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Original Research

Self-Monitoring of Blood Glucose: Impact of Quantity Limits in Public Drug Formularies on Provincial Costs Across Canada

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ABSTRACT

Objectives: For most patients with diabetes, routine use of blood glucose test strips (BGTS) has not been shown to be beneficial, yet the economic implications of broad publicly funded reimbursement for BGTS are substantial. We assessed the potential impact of BGTS quantity limits on utilization and costs for 6 publicly funded drug plans across Canada.
Methods: A cross-sectional analysis was conducted in 6 provinces (Alberta, Saskatchewan, Manitoba, Nova Scotia, Newfoundland and Labrador and Prince Edward Island) for patients who received at least 1 prescription for BGTS in 2014 through the public drug program. We determined the number of BGTS that would have exceeded the quantity limits and the associated costs to the provincial drug program.
Results: A total of $38,051,026 was spent on BGTS reimbursed through public drug programs among the 6 provinces. In provinces where BGTS use is largely restricted to patients using insulin, the potential annual savings were minimal, ranging from 0.4% to 2.3%, whereas in provinces with more liberal listings, potential savings ranged from 12.4% to 19.8%. Combining these results with data from a previous analysis in Ontario and British Columbia, the cost savings associated with BGTS quantity limits for 8 provinces across Canada (capturing approximately three-quarters of the Canadian population) is estimated to be $30.3 million annually.
Conclusions: The national implementation of a quantity limit policy for BGTS that aligns with evidence of efficacy, optimal prescribing and patient safety can lead to considerable savings for most public drug plans across Canada.

Mots clés :
glycémie
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diabète
auto-surveillance
uto-mesure
utilisation

RÉSUMÉ

Objectifs : Pour la plupart des patients diabétiques, l'utilisation systématique des bandelettes réactives pour la glycémie (BRG) ne s'est pas révélée bénéfique, mais les conséquences économiques des remboursements largement financés par les fonds publics des BRG sont substantielles. Nous avons évalué les conséquences potentielles des limitations du nombre de BRG sur l'utilisation et les coûts des 6 régimes publics d'assurance-médicaments du Canada.
Méthodes : Une analyse transversale a été menée dans 6 provinces (Alberta, Saskatchewan, Manitoba, Nouvelle-Écosse, Terre-Neuve-et-Labrador et île-du-Prince-Édouard) auprès de patients qui avaient reçu au moins 1 ordonnance de BRG en 2014 dans le cadre d'un régime public d'assurance-médicaments. Nous avons déterminé le nombre de BRG qui auraient excédé les limitations de quantité et les coûts associés aux régimes publics d'assurance-médicaments provinciaux.

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Résultats : Un total de 38 051 026 $ a été dépensé pour le remboursement des BRG par les régimes publics d'assurance-médicaments des 6 provinces. Dans les provinces où l'utilisation des BRG se limitait généralement aux patients prenant de l'insuline, les économies annuelles potentielles étaient minimes, allant de 0,4 % à 2,3 %, alors que dans les provinces ayant des listes plus ouvertes, les économies potentielles allaient de 12,4 % à 19,8 %. En combinant ces résultats aux données d'une analyse précédente de l'Ontario et de la Colombie-Britannique, les économies d'échelle associées aux limitations du nombre de BRG de 8 provinces du Canada (qui s'emparent approximativement les trois-quarts de la population canadienne) sont estimées à 30 300 000 $ annuellement.
Conclusions : La mise en œuvre nationale de politiques en matière de limitations du nombre de BRG qui s'harmonisent aux données probantes sur l'efficacité, de prescription optimale et de sécurité du patient peut entraîner des économies considérables pour la plupart des régimes publics d'assurance-médicaments du Canada.

Introduction

Self-monitoring of blood glucose (SMBG) for patients with diabetes on insulin therapy is considered an essential part of management because it allows for adjustment of insulin doses, with the goal of optimizing glycated hemoglobin (A1C) levels and preventing complications, including hypoglycemia (1,2). However, for patients with type 2 diabetes not using insulin, frequent monitoring by means of blood glucose test strips (BGTS) is controversial (3,4). Although some studies have shown small positive effects on glycemic control in this population, the effect is temporary and not considered clinically meaningful (5). As well, there is no evidence to suggest that general health-related quality of life, well-being or patient satisfaction is improved by the routine use of SMBG among noninsulin-treated patients. In fact, some studies have reported a possible increase in anxiety and depression scores in noninsulin-treated patients with diabetes who routinely use SMBG (6,7).

As a result, several guidelines and therapeutic reviews pertaining to the management of patients with diabetes have addressed the issue of frequency of use of BGTS (8–10). Most of these reviews do not specifically outline optimal testing frequencies in noninsulin-treated patients with diabetes, but a review by the Canadian Agency for Drugs and Technologies in Health (CADTH) in 2009 recommended a maximum of 14 tests per week for patients with type 2 diabetes using insulin in conjunction with other antidiabetic drugs and no routine SMBG by other patients with diabetes (9,11). In contrast, a guidance document published by the Canadian Diabetes Association (CDA) suggested that the number of SMBG tests be individualized for patients with type 2 diabetes using insulin; 15 test strips per month should be available for patients taking antidiabetes drugs, who have lower risks for hypoglycemia, and 30 test strips per month should be available for for patients taking antidiabetes drugs, who have higher risks for hypoglycemia (i.e. sulfonylureas, meglitinides) (12).

In Canada, a total of $247 million was spent on BGTS in 8 publically funded programs in 2006, with over half of the total expenditures attributable to patients not using insulin (13). In order to encourage appropriate use of these products and to decrease expenditures, policies of quantity limits for BGTS have been suggested and have been implemented in some jurisdictions across Canada. For example, in 2013, the Ontario Ministry of Health and Long-Term Care's public drug program implemented test strip quantity limits aligned with the CDA's guidance (12,14). A similar policy was subsequently adopted by the British Columbia and Saskatchewan public drug plans in 2015.

Quantity-limit policies are designed to encourage more appropriate use of BGTS, but they have also been shown to have considerable potential for cost savings in public drug programs. Indeed, it is estimated that Ontario and British Columbia will save approximately $100 million and $23 million, respectively, over the 5-year period following the introduction of the new policies (15). Despite this, the potential impact of introducing a policy of quantity limits in other jurisdictions across Canada is not known because provinces have differing levels of reimbursement through their provincial drug programs (Supplementary Appendix) (16,17). Therefore, we designed a study to estimate the potential impact of BGTS quantity limits that are similar to those already implemented in Ontario and British Columbia, on BGTS utilization and expenditures in 6 additional provincial drug plans across Canada.

Methods

We conducted a cross-sectional study among patients residing in 6 provinces across Canada (Alberta, Saskatchewan, Manitoba, Nova Scotia, Newfoundland and Labrador, and Prince Edward Island) who were dispensed at least 1 prescription for BGTS between January 1 and December 31, 2014, through a provincial public drug program. We leveraged the Canadian Institute for Health Information's National Prescription Drug Utilization Information System (NPDUIS) database to identify all prescriptions for BGTS and other diabetes therapies dispensed to each patient over the study period. We did not analyze data for Quebec, New Brunswick or the Territories because BGTS data for these jurisdictions is not captured in the NPDUIS database. This protocol was approved by the Research Ethics Board of St. Michael's Hospital, Toronto.

Each patient was assigned to 1 of 4 mutually exclusive diabetes therapy groups based on the type of diabetes therapies that they received during the study period, as follows: 1) patients dispensed at least 1 prescription for insulin; 2) patients dispensed at least 1 prescription for an oral glucose-lowering medication that may induce hypoglycemia (i.e. sulfonylureas or repaglinide) but not insulin; 3) patients dispensed at least 1 prescription for an oral glucose-lowering medication that does not induce hypoglycemia, but not insulin or hypoglycemia-inducing oral medications and 4) patients dispensed no insulin or oral glucose-lowering therapy.

Statistical analysis

We determined the total number of patients receiving BGTS, the number of strips dispensed and the associated costs for each provincial drug program, stratified by diabetes therapy group for 2014. We then modeled the potential 1-year impact of introducing quantity limits in each province that align with those implemented in Ontario, British Columbia and Saskatchewan. Specifically, these thresholds are a maximum of 3000 strips annually for insulin users, 400 strips annually for those using oral glucose-lowering medications that may induce hypoglycemia, and 200 strips annually for all others with diabetes. For each patient, we determined the number of test strips that would have exceeded these thresholds in 2014 and the associated costs to the provincial drug program. Patient-level reductions in utilization and costs were aggregated at the level of diabetes therapy group and province.

Results

In 2014, the total program cost for BGTS in the 6 provincially funded programs studied ranged from $935,278 in Prince Edward Island to $9.4 million in Saskatchewan (Table 1). In Alberta and Prince Edward Island where BGTS reimbursement is already limited largely to patients receiving insulin, 99% and 93%, respectively, of all BGTS dispensed were for patients receiving insulin. In contrast, in the other 4 provinces studied, those in which BGTS reimbursement is more liberal, the proportion of BGTS dispensed to patients receiving insulin ranged from 53% (Newfoundland and Labrador) to 62% (Saskatchewan). Approximately 7% (range, 5.6% to 7.6%) of BGTS were dispensed to patients receiving no diabetes drug therapy in the 4 provinces studied that had more liberal coverage of BGTS, compared to 0.4% in Alberta and 1.5% in Prince Edward Island.

In the 6 provinces studied, a total of $38,051,026 was spent on BGTS reimbursed through public drug programs in 2014. We estimate that the introduction of quantity limits in these provinces would lead to an overall savings of $4,631,849 (12.2%) annually. However, the impact of this policy varied considerably among provinces. In provinces where BGTS use is largely restricted to patients using insulin, the potential annual savings were relatively small, ranging from 0.4% (in Alberta, $25,112 of $7,178,925) to 2.3% (in Prince Edward Island, $21,663 of $935,278) (Figure 1) annually. However, in the remaining provinces, the potential savings associated with quantity limits was higher, ranging from 12.4% (in Nova Scotia, $863,070 of $6,988,646) to 19.8% ($1,295,106 of $6,540,569 in Newfoundland and Labrador), annually.

Discussion

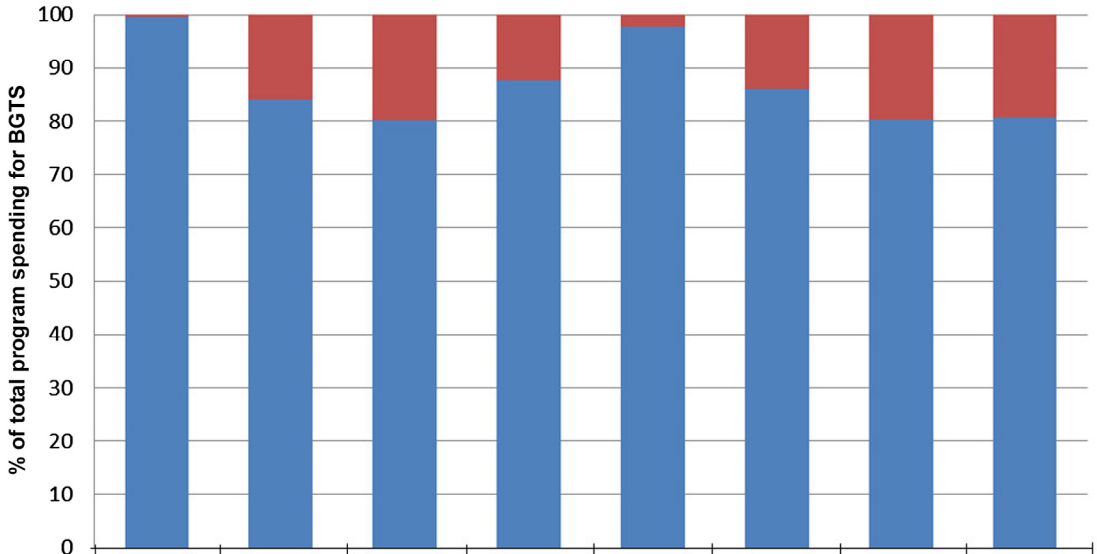
In this population-based study of publicly funded BGTS users in 6 Canadian provinces, we found that a policy of quantity limits could have considerable cost-savings implications in jurisdictions with liberal reimbursement policies. These results align with a previously published analysis (15) that estimated potential savings of 19.7% ($21.1 million) in Ontario and 19.2% ($4.5 million) in British Columbia in 2014 if the same quantity limits had been introduced. Therefore, among 8 of the 10 provinces in Canada (representing 74.4% of the Canadian population in 2014), the cost savings associated with the introduction of BGTS quantity limits by provincial publically funded drug programs is estimated to be $30.3 million (17.9%) annually. Despite these overall savings, the impact of such a policy would differ among the provinces, depending on their current level of BGTS reimbursement. For example, in provinces where BGTS coverage is limited largely to patients receiving insulin (Alberta and Prince Edward Island), the impact is minimal, with projected savings of less than 1.5%. However, in provinces that allow broad access to BGTS, the implementation of quantity limits would likely result in savings ranging from 12% to 20%.

The financial implications of broad publicly funded reimbursement for BGTS are significant. For example, in Ontario in 2012 and 2013, BGTS represented the second largest expenditure by the Ontario Public Drug Programs and accounted for $139 million, or 3.9% of total drug expenditures in the province (18). Similarly, test strips were the British Columbia Pharmacare's third highest expenditure in 2012 (19). In order to optimize the use of SMBG by patients

Table 1
Blood glucose test strips utilization and costs by province and by diabetes group, 2014

Diabetes group	Patients n (%)	Actual BGTS dispensed N (%)	Actual total program paid	Modeled BGTS dispensed n (%)	Modeled total program paid
Alberta					
Overall	21,161 (100%)	10,053,506 (100%)	$7,178,925	10,013,106 (100%)	$7,153,813
Insulin	20,697 (97.8%)	9,931,831 (98.8%)	$7,091,599	9,928,831 (99.2%)	$7,091,242
HI OHA	160 (0.8%)	40,543 (0.4%)	$29,773	35,293 (0.4%)	$25,927
NHI OHA	155 (0.7%)	41,093 (0.4%)	$30,104	25,264 (0.3%)	$18,860
No drug therapy	149 (0.7%)	40,039 (0.4%)	$27,450	23,718 (0.2%)	$17,784
Manitoba					
Overall	44,778 (100%)	19,419,608 (100%)	$6,986,410	16,607,537 (100%)	$5,881,724
Insulin	14,526 (32.4%)	11,153,664 (57.4%)	$4,371,790	11,014,340 (66.3%)	$4,306,193
HI OHA	12,375 (27.6%)	3,842,163 (19.8%)	$1,392,882	2,926,109 (17.6%)	$958,174
NHI OHA	11,422 (25.5%)	3,021,863 (15.6%)	$880,315	1,757,347 (10.6%)	$428,187
No drug therapy	6,455 (14.4%)	1,401,918 (7.2%)	$341,423	909,741 (5.5%)	$189,170
Newfoundland and Labrador					
Overall	15,856 (100%)	8,039,887 (100%)	$6,540,569	6,459,981 (100%)	$5,245,463
Insulin	5681 (35.8%)	4,283,391 (53.3%)	$3,474,234	4,275,833 (66.2%)	$3,468,103
HI OHA	4823 (30.4%)	1,951,837 (24.3%)	$1,597,843	1,316,272 (20.4%)	$1,072,170
NHI OHA	3968 (25.0%)	1,354,137 (16.8%)	$1,110,975	647,753 (10.0%)	$527,700
No drug therapy	1384 (8.7%)	450,522 (5.6%)	$357,518	220,123 (3.4%)	$177,490
Nova Scotia					
Overall	21,751 (100%)	9,482,540 (100%)	$6,988,646	8,257,031 (100%)	$6,125,575
Insulin	8308 (38.2%)	5,732,064 (60.4%)	$4,346,985	5,700,578 (69.0%)	$4,322,294
HI OHA	5644 (25.9%)	1,810,325 (19.1%)	$1,320,415	1,384,443 (16.7%)	$1,002,138
NHI OHA	4741 (21.8%)	1,246,549 (13.1%)	$860,760	740,146 (9.0%)	$509,941
No drug therapy	3058 (14.1%)	693,602 (7.3%)	$460,485	431,864 (5.2%)	$291,202
Prince Edward Island					
Overall	2674 (100%)	1,469,923 (100%)	$935,278	1,427,795 (100%)	$913,614
Insulin	2395 (89.6%)	1,367,612 (93%)	$875,895	1,367,612 (95.8%)	$875,895
HI OHA	128 (4.8%)	45,980 (3.1%)	$26,017	34,195 (2.4%)	$20,858
NHI OHA	95 (3.6%)	34,558 (2.4%)	$20,821	16,488 (1.2%)	$10,643
No drug therapy	56 (2.1%)	21,773 (1.5%)	$12,544	9500 (0.7%)	$6218
Saskatchewan					
Overall	42,045 (100%)	18,226,229 (100%)	$9,421,198	15,815,907 (100%)	$8,098,986
Insulin	15,212 (36.2%)	11,212,164 (61.5%)	$5,958,350	11,173,564 (70.6%)	$5,931,616
HI OHA	8099 (19.3%)	2,467,536 (13.5%)	$1,316,610	1,882,258 (11.9%)	$963,248
NHI OHA	12,360 (29.4%)	3,160,524 (17.3%)	$1,527,256	1,887,848 (11.9%)	$842,838
No drug therapy	6374 (15.2%)	1,386,005 (7.6%)	$618,982	872,237 (5.5%)	$361,284

BGTS, blood glucose test strips; HI OHA, hypoglycemia-inducing oral hypoglycemia agent; NHI OHA, nonhyoglycemia-inducing oral hypoglycemia agent.



	AB	MB	NL	NS	PEI	SK	ON*	BC*
Actual spending	$7,178,925	$6,986,410	$6,540,569	$6,988,646	$935,278	$9,421,198	$107,113,958	$23,586,698
Modeled spending	$7,153,813	$5,881,724	$5,245,463	$6,125,575	$913,614	$8,098,986	$86,033,072	$19,048,612
Potential cost savings	$25,112	$1,104,686	$1,295,106	$863,070	$21,663	$1,322,212	$21,080,886	$4,538,086

Figure 1. Potential annual savings and total program spending for BGTS in each province, 2014.

with diabetes, Ontario implemented a policy of quantity limits in 2013, and it resulted in annual savings of 22.5% ($24 million) (20). The results of this and other studies suggest that both British Columbia (15) and Saskatchewan will achieve similar cost savings following the introduction of their quantity-limiting policies in 2015. Our study suggests that other provinces, namely Nova Scotia, Newfoundland and Labrador, and Manitoba, which currently have broad access to BGTS, would be likely to see cost savings ranging from 12% to 20%. These results align with a recently published analysis in Manitoba, which estimated reductions in government costs for BGTS to be approximately $1.4 million in 2013 (21).

This study has several strengths, including its use of patient-level data to estimate the impact on publicly funded programs of a quantity limit policy in 8 of Canada's 10 provinces, capturing approximately three-quarters of the Canadian population. However, there are several limitations in the study that should be noted. First, due to the retrospective nature of our study, we were unable to ascertain whether dispensed test strips were actually used. However, because the strips were reimbursed by the public drug programs, our estimates of cost savings remain valid. Second, we did not have access to data from Quebec, New Brunswick, the Territories or federal plans (e.g. the Non-Insured Health Benefits program), as well as income assistance recipients in Alberta and Nova Scotia. Therefore, the potential savings we report are underestimates of the amounts that could be realized if similar quantity-limiting policies were introduced by all public drug plans across Canada. Finally, an evaluation of the impact of the quantity-limiting policy in Ontario identified a transient spike in BGTS dispensing in the month preceding implementation of the policy, which was suggestive of hoarding of BGTS in anticipation of future restrictions on reimbursement (20). Therefore, although this is a one-time cost that will be far exceeded by future savings achieved through quantity limits, policy makers should consider the possibility of a similar increase in BGTS-related costs prior to implementing similar policies in their jurisdictions.

Conclusions

This study demonstrates that implementation of a quantity-limit policy for BGTS that aligns with evidence concerning efficacy, optimal prescribing and patient safety can lead to considerable savings for most public drug plans across Canada. Formulary modernization initiatives such as the introduction of quantity limits for BGTS provide opportunities to decrease expenditures without compromising patient outcomes. Savings achieved could be redirected toward other programs such as behavioural programs that have been shown to provide benefits for patients with diabetes (22).

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Appendix

Quantity limits and coverage of blood glucose test strips (2014)

Province	Quantity limits and coverage of blood glucose test strips (2014, for eligible individuals)
British Columbia (1)	No restriction*
Alberta (2)	Patients with diabetes who are currently and regularly using insulin; eligible individuals have coverage to a maximum of $600 per person each benefit year for eligible diabetes supplies purchased from a licensed pharmacy
Saskatchewan (3)	No restriction†
Manitoba (4)	Maximum 4000 strips/year
Ontario (5)	Patients using insulin: 3000 strips/year Patients on oral antidiabetic drugs at increased risk for hypoglycemia: 400 strips/year Other patients with diabetes: 200 strips/year
Quebec (6)	No restriction
Nova Scotia (7)	No restriction
Newfoundland and Labrador (8)	Patients on medication for diabetes: 2500 test strips/365 day period
Prince Edward Island (9)	Patients must have used insulin within 150 days
New Brunswick (10)	Patients with newly diagnosed diabetes: 50 strips/year Patients on oral medications: 100 strips/year Patients on insulin: as per doctor's recommendations *Note:* Not available through drug plans; available through Social Development program

* As of January 1, 2015, British Columbia (BC) implemented quantity limits (the same as Ontario).

† As of October 2015, Saskatchewan implemented quantity limits (the same as Ontario).

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