

The Cost of Blood Glucose Test Strips in Saskatchewan, 1996: A Retrospective Database Analysis

Chad G. Mitchell^{1,2} BSc(Pharm), Scot H. Simpson¹ PharmD MSc, Jeffrey A. Johnson^{1,2} PhD

¹Institute of Health Economics, Edmonton, Alberta, Canada

²University of Alberta, Edmonton, Alberta, Canada

ABSTRACT

INTRODUCTION

The cost of blood glucose (BG) test strips for self-monitoring of blood glucose (SMBG) is of relevance, as indicated by the recent *Diabetes Report Card 2001: Provincial, Territorial and Federal Policy and Programs for People with Diabetes*, which shows that cost and access to diabetes-related drugs and supplies under the provincial health systems remain serious areas of concern.

METHODS

The authors described the costs of BG test strips for individuals with diabetes in Saskatchewan, Canada, for 1996, and compared these costs by treatment and by age.

RESULTS

Less than one-half of individuals with diabetes had claims for BG test strips. The mean total cost for BG test strips per individual was Can \$241.53. Individuals taking insulin alone had the highest mean total cost per person (\$383.18) compared to individuals using oral antihyperglycemic agents alone (\$159.20) or diet alone (\$116.48) ($p < 0.001$).

CONCLUSION

The use of BG test strips increased overall Saskatchewan Prescription Drug Plan (SPDP) expenditures, as well as expenses for individuals with diabetes. There is a lack of information, however, on the effect of SMBG alone on glycemic control and overall health outcomes.

Address for correspondence:

Jeffrey A. Johnson

Institute of Health Economics

1200-10405 Jasper Avenue

Edmonton, Alberta

T5J 3N4 Canada

Telephone: (780) 448-4881

Fax: (780) 448-0018

E-mail: jeff.johnson@ualberta.ca

RÉSUMÉ

INTRODUCTION

Le coût des bandelettes réactives pour l'auto-surveillance de la glycémie est important, comme l'indique un récent rapport de l'Association canadienne du diabète intitulé *Rapport de 2002 sur le diabète : Politique provinciale, territoriale et fédérale et programmes destinés aux diabétiques*. Le rapport indique que le coût des médicaments et des fournitures associés au diabète et la facilité de les obtenir en vertu des régimes provinciaux de soins médicaux demeurent une sérieuse préoccupation.

MÉTHODES

Les auteurs donnent les coûts des bandelettes réactives pour l'auto-surveillance de la glycémie chez les personnes atteintes de diabète en Saskatchewan, au Canada, en 1996, et comparent ces coûts selon le traitement et selon l'âge des personnes.

RÉSULTATS

Moins de la moitié des personnes atteintes de diabète ont fait des demandes de remboursement pour des bandelettes réactives pour l'auto-surveillance de la glycémie. Le coût total moyen par personne de ces bandelettes réactives était de 241,53 \$CAN. Le coût total moyen par personne était plus élevé chez les personnes ne prenant que de l'insuline (383,18 \$) que chez les personnes ne prenant que des anti-hyperglycémiques oraux (159,20 \$) ou que chez celles qui ne faisaient que suivre un régime (116,48 \$) ($p < 0,001$).

CONCLUSION

Le coût des bandelettes réactives pour l'auto-surveillance de la glycémie a augmenté les dépenses globales du régime de médicaments d'ordonnance de la Saskatchewan ainsi que les frais engagés par les personnes atteintes de diabète. Toutefois, il existe un manque d'information sur l'effet de l'auto-surveillance seule sur l'équilibre de la glycémie et sur l'issue thérapeutique globale.

INTRODUCTION

The economic impact of diabetes is drawing increasing attention in Canada (1,2). Currently, the total cost of diabetes in Canada is a gross estimate of US \$9 billion based largely on estimates from the United States (US), which include both direct medical costs (e.g. hospitalizations) and indirect costs (e.g. lost productivity due to premature death) (1). In Canada, there is little information about the individual components of diabetes management costs (1), with available estimates being based on various sources. The cost of diabetes-related testing supplies has received relatively little attention as a component of the overall costs.

Self-monitoring of blood glucose (SMBG) is considered an essential component of management for people with diabetes who are treated with insulin, and an integral component of the management of type 2 diabetes in the Canadian Diabetes Association's (CDA's) 1998 Clinical Practice Guidelines for the Management of Diabetes in Canada (3). There are, however, no specific guidelines on testing frequency, particularly for people with type 2 diabetes. The American Diabetes Association's (ADA's) clinical practice guidelines indicate that the optimal testing frequency is unknown (4). The CDA's clinical practice guidelines also recommend testing urine for ketones as a form of self-monitoring (3). If provincial health systems were to provide or increase insurance coverage for blood glucose (BG) test strips, studies into the clinical and economic impact of this policy change should be considered.

The cost of test strips for SMBG is of relevance, as indicated by the recent *Diabetes Report Card 2001: Provincial, Territorial and Federal Policy and Programs for People with Diabetes*, which shows that cost and access to diabetes-related drugs and supplies under the provincial health systems remain serious areas

of concern (2). There is wide variation in the extent of public insurance coverage for diabetes-related testing supplies across the provinces (2). Questions have also been raised about the overall benefit of SMBG in all patients with diabetes (5,6). This analysis was therefore conducted to estimate the total and per person expenditures for BG test strips using administrative data from the Saskatchewan Prescription Drug Plan (SPDP).

METHODS

Individuals within the linkable administrative databases of Saskatchewan Health who were likely to have a clinical diagnosis of diabetes in the years of 1991 to 1996 were identified. Individuals were considered to have diabetes if they had, during the period 1991 to 1996, ≥ 1 outpatient dispensation record for insulin or an oral antihyperglycemic agent, ≥ 2 physician visits with a diagnosis of diabetes within a 2-year period, or ≥ 1 hospitalization for diabetes, using the International Classification of Diseases, Ninth Revision (ICD-9), diagnostic code 250 (7). Excluding the drug component, this definition has been validated in Manitoba (8) and Ontario (9), and adapted for the National Diabetes Surveillance System (10).

All dispensation claims for prescription drugs and BG test strips covered by the SPDP were abstracted for cohort members in 1996 from the SPDP data files. The category for diabetes-related testing supplies included in the data sets did not separate BG test strips and urine ketone testing agents; however, the majority (95%) of claims were for BG test strips. BG meters, lancets, swabs, etc., were not included in the diabetes-related testing supplies category. Nonprescription drugs and other drugs not covered by the SPDP were also not included in these estimates. Those eligible for SPDP claims were residents of Saskatchewan, Canada, registered

Table 1. Mean cost of BG test strips per individual by age, Saskatchewan 1996

Age (years)	Number of subjects	Number of subjects with ≥ 1 claim for test strips (% of total subjects)	SPDP share [†] (Can \$)	Patient share [†] (Can \$)	Total ^{†*} (Can \$)
<15	582	396 (68.0%)	239.26 (331.31) (38.5%)	382.67 (374.17) (61.5%)	621.93 (474.77)
15–24	848	373 (44.0%)	230.94 (386.50) (58.2%)	165.67 (302.84) (41.8%)	396.61 (514.53)
25–64	17 055	7617 (44.7%)	110.56 (236.46) (44.0%)	140.46 (187.29) (56.0%)	251.03 (321.24)
≥ 65	15 959	6575 (41.2%)	95.12 (156.67) (47.9%)	103.63 (115.82) (52.1%)	198.76 (218.14)

[†]Results are mean (SD) and percentage of total cost

* $p < 0.001$ between age groups using the Kruskal-Wallis test

BG = blood glucose

SD = standard deviation

SPDP = Saskatchewan Prescription Drug Plan

with Saskatchewan Health unless coverage was provided by another federal or provincial government or nongovernmental agency. Registered First Nations people were therefore not included in this analysis.

The costs of BG test strips for individuals with diabetes in 1996 were described and compared for subjects in 4 treatment groups defined by SPDP claims for prescription medications: diet (i.e. no SPDP claims for any diabetes-related medication), oral antihyperglycemic therapy alone, insulin alone or combination therapy. The costs of test strips were also compared by age group. Since assumptions for parametric tests of significance were not met (i.e. skewed distribution and unbalanced cell sizes), the nonparametric Kruskal-Wallis test was used to compare costs between the 4 treatment groups and between age groups.

Prescription drug and test strip costs were categorized according to government share, patient share and total costs. SPDP employs a deductible/co-payment arrangement for most individuals. Depending on the applicable SPDP benefit category, patients were responsible for up to 35% of the eligible drug or supply cost after reaching a semi-annual deductible limit of Can \$850.00. Family units approved under the income-tested Special Support Program had their co-payment established according to the relation between family income and eligible drug costs. For recipients of the Family Income Plan and the Saskatchewan Income Plan, and those Guaranteed Income Supplement recipients in special care homes, the semi-annual deductible was \$100.00 prior to a co-payment of 35%; all other Guaranteed Income Supplement recipients had a semi-annual deductible of \$200.00 prior to a

co-payment of 35%. Individuals receiving social assistance were entitled to receive insulin and oral antihyperglycemic agents at no charge and paid a maximum of \$2.00 for all other drugs approved for coverage under the SPDP.

RESULTS

In 1996, 34 444 individuals, excluding registered First Nations people, were identified as having diabetes in Saskatchewan. The average age of these individuals was 60.1 years (standard deviation [SD]: 16.7 years), with approximately an equal number of males (52.7%) and females. Less than one-half of these individuals (14 961 [43.4%]) had ≥ 1 claim for BG test strips, for a total cost of \$3.6 million. This represented 12.5% of the total (\$28.8 million) cost for SPDP claims (i.e. all diabetes-related and nondiabetes-related drug prescriptions, and all test strips) for this group of individuals. The government covered \$1.65 million of the cost of test strips through various eligibility plans; the share of the cost for which individuals were responsible was \$1.96 million. The mean total cost for test strips per individual with dispensation claims for test strips was \$241.53. The claimants' average share for test strips was \$131.36 (54.4%), and the government share was \$110.17 (45.6%). The use of private, third-party insurance to cover the patient share of the expenses was not known.

Individuals from 25 to 64 years of age accounted for 50.9% of the cohort that had dispensation claims for test strips, and those ≥ 65 years of age represented 44.0% of those with dispensation claims for test strips. The total cost of test strips for those ≥ 65 years of age was \$1.31 million or 36.3% of the total cost of test strips in 1996. The mean total cost of

Table 2. Mean cost of BG test strips per individual by therapy, Saskatchewan 1996

Treatment	Number of subjects	Number of subjects with ≥ 1 claim for test strips (% of total subjects)	SPDP share[†] (Can \$)	Patient share[†] (Can \$)	Total^{**} (Can \$)
Insulin alone	7058	5141 (72.8%)	187.46 (299.24) (48.9%)	195.72 (250.20) (51.1%)	383.18 (409.64)
Insulin + oral antihyperglycemic agents	1038	888 (85.5%)	188.99 (248.13) (56.4%)	146.30 (155.44) (43.6%)	335.29 (297.96)
Oral antihyperglycemic agents alone	14 409	7143 (49.5%)	63.42 (124.89) (39.8%)	95.78 (98.79) (60.2%)	159.20 (165.72)
No medication	11 939	1789 (15.0%)	35.62 (80.10) (30.6%)	80.86 (82.30) (69.4%)	116.48 (118.48)

[†]Results are mean (SD) and percentage of total cost

^{**} $p < 0.001$ between treatment groups using the Kruskal-Wallis test

BG = blood glucose

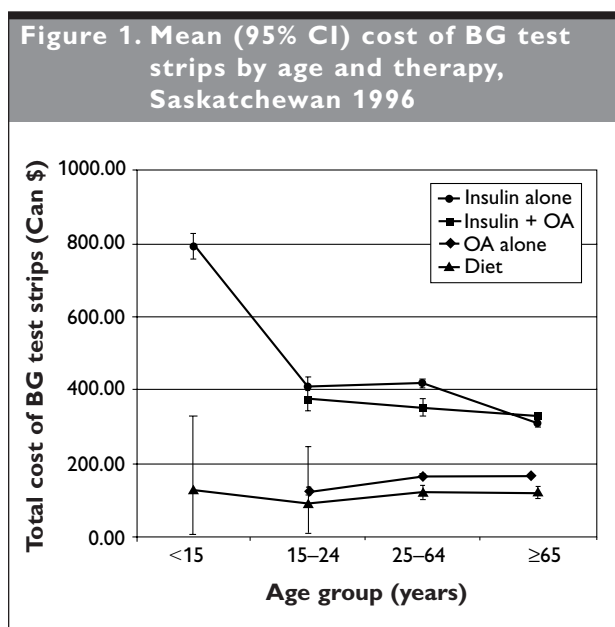
SD = standard deviation

SPDP = Saskatchewan Prescription Drug Plan

test strips for those ≥ 65 years of age was \$198.76, with the SPDP contributing an average of \$95.12 per patient (Table 1). Individuals <15 years of age had the highest patient share of expenses for test strips; for those who had dispensation claims for test strips, the mean patient share was \$382.67 with an average total cost of \$621.93 per individual.

Of the 7058 individuals who had dispensation claims for insulin alone (no oral antihyperglycemic agents), 5141 (72.8%) had dispensation records for test strips. A total of \$1.97 million was spent on test strips for patients with insulin dispensation claims alone. The mean total cost of test strips for individuals who had dispensation claims for test strips in this group was \$383.18 per claimant (Table 2). The patient share of the cost in this group was an average of \$195.72.

Of the 14 409 individuals who had dispensation claims for oral antihyperglycemic agents alone (no insulin), 49.5% had dispensation claims for test strips. The total cost of test strips for this group was \$1.14 million, or approximately \$159.20 per individual with dispensation claims for test strips. The average patient share of this expense was \$95.78. Of the 1038 individuals who had dispensation claims for both oral antihyperglycemic agents and insulin, 85.5% had dispensation claims for test strips. The mean patient share for test strips for individuals using combination therapy was \$146.30, with a mean total cost per claimant testing of \$335.29. Of the 11 939 individuals identified as having diabetes and no dispensation claims for oral antihyperglycemic agents or insulin, 1789 (15.0%) had dispensation claims for test strips. The average patient share for individuals in this group was \$80.86.



BG = blood glucose

CI = confidence interval

OA = oral antihyperglycemic agents

Individuals who were using insulin (alone or in combination) had the highest mean cost of test strips in all age groups (Figure 1). Children using insulin had the highest overall mean cost of test strips. Although the 95% confidence intervals (CIs) did not overlap, adults treated with diet alone or taking oral antihyperglycemic agents alone did not appear to have substantially different costs for test strips.

DISCUSSION

This study highlights the costs associated with BG test strips in Saskatchewan in 1996. Test strips were found to account for approximately 12.5% of the total cost of SPDP claims for individuals identified as having diabetes. Interestingly, less than one-half of individuals with diabetes had claims for test strips. This distribution was skewed, however, with only 15% of subjects not taking insulin or oral antihyperglycemic agents having claims for test strips.

The overall average annual cost of test strips for those identified as having diabetes was \$241.53 per person, with individuals or their families being responsible for approximately 54% of this cost. This cost varied considerably, however, depending on the individual's age and type of therapy. Based on the available data, it is not known if individuals paid this amount themselves or if private insurance claims were made to cover this share of the cost.

The average total cost of test strips per individual was the highest for individuals <15 years of age, with a mean total cost of \$621.93 per individual with dispensation claims for test strips; the SPDP covered 38.5% of this total cost for the families of these individuals. A small number of individuals <15 years of age had claims for test strips but not for insulin or oral antihyperglycemic agents, so were included in the diet therapy group; it is not clear from the data if these individuals are children with type 1 or type 2 diabetes. Interestingly, the total cost of test strips decreased with increasing age. For individuals >65 years of age, the average total cost of test strips in 1996 was \$198.76, with SPDP covering just under 50% of this total cost.

As expected, the cost of test strips varied with the type of treatment and was substantially higher for individuals using insulin. The total annual cost for test strips for those with insulin dispensation claims alone was \$1.97 million, or \$383.18 per person with dispensation claims for test strips, with SPDP covering approximately one-half of the total cost. For those using oral antihyperglycemic agents alone, the mean total cost per claimant was less than half that for those using insulin, at \$159.20; the patients themselves covered 60% of these costs. Those individuals with dispensation claims for both oral antihyperglycemic agents and insulin spent almost \$340.00 on test strips. The increased expenditures on test strips for people using insulin are justified by the increased risk of hypoglycemia associated with insulin use, necessitating increased SMBG. Awareness and management of hypoglycemia is a clear benefit of SMBG for individuals with type 1

diabetes (3,4). However, the benefits of SMBG in patients with type 2 diabetes are less well understood (5).

There are several limitations of the analysis of the available data in this study. In particular, only the data contained in the administrative databases were described, so relating the number of claims and cost to clinical data, including degree of glycemic control, could not be done. Furthermore, the data used for this analysis were the costs of diabetes-related testing supplies in 1996. For the purpose of this analysis, more recent data were not accessed from Saskatchewan Health; however, further analysis is planned using data from more recent years. The costs reported in this study include only individuals who were eligible for SPDP claims during the study period. This includes approximately 91% of Saskatchewan residents; registered First Nations people, federal employees and inmates of federal prisons were not included. Therefore, it was not possible to compare the costs of test strips for registered First Nations people with those of the general population.

CONCLUSION

The use of BG test strips increases the overall SPDP expenditures in the general population, as well as the expenses for individuals with diabetes. This increased cost is presumed to be linked with improved health outcomes in people with diabetes and, potentially, reduced total costs of care overall. There is a lack of information, however, on the effect of SMBG alone on glycemic control and overall health outcomes (5,6,11).

ACKNOWLEDGEMENTS

Dr. Jeffrey A. Johnson holds a Canada Research Chair in Diabetes Health Outcomes and a Population Health Investigator Award through the Alberta Heritage Foundation for Medical Research.

This study was funded in part by a grant from the Institute of Health Economics to the Alliance for Canadian Health Outcomes Research in Diabetes (ACHORD) Group.

The authors wish to thank Winanne Downey, BSP, and Andrea Laternas, BSP, Saskatchewan Health, for their help in compiling the data sets and their comments on earlier drafts of this manuscript.

This study is based in part on de-identified data provided by Saskatchewan Health. The interpretation and conclusions contained herein do not necessarily represent those of the Government of Saskatchewan or Saskatchewan Health.

REFERENCES

1. Health Canada. *Diabetes in Canada: National Statistics and Opportunities for Improved Surveillance, Prevention, and Control*. Ottawa, ON: Health Canada; 1999. Publication H49-121/1999.
2. Canadian Diabetes Association. *Diabetes Report Card 2001: Provincial, Territorial and Federal Policy and Programs for People with Diabetes*. Toronto, ON: Canadian Diabetes Association; 2001.
3. Meltzer S, Leiter L, Daneman D, et al. 1998 clinical practice guidelines for the management of diabetes in Canada. *CMAJ*. 1998;159(suppl 8):S1-S29.
4. American Diabetes Association. Tests of glycemia in diabetes. *Diabetes Care*. 2002;25(suppl 1):S97-S99.
5. Coster S, Gulliford MC, Seed PT, et al. Self-monitoring in type 2 diabetes mellitus: a meta-analysis. *Diabet Med*. 2000;17:755-761.
6. Kennedy L. Self-monitoring of blood glucose in type 2 diabetes: time for evidence of efficacy [editorial]. *Diabetes Care*. 2001;24:977-978.
7. Osei W, Baker M, Beck P, et al. *Diabetes in Saskatchewan: An Epidemiological Account. Report to the Saskatchewan Advisory Committee on Diabetes*. Regina, SK: Saskatchewan Health; December 1997.
8. Blanchard JF, Ludwig S, Wajda A, et al. Incidence and prevalence of diabetes in Manitoba, 1986–1991. *Diabetes Care*. 1996;19:807-811.
9. Hux JE, Ivis F, Flintoft V, Bica A. Diabetes in Ontario: determination of prevalence and incidence using a validated administrative data algorithm. *Diabetes Care*. 2002;25:512-516.
10. Clotey C, Mo F, LeBrun B, et al. The development of the National Diabetes Surveillance System (NDSS) in Canada. *Chronic Dis Can*. 2001;22:67-69.
11. Faas A, Schellevis FG, Van Eijk JT. The efficacy of self-monitoring of blood glucose in NIDDM subjects. A criteria-based literature review. *Diabetes Care*. 1997;20:1482-1486.