

TYPE 2 DIABETES

SELF-MONITORING OF BLOOD GLUCOSE IN ADULTS WITH TYPE 2 DIABETES NOT TREATED WITH INSULIN

This optimal usage guide is provided for information purposes only and should not replace the judgment of a professional. These recommendations do not apply to pregnant women.

CONTEXT

Self-monitoring of blood glucose (SMBG) is an approach used by people with diabetes, in the context of disease self-management, to measure their capillary blood glucose using test strips and a blood glucose meter, in order to adjust medication and lifestyle accordingly or to monitor their effects on diabetes control. Although SMBG is widely used and recommended, there is controversy regarding its real benefits for people with **type 2 diabetes not treated with insulin**. Currently available evidence does not clearly establish the cost effectiveness nor the benefits of SMBG when it comes to glycemic control. The optimal frequency is also a point of controversy.

For the purpose of guiding the use of SMBG, with its rapidly growing costs, several major guideline-making bodies have released recommendations, which are widely diverging at times.

- ▶ **The objective of this guide is to orient and support healthcare professionals and providers to ensure optimal use of SMBG by adults with type 2 diabetes not treated with insulin. To support the process of formulating the recommendations in this guide, INESSS reviewed current scientific evidence and contextual data.**

GENERAL POINTS

In Québec, with respect to people with **type 2 diabetes not treated with insulin** and covered by public prescription drug insurance, between 2003 and 2011:

- The number of blood glucose test strips billed rose from 35 million to 50 million.
- Costs rose from \$31 million to \$45 million.
- Nine out of ten test strip prescriptions were ordered by family physicians.
- ▶ Diabetes treatment is aimed at achieving optimal glycemic control. The goal is to prevent acute complications (hyperglycemia and hypoglycemia) and to reduce the risks of chronic complications that are microvascular or, in some cases, macrovascular.
- ▶ Blood glucose monitoring is performed mainly by measuring glycosylated hemoglobin (A1c) and capillary blood glucose. A1c reflects blood glucose over the past three months or so. It should be measured every three months if blood glucose targets are not met, then every six months when they are met.
- ▶ SELF-MANAGEMENT of a chronic disease such as diabetes allows patients to better understand their disease, to take action and to become more responsible for themselves. SMBG is one component of disease self-management.
- ▶ SMBG makes it possible to:
 - Detect hyperglycemia.
 - Detect, confirm, promptly treat and reduce the frequency of hypoglycemic episodes.
 - Complete the information provided by A1c, which does not give information on glycemic variability and which may be skewed by some factors (e.g., presence of anemia or hemoglobinopathy).
 - See how meals, physical activity, stress and medication affect blood glucose.
 - Make lifestyle or medication changes based on the results.
 - Enable persons with diabetes to take responsibility for managing their disease.
- ▶ The use of SMBG may have a positive or negative effect on quality of life. This should be taken into account in patient care.

THERAPEUTIC TARGETS FOR GLYCEMIC CONTROL¹

SELF-MONITORING OF BLOOD
GLUCOSE (SMBG)

GLYCEMIC TARGETS	Fasting and pre-prandial (mmol/L)	4.0-7.0
	2 h post-prandial (mmol/L)	5.0-10.0 (5-8 if A1c target not met)
A1c TARGETS	≤ 6.5%	Patients at risk for nephropathy and retinopathy, but taking the risk of hypoglycemia into account
	≤ 7%	Most patients
	From 7.1% to 8.5%	Patients with one of the following conditions: <ul style="list-style-type: none"> • Limited life expectancy • High level of functional dependency • Extensive coronary artery disease at high risk of ischemic events • Multiple co-morbidities • Recurrent severe hypoglycemia • Hypoglycemia unawareness • Longstanding diabetes with inability to achieve an A1c ≤ 7% despite effective doses of multiple antihyperglycemic agents, including intensified basal-bolus insulin therapy

1. Targets recommended by CDA in 2013

PRINCIPLES OF SMBG USE

- ▶ SMBG offers real potential for improving glycemic control if it accompanies diabetes education, treatment and actions in response to the results. **It is therefore imperative to propose diabetes education and to ensure compliance on the part of the affected person or his/her informal caregivers prior to prescribing SMBG.**
- ▶ The timing and frequency of measuring blood glucose depend on the treatment, the risk of hypoglycemia, the meeting or not of targets, the information on glycemia desired and the possibility of making behaviour or medication changes based on the results. The timing and frequency of measuring blood glucose must therefore be individualized. In the presence of hyperglycemia, it is generally preferable to suggest that patients perform pre-prandial blood glucose tests rather than post-prandial testing, the latter being more difficult to optimize.

PRESCRIBING SMBG MEANS:

- Equipping people with diabetes with the appropriate glucose meter.
- Specifying glycemic targets (pre-prandial and post-prandial).
- Specifying the timing and frequency of blood glucose measurement.
- Explaining how to record blood glucose levels in an organized manner.
- Developing a plan of action, in conjunction with the diabetic person (in case of hypoglycemia and hyperglycemia).
- Regularly monitoring how the person is using SMBG.
- Checking the accuracy of the glucose meter at least once a year by comparing the result of a fasting blood glucose test performed intravenously at the same time (a difference of 20% more or less is acceptable). Do not compare results acquired by different glucose meters.
- Re-evaluating the relevance of continuing to use SMBG every three to six months according to clinical condition and results.

SMBG: KEY MESSAGES

- **Teach** self-management by explaining how to interpret and apply SMBG results.
- **Individualize** the frequency of capillary blood glucose measurement.
- **Use** the results to make lifestyle and medication changes.
- **Re-evaluate** use and frequency every 3 to 6 months.



SELF-MONITORING OF BLOOD GLUCOSE (SMBG)

INDIVIDUALIZING SMBG USE (TYPE 2 DIABETES NOT TREATED WITH INSULIN)

DAILY USE ¹	SUBGROUPS	SUGGESTED FREQUENCY
Daily use not recommended	Non-recent diagnosis of diabetes (more than 6 months prior), meeting A1c targets and either of these two conditions: <ul style="list-style-type: none"> • Treated by lifestyle management • Use of medications not causing hypoglycemia 	Measurement generally not required or according to clinical circumstances
Daily use possibly recommended	Use of antidiabetics with the potential to cause hypoglycemia ¹	Add a measurement when symptoms appear in order to confirm hypoglycemia and when hypoglycemia usually occurs (with or without symptoms) to verify if there is a trend
	A1c targets not met	Once per day or according to clinical circumstances to support follow-up of lifestyle and medication changes
Daily use recommended	Recent diagnosis of diabetes (less than 6 months prior)	Once per day or according to clinical circumstances (by varying the time of day of the test) to gauge the effects of lifestyle and medication
	Treatment initiation or adjustment, especially upon inclusion of oral antidiabetics with the potential to cause hypoglycemia ²	Once per day or according to clinical circumstances (by varying the time of day of the test) to gauge the effects of lifestyle and medication
	Occupation requiring strict control of hypoglycemia ³ (e.g., driving, work requiring constant alertness)	As often as the occupation requires

1. Regardless of the recommended use, some special circumstances may justify adjusting the frequency.
 2. Antidiabetics with the potential to cause hypoglycemia: gliclazide, glimepiride, glyburide, chlorpropamide, tolbutamide, repaglinide and nateglinide.
 3. This refers to hypoglycemia induced by the use of antidiabetics with the potential to cause hypoglycemia.

SPECIAL CIRCUMSTANCES

- ▶ During a short, intensive period of diabetes education, it is acceptable to perform several glucose tests per day to meet the needs related to this education. The person must thus be told to return to the recommended frequency at the end of this period.
- ▶ In the presence of an intercurrent illness (e.g., an infection) or in the case of use of certain medications, increasing the frequency of SMBG may be justified in order to prevent glycemic variations and to adjust treatment.
- ▶ For the purposes of evaluating the blood glucose effects of a meal, a food or a particular physical activity and of teaching patients how to perform this evaluation, it is advisable to take measurements before and after the meal/food or activity.
- ▶ Treatment with antidiabetics with the potential to cause hypoglycemia may require a greater testing frequency (e.g., during physical activity or in older persons) to detect asymptomatic hypoglycemic episodes.

SYMPTOMS OF HYPOGLYCEMIA AND HYPERGLYCEMIA

HYPOGLYCEMIA	HYPERGLYCEMIA
<p>Neurogenic</p> <ul style="list-style-type: none"> • Trembling/shaking • Palpitations • Sweating • Anxiety • Hunger 	<ul style="list-style-type: none"> • Intense thirst • Excessive hunger • Tiredness • Sleepiness <ul style="list-style-type: none"> • Frequent need to urinate • Blurred vision • Dry mouth
<p>Neuroglycopenic (additional symptoms in moderate to severe cases)</p> <ul style="list-style-type: none"> • Difficulty concentrating • Confusion • Weakness • Sleepiness 	<p>If hyperglycemia is not corrected, the following symptoms may occur:</p> <ul style="list-style-type: none"> • Rapid weight loss • Slow wound healing • Fruity breath • Stomach cramps • Nausea, vomiting <ul style="list-style-type: none"> • Ketone bodies in the urine or blood • Alteration in consciousness potentially leading to coma

USEFUL TOOLS

Basics of type 2 diabetes <http://guidelines.diabetes.ca/CDACPG/media/documents/patient-resources/type-2-diabetes-the-basics.pdf>

Nutrition

Basic principles <http://guidelines.diabetes.ca/PatientResources.aspx#SME>

A Glance at Meal Planning for People with Diabetes publications.msss.gouv.qc.ca/acrobat/f/documentation/2009/09-215-01A.pdf

Pharmacologic Management of Type 2 Diabetes guidelines.diabetes.ca/executivesummary/ch13

Promoting self-management education guidelines.diabetes.ca/SelfManagementEducation/SMETools

SMBG for patients http://www.diabetes.ca/documents/about-diabetes/112022_managing-your-blood-glucose_0413_lc_final.pdf

Hyperglycemia, hypoglycemia and treatment http://www.diabetes.ca/documents/about-diabetes/Lows_and_Highs_final1.pdf

Factors that can affect A1c values <http://guidelines.diabetes.ca/Browse/Chapter9#bib74>

Diabetes and driving www.diabetes.ca/diabetes-and-you/living/guidelines/commercial-driving/

Organizing care

Provincial group prescriptions for diabetes www.inesss.qc.ca/index.php?id=397

Patient Care Flow Sheet guidelines.diabetes.ca/OrganizingCare/PatientCareFlowSheet

The 5 Rs for all Patients with Diabetes guidelines.diabetes.ca/OrganizingCare/The5Rs

OTHER RESOURCES AVAILABLE

The Diabetes Québec website also provides a variety of information www.diabete.qc.ca/en/

MAIN REFERENCES

Institut national d'excellence en santé et en services sociaux (INESSS). *Autosurveillance glycémique chez les adultes atteints de diabète de type 2 non traités par l'insuline : rapport d'évaluation des technologies de la santé*. Written by Christine Lobè, Hélène Guay, Éric Tremblay and Alain Prémont. ETMIS 2013;9(10).

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Canadian Diabetes Association (CDA) 2013. Clinical practice guidelines for the prevention and management of diabetes in Canada. *Can J Diabetes* 2013;37(Suppl.1):S1-S216.

This guide was developed in collaboration with a multidisciplinary working group that included patient representatives. In addition, participation from MSSS, Diabetes Québec, professional orders (OPO, OIIQ, OPDQ), federations (FMOQ, FKQ) and associations (AMEQ, AMIQ, APES, AQPP) was solicited on two occasions during the development process.

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