This issue of DRCC Facts About Diabetes explores the elements of costs related to diabetes. The first section presents recent research exploring excess costs of healthcare and medical complications for those with diabetes in Ontario. The second section brings in some statistics from the Champlain region, to put it into a regional perspective.

**Excess Costs of Diabetes and Complications**


**Focus:** This study explores the costs of healthcare over an 11 year period in Ontario (1995-2005), focusing on clients with diabetes (type 1 and type 2 combined). The excess cost of diabetes is estimated as the difference between health care costs attributed to people with diabetes compared with healthcare costs of those without diabetes. When exploring complications, the study focuses on the following: myocardial infarction, stroke, angina, heart failure, amputation, nephropathy, cataracts and blindness in one eye.

**What did they do?** The study population was Ontario adults aged 35 years and over. Using administrative health data, they identified their two groups: 1. People with diabetes (cases); and 2. People without diabetes (controls). People with diabetes needed one hospitalization record or two physician claims with diabetes diagnosis to qualify as cases. People are included as controls in the study if they had at least one healthcare claim. Costs of cases and controls were estimated using a variety of data sources, including utilization data and OHIP data. See Table 1 for a summary of the methods used in the study.

Table 1 Summary of Methods from Goeree et al Study[1]

<table>
<thead>
<tr>
<th>Cases and Controls</th>
<th>Matching</th>
<th>Usage and Cost Data</th>
<th>Analysis</th>
</tr>
</thead>
</table>
| **Cases (people with diabetes) were determined using Ontario Diabetes Database (ODD). The ODD was created from administrative databases (Discharge Abstracts Database (DAD), Physician Service Claim data) linked with the Registered Persons Database (RPDB) (those eligible for OHIP) to identify all adults with diabetes in Ontario, since April 1 1991. An individual was included in the ODD if they had: one hospitalization record with a diabetes diagnosis and/or two physician claims with a diabetes diagnosis. Women with gestational diabetes are excluded from the analysis.**
| The study matches cases (1 diabetes case to 2 non diabetes controls) by age, geography, sex, and income. Database contained diabetes cases (n=610,852 incident n=933041 prevalent) and non-diabetes cases (1,221,704). | The study draws utilization data from healthcare professional services, emergency room visits, home care services and prescription drugs¹ from April 1 1994 to March 31 2005 | Estimates of total costs of health used incident diabetes cases and matched cohort. Difference in costs tested with Student’s t-test. |
| **Control group all patients in Ontario older than 35 years with at least one health care claim from the same administrative databases (Physician Service Claim data and DADs). The control group excluded clients less than 35 years or those missing income quintile data required for case matching (pairing up cases with comparable controls).**
| There were an insufficient number of cases for complication-specific costs thus all patients without diabetes were used for comparison (control group) | Cost estimates use many sources, including the DAD (Resource Intensity Weights), costs from MOHLTC, OHIP data, etc. Some imputation of costs was used. | Estimates of cost of complications used all cases with diabetes and all valid non-diabetes adults for comparison. |

¹ Data were drawn from the Discharged Abstract Database, the Same Day Surgery Database, Ontario Drug Benefit program, OHIP billing records and fee codes, Ontario Home Care Administration System database.
Average cost for both populations is calculated per patient per year. The excess cost is calculated as the difference between those with diabetes and those without diabetes.

**What did they find?** The average total cost of healthcare for those with diabetes is $5,104 for the first year of diagnosis; the average cost of healthcare for adult without diabetes is estimated to be $2,174 per patient per year.

The excess average healthcare cost for those with diabetes is $2,930 in the first year of diagnosis. The excess average cost of healthcare for those with diabetes decreases over years following the year of diagnosis (around $1,240 excess compared with the non-diabetes population). Total cost is estimated for incident cases of diabetes only. The excess cost increases drastically in the older age groups and the cost is slightly higher for men compared with women (see Figure 1 below).

The second part of the analysis focuses on the costs related to medical complications; the results of a selection of the complications are presented in Figure 2 below. Much like the average cost, the excess cost of complications was higher in the first year after diagnosis of diabetes. Along the same line, the rates of complications were highest in first year of diagnosing diabetes, excepting nephropathy. For all complications explored, the annual cost was higher for people with diabetes in the first year after diagnosis, compared with those without diabetes. The excess costs for people with diabetes were substantial for those who had amputations ($5,133 excess cost), nephropathy ($4,117 excess cost), heart failure ($1,440 excess cost) and stroke ($3,965 excess cost) in their first year following diagnosis.

**Limitations:** Cost estimates are dependent on the quality and content of data considered; therefore some elements are not factored in due to unavailability of data sources and the inherent weakness of the data sources used (e.g. administrative data). The drug data are incomplete across all age groups due to a reliance on the Ontario Drug Benefit database, which may underestimate costs in lower age groups. There may be other confounding factors between those with diabetes and those without (i.e. obesity) that were not accounted for. There were large standard deviations for costs estimates, though this is not abnormal given the type of analysis. The analysis excluded First Nations populations (due to a different billing process) and excluded those without income data (required for linking). For future studies it would be interesting to see differences in costs between type 1 and type 2 diabetes, as well as client characteristics (socioeconomic status, health behaviours, etc.).

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2 Based on Table 4, page 41 of (Goeree et. al., 2009)
3 Based on Table 5, page 42 of (Goeree et al, 2009)
Main point: Average annual healthcare costs are higher for people with diabetes than those without, particularly in the first year following diagnosis. Complications such as amputations, nephropathy and stroke cost more for adults with diabetes than for adults without diabetes.

Focus on Champlain

Given the information provided in the study above, a few statistics concerning complications in the Champlain region are presented below to connect the findings to our region. Compared to the Ontario average, the age adjusted rate for renal replacement and foot infection, ulcer or amputation is higher in the Champlain Region (see Table 2 below). The acute myocardial infarction incidence per 100’000 is higher in Champlain for males compared with their Ontario counterparts, and higher for both sexes in the low income group[2].

Table 2: Age-adjusted rates of complications for people with diabetes in the Champlain region, age 18 years* (2008/09)[3]

<table>
<thead>
<tr>
<th>Complications</th>
<th>Total who received therapy</th>
<th>Adjusted rate per 100,000: Champlain</th>
<th>Adjusted rate per 100,000: Ontario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of adults with diabetes who received renal replacement therapy</td>
<td>725</td>
<td>804</td>
<td>780</td>
</tr>
<tr>
<td>Rate of adults with diabetes who had a foot infection, ulcer or amputation</td>
<td>3,358</td>
<td>3,610</td>
<td>3,244</td>
</tr>
<tr>
<td>Hospitalization rate for acute myocardial infarctions (AMI) for those with diabetes</td>
<td>1,070</td>
<td>1,145</td>
<td>1,163</td>
</tr>
</tbody>
</table>

If we focus on amputations, the excess cost is $5,133 in the first year after diagnosis[1] and the rate of foot infections, ulcers or amputations is 3,610 per 100 000 in Champlain (higher than the provincial rate)[3]. Efforts to improve foot care services for people with diabetes can result in a reduction of the amputation rate [4]. With a lower rate of amputation for people with diabetes, extra cost savings could be realized due to higher costs of care– more so than if we decrease rate of amputation for the general public. This could hold true for all the complications explored in the Goeree study, which is further reason for efforts to reduce the rate of diabetes and improve services and support for the management of the disease in Champlain. With rising rate of diabetes may come additional costs, above and beyond those directly related to the management of the disease.

A targeted approach for the prevention/reduction of amputations, stroke, heart failure and nephropathy specifically for people with diabetes may result in more substantial cost savings than broad initiatives for the general population.

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References