Assessing Health Status in Manitoba Children

Acute and Chronic Conditions

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ABSTRACT

Background: Numerous child health status measures have been developed, ranging from assessments of physical and mental health to activity continuums. Our objective was to report the regional distribution of physical morbidity among children in Manitoba.

Methods: Using Manitoba's population-based prescription and health care data for 1998/99, the prevalence of children with lower respiratory tract infections, four chronic conditions (asthma, cardiovascular disease, Type 1 diabetes mellitus and seizure disorders) and physical disabilities, including spina bifida and cerebral palsy, was determined for 12 Regional Health Authorities and 12 Winnipeg Community Areas, ranked by a measure of population healthiness, the premature mortality rate (PMR). Prescription rates were also reported by neighbourhood income quintile, derived from census data.

Results: Hospitalization for lower respiratory tract infection was highest in infants (6%) and increased with successive decreases in neighbourhood income or in the population healthiness of a region. On the basis of a physician diagnosis or prescription drug for asthma, 10% of school-age children had asthma. Asthma treatment rates in northern Manitoba were substantially lower than in Winnipeg. Treatment rates for cardiovascular conditions, Type I diabetes and seizure disorders approached 1% in adolescents and there were no regional differences in the distribution of these conditions. The prevalence of physical disability was highest in northern Manitoba.

Conclusion: A minority of Manitoba children suffer from chronic and serious acute health problems in childhood, but the burden of illness is not evenly distributed among children.

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

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The 1989 Convention on the Rights of the Child proposes a broad definition of health which describes a child's right to adequate circumstances for physical, mental, spiritual, moral and social development.[1] Numerous child health status measures have been developed over the years, ranging from simple scales assessing physical and mental health to activity continuums which assess the impact of illness on normal social role performance. What measures of child health should be used? The premature mortality rate has been accepted as a population health measure, but childhood mortality is an uncommon event, limiting its usefulness as a measure of health status.[2] Morbidity is more common in childhood, and includes physical, developmental, psychological, emotional and behaviour problems.

Physical conditions such as chronic illness and disability impose a considerable morbidity burden for children, in terms of interference with sleep, play and school, and dependency on medications or technology.[3,4] Almost 30% of children with asthma, cardiovascular conditions or diabetes are limited in their usual activities; the prevalence of activity limitation doubles in children with seizure disorders.[3,5] Over 80% of children with asthma, diabetes or seizure disorders take medications, and miss on average one week of school per year. Up to 90% of children with physical disabilities are limited in their usual activities. Recurrence of acute conditions such as lower respiratory tract infections also interferes with quality of life. This paper describes the regional distribution of the following physical conditions among Manitoba's children: 1) lower respiratory tract infections, 2) four chronic conditions (asthma, cardiovascular disease, Type 1 diabetes mellitus and seizure disorders), and 3) physical disabilities, including spina bifida, cerebral palsy and other paralytic conditions.

METHODS

Study design

This was a cross-sectional study of treatment prevalence of acute and chronic conditions in Manitoba children in 1998/99, reported by geographic area and neighbourhood income. The geographic areas used are 12 regions of Manitoba, called Regional Health Authorities (RHAs), and 12 sub-

TABLE I

Comparison of Treatment Prevalence Rates from Health Care Data (1996/97) and Disease Prevalence Rates from NPHS (1996) Survey

Condition	Age (yr)	Drug/Diagnosis Definition*	95% CI	NPHS 1996	95% CI
Asthma	5-9	11.00	10.70-11.30	12.40	7.90-16.99 M
	10-14	9.00	8.80-9.30	10.40	6.14-14.58 M
	15-19	7.70	7.50-8.00	12.70	8.13-17.25 M
Cardiovascular†	5-9	0.45	0.40-0.52	0.84	0.34-1.35 M
	10-14	0.58	0.52-0.66	0.64	-0.04-1.32 U
	15-19	1.11	1.02-1.21	0.54	0.13-0.95 U
Cardiovascular	5-9	0.27	0.23-0.32	0.84	0.34-1.35 M
Excluding Stroke†	10-14	0.42	0.37-0.49	0.64	-0.04-1.32 U
	15-19	0.89	0.81-0.98	0.54	0.13-0.95 U
Diabetes (Type I)	5-9	0.11	0.08-0.14		
	10-14	0.22	0.18-0.27		
	15-19	0.37	0.31-0.43		
Seizures	5-9	0.36	0.31-0.42	0.14	-0.07-0.35 U
	10-14	0.44	0.39-0.51	0.89	-0.16-1.93 U
	15-19	0.62	0.56-0.70	2.29	-0.38-4.96 U

* diagnosis data from physician claims/hospital separations and drug data from prescription database
† change in drug/diagnosis definition, but survey question remains the same
M = marginal estimates due to high sampling variability, U = unacceptable estimates due to high sampling variability

regions of Winnipeg, Manitoba's largest city, called Winnipeg Community Areas (Winnipeg CAs). RHAs and Winnipeg CAs were ranked by the premature mortality rate (PMR), the best single measure to represent the healthiness of a population, and its need for health care services.[6,7]

Study population and data sources

Administrative data were obtained on children aged 0 to 19 from the Population Health Research Data Repository (PHRDR) at the University of Manitoba. These data are anonymized, encounter-based records of Manitobans' interactions with the health care system. Four databases were used: 1) registration files, 2) records of physician reimbursement, 3) records of hospitalizations, and 4) records of prescriptions dispensed in retail pharmacies.

The registration file contains a record for every individual eligible to receive insured health services, and includes the individual's birth date, gender and geographic location. Records of physician reimbursement for medical care provided are submitted under a fee-for-service arrangement, and contain information on one patient diagnosis at the 3-digit level of the ICD-9-CM classification system and physician specialty. Discharge abstracts for hospital services include information on up to 16 ICD-9-CM diagnostic codes, of which the first diagnosis is the primary diagnosis responsible for the hospital stay. Prescription records are submitted by retail pharmacies for reimbursement by provincial drug insurance plans and for drug utilization review purposes. These records contain the drug's name, identification number, dosage form, and quantity dispensed, as well as the date the drug was dispensed.

The reliability and validity of the PHRDR databases have been found to be high for describing population drug use and health care utilization for specific conditions.[8,9] However, physician contact and prescription use in northern Manitoba nursing stations is incompletely recorded in the health care databases. Further, care must be taken when making inferences about disease prevalence from health care utilization data. Health care contact is less frequent among children living in rural versus urban areas.[10] Further, children are more likely to use prescription medications for chronic conditions than to visit a physician on an annual basis.[11] Our measure of chronic conditions also included prescription drug use to minimize bias subsequent to less frequent physician contact.

The face validity of defining chronic conditions according to diagnosis or prescription data was determined by comparing the rate of children defined on this basis, with the prevalence of children with the condition in the 1996 Manitoba sample of the National Population Health Survey (NPHS), recognizing the limitations of survey estimates of disease due to small sample size and wording of questions (i.e., ever had asthma versus current asthma). As parents may not view vascular diseases as "heart conditions," two categories of cardiovascular conditions were compared with survey data: all conditions and cardiovascular conditions excluding cerebrovascular (e.g., stroke) and vascular disorders. No comparisons with the survey data were made for the Type I diabetes case definition which had been validated previously by comparison to the Diabetes Education Resource Database.[12] To assess whether regional differences in chronic conditions could be real, we compared regional variation in overall health care contact and receipt of prescription drugs with regional variation in condition-specific treatment prevalence rates.

Study measures and analyses

The 1998/99 prevalence rate of children receiving health care was determined for: 1) lower respiratory tract infections, 2) four chronic conditions (asthma, cardiovascular disease, Type 1 diabetes mellitus and seizure disorders), and 3) physical disabilities, including spina bifida, cerebral palsy and other paralytic conditions. Hospitalization for lower respiratory tract infection included a hospitalization for pneumonia, bronchiolitis and bronchitis, and in children less than 5 years old, it also included hospitalization for asthma.[13] The treatment prevalence of asthma, cardiovascular conditions and seizure disorders was defined on the basis of at least one physician visit or hospitalization for these conditions or the receipt of at least one prescription drug to treat the condition. Children with a physical disability were identified on the basis of a physician visit or hospitalization for spina bifida, cerebral palsy or paralytic conditions from birth to 1998/99.[14]

The denominator was the population of children residing in Manitoba as of December 31, 1998. Age-specific and age-adjusted treatment prevalence rates were determined for each RHA and Winnipeg CA, and urban and rural neighbourhood income quintiles. Rates were suppressed where cell counts were less than 5. Children were placed into neighbourhood income quintiles, RHAs, and Winnipeg CAs, according to the postal code of their place of residence. Rural and urban neighbourhood income quintiles were created from Statistics Canada Census 1996 by aggregating household income data to the census enumeration area and ranking neighbourhood income quintiles from 20% of the population residing in the low-

est income neighbourhoods to 20% of the population residing in the highest income neighbourhoods.[15-17]

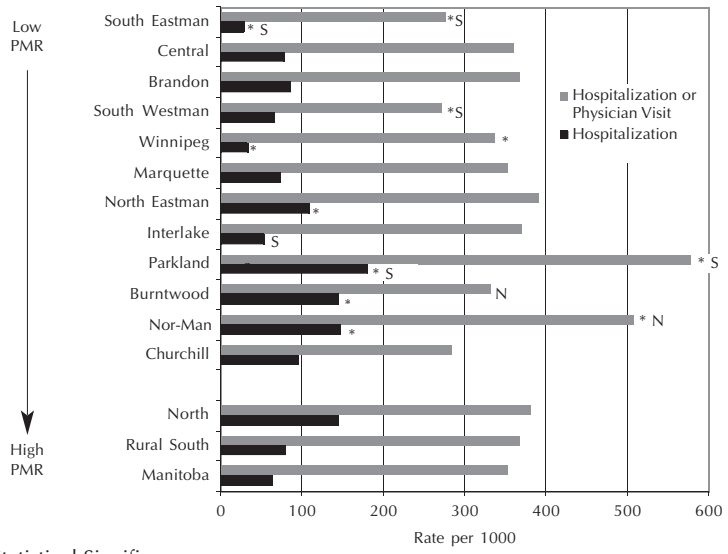
Using t-test methodology developed by Carriere and Roos,[18] treatment prevalence rates for individual RHAs and Winnipeg CAs were compared, at the 99% level of confidence, to the total Manitoba child population, Winnipeg, Non-Winnipeg (all children residing outside of Winnipeg), rural south (children residing in rural regions below the 53rd parallel) and north (children residing in regions above the 53rd parallel). Visual inspections of the regional rates, ranked according to PMR (lowest to highest), were performed to provide insight into the relationship with the healthiness of the population within a region (PMR). To further assess the association with PMR, treatment prevalence rates for regions were correlated with region PMR, using Spearman's rank correlation. Trends in prevalence rates across income quintiles were assessed with the Cochran-Armitage test for trend at the 95% level of confidence.

RESULTS

Validation of chronic conditions

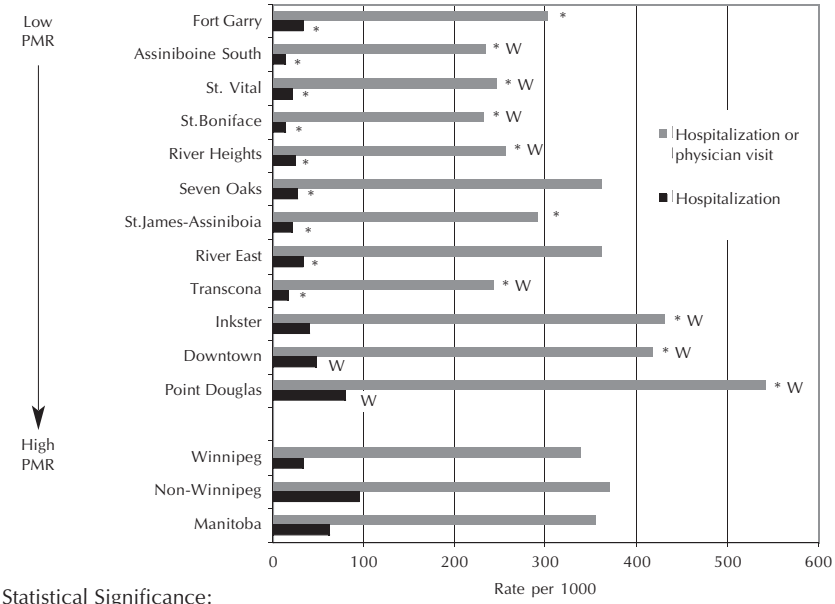
Age-specific asthma treatment rates fell within the 95% confidence intervals for asthma prevalence reported in the NPHS for children less than 15 years of age, indicating similarity in prevalence (Table I). The NPHS documented a higher prevalence of adolescents with asthma than that derived from health care administrative data, suggesting under-representation by health care administrative data or survey over-reporting of asthma which was no longer current.[19] The treatment rates of the other conditions were similar to survey rates, but because of their low prevalence, survey rates were unreliable.

Fewer children in Northern Manitoba had health care use or received prescription drugs than children living in Winnipeg. The ratio of the prevalence of any health care for Winnipeg children (86.3%) versus northern Manitoba children (67.6%) was 1.1. The ratio of the treatment prevalence for cardiovascular conditions between these regions was similar (Winnipeg/North ratio=1.3). However, the Winnipeg-to-North treatment prevalence ratio for asthma was 2.7.



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. Rate of children aged < 1 year with at least one health care contact for lower respiratory tract infection by RHA, 1998/99



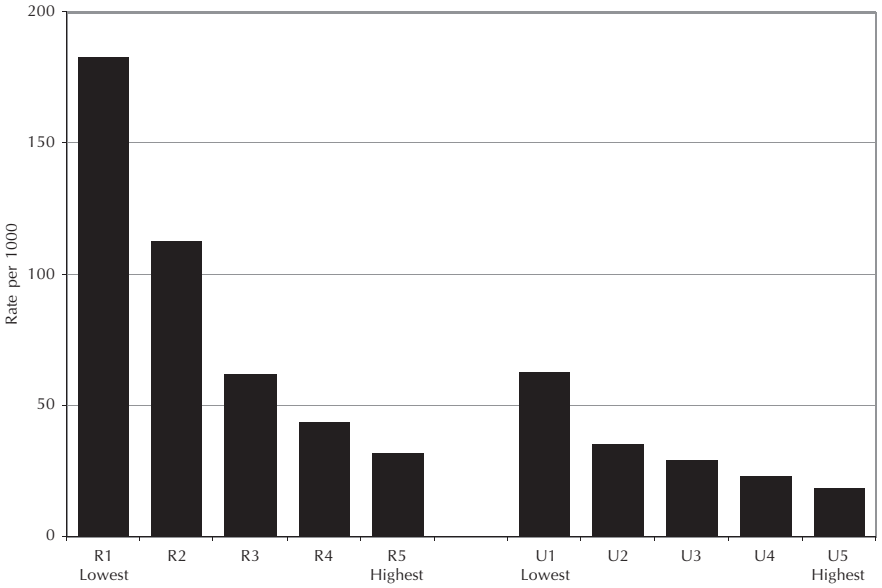
Statistical Significance:
* - Rate significantly different from Manitoba mean at p<0.05
W - Rate significantly different from Winnipeg mean at p<0.05

Figure 2. Rate of children aged < 1 year with at least one health care contact for lower respiratory tract infection by Winnipeg CA, 1998/99

Treatment prevalence rates

Eighty percent of Manitoba children saw a physician or were hospitalized in 1998/99 and 59% received at least one prescription drug. Defining health care contact on the basis of use of physician services, hospitalization or the receipt of a prescription drug, 83% of children received health care treatment.

1) Lower respiratory tract infection. In 1998/99, less than 1% of all children were hospitalized for a lower respiratory tract infection (LRI). The prevalence rate of hospitalization for LRI was highest in children less than one year of age (6% of infants), but declined dramatically by the age of five. The prevalence rate of LRI hospitalization in infants was highly correlated with the PMR (the healthiness) of the RHA populations (Spearman rank correlation =0.66, p<0.02). The rate in the Nor-



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. Rate of children aged < 1 year with at least one hospitalization for lower respiratory tract infection by rural and urban income quintile

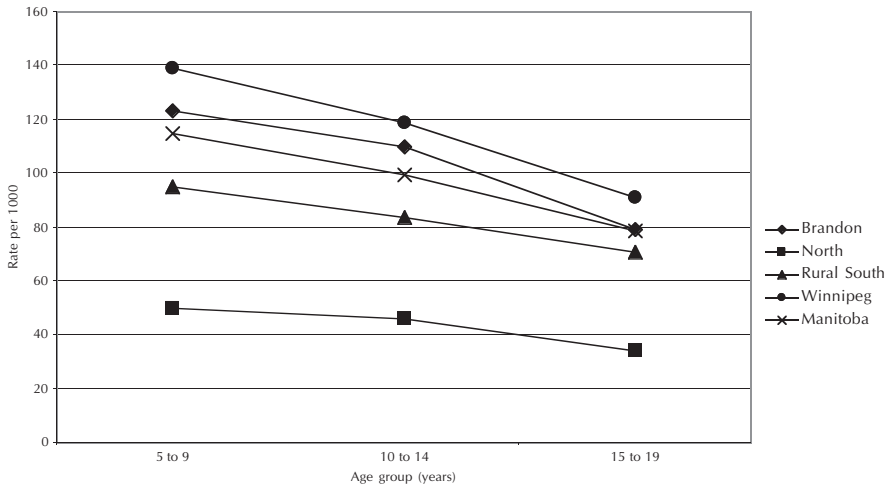


Figure 4. Rate of children with at least one health care contact or prescription drug for asthma by age and Manitoba region, 1998/99

Man, Burntwood and Parkland RHAs was significantly higher than the southern rural and the provincial average (Figure 1). Hospitalization for LRI was also highly correlated with the healthiness of populations in the Winnipeg CAs (Spearman rank correlation=0.61, p<0.04) (Figure 2). Infants living in the Point Douglas area were significantly more likely to be hospitalized for LRI than all Winnipeg infants combined (Figure 2). Of note, the prevalence rate of LRI hospitalization in the northern RHAs (150 per 1,000 infants) was 10-fold greater than the rate for infants living in the Winnipeg communities with the healthiest populations.

Hospitalization for LRI represents only the "tip of the iceberg" for all LRI morbidity as shown when physician contacts for LRI are combined with hospitalization rates (Figure 1). However, under-reporting of physician contacts in nursing stations makes this a less useful measure for comparisons across RHAs. Furthermore, there may be variation in LRI hospitalization by income neighbourhoods within RHAs and Winnipeg CAs. We observed increases in LRI hospitalization with decreasing neighbourhood income (Figure 3); this gradient effect was substantially steeper in rural areas (Cochran-Armitage trend test, p<0.0001).

2) Asthma. Ten percent of Manitoba's school-age children (5-19 years old) had either a physician diagnosis of asthma or a prescription for an asthma drug in 1998/99. The asthma treatment prevalence declined with age, from 11.5% in children 5-9 years to 8% in adolescents.

Asthma treatment rates were highest in Winnipeg (and Brandon in younger children), followed by southern rural areas, and then by the North (Figure 4). Among southern rural RHAs, the asthma treatment prevalence rate was significantly higher in the Interlake region than the southern rural average. Within Winnipeg, most asthma treatment rates did not differ by Winnipeg CA from the Winnipeg average, but a significantly higher rate was observed in the St. James-Assiniboine area for children 10 years of age and older.

3) Other chronic conditions. As documented for 1996/97 (Table I), the treatment prevalence for other chronic conditions in 1998/99 increased with age and was low in children less than 15 years old. On the basis of a physician visit, hospitalization or prescription drug, 1.2% of children, aged 15-19 years, had a cardiovascular condition, 0.7% had a seizure disorder, and 0.3% had Type I diabetes mellitus. In this age group, no statistically significant differences for the treatment prevalence of cardiovascular conditions, seizure disorders and type I diabetes were observed among RHAs or Winnipeg CAs. Age comparisons of the treatment prevalence for cardiovascular conditions (most frequent diagnosis was hypertension) by neighbourhood income documented the beginnings of a graded association with income (Figure 5). Higher cardiovascular condition rates were observed with decreases in neighbourhood income in urban areas among older children [Cochran-Armitage trend test for 5-9 year olds (NS), for 10-14 year olds (p<0.05), for 15-19 year olds (p<0.10)].

4) Physical disability (spina bifida, cerebral palsy and other paralytic conditions). In 1998/99, less than 1% of children were found to have spina bifida, cerebral palsy or paralytic conditions, determined on the

basis of their health care utilization records from birth. Figure 6 shows age-standardized disability rates by Winnipeg, Brandon, and northern and southern Manitoba. Winnipeg and northern regions were more likely to have children with these disabilities, but the only statistically significant difference was between northern versus southern rural rates of cerebral palsy/paralytic conditions.

DISCUSSION

Over 80% of Manitoba children received health care in 1998/99. However, health care for the acute and chronic conditions selected for study was not common. Hospitalization of children for respiratory conditions has declined over the past two decades;[20] less than 1% of all Manitoba children were hospitalized for LRI. However, LRI hospitalization rates were highest in infants and are a significant cause of mortality in this age group.[21] Infants living in low-income regions or the least healthy regions in Manitoba, as indicated by the PMR, were much more likely to be hospitalized for LRI. Similarly, higher LRI hospitalization rates among young children have been reported in US geographic areas characterized by higher rates of poverty.[13] A variety of risk factors for LRI, such as household crowding, smoking and lower breastfeeding rates, have been associated with living in a low-income household.[22] Manitoba regions with the highest LRI hospitalization rates also had the highest rates of these risk factors.[23]

Asthma was the most common chronic condition in childhood. On the basis of physician diagnosis or prescription use for asthma, 10% of school-age children had asthma in 1998/99, similar to the prevalence reported by the recent Canadian Student Lung Health Survey.[11] Not all children with asthma symptoms continue to have asthma as they grow older.[19] In our study, the treatment prevalence for asthma declined with age, compatible with this "growing out of asthma" phenomenon. Much lower asthma treatment rates were observed in northern Manitoba. While this finding may be a function of missing data on physician visits and prescriptions dispensed in nursing stations, relative differences in asthma treatment prevalence between Winnipeg and northern Manitoba were in excess of differences for health care contact between the two regions. Further, an asthma treatment definition which included prescription drug use potentially diminished bias from urban-rural differences in physician contact.[10,11] Our observations of lower asthma treatment rates in northern and southern rural regions do have some biological plausibility. First, a lower prevalence of asthma has been reported in Aboriginal children living in rural Manitoba and Australia.[24,25] Second is the cleanliness hypothesis which has been proposed to explain geographical differences in asthma prevalence.[26] The hypothesis states that children exposed to "germs" at an earlier age are much less likely to get asthma. We observed that northern and southern regions were also more likely than Winnipeg to have infants with lower respiratory tract infections.

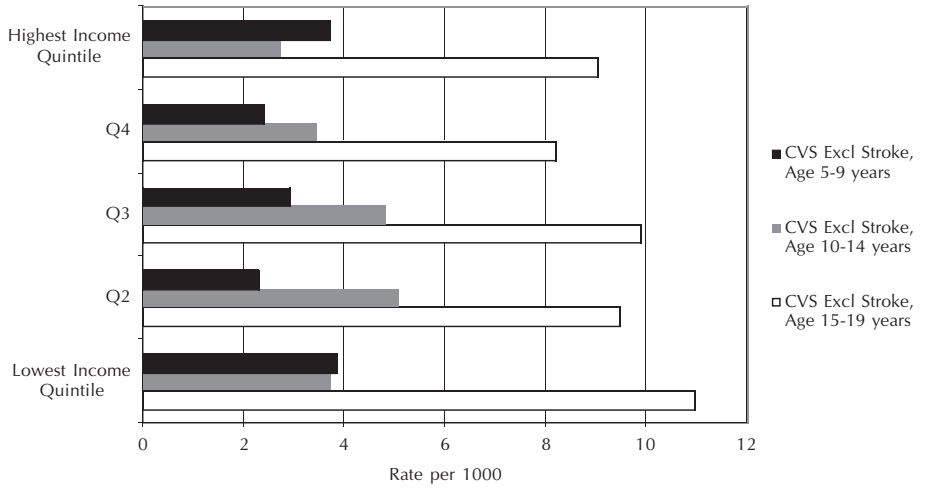


Figure 5. Rate of children with at least one health care contact or prescription drug for cardiovascular (CVS) conditions by age and urban income quintile, 1998/99

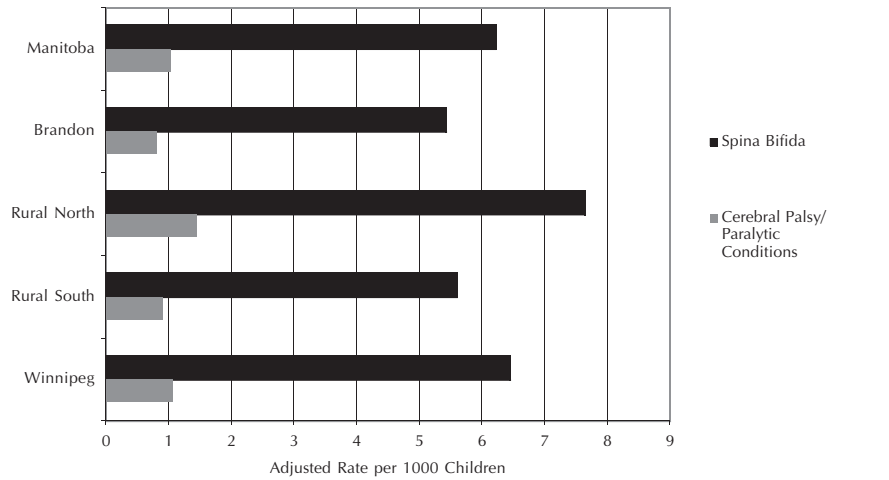


Figure 6. Rate of children aged 0-19 years with a major physical disability by Manitoba Region, 1998/99

Other chronic conditions in childhood were much less common than asthma, and their prevalence increased with age.[27] In our research, treatment rates for cardiovascular conditions, Type I diabetes and seizure disorders approached 1% in adolescents and there were no regional differences in the distribution of these conditions. We reported only on the prevalence of Type I diabetes in children, but there are regional differences in the prevalence of Type II diabetes, a disease which is reaching epidemic proportions in young Aboriginals.[28] Higher cardiovascular condition rates were observed with decreases in neighbourhood income in urban areas. This phenomenon has been documented by others, and has been attributed to the differential acquisition in children of risk factors, such as seden-

tary lifestyle and smoking, by household income.[29]

Physical disability can be the outcome of the prenatal period or of events later in childhood secondary to injury. The prevalence of physical disability was higher in the North, which we postulate is the outcome of higher rates of injury.[30] These disabilities cause a major interference with the activities of these children, significant consumption of health care services, and a high level of dependence on families for personal care.[31]

In summary, a minority of Manitoba children suffer from chronic and serious acute health problems in childhood, but the burden of illness is not evenly distributed among children. Acute conditions such as respiratory tract infections, and physical disability are more common in Northern Manitoba children, but asthma is more common in urban children. Our validity assessments suggest that these regional differences are real. However, we have presented data on physical health in Manitoba children, recognizing that physical health represents only one dimension of child health. Other dimensions, such as mental and emotional health, are equally as important and may be more pervasive in children.

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RÉSUMÉ

Contexte : Il existe de nombreuses mesures de l'état de santé des enfants; elles vont des évaluations de la santé physique et mentale aux continuums de l'activité physique. On présente ici la répartition régionale des troubles physiques chez les enfants manitobains.

Méthode : À l'aide des données représentatives du Manitoba sur la prescription de médicaments et les soins de santé (1998-1999), nous avons déterminé la prévalence des enfants présentant des infections des voies respiratoires inférieures, quatre états chroniques (asthme, maladie cardiovasculaire, diabète de type 1, troubles épileptiques) ou des déficiences physiques comme le spina-bifida et l'infirmité motrice cérébrale dans 12 ORS et 12 CR de Winnipeg, classés selon une mesure de l'état de santé de la population (le TMP). Les taux de prescription de médicaments sur ordonnance sont également présentés par quintile de revenu des quartiers (selon les données du recensement).

Résultats : Le plus haut taux d'hospitalisation pour infection des voies respiratoires inférieures a été mesuré chez les nourrissons (6 %) et augmentait avec les diminutions successives du revenu du quartier ou de l'état de santé de la population de la sous-région. D'après les diagnostics des médecins et les médicaments prescrits contre l'asthme, 10 % des enfants d'âge scolaire étaient asthmatiques. Les taux de traitement de l'asthme dans le Nord du Manitoba étaient sensiblement plus faibles qu'à Winnipeg. Les taux de traitement des maladies cardiovasculaires, du diabète de type 1 et des troubles épileptiques atteignaient près de 1 % chez les adolescents; on n'observe aucun écart régional dans la répartition de ces troubles. C'est dans le Nord du Manitoba que la prévalence des déficiences physiques était la plus élevée.

Conclusion : Une minorité d'enfants manitobains souffre de problèmes de santé chroniques et graves durant l'enfance, mais le fardeau de la maladie n'est pas équitablement réparti entre les enfants.