definition of infant mortality, since the inclusive rate may obscure the association of this child health indicator with indicators of community health and well-being.

DISCUSSION

Fertility and infant/child mortality rates for Manitoba are highly correlated with the health and socioeconomic indicators of the region's population in which Manitoban children reside. This underscores the relationships of systemic community health and well-being with child health. Manitoba also has a high proportion of births (18%) to women less than 20 years old, compared to national statistics from Canada and the USA (11% and 12.5% respectively). Although the overall Manitoba birth rate is declining, children continue to be born at disproportionate rates in regions of poorer health and higher socioeconomic risk. Children also die at disproportionate rates in these regions, in any given age group from birth to late adolescence.

The Manitoba inclusive infant mortality rate of 6.6/1000 for 1994 to 1998 may be slightly higher than Canadian rates (6.3/1000 live births in 1994; 5.6/1000 in 1997),¹⁵ yet much lower than the USA 1997 rate of 7.2/1000.¹⁶ The leading causes of death for Manitoba were: congenital anomalies (26%) and being of short gestational age/low birthweight (18%) for neonates; and SIDS (29%) for post-neonates.⁵

Over the past few decades, the key reasons for decreased infant mortality rates in developed countries have been a) the improved rate of survival of low birthweight and preterm babies due to better resuscitation and care, and b) an increase in genetic counselling and congenital anomalies screening. But recent assisted reproductive technologies may actually

have the effect of increasing infant mortality rates in the future, since multiple births increase the risk of preterm or low birth-weight infants.¹⁷ Thus it would follow that Manitoba may actually see a rise in infant mortality as assisted reproductive technology becomes more common.

Manitoba infant mortality rates also vary by income, with double the rate in the lowest compared to the highest quintile. This gradient effect operates in both rural and urban income groupings, observable throughout all five quintiles for both rural and urban groupings. This means that income does not affect the poor only – gradients indicate an increasing infant mortality rate for decreasing income levels at each of the five quintile groupings. Absolute rates, however, are substantially higher in rural quintiles compared to the corresponding urban quintiles. Similar income gradient effects have also been observed for Canada-wide data,^{5,18} where urban infant mortality rates were 1.7 times higher in the lowest compared to the highest quintile (7.5/1000 vs. 4.5/1000 for 1986-1991; and 6.5/1000 vs. 3.9/1000 for 1996).

The Manitoba overall child mortality rates were stable from 1994 to 1998. But there were differential rates by geographical region and by socioeconomic risk. Children living in the North had a disproportionately high child mortality rate, and males 5 to 19 years in South Rural areas had death rates 26% to 47% higher than the Manitoba averages. The leading cause of death for Manitoba children ages 1 to 19 years was injury: one half of the deaths for children ages 1 to 9, and three quarters of the deaths for children ages 10 to 19 years. The degree to which injury plays a role in child death underscores the importance of preventive injury programs, especially in the north and in south rural areas. It may also point to risky behaviour patterns in rural south and north areas, possibly related to access to snowmobiles, alternate terrain vehicles, and farm machinery, as well as to more risky infrastructures such as poorer road conditions in rural and northern areas. Manitoba causes of death are similar to Canadian statistics which indicate that 41% of deaths for children

ages 5 to 9 years, and 52% of deaths for children ages 10 to 14 years, are due to accidents, motor vehicle deaths, homicides and suicides.¹⁹

Addressing the matters of life and death for the children of Manitoba is not easy. But the disparity in mortality rates among children, and, arguably, in fertility rates, between sub-regions of Manitoba indicates there is room for improvement on some of the basic levels of public health. The correlation reported here between infant mortality rates and fertility rates, and health and socioeconomic conditions, underscores the importance of macro-level policies when addressing issues of child health.

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RÉSUMÉ

Objectif : Déterminer les taux de fécondité et de mortalité juvénile au Manitoba.

Méthode : Les taux de fécondité et de mortalité ont été dérivés des chiffres de 1994 à 1998 de la base de données Population Health Research Data Repository and Vital Statistics. Les données sont présentées selon les 12 ORS, les 12 CR de Winnipeg et le quintile de revenu. Chaque indicateur est corrélé avec le taux de mortalité prématurée (c.-à-d. avant 75 ans, ajusté selon l'âge et le sexe) et avec le SEFI (un indice composite normalisé de facteurs socio-économiques), tous deux considérés comme pouvant remplacer les chiffres sur la santé globale et le bien-être socio-économique des populations.

Résultats : Le taux de fécondité dans l'ensemble du Manitoba était de 1,77 enfant par femme; il variait de 1,62 à 3,15 selon l'ORS et de 1,21 à 2,30 selon le CR de Winnipeg. Le taux de mortalité infantile au Manitoba était de 6,6 pour 1 000 (5,5 pour 1 000 si l'on exclut les bébés de moins de 500 g ou ceux nés avant 20 semaines de gestation); il variait de 4,5 à 10,2 selon l'ORS (de 4,2 à 9,8 avec les exceptions citées plus haut) et de 3,7 à 8,4 selon le CR (2,7 à 6,7). Le taux de mortalité infantile variait aussi du simple au double entre le premier et le dernier quintile de revenu ($p < 0,001$). Les taux de mortalité juvénile affichaient des écarts géographiques et selon le sexe, les enfants du Nord de la province étant les plus à risque. Les blessures étaient la principale cause de mortalité (étant responsables de 52 % des décès chez les 1 à 9 ans et de 75 % des décès chez les 15 à 19 ans).

Conclusion : Les taux de fécondité et de mortalité infantile et juvénile étaient positivement associés au TMP et au SEFI, avec des écarts géographiques considérables.