The impact of policies to reduce blood glucose test strip utilization and costs in Canada

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ABSTRACT

OBJECTIVES: Several strategies have been proposed to manage the utilization of blood glucose test strips (BGTS) in Canada; however their potential impacts on utilization and costs of publically funded test strips are unknown.

METHODS: We investigated the impact of three potential policies that would restrict the number of test strips reimbursed by the public drug plans in Ontario and British Columbia (BC), and incorporated negotiated price reductions. These policies were based on recommendations from the Canadian Agency for Drugs and Technologies in Health, a briefing document by the Canadian Diabetes Association, and a new policy introduced by the Ontario Ministry of Health and Long-Term Care. BGTS utilization rates were assessed in two cross-sectional analyses among adults aged 18 years or older in BC and 65 or older in Ontario who received publicly-funded BGTS between January 2004 and December 2012. We modeled the 5-year utilization and cost implications of the three policies using time-series analysis.

RESULTS: In 2012, there were 317,130 test strip recipients in Ontario and 136,659 recipients in BC, at a cost of \$104.4 million and \$22.6 million respectively. Under the scenarios of reduced BGTS quantities, 5-year cost savings ranged between \$98.8 million (18.2% reduction) and \$224.1 million (41.4% reduction) in Ontario and between \$23.1 million (19.2% reduction) and \$51.1 million (42.4% reduction) in BC. Price reductions of 15% resulted in annual savings of \$14.4 million (13.7% reduction) in Ontario and \$3.4 million (14.1% reduction) in BC.

CONCLUSIONS: Policies that align with evidence and expert guidance could impart substantial cost savings in multiple jurisdictions despite different public drug plans.

KEY WORDS: Self-monitoring; self-testing; blood glucose; diabetes; utilization

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In Canada, more than one fifth of those aged 65 years and older have diabetes.¹ Consequently, use of blood glucose test strips (BGTS) among these patients has substantial financial implications for public drug programs, which typically cover the costs of these products for all seniors.^{2,3} In Ontario, almost 120 million test strips were dispensed in 2008, at a cost to the government of more than \$85 million.^{2,3} Although self-monitoring of blood glucose (SMBG) is recommended in clinical practice guidelines, its routine use and optimal frequency have been the subject of considerable debate. Evidence from clinical trials of non-insulin-treated patients indicates that while SMBG may help improve glycemic control, the magnitude of benefit may not be clinically meaningful. Furthermore, there is little evidence that monitoring is associated with improved quality of life, patient satisfaction or long-term complications, and some evidence suggests that it may actually increase anxiety and depression scores.⁴⁻⁶

Several strategies have been proposed for containing the utilization and costs of BGTS in Canada, including quantity limits that align with recent optimal frequency recommendations and negotiated price reductions. In 2009, the Canadian Agency for Drugs and Technologies in Health (CADTH) completed a

therapeutic review and released a report that made specific recommendations regarding the frequency with which patients should be using BGTS.⁷ Subsequent research in Ontario suggested considerable utilization and cost impacts of reduced frequency of BGTS use, although this study relied on

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hypothetical quantity limits that were not modeled after any specific policy recommendations.^{2,3} Thereafter, the Canadian Diabetes Association (CDA) released a briefing document for health care providers recognizing that some limits to testing frequency may be warranted in patients not treated with insulin, with specific suggestions around monthly limits.⁸ Finally, in August 2013, the Ontario Ministry of Health and Long-Term Care released new reimbursement levels for BGTS that were generally aligned with CDA's briefing document.⁹

Despite this research and the policy change in Ontario, much remains unknown about potential policies for the reimbursement of BGTS both in Ontario and in other Canadian provinces. For example, it remains unclear what implications the Ontario policy will have on BGTS utilization and costs relative to the CADTH quantity limits and whether the impact of limits on BGTS will be similar across the different public drug plan designs present in Canada.¹⁰ Further, while Canadian prices for BGTS supplies remain high by international standards,^{11,12} no study has estimated the cost implications of potential negotiated discounts with manufacturers. The objective of this study was to estimate the potential impact of imposing BGTS quantity limits and price reductions on the utilization and costs of publicly-funded test strips in two provinces in Canada with different public drug programs: the seniors drug program in Ontario and the universal high-deductible public drug program in British Columbia.

METHODS

We conducted two cross-sectional time-series analyses among adults who received a publicly-funded prescription for BGTS between January 1, 2004 and December 31, 2012 – one among those aged 18 years or older in British Columbia (BC) and the other among those aged 65 or older in Ontario. Inclusion criteria were determined by data availability in each province. In Ontario, all residents aged 65 years and older are eligible for public coverage of prescription drugs and are only required to pay a small co-payment with each prescription (ranging between \$2 and \$6.11 per prescription). In BC, all residents registered for the Fair PharmaCare plan are eligible for public coverage. In contrast to the universal seniors coverage in Ontario, coverage in BC is provided for eligible prescriptions after households reach an income-based deductible (typically 3% of household income). This study was approved by the Research Ethics Board (REB) of Sunnybrook Health Sciences Centre, Toronto, ON and by the Behavioural REB of The University of British Columbia, Vancouver, BC.

In Ontario, we used the Ontario Drug Benefit (ODB) database to identify prescription records for diabetes drugs and test strips. This database includes details on the specific drug prescribed, date of dispensation, and costs of prescription. In BC, we used the PharmaNet database to identify all prescription records for diabetes drugs and test strips, and the PharmaCare database to obtain prescription costs. All analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC).

Cohort definition

We defined annual cohorts of adults who had a claim for at least one publicly-funded test strip over each year of the study period,

in each province studied. Recipients who were alive at the beginning of each year were stratified into one of four hierarchical therapy groups based on their medication use over the year: insulin, hypoglycemia-inducing oral glucose-lowering drugs (sulfonylureas and meglitinides), non-hypoglycemia-inducing oral glucose-lowering drugs (metformin and others) and no glucose-lowering drug therapy.

Our main outcomes were the number of BGTS claims and test strips dispensed (overall and per patient, daily) and their associated costs (separated into dispensing costs and product costs; overall, and per patient, daily) for each of the four treatment groups.

Scenarios for annual quantity limits

We investigated the implications of three different policy scenarios that incorporated restrictions on the number of test strips and prescriptions dispensed ([Supplementary Appendix](#)). The first scenario was guided by CADTH's COMPUS Expert Review Committee (CERC) 2009 recommendations for routine testing, which were based largely on evaluating the cost-effectiveness of SMBG while still considering issues such as patient empowerment, self-management and individualization of therapy.⁷ CERC's recommendations for routine testing suggested individualized use among patients with type 1 diabetes (no annual strip limit), 14 strips weekly (728 strips annually) for patients with type 2 diabetes who use insulin (to allow twice daily monitoring), and no use for patients with type 2 diabetes in all other therapy groups.⁷

We are unable to accurately stratify by type 1 and type 2 diabetes in our databases. However, because the CERC recommendations differentiate between these groups, we stratified insulin users based on their use of oral glucose-lowering drugs. For each year, if a patient was placed in the insulin drug therapy group, quantity limits associated with type 1 diabetes were applied if they received prescriptions for only insulin and those for type 2 diabetes were applied if they received both insulin and any oral glucose-lowering drug. Because these recommendations provide guidelines for routine use of BGTS, our scenarios allowed 100 strips annually among patients with type 2 diabetes not using insulin to allow for sporadic use. The second scenario was informed by CDA's 2011 briefing document which suggested unlimited testing for insulin users regardless of diabetes type because they believed this to be more practical than CERC's recommendation given the large number of patients using insulin who would benefit from individualized therapy.⁸ CDA's briefing document also suggested 30 strips monthly (360 strips annually) among hypoglycemia-inducing oral drug users and 15 strips monthly (180 strips annually) for all other individuals with diabetes, which would allow a small amount of testing among these patients.⁸ Finally, in August of 2013, the Ontario Public Drug Program implemented a policy imposing quantity limits for BGTS among public drug beneficiaries that was largely based on CDA's briefing document.⁹ To model this scenario, we allowed a maximum of 3000 test strips annually among insulin users, 400 test strips annually among users of hypoglycemia-inducing oral drugs, and 200 strips annually for all other patients with diabetes.

Table 1. Blood glucose test strip utilization and costs for patients aged 18 years and older in BC and patients aged 65 and older in Ontario, 2012

Diabetes group	Patients N (%)	BGTS prescriptions N (%)	BGTS N (%)	No. strips/ patient/day (mean, SD)	Total cost of BGTS	Mean cost/ patient/day
Ontario						
Overall	317,130	1,059,507	143,273,138	1.24 (1.54)	\$104,519,875	\$0.90
No glucose-lowering drug therapy	50,801 (16.0%)	108,643 (10.3%)	13,287,136 (9.3%)	0.72 (1.01)	\$9,339,757	\$0.50
Non-hypoglycemia-inducing oral glucose-lowering drugs	98,691 (31.1%)	261,386 (24.7%)	32,672,038 (22.8%)	0.91 (0.91)	\$23,633,226	\$0.66
Hypoglycemia-inducing oral glucose-lowering drugs	85,471 (27.0%)	269,787 (25.5%)	35,116,465 (24.5%)	1.13 (1.28)	\$25,765,801	\$0.83
Insulin	82,167 (25.9%)	419,691 (39.6%)	62,197,499 (43.4%)	2.07 (2.19)	\$45,781,091	\$1.53
British Columbia						
Overall	136,659	434,955	33,723,126	0.68 (1.25)	\$22,556,362	\$0.45
No glucose-lowering drug therapy	26,486 (19.4%)	47,684 (11.0%)	1,943,321 (5.8%)	0.20 (0.59)	\$1,331,770	\$0.14
Non-hypoglycemia-inducing oral glucose-lowering drugs	35,066 (25.7%)	77,796 (17.9%)	4,823,943 (14.3%)	0.38 (0.78)	\$3,379,675	\$0.26
Hypoglycemia-inducing oral glucose-lowering drugs	30,851 (22.6%)	80,893 (19.6%)	6,438,663 (19.1%)	0.57 (0.98)	\$4,575,495	\$0.41
Insulin	44,256 (32.4%)	228,582 (52.6%)	20,517,199 (60.8%)	1.27 (1.70)	\$13,269,422	\$0.82

BGTS = blood glucose test strip.

Reduction in volume of test strip dispensing and associated cost savings from implementing each of the scenarios described above was calculated by restricting the number of test strips and prescriptions allowed for each patient within each calendar year of the study period according to their diabetes therapy group. To account for dispensing fees, we assumed that each prescription would correspond to a maximum of 100 strips dispensed (e.g., 360 test strips would be provided in 4 dispensed prescriptions). If an individual was prescribed less than the maximum amount allowed, their dispensing fees were not changed.

Statistical analysis

The number of prescriptions, quantity dispensed and costs of BGTS were determined for each year and for each quantity limit scenario from 2004 to 2012. The product and dispensing costs for each quantity limit scenario were modelled using time series analysis, a statistical method that generates models to fit correlated time-sequenced data points and produce forecasts.¹³ The analysis was performed using the time series forecasting module in SAS/ETS (SAS Institute, Cary, NC). A stationary series was created by taking the first difference of the data to remove any trend. Models with the best fit were selected based on having low Akaike information criterion (AIC). Diagnostic tests were used to evaluate and compare the models. The linear (Holt) exponential smoothing model had the best fit for the majority of the scenarios modelled. This model takes into account a linear trend in the series and fits a smoothing equation for forecasting. We used the linear (Holt) exponential smoothing to estimate potential 5-year cost savings by projecting costs for the years 2013 to 2017.¹³

Scenarios for reduced test strip unit cost

The impacts of negotiated price reductions together with quantity restrictions were also investigated using prescription patterns in 2012. To model a policy situation in which prescribing was restricted to one product with a lower negotiated price, we identified the most commonly used brand of test strip in 2012 in each province. In BC, this was One Touch Ultra® BG test strip (\$0.67/strip), and in Ontario, it was Ascensia

Microfill® test strip (\$0.67/strip). The total number of strips dispensed in 2012 was multiplied by the price of the most commonly prescribed test strip in each province to calculate the estimated product cost for each quantity limit scenario (Current, CERC, CDA, and Ontario) if only one brand of test strip was reimbursed. The total cost was calculated as the sum of the average dispensing cost (from PharmaCare and ODB in 2012) and the calculated product cost. The impact of price reductions was calculated by decreasing the total cost by 5% increments, from 5% to 50%, for each quantity limit scenario in each province for the year 2012.

RESULTS

In 2012, 317,130 individuals in Ontario and 136,659 individuals in BC had test strips reimbursed by their public drug plan, amounting to a total cost of \$104.4 million and \$22.6 million respectively. On average, Ontario patients had more than 2 strips reimbursed daily (mean 2.07 test strips) when treated with insulin and between 0.7 and 1.1 strips reimbursed daily when treated with other diabetes therapies (Table 1). In comparison, the average number of strips reimbursed daily was lower in BC, with insulin users testing just over once daily (mean 1.27 test strips), and all other treatment groups using between 0.2 and 0.6 test strips daily. In Ontario, almost 10% (9.3%; 13.3 million strips) of test strips were dispensed to individuals receiving no glucose-lowering therapy, compared to only 5.8% of test strips (1.9 million strips) in BC ($p < 0.01$). Conversely, almost two thirds (60.8%) of all test strips in BC were dispensed to patients treated with insulin, compared to only 43.4% in Ontario ($p < 0.01$).

Scenarios for reduced quantities

Under the 3 modeling scenarios, the costs of test strips would be reduced considerably in both Ontario and BC. Notably, the percentage reductions in public reimbursement were very similar between the two provinces despite the different drug plan structures. In Ontario, potential 5-year cost savings ranged from \$98.8 million (an 18.2% reduction if Ontario's 2013 policy were implemented) to \$224.1 million (a 41.4% reduction if CERC recommendations were applied; Figure 1). Similarly, the 5-year

Figure 1. Five-year projected costs of blood glucose test strips associated with three scenarios related to quantity limits among patients aged 65 years and older, Ontario, 2013–2017

potential cost reductions estimated among adults in BC ranged from \$23.1 million (a 19.2% reduction if the 2013 Ontario Policy was implemented) to \$51.1 million (a 42.4% decrease if the more restrictive CERC recommendations were applied; Figure 2). In contrast, if current SMBG testing patterns continue in Ontario and BC, the total cost of test strips is projected to exceed \$540 million and \$120 million dollars respectively over the next five years.

Scenarios for reduced quantities and unit costs

Applying the price of the most commonly dispensed publicly-funded test strip in each province (\$0.67/strip), the total cost of test strips in 2012 was \$105.2 million in Ontario and \$23.9 million in BC, slightly higher than the actual costs observed that year. The impact of a 15% price reduction per strip in Ontario ranged from \$14.4 million in savings (no quantity limits; 13.7% reduction) to a high of \$58.4 million in savings (55.6% reduction) if both price reductions and the CERC recommended quantity limits were implemented (Figure 3). In BC, a 15% price reduction would lead to savings ranging from

\$3.4 million (no quantity limits; 14.1% reduction) to \$11.7 million (48.9% reduction) if both price reductions and the CERC recommendations were implemented (Figure 4).

DISCUSSION

In this large, population-based study spanning two provinces in Canada, we found the prevalence of BGTS use among patients with diabetes is high, resulting in substantial annual costs to public payers (\$104 million and \$23 million in Ontario and BC respectively). This study suggests that policies for reduced BGTS quantities or unit costs would have substantial impacts on the volume and costs of these products in both provinces despite differences in their public drug plan designs. In particular, the implementation of Ontario's 2013 policy is projected to result in a 20% reduction in 5-year BGTS costs in Ontario (18%; \$99 million). Were BC to implement the same policy, the projected relative reduction in 5-year costs is similar (19%; \$23 million). Furthermore, if both provinces implemented these quantity limits with a 15% per-strip price reduction, this would lead to an additional 14% reduction in annual BGTS costs in

Figure 2. Five-year projected costs of blood glucose test strips associated with three scenarios related to quantity limits among patients aged 18 years and older. British Columbia, 2013–2017

both Ontario (\$14 million) and BC (\$3.4 million). These considerable cost savings could be diverted to other diabetes initiatives that may have broader impacts on patient quality of life and long-term outcomes.^{14–16}

These findings have important national implications. The prevalence of diabetes continues to rise as the population ages,¹ and the increasing use of BGTS among patients with diabetes not receiving insulin² has considerable financial implications for public payers. Furthermore, major discrepancies remain in utilization rates and costs of blood glucose test strips internationally, likely reflecting a lack of consensus in clinical guidelines regarding the optimal use of these products among non-insulin-treated patients, as well as differing costs and reimbursement policies.^{11,17} For example, in Canada, BGTS costs more than \$0.70 per strip,¹¹ compared to \$0.21 in New Zealand,¹² \$0.39 in the US and \$0.56 in the UK.¹¹ Similarly, in one international study, the self-reported frequency of test-strip use among patients with diabetes using oral glucose-lowering

medication ranged from no use in India to 14 strips/week in Germany and Argentina.¹⁷ Finally, although there is evidence that SMBG is a useful tool in managing glycemic control among some patients with diabetes, clinical evidence also suggests that among a subgroup of patients with type 2 diabetes who do not use insulin, frequent use of BGTS may not have long-term clinical benefits and may instead lead to increased patient anxiety.^{4,6,18–20} As a result, strategies to address this issue – including policies that reduce the reimbursed quantity of BGTS or lower test-strip costs of these products through price negotiations with manufacturers – are important considerations for decision-makers worldwide.^{9,21,22}

Some limitations of this analysis merit emphasis. First, in Ontario, public drug coverage is only provided universally among those aged 65 and older. Although those younger than 65 may be eligible for coverage in some situations (e.g., social assistance, disability support), they were not included in this analysis because eligibility can vary over time. As a result, we

Figure 3. Cost impacts of various scenarios for decreased blood glucose test strip unit cost and quantity restrictions in Ontario, 2012

Figure 4. Cost impacts of various scenarios for decreased blood glucose test strip unit cost and quantity restrictions in British Columbia, 2012

likely underestimate the true impact of the modeled policies in Ontario because we do not include any prescribing information for individuals younger than 65 receiving publicly-funded blood glucose test strips. Second, our ability to differentiate between

type 1 and type 2 diabetes patients who are using insulin is limited. As a result, our definition may misclassify some patients with type 2 diabetes, which in turn could cause us to underestimate of the potential cost implications of the CERC

recommendations. Finally, when modeling scenarios for reduced test strip unit cost, we could not account for multiple brands of test strips in the analysis, and our calculations are predicated on the cost of the most commonly dispensed test strip in each province.

CONCLUSIONS

Our findings highlight the potential for policy changes that align with current evidence to have substantial cost-saving implications across Canada with no adverse clinical consequences. Both the Ontario public drug program and the Canadian Non-Insured Health Benefits Program implemented policies for reduced quantities in 2013,^{9,21} which may lead other provinces and territories to consider similar changes over the coming years. This research suggests that both reducing reimbursed quantity limits and negotiating lower unit costs for BGTS could have a considerable impact on utilization and costs irrespective of differences in drug plan design. Therefore, both options would be reasonable options for consideration in all Canadian jurisdictions. Future analyses should evaluate the impact of recent policy changes in Ontario to determine whether cost savings align with these projections and whether these restrictions have impacted health outcomes among patients with diabetes.

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RÉSUMÉ

OBJECTIFS : Plusieurs stratégies ont été proposées pour gérer l'utilisation des bandelettes de test glycémique (BTG) au Canada, mais on ignore leurs effets potentiels sur l'utilisation et le coût des bandelettes de test glycémique financées par les deniers publics.

MÉTHODES : Nous avons étudié l'effet de trois politiques possibles qui limiteraient le nombre de bandelettes de test remboursées par les régimes d'assurance médicament en Ontario et en Colombie-Britannique (C.-B.), et avons incorporé des réductions de prix négociées. Ces politiques étaient fondées sur des recommandations de l'Agence canadienne des médicaments et des technologies de la santé, sur un document préparatoire de l'Association canadienne du diabète et sur une nouvelle politique introduite par le ministère de la Santé et des Soins de longue durée de l'Ontario. On a évalué le taux d'utilisation des BTG dans deux analyses croisées chez des adultes âgés de 18 ans et plus en C.-B. et de 65 ans et plus en Ontario qui recevaient des BTG financées par les fonds publics entre janvier 2004 et décembre 2012. Nous avons établi le modèle d'une utilisation sur 5 ans et des conséquences financières de ces trois politiques selon une analyse des séries chronologiques.

RÉSULTATS : En 2012, il y avait 317 130 receveurs de bandelettes en Ontario et 136 659 en C.-B., pour un coût de 104,4 millions \$ et de 22,6 millions \$ respectivement. Selon les scénarios des quantités réduites de BTG, les économies sur 5 ans étaient entre 98,8 millions \$ (réduction de 18,2 %) et 224,1 millions \$ (réduction de 41,4 %) en Ontario et entre 23,1 millions \$ (réduction de 19,2 %) et 51,1 millions \$ (réduction de 42,4 %) en C.-B. Une réduction de prix de 15 % entraînait des économies annuelles de 14,4 millions \$ (réduction de 13,7 %) en Ontario et de 3,4 millions \$ (réduction de 14,1 %) en C.-B.

CONCLUSIONS : Les politiques qui correspondent aux faits et aux conseils des experts pourraient permettre des économies importantes dans plusieurs compétences malgré les régimes publics d'assurance médicament différents.

MOTS CLÉS : autosurveillance; autodiagnostic; glycémie; diabète; utilisation