Health Service Utilization by Manitoba Children

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ABSTRACT

Objective: To compare physician and hospital utilization rates by children across subregions of Manitoba.

Methods: 1998/99 data for physician visits and hospitalizations for children aged 0 to 19 were extracted from the Population Health Research Data Repository. Rates of utilization were compared across 12 regions (RHAs) within Manitoba, and 12 community areas within Winnipeg. Rates were also compared across premature mortality rates (PMR) and area income levels.

Results: Substantial regional variation was found for utilization rates. The hospitalization rate for children from the three northern RHAs (highest PMRs) (114/1000) was almost four times the Winnipeg rate (30/1000) and almost double the rate for the rural south RHAs (lowest PMRs) (59/1000). The variation among regions in physician visits ranged from under 2 visits in 2 of the northern RHAs to almost 4 visits in urban areas. However, the low visit rates in rural RHAs are offset somewhat by greater use of nurses. Hospitalizations and physician visits were also related to area income level.

Conclusion: Findings are discussed in terms of health care need.

In 1973, John Wennberg and Alan Gittelsohn published a paper examining the rate at which surgery was performed in various New England communities. They found, for example, that the rate of tonsillectomy in Vermont ranged from 3 to 15 per 1000 residents.¹ Since then, numerous "small area" analyses have been done. These studies are of interest to health policy analysts and policy-makers because large variations in utilization of health services suggest overuse in areas with above-average rates and underuse in areas with below-average rates. "Small area" studies cannot resolve the question of what utilization rate is appropriate, but they can suggest hypotheses that deserve further research.

In this paper, we examine regional differences in utilization rates of physician and hospital services by children ages 0 to 19 years living in Manitoba, Canada. In addition to describing overall rates of health care use, we also examine regional differences in the location of health services provided, and the use of specialist physicians. We also look at the relationship between income levels and health care use as well as the relationship between the premature mortality rate (PMR) and the Socioeconomic Factor Index (SEFI) and health care use. PMR is considered an indicator of the healthiness of a population, with higher PMR generally associated with both poorer health and lower socioeconomic status. SEFI is an indicator of the socioeconomic conditions within a region, with high SEFI associated with conditions considered to be less favourable to overall health (see Martens, et al. this issue, for a description of PMR and SEFI and the use of PMR as a conceptual framework).²

METHODS

Data were derived from the population-based Population Health Research Data Repository. Details about these anonymized data sets can be found elsewhere (see Brownell, et al. this issue).³ Specifically we examined physician claims and hospital separation abstracts for the period April 1, 1998 through March 31, 1999. Hospitalization rates included all inpatient separations for 0-19 year old children residing in Manitoba, excluding births, in the numerator and all children residing in the province of Manitoba dur-

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ing the study year in the denominator. Physician visits included all ambulatory encounters with Manitoba physicians by 0-19 year old Manitoba residents in the numerator, and all children residing in Manitoba during the study year in the denominator. Physician visits were further broken down by specialty of physician in the following categories: general practitioners, paediatricians, and all other specialists. Regional rates indicate where children who received the health care services resided, rather than where the services were delivered. All rates using children 0 to 19 years were age- and sex-adjusted using the direct method of standardization.

These utilization data were broken down by regions. At the provincial level, we used 12 subregions called Regional Health Authorities (RHAs). We further sub-divided Manitoba's largest city, Winnipeg, which is itself an RHA, into 12 subregions called Winnipeg Community Areas (Winnipeg CAs). Summary rates are given for 1) the total Manitoba child population, 2) Winnipeg, 3) Non-Winnipeg (all children residing outside of Winnipeg), 4) Rural South (children residing in rural regions below the 53rd parallel) and 5) North (children residing in regions above the 53rd parallel). Comparisons of utilization rates across regions used t-test methodology developed by Carriere and Roos.⁴ To adjust for multiple comparisons between each RHA or Winnipeg CA and an overall provincial or Winnipeg rate, 99% confidence intervals were used. Rates were suppressed where cell counts were less than 5. Because regions are ordered according to PMR (from lowest to highest) in each graph, visual inspection of the regional graphs provides insight into the relationship between the healthiness of the population within a region (PMR) and the utilization variables. To further assess the association between utilization and PMR as well as the socioeconomic conditions in the region, hospital separation and physician visit rates for the regions were correlated with the regions' PMRs and SEFIs, using Spearman's rank correlation.

An index of morbidity burden was created, using the Adjusted Clinical Group (formerly Ambulatory Care Group) classification system.⁵ All children with a health care contact were sorted into those receiving well child care (a group with no morbidity) and those seeking all other types of

TABLE 1

Health Care Utilization Rates by Age, Children 0-19 Years in Manitoba

Hospitalization per 1000	Age <1	1-4	5-9	10-14	15-19	Total
	217.44	52.89	26.90	29.24	70.38	48.12
Physician Visits per Child per Year	Age <1	1-4	5-9	10-14	15-19	Total
Total	7.47	5.10	3.08	2.58	3.17	3.59
General Practitioners	4.12	3.08	1.97	1.81	2.58	2.40
Paediatricians	2.86	1.65	0.87	0.51	0.19	0.86
Other Specialists	0.50	0.37	0.24	0.27	0.40	0.33

care. The latter category was in turn sorted into lower morbidity burden and higher morbidity burden. Lower and higher morbidity burden were determined based upon the number of acute, recurrent and chronic conditions diagnosed in the child.⁶

Survey data from the 1996 National Population Health Survey (NPHS) were used to estimate nursing station visits as these are not captured in the administrative data. For some Manitoba children, especially those in sparsely populated rural areas, nurses assigned to nursing stations are more accessible than physicians and hospitals. These nurses are trained to provide services ordinarily provided by physicians in more populated areas. The NPHS survey did not include children living in First Nations communities, and because many of these communities are situated in sparsely populated rural areas, nursing station visit data from the NPHS underestimate the use of these nurses in these areas.

To obtain income level information, rural and urban neighbourhoods were each divided into five different income levels referred to as quintiles, based on 1996 Census information available through Statistics Canada.³ Cochran-Armitage trend tests were used to assess the significance of the relationships between health care utilization variables and neighbourhood income level.

RESULTS

Health care utilization

In 1998/99, 80% of Manitoba children had at least one health care contact. Almost 5% of all Manitoba children were hospitalized (48/1000) and the average rate of physician visits was 3.6 per child. The most common diagnosis for hospitalization was bronchitis/ bronchiolitis and, for physician consultation, upper respiratory tract infection. Approximately 10% of

children with health care contacts were classified as higher morbidity burden (e.g., acute, recurrent and chronic conditions). These children used a disproportionate number of services, especially acute care services (30% of hospitalizations and 20% of physician services). However, the majority of health care services were for children with lower morbidity burden.

Hospital utilization

Hospital Utilization by Region

Figures 1 and 2 show the hospitalization rates in 1998/99 by RHAs and Winnipeg CAs respectively, with significant regional variation evident. The hospitalization rate for Non-Winnipeg children (68/1000) was over twice as high as that for Winnipeg children (30/1000). The hospitalization rate for children from the north, areas with the highest PMRs, was almost 4 times higher (114/1000) than that for Winnipeg children, whereas the rate for children from the rural south, areas with the lowest PMR, was almost twice as high (59/1000) as the Winnipeg rate. For children from all Winnipeg CAs except the two with the highest PMRs (Downtown and Point Douglas), the hospitalization rates were lower than the provincial average. For children from these high PMR areas, the hospitalization rates were higher than the Winnipeg average, but still lower than the Non-Winnipeg average. Hospitalization rates correlated significantly with PMR ($r=0.71$, $p<0.0001$), with regions with less healthy populations having higher hospitalization rates. The hospitalization rates also correlated significantly with SEFI ($r=0.62$, $p<0.01$), with regions with less favourable socioeconomic conditions having higher hospitalization rates.

Figure 1 also indicates where residents of the various regions were hospitalized. About 28% of northern residents and 29% of chil-

Statistical Significance (For Totals Only):

* - Rate significantly different from Manitoba mean at $p < 0.05$

S - Rate significantly different from mean for Rural South at $p < 0.05$

N - Rate significantly different from mean for North at $p < 0.05$

Figure 1. Hospitalization rates for children aged 0-19 years by location of hospital and RHA, 1998/99

† - The RHA for all of the Winnipeg CAs is Winnipeg

* - Rate significantly different from Manitoba mean at $p < 0.05$

W - Rate significantly different from Winnipeg mean at $p < 0.05$

Figure 2. Hospitalization rates for children aged 0-19 years by location of hospital and Winnipeg CA, 1998/99

dren from the rural south were hospitalized in Winnipeg; however these percentages varied across regions, ranging from 10% to 55%. Almost 65% of children residing outside of Winnipeg (including the North, Rural South and Brandon) were hospitalized in their own RHA, but this value also varied, ranging from 42% to 86%.

Hospital Utilization by Age

Hospital utilization varies with age, with the highest utilization rates for children under one year of age decreasing substantially after the first year, and then increasing somewhat in the 15 to 19 year age group (Table I).

Hospital Utilization by Income

Significant trends were found for hospitalization rates for both rural and urban neighbourhood income levels, with higher hospitalization rates associated with lower income (Cochran-Armitage trend, $p < 0.0001$, Figure 3). Children living in the lowest neighbourhood income quintile in urban and rural areas were 3 times more likely to be hospitalized than children in the highest income quintile.

Physician visits

Physician Visits by Region

Figure 4 shows the physician visit rates per 1000 children 0 to 19 years of age by RHA. Physician visit rates varied significantly across regions, with children from Winnipeg and Brandon (the two areas with the highest supply of physicians) having almost 4 visits per child annually, whereas children from the northern regions of Churchill and Burntwood had fewer than 2 visits per child. The significantly lower visit rates shown for children residing in the north were at least partly attributable to the higher use of nursing stations for health care services in these regions; these visits are not captured in the administrative data. According to the 1996 NPHS, 18% of residents of northern Manitoba (excluding those First Nations persons living "on reserve", who were excluded from the survey sample) had at least one contact with a nurse or nurse practitioner for health consultation, compared to 12% for the Rural South and 6% for urban (Winnipeg and Brandon) Manitoba. Those residing in the Rural South also had significantly lower physician visit rates than the Manitoba average, which is strongly influenced by the higher Winnipeg rates. As Figure 5 indicates, the visit rates for Winnipeg children were significantly higher (4 visits per child) than those for Non-Winnipeg children (3.2 visits per child). Physician visits in the Winnipeg CAs ranged across areas from 3.7 to 4.5 (Figure 5).

Due to missing data in the North, correlations between PMR and physician visits were run separately for RHAs and Winnipeg CAs. A significant association was found between PMR and physician visit rates only for the Winnipeg CAs, with those areas with less healthy populations

having higher physician visits ($r=0.62$, $p<0.03$). Likewise, correlations with SEFI were significant only for the Winnipeg CAs ($r=0.74$, $p<0.01$), with community areas with less favourable socioeconomic conditions having higher physician visit rates.

Physician Visits by Specialty

Figures 4 and 5 also show the types of physicians accessed by children living in different areas. Children residing in Winnipeg were far more likely to access specialists (paediatricians* and other specialists) than non-Winnipeg children. Winnipeg children made over 3.5 times more visits to specialists (1.82/1000) than their Non-Winnipeg counterparts (0.51). Although the use of specialists varied across areas, correlation analyses showed that the use of specialists was not correlated with PMR or SEFI in either the RHAs or the Winnipeg CAs.

Almost 80% of the physician visits for children in the north and over 75% of the visits for those in the south were provided within the child's own RHA (not shown). The percent of visits provided within the Non-Winnipeg RHAs varied by region, ranging from less than 60% to about 90%. For all RHAs except Winnipeg and Brandon, the majority of visits to paediatricians and other specialists took place outside the child's own RHA, most often in Winnipeg.

Physician Visits by Age

Physician visits also vary by age, with substantially more visits in the first year of life, and declining after one year of age (Table I). Visits to paediatricians dropped steadily with each age group after the first year of life, whereas visits to other specialists decreased after the first year of life, but then increased again in the 15 to 19 year group (Table I).

Physician Visits by Income

Significant trends were found for physician visit rates across income quintiles; however the trends went in opposite directions for rural and urban income. For children living in rural areas, lower income levels were associated with decreasing

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. Hospitalization rates for children aged 0-19 years by urban and rural income quintiles, 1998/99

Statistical Significance:

* - Rate significantly different from Manitoba mean at $p<0.05$

N - Rate significantly different from mean for North at $p<0.05$

S - Rate significantly different from mean for Rural South at $p<0.05$

Figure 4. Physician visit rates for children aged 0-19 years by physician specialty and RHA, 1998/99

physician visits, potentially an outcome of missing data from northern regions (Cochran-Armitage $p<0.0001$). For children living in urban areas, physician visits increased as neighbourhood income level decreased (Cochran-Armitage trend

$p<0.001$). Children living in the lowest income neighbourhoods in urban areas made 20% more visits to physicians (4.1 per child) than those living in the highest urban income neighbourhoods (3.5 per child).

* Paediatricians are defined as specialists here based on training, rather than the level of care they deliver. Indeed, paediatricians in Winnipeg and Brandon provide not only specialist care but also primary care which, for rural residents, is delivered by general practitioners.

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

Figure 5. Physician visit rates for children aged 0-19 years by physician specialty and Winnipeg CA, 1998/99

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 6. Rate of visits to specialist physicians by urban and rural income quintiles

For both rural and urban children, the likelihood of visiting a specialist increased as neighbourhood income level increased (Cochran-Armitage $p < 0.0001$ for both rural and urban quintiles, Figure 6). For urban areas, children living in the highest income neighbourhoods had 11% more visits to specialists (1.86 per child) than

those living in the lowest income neighbourhoods (1.67 per child). For rural areas, the differences were more dramatic: those from the highest income neighbourhoods had 170% more visits to specialists (0.98 per child) than children from the lowest income neighbourhoods (0.36 per child).

DISCUSSION

This paper confirms the findings of a substantial body of “small area” research, namely, that medical utilization rates can vary substantially between communities in the same general area.⁷⁻¹⁰ Our data indicate that physician and hospital utilization rates for children vary considerably by region within Manitoba. This is especially true of hospital utilization rates. It is often suggested that above-average use rates signify overuse of medical services. Does high use of hospitals or physician services in one area compared to another necessarily mean that the high-use areas are over-served? In the case of health services use by Manitoba children, we think the answer is “not necessarily.” In order to state with confidence that a high-use region is overusing medical services, one would have to make at least two adjustments to raw use rates for all regions in the comparison, one on the demand side and one on the supply side. On the demand side, we must adjust for differences in population health. Where populations are of similar health status and rates vary greatly, then one may question whether usage patterns relate to the needs of the population. On the supply side, we must adjust for, or at least take note of, differences in availability of health care providers.

Data reported here and elsewhere in this volume (see Martens, et al., this issue)² indicate that the variations in hospitalization among regions within Manitoba reflect differences in need for hospital services rather than differences in physician propensity to hospitalize. The relationship reported in this paper between PMR (and SEFI) and hospitalization rates for both RHAs and Winnipeg CAs suggests that much of the variation observed across regions in hospitalization is due to the needs of the populations within the regions. In other words, the sicker populations with higher socioeconomic risk had higher hospitalization rates. High use of hospitals by children in northern regions is not surprising because these populations have high health risks. As Brownell et al. have shown elsewhere in this volume,¹¹ injuries to children serious enough to warrant hospitalization occur at a much higher rate in the north and the south – especially the north – than they do in Winnipeg.

Likewise, higher hospitalization rates for children from lower income neighbourhoods, a trend observed in this study and also reported elsewhere,¹² are not surprising given the higher health needs of children from lower income groups. Research suggests that these gradients in hospital use across socioeconomic status reflect real differences in the health of these groups, not differences driven by social causes of admissions. Patients admitted to Winnipeg hospitals from the lowest income neighbourhoods were just as likely to meet criteria suggesting that acute care was required as were patients admitted from middle income or even from the highest income neighbourhoods.¹³ On the other hand, higher use of hospitals by children in relatively healthy areas in the rural south compared to Winnipeg children may signal the need to focus on whether over-servicing exists.

The other factor that must be taken into account in comparing regional use rates is the availability of physicians and hospitals. The low physician visit rate for the three northern RHAs shown in Figure 4 is almost certainly due to the lower availability of physicians in those RHAs.

Within Winnipeg CAs, the relationship between PMR (and SEFI) and physician visits suggests that those children living in areas of higher health need are also seeing physicians more frequently, which is exactly how an equitable health care system should work. However, when we looked at visits to specialists, we found that those children from the lower income neighbourhoods in urban areas were less likely to see specialists than children from higher income neighbourhoods, despite apparently equal availability of these specialists to the lower income urban children. Others¹⁴ have also found a gradient for specialist visits in Canada, with those from higher income groups more likely to see a specialist. In the current study, children from high-income rural areas were almost 3 times as likely to visit specialists than their counterparts from lower income neighbourhoods. Although no direct financial barriers exist in accessing specialists in Manitoba, due to universal coverage, indirect barriers, such as having to travel to Winnipeg or Brandon to meet with spe-

cialists, may play a role in the lower specialist visit rates for rural low income children. As mentioned above, however, even for urban children the gradient exists, with children from higher income groups more likely to visit specialists. Over all income levels, Winnipeg children are more than 3.5 times more likely to access specialists than their rural counterparts. Because a good part of this care may be primary care by paediatricians, it may, at least in part, reflect parental preference for a paediatrician. Regardless, it is clear that use of specialists is not equitable across regions and income groups for Manitoba children.

In conclusion, when considering the over-servicing debate, we must distinguish over-servicing from legitimate high use driven by high health care needs. Where high health care needs coincide with high use, it appears to be one indication that the system is working well, and that those who need services most are receiving them. Where high use coincides with relatively healthy populations, we need to ask whether lower use areas are being under-serviced or whether the high-use, healthy areas are instances of over-servicing. Similarly, in evaluating whether below-average use rates are appropriate and may, therefore, serve as a standard against which to compare higher-use regions, we must determine whether access barriers have depressed use rates.

REFERENCES

1. Wennberg J, Gittelsohn A. Small area variations in health care delivery. *Science* 1973;182:1102-8.

2. Martens P, Frohlich N, Carriere K, Derksen S, Brownell M. Embedding child health within a framework of regional health: Population health status and sociodemographic indicators. *Can J Public Health* 2002;93(Suppl 2):S15-S20.
3. Brownell M, Mayer T, Martens P, Kozyskij A, Fergusson P, Bodnarchuk J, et al. Using a population-based health information system to study child health. *Can J Public Health* 2002;93(Suppl. 2):S9-S14.
4. Carriere K, Roos LL. A method of comparison for standardized rates of low-incidence events. *Med Care* 1997;35:57-69.
5. Johns Hopkins University School of Hygiene and Public Health. ACG Software Documentation and Users Manual (v 4.5). Baltimore: Johns Hopkins University, 2000.
6. Smith NS, Weiner JP. Applying population-based case mix adjustment in managed care: The Johns Hopkins Ambulatory Care Group system. *Managed Care Q* 1994;2(3):21-34.
7. Dyck FJ, Murphy FA, Murphy JK, Road DA, Boyd MS, Osborne E, et al. Effect of surveillance on the number of hysterectomies in the province of Saskatchewan. *N Engl J Med* 1977;296:1326-28.
8. Perrin JM, Homer CJ, Berwick DM, Woolf AD, Freeman JL, Wennberg J, et al. Variations in rates of hospitalization of children in three urban communities. *N Engl J Med* 1989;320:1183-87.
9. Roos NP, Henteleff PD, Roos LL. A new audit procedure applies to an old question: Is the frequency of T & A justified? *Med Care* 1977;15:1-18.
10. Roos NP, Roos LL. Surgical rate variations: Do they reflect the health or socio-economic characteristics of the population? *Med Care* 1982;20:945-58.
11. Brownell M, Friesen D, Mayer T. Childhood injury rates in Manitoba: Socioeconomic influences. *Can J Public Health* 2002;93(Suppl. 2):S50-S56.
12. Hanvey L, Avard D, Graham I, Underwood K, Campbell J, Kelly C, et al. *The Health of Canada's Children: A CICH Profile*. 2nd edition. Ottawa: Canadian Institute of Child Health, 1994.
13. DeCoster C, Peterson S, Kasian P. Inappropriate hospital use by patients receiving care for medical conditions: Targeting utilization review. *Can Med Assoc J* 1997;157(7):889-96.
14. Dunlop S, Coyte PC, McIsaac W. Socio-economic status and the utilization of physicians' services: Results from the Canadian National Population Health Survey. *Soc Sci Med* 2000;51:123-33.

RÉSUMÉ

Objectif : Comparer les taux d'hospitalisation et de visites chez le médecin pour les enfants des sous-régions du Manitoba.

Méthode : Les données de 1998-1999 sur les visites chez le médecin et les hospitalisations des enfants (de 0 à 19 ans), proviennent du Population Health Research Data Repository. On a comparé les taux respectifs dans 12 ORS du Manitoba et 12 CR de Winnipeg, et comparés ces taux aux TMP et aux niveaux de revenu régionaux.

Résultats : D'importants écarts régionaux ont été observés. Le taux d'hospitalisation des enfants des trois ORS nordiques (dont les TMP étaient les plus élevés) (114/1 000) était près de quatre fois celui de Winnipeg (30/1 000) et près du double de celui des ORS du Sud rural (dont les TMP étaient les moins élevés) (59/1 000). Pour ce qui est des visites chez le médecin, elles étaient inférieures à deux dans deux des ORS nordiques, mais allaient jusqu'à quatre dans les agglomérations urbaines. Toutefois, le faible taux des visites chez le médecin dans les ORS ruraux était compensé dans une certaine mesure par le recours accru aux infirmières. Les hospitalisations et les visites chez le médecin présentaient aussi un lien avec le niveau de revenu.

Conclusion : Ces constatations sont examinées dans l'optique des besoins en soins de santé.