Excess Costs of Diabetes in the Aboriginal Population of Manitoba, Canada

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In Canada and abroad, researchers have identified the high national costs of diabetes. These results have been verified by chart review for a Canadian clinic and with administrative data in a Health Maintenance Organization in the U.S. No studies have focussed on specific subpopulations. Government reports and research studies on diabetes have identified Canadian Aboriginal or First Nation populations as having a very high prevalence rate for diabetes. The cost of services for this sub-population has yet to be documented.

Using Manitoba Medicare databases, we conducted an analysis of the “excess costs” of diabetes in Manitoba Aboriginals, focussing on the utilization of all residents of Manitoba. We derived several different measures of “excess costs” — one focussing on the “excess prevalence” of diabetes and one on “excess utilization.”

METHODS

Data sources

Manitoba Health provides universal health insurance for Manitoba residents; this health plan includes full coverage for physician and hospital services, and partial coverage for other professional services (physiotherapy, chiropractors and optometrists) and for utilization in personal care homes (nursing home care). Manitoba Health also maintains computerized records on hospital admissions, physician visits, and the use of personal care homes.

For each physician service, the patient’s identification, date of service, diagnosis (a three-digit ICD-9-CM code, International Classification of Diseases, 9th revision), and service tariff code are entered into a “physician claims” database. Manitoba hospitals submit an abstract to Manitoba Health that includes the patient’s identification, dates of admission and discharge, attending physicians, and up to 16 ICD-9-CM diagnoses. Personal-care home utilization (by day) and other professional service encounters are also recorded. The accuracy of these administrative health data has been demonstrated.

Manitoba Health also maintains a population registry that contains dates of insurance coverage, family information, and residence information for Manitoba residents. Death reports from Manitoba Vital Statistics are routinely reviewed and used to update the population registry. Since 1984, a unique personal identifier has been maintained.

We used the Manitoba Health population registry to identify registered members of Manitoba’s First Nations (i.e., Canadian Indians who are registered under the Indian Act of Canada). This identification is based on self-report when persons register with Manitoba Health. It has been estimated that approximately 100,000 (9%) of Manitoba’s 1.14 million people belong to Manitoba’s First Nations. The Manitoba Health registry accurately identifies approximately 65% of the First Nation population. The remaining 35% are misclassified, representing only 3% of the “non-First Nation” population in the Manitoba Health databases.
Identification of persons with diabetes

To identify persons with diabetes, we used the Manitoba Diabetes Database (MDD). All physician claims and hospital separation records from the Manitoba Health insurance databases with the ICD-9-CM diagnostic code for diabetes (250) for fiscal year 1984 through fiscal year 1996 (1 April 1984 through 31 March 1996) were extracted into a separate database for analysis. The MDD was then created by arranging the record of each individual into a longitudinal record, using the unique identifier to link all of the physician claims and hospital separation records. An individual in the diabetes database was defined as having clinically diagnosed diabetes if he/she had at least two separate physician claims for diabetes within two years of each other or at least one hospital separation record with a diagnosis of diabetes. We only included persons aged 15 years of age and older in this study.

Variables

Cost per Person

We divided the cost per person into two components—the cost per service and the use of services. Use is measured by physical units of each service. We measure the cost per service in terms of dollar per physical units (e.g., cost per day in a personal care home). The product of these two variables (cost times quantity utilized) comprises a dollar measure of the resources used.

Utilization of Services

We measured the use of physician services by the number of each type of service provided. The use of personal care homes was measured by days. We defined hospital care to include all inpatient encounters and outpatient (surgical) procedures. We used the Case Mix Group (CMG) patient classification system developed by the Canadian Institute for Health Information (CIHI) to identify inpatient services, and the Day Procedure Group (DPG) classification system to classify outpatient surgical encounters. We weighted each encounter according to the Resource Intensity Weight (RIW) measures. We measured outpatient kidney dialysis by estimating person years of hemodialysis and peritoneal dialysis, based on services billed by physicians for each type of service.

Cost per Service

We measured physician fees using the Manitoba tariff code. We assigned a cost to personal care home days; this included the Manitoba Health reimbursement rate plus any out-of-pocket payment. For inpatient care, we estimated the cost of an RIW to be $2,050, which was the provincial average cost (G. Finlayson, personal communication, Manitoba Centre for Health Policy and Evaluation). We separately estimated cost per person year for hemodialysis and peritoneal dialysis by dividing the direct cost for each program by the number of person years in that program for 1996.

Analysis

Mean Cost per Person

We calculated the total cost and mean cost per person by age group, First Nation status and the presence/absence of diabetes. We used the direct method to adjust for differing age distributions. The First Nation population with diabetes was the reference population.

“Excess Costs”

We define excess costs related to diabetes as the actual costs of health care services which are used by all status Indians, minus those expected costs for the same population, adjusted for specific variables. We estimated two different measures of excess cost. First, we measured excess cost due to higher diabetes prevalence, based on intergroup (First Nation compared to the general population) differences in cost when only diabetes prevalence varies (cost per person remained the same as in the First nation’s population.) Second, we measured excess cost due to utilization differences between groups by allowing only cost per person to vary.

Hospitalization Costs

To indicate the contribution of cost per case and admission rates to total hospital costs, we derived indexes which indicated the contribution of these variables. In a second analysis, we examined the admission rates for each of the following complicating diagnoses: circulatory disorders, infectious diseases, peripheral neuropathy and skin conditions, renal disorders, diabetes. We also examined rates for specific physician procedures, including vascular procedures, cardiovascular procedures, amputations, dialysis procedures and eye procedures. Age-specific differences between population groups in rates indicate whether excess hospitalizations were due to complicating diagnoses.

RESULTS

The population distribution and diabetes prevalence for First Nation and general populations are shown in Table I. In total there were 894,420 persons over the age of 15 who were registered in the Manitoba Health database in 1995/96. Of these, 39,110 (4.3%) were registered as First Nation persons. The general population is more heavily distributed in the older age categories than the First Nation population. Diabetes prevalence rates were higher for all age groups in the status population. In the older groups (over 65), the rates of diabetes for Aboriginals were about double those of the general population.

Per Person Costs Adjusted to the Status Population with Diabetes

In Table II, we show the per capita costs, by service, adjusted to the age distribution of the First Nation population with diabetes. First Nation persons with diabetes have per capita costs of $3,656; this is our reference value. When age-adjusted to the status Indian population, the general population with diabetes had costs per person of $2,169; this is 59% of the costs of the status group.

Excess Costs

The total (actual) expenditures for the First Nation population was $46.5 million. The total cost, when per capita costs for the general population with diabetes were substituted for those of the First Nation population, was $39.7 million. The total cost when the diabetes prevalence rates for the general population were used, was $39.1 million. Our two measures of excess costs were: $6.8 million for excess costs due to utilization and $7.4 million for
excess costs due to prevalence. Thus we estimate the excess costs due to higher utilization to be 14.6% of total expenditures for status Indians (including expenditures for persons with and without diabetes); we estimate excess costs due to higher prevalence rates to be 15.9% of the total actual expenditures. These measures are not additive as they ignore interaction terms.

**Hospitalization Costs**

Most of the excess utilization costs were due to hospitalizations. The major contributor to hospital cost differences was admission rates. Age- and status-adjusted, the admission rate for Aboriginals with diabetes was 2.74 times that for the general population with diabetes.

Aboriginals had higher hospitalization rates than did the general population for most complicating conditions, within most age groups. Taking the 65 to 74 year group as an example, we noted the following differences. Hospital rates per 1,000 population for First Nation and general populations with diabetes (respectively) were as follows: circulatory disorders, 220 and 69; infectious diseases, 7.5 and 2.3; peripheral neuropathy, 17.7 and 2.3; renal disorders, 59.3 and 5.1; complications of diabetes, 206 and 45. Within-group procedure rates per 100,000 population were as follows (First Nation and general population in order): vascular procedures, 937 and 540; amputations, 3,333 and 432; cardiovascular procedures, 937 and 540; dialysis procedures, 1,875 and 378; eye procedures, 5,625 and 3,545. With the exception of vascular procedures (where the First Nation rate is higher except for the 55-64 age group), these numbers were typical of the ratios for all age groups in the older populations. In general, however, the case mix index was lower for First Nation persons with diabetes than for patients with diabetes in the general population.

**DISCUSSION**

The First Nations population of Manitoba has a higher prevalence of diabetes than the general population and First Nations persons with diabetes have markedly higher per capita health care costs than persons in the general population. These results translate into considerable excess costs. The rate of hospital admissions, but not the cost per admission, plays a major role in explaining differences in per capita costs.

There are several limitations of our analysis. First, not all registered First Nation persons have been identified in the database. Manitoba Health estimates a total population of registered First Nations persons (15 years and older) to be 39,261. The Medical Services Branch of Health Canada estimates this population to be 59,471 (C. Green, personal communication). Therefore, our estimates of global health care costs in First Nations for these services are low. However, unless there are substantial differences in the per capita costs of misclassified First Nation persons, and we have no reason to suspect this, then our estimates of the per capita costs will not be much affected. Furthermore, our estimates of the proportion of excess costs due to prevalence and excess per capita costs, should not be much affected by this misclassification.

Our measure of costs has excluded certain important types of services, including outpatient drugs and transportation. Prescription drugs for Aboriginals are paid for by the federal government. Although records could not be linked to the Manitoba database, the average annual prescription drug costs for those First Nation persons who use drugs specific for diabetes conditions (i.e., insulin and oral hypoglycemic agents) amounted to $893 per person; the comparable cost for persons without diabetes was $426. We did not have comparable data for persons with diabetes in the general population.

We base our policy implications on the fact that excess costs due to both prevalence and utilization of health care (especially hospital) services are substantial. Excess costs due to diabetes prevalence call for the design and implementation of effective primary prevention programs, but there is little evidence about these programs. Excess costs due to per capita costs and health care use are more clearly linked to secondary prevention. The Diabetes Control and Complications Trial (DCCT) in the U.S.15-17 and the United Kingdom Prospective Diabetes Study18-20 have produced evidence that complications of diabetes can be postponed through intensive secondary preventive care. Aggressive secondary prevention should be considered.

### Table I

**Population Size and Diabetes Prevalence by First Nation Status and Age Group in the Manitoba Health Diabetes Database, 1995/96**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>First Nation Population</th>
<th>Diabetes Prevalence Cases (Rate per 100)</th>
<th>General Population</th>
<th>Diabetes Prevalence Cases (Rate per 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-24</td>
<td>12,280</td>
<td>150 (1.2)</td>
<td>159,590</td>
<td>780 (0.5)</td>
</tr>
<tr>
<td>25-34</td>
<td>11,080</td>
<td>540 (4.9)</td>
<td>174,900</td>
<td>2,100 (1.2)</td>
</tr>
<tr>
<td>35-44</td>
<td>7,070</td>
<td>960 (13.6)</td>
<td>176,180</td>
<td>4,000 (2.3)</td>
</tr>
<tr>
<td>45-54</td>
<td>4,020</td>
<td>1,190 (29.6)</td>
<td>126,520</td>
<td>6,870 (5.4)</td>
</tr>
<tr>
<td>55-64</td>
<td>2,470</td>
<td>960 (38.9)</td>
<td>83,120</td>
<td>9,250 (11.1)</td>
</tr>
<tr>
<td>65-74</td>
<td>1,360</td>
<td>520 (38.2)</td>
<td>72,410</td>
<td>11,800 (16.3)</td>
</tr>
<tr>
<td>75+</td>
<td>830</td>
<td>260 (31.3)</td>
<td>62,590</td>
<td>10,750 (17.2)</td>
</tr>
<tr>
<td>Total</td>
<td>39,110</td>
<td>4,580 (11.7)</td>
<td>855,310</td>
<td>45,550 (5.3)</td>
</tr>
</tbody>
</table>

### Table II

**Age-standardized* Selected Provincial per Capita Costs (Canadian Dollars) by Health Service Component and Population Group in Manitoba, Canada, 1995/96**

<table>
<thead>
<tr>
<th></th>
<th>General Population</th>
<th>First Nation Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Diabetes</td>
<td>With Diabetes</td>
</tr>
<tr>
<td>Hospitalization costs</td>
<td>$479</td>
<td>$1,196</td>
</tr>
<tr>
<td>Personal care home services</td>
<td>251</td>
<td>349</td>
</tr>
<tr>
<td>Professional services</td>
<td>271</td>
<td>519</td>
</tr>
<tr>
<td>Outpatient dialysis</td>
<td>10</td>
<td>114</td>
</tr>
<tr>
<td>Totals</td>
<td>$1,011</td>
<td>$2,169</td>
</tr>
</tbody>
</table>

* per capita costs are age-standardized to the First Nation population with diabetes using the direct method.
ACKNOWLEDGEMENTS

We acknowledge the support of the Medical Services Branch of Health Canada and the Public Health Branch of Manitoba Health; and the contributions of Alexa Brewer, Monique Charron, Patricia Hoes and Abdullelah Mohammed of Health Canada; Michael Loyd of M. Loyd Associates, Winnipeg; and Greg Finlayson of the Manitoba Centre for Health Policy and Evaluation.

REFERENCES

11. Roos LL, Roos NP, Cageorge SM, Nicol P. How good are the data: Reliability of one health care data bank. Medical Care 1982;20(266):276.

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Si vous travaillez avec des jeunes et que leur santé vous préoccupe, Ma santé, je m’en OCCUPE! comprend 10 leçons, dont chacune est axée sur une thème de santé importante pour les jeunes : Sentiments, Sexe sans danger, Estime de soi, Toxicomanies, Boire, Fumer, Milieux de vie, Préjugés, Sans abri, et Bien manger.

La façon idéale d’utiliser cette ressource est d’en faire un programme d’études pour aider à accroître la sensibilisation et les compétences en matière d’alphabétisation et de santé des jeunes qui ont du mal à lire. Cependant, les histoires et les exercices peuvent apporter à TOUS les jeunes, sans égard à leur niveau d’alphabétisation, l’occasion de réfléchir à la prise de décisions qui ont des répercussions sur leur santé et d’acquérir les compétences nécessaires en cette matière.

Avec Ma santé, je m’en OCCUPE!, vous pourrez aider des jeunes à vivre en meilleure santé.