

# Frequent Bedside Monitoring of Capillary Blood Glucose in Medical Inpatients

Health Quality Ontario

## Context

Frequent bedside monitoring of capillary blood glucose (i.e., a finger-prick test every four to six hours) may be routinely ordered for diabetic medical inpatients, regardless of their glycemic status. This may be justified as a strategy for managing hyperglycemia, but many physicians believe such frequent routine monitoring is unnecessary for those who are not insulin dependent. This review considers whether frequent bedside monitoring has benefits for non-critically ill medical inpatients.

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## Research Question

For medical inpatients with type 2 diabetes that is controlled by diet or oral medications, does frequent bedside monitoring of capillary blood glucose have benefit or reduce harm, compared with less frequent monitoring?

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## Conclusion

No RCTs, observational studies, systematic reviews, or meta-analyses met the inclusion criteria. The Endocrine Society and the Canadian Diabetes Association publish guidelines on blood-glucose monitoring in the non-critical care setting.

# Acknowledgements

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This report was developed by a multi-disciplinary team from Health Quality Ontario. The lead clinical epidemiologist was Immaculate Nevis, the medical librarian was Corinne Holubowich, and the medical editor was Sue MacLeod. Others involved in the development and production of this report were Irfan Dhalla, Andree Mitchell, Farhad Samsami, and Christopher Pagano.

[Choosing Wisely Canada](#) is a national campaign that aims to help physicians and patients engage in informative conversations about tests, treatments, and procedures, and help physicians and patients make smart and effective choices to ensure high-quality care. It will support physicians as they work with patients to ensure they not only get the care they need, but avoid tests, treatments, and procedures that have no value and could cause them harm.

As part of this campaign, Health Quality Ontario (HQO) has developed rigorous, evidence-based reviews of tests, treatments, and/or procedures that may be overused. Choosing Wisely Canada has made recommendations based on the evidence provided by HQO. These recommendations are available on the [Choosing Wisely Canada website](#).

## Methodology

Research questions are developed by Choosing Wisely Canada, in consultation with experts, end users, and/or applicants in the topic area. Evidence Development and Standards then produces one of two types of rapid reviews, or a special report to answer the research question. A rapid review of systematic reviews is conducted when a systematic literature search identifies relevant systematic reviews, health technology assessments, or meta-analyses that meet the inclusion criteria specified in the methods section. A rapid review of primary studies is conducted when none of the aforementioned study designs are available. On occasion, a special report may be provided that does not strictly follow the rapid review methodology set out by HQO. These reports are completed in a 2- to 8-week time frame. For more detail on rapid review methodology, please visit the Health Quality Ontario website at:

<http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations/rapid-reviews>

# Context

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## Objective of Review

The objective of this review was to determine the effectiveness of frequent bedside capillary monitoring in adult medical inpatients who have type 2 diabetes that is controlled by diet or oral medications.

## Clinical Need and Target Population

### Description of Disease/Condition

When hospitalized, people whose type 2 diabetes is controlled by diet or oral medications may experience variations in their blood glucose levels. To monitor and manage blood glucose levels in such patients, some guidelines imply or state that physicians should routinely order bedside finger-prick testing every four to six hours. However, many physicians believe that such frequent routine monitoring is unnecessary in patients who are not on insulin. (1, 2)

### Prevalence and Incidence

Diabetes mellitus, which includes both type 1 and type 2 diabetes, is one of the most common chronic diseases in Canada. Among people aged 20 and older, the prevalence rate in 2008/09 was 8.7% (95% confidence interval 8.72–8.74%), according to the Canadian Chronic Disease Surveillance System; this represented one in 11 Canadians. In that fiscal year, about 6.3 new cases appeared per 1,000 Canadians. Males (6.8 new cases per 1,000) had higher overall incidence rates than females (5.7 new cases per 1,000). (3)

## Technology/Technique

To improve diabetes management in adult diabetic inpatients, bedside capillary blood glucose determination is done routinely. The testing can be done by a range of trained hospital personnel and yields results rapidly with minimal discomfort to the patients. It is known to have helped with therapeutic decisions, thus contributing to improved patient care. (1)

# Question, Methods, and Findings

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## Research Question

For medical inpatients with type 2 diabetes that is controlled by diet or oral medications, does frequent bedside monitoring of capillary blood glucose have benefit or reduce harm, compared with less frequent monitoring?

## Methods

See Appendix 1 for a detailed description of the search strategy, including terms and results.

### Inclusion Criteria

- English-language full-text publications
- published between January 1, 2009, and December 22, 2014
- randomized controlled trials (RCTs), observational studies, systematic reviews (SRs), and meta-analyses
- adult medical inpatients with type 2 diabetes, not insulin dependent

### Exclusion Criteria

- medical inpatients who are critically ill or in an intensive care unit
- medical inpatients who are diabetic and on insulin
- medical inpatients who are diabetic and have had an episode of hypoglycemia during their hospital stay
- medical inpatients being started on medications such as steroids, which can cause fluctuations in blood glucose levels
- paediatric medical inpatients

### Outcomes of Interest

- hyperglycemia
- hypoglycemia
- increased incidence of infections
- morbidity or mortality as defined by primary studies

## Findings

The database search yielded 1,972 citations published between January 1, 2009, and December 22, 2014, (with duplicates removed). Articles were excluded based on information in the title and abstract. The full texts of 27 potentially relevant articles were obtained for further assessment.

No RCTs, observational studies, systematic reviews, or meta-analyses met the inclusion criteria.

In the absence of studies meeting the inclusion criteria, we examined an Endocrine Society Clinical Practice Guideline (2012) for management of hyperglycemia in hospitalized patients in non-critical care settings. (4) Under the heading “Monitoring glycaemia in the non-critical care setting,” it read:

“We suggest the following schedules for POC testing: before meals and at bedtime in patients who are eating, or every 4–6 h in patients who are NPO [receiving nothing by mouth (nil per os)] or receiving continuous enteral feeding.” (4)

We also examined a guideline from the Canadian Diabetes Association (2013). Under the heading “Bedside BG monitoring,” it read:

“Currently, there are no studies that have examined the effect of the frequency of bedside BG testing on the incidence of hyper- or hypoglycemia in the hospital setting. The frequency and timing of bedside BG monitoring should be individualized; however, monitoring is typically performed before meals and at bedtime in patients who are eating, every 4 to 6 hours in patients who are NPO (nothing by mouth) or receiving continuous enteral feeding, and every 1 to 2 hours for patients on continuous IV insulin.” (5)

Note that both guidelines were based on expert opinion alone, which we deemed to be very low quality of evidence.

## Conclusions

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No RCTs, observational studies, systematic reviews, or meta-analyses met the inclusion criteria. Guidelines from the Endocrine Society (2012) and the Canadian Diabetes Association (2013) provided suggestions as to how blood glucose can be monitored in the non-critical care setting.

# Appendices

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## Appendix 1: Research Methods

### Literature Search Strategy

A literature search was performed on December 22, 2014, using Ovid MEDLINE, Ovid MEDLINE In-Process and Other Non-Indexed Citations, Ovid Embase, EBSCO Cumulative Index to Nursing & Allied Health Literature (CINAHL), and EBM Reviews, for studies published from January 1, 2009, to December 22, 2014. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search.

**Search date:** December 22, 2014

**Librarians:** Corinne Holubowich

**Databases searched:** Ovid MEDLINE, Ovid MEDLINE In-Process, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, CRD Health Technology Assessment Database, Cochrane Central Register of Controlled Trials, and CINAHL

Database: EBM Reviews - Cochrane Central Register of Controlled Trials <November 2014>, EBM Reviews - Cochrane Database of Systematic Reviews <2005 to November 2014>, EBM Reviews - Database of Abstracts of Reviews of Effects <4th Quarter 2014>, EBM Reviews - Health Technology Assessment <4th Quarter 2014>, All Ovid MEDLINE(R) <1946 to Present>

Search Strategy:

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- 1 exp Inpatients/ (14444)
  - 2 exp Hospitalization/ (177914)
  - 3 exp Hospitals/ (214776)
  - 4 \*Hospital Units/ (4964)
  - 5 Point-of-Care Systems/ (8072)
  - 6 (inpatient\* or hospitali\* or (length adj2 stay) or (patient\* adj2 (hospital\* or admit\* or admission\*))) or ((patient\* or inpatient\*) adj2 (medical or nonsurgical or non surgical or non critical or non critically ill)) or (medical adj care unit\*) or bedside).ti,ab. (369562)
  - 7 or/1-6 (647351)
  - 8 Blood Glucose/ (146651)
  - 9 ((blood adj glucose) or (blood adj sugar) or glucomet\*).ti,ab. (62886)
  - 10 or/8-9 (174894)
  - 11 exp Capillaries/ (29356)
  - 12 capillar\*.ti,ab. (118539)
  - 13 Monitoring, Physiologic/ (48824)
  - 14 exp Fingers/ (34457)
  - 15 (monitor\* or finger prick\* or value\* or sample\* or level\* or continuous or measure\* or CBGM or test\*).ti,ab. (7953165)
  - 16 or/11-15 (8056421)
  - 17 7 and 10 and 16 (4494)
  - 18 limit 17 to english language [Limit not valid in CDSR,DARE; records were retained] (4053)
  - 19 limit 18 to yr="2009 -Current" [Limit not valid in DARE; records were retained] (1865)
  - 20 exp Animals/ not (exp Animals/ and Humans/) (4104011)

- 21 19 not 20 (1842)
- 22 remove duplicates from 21 (1545)

## CINAHL

#	Query	Results
S1	(MH "Inpatients")	60,142
S2	(MH "Hospitalization")	18,213
S3	(MH "Length of Stay") OR (MH "Patient Admission")	31,202
S4	(MH "Hospitals+")	77,109
S5	(MM "Hospital Units")	2,116
S6	(MH "Point-of-Care Testing")	2,250
S7	(inpatient* or hospitali* or (length N2 stay) or (patient* N2 (hospital* or admit* or admission*)) or ((patient* or inpatient*) N2 (medical or nonsurgical or non surgical or non critical or non critically ill)) or (medical adj care unit*) or bedside)	165,765
S8	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7	230,883
S9	(MH "Blood Glucose")	20,979
S10	((blood N1 glucose) or (blood N1 sugar) or glucomet*)	28,535
S11	S9 OR S10	28,535
S12	(MH "Capillaries")	921
S13	capillar*	4,377
S14	(MH "Monitoring, Physiologic")	13,701
S15	(MH "Fingers+")	3,112
S16	monitor* or finger prick* or bedside or sugar* or value* or sample* or level* or continuous or measure* or CBGM or test*	1,095,734
S17	S12 OR S13 OR S14 OR S15 OR S16	1,099,505
S18	S8 AND S11 AND S17	1,662
S19	S8 AND S11 AND S17 Limiters - Published Date: 20090101-20141231; English Language	804



## References

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- (1) American Diabetes Association. Bedside blood glucose monitoring in hospitals. *Diabetes Care*. 2003;26(Suppl 1):S119.
- (2) Klonoff DC, Buckingham B, Christiansen JS, Montori VM, Tamborlane WV, Vigersky RA, et al. Continuous glucose monitoring: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab*. 2011;96(10):2968-79.
- (3) Public Health Agency of Canada. Data from the Canadian Chronic Disease Surveillance System. Ottawa (ON): Public Health Agency of Canada; 2011.
- (4) Umpierrez GE, Hellman R, Korytkowski MT, Kosiborod M, Maynard GA, Montori VM, et al. Management of hyperglycemia in hospitalized patients in non-critical care setting: an endocrine society clinical practice guideline. *J Clin Endocrinol Metab*. 2012;97(1):16-38.
- (5) Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. Canadian Diabetes Association 2013 clinical practice guidelines for the prevention and management of diabetes in Canada: in-hospital management of diabetes. *Can J Diabetes*. 2013;37(1):S1-S212.

## Suggested Citation

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## Conflict of Interest Statement

All authors in the Evidence Development and Standards branch at Health Quality Ontario are impartial. There are no competing interests or conflicts of interest to declare.

## Disclaimer

This report is the work of the Evidence Development and Standards branch at Health Quality Ontario and is developed from analysis, interpretation, and comparison of published scientific research. It also incorporates, when available, Ontario data and information provided by experts. This report may not reflect all the available scientific research and is not intended as an exhaustive analysis. The analysis may not have captured every relevant publication and relevant scientific findings may have been reported since completion of the review. Health Quality Ontario assumes no responsibility for omissions or incomplete analysis resulting from its reports. This report is current as of the date of the literature search specified in the Research Methods section. This report may be superseded by an updated publication on the same topic. Please check the Health Quality Ontario website for a list of all publications: <http://www.hqontario.ca/evidence/publications-and-ohtac-recommendations>.

# About Health Quality Ontario

Health Quality Ontario is the provincial advisor on the quality of health care. We are motivated by a single-minded purpose: **better health for all Ontarians.**

## Who We Are

We are a scientifically rigorous group with diverse areas of expertise. We strive for complete objectivity, and look at things from a vantage point that allows us to see the forest and the trees. We work in partnership with health care providers and organizations across the system, and engage with patients themselves, to help initiate substantial and sustainable change to the province's complex health system.

## What We Do

We define the meaning of quality as it pertains to health care, and provide strategic advice so all the parts of the system can improve. We also analyze virtually all aspects of Ontario's health care. This includes looking at the overall health of Ontarians, how well different areas of the system are working together, and most importantly, patient experience. We then produce comprehensive, objective reports based on data, facts and the voice of patients, caregivers and those who work each day in the health system. As well, we make recommendations on how to improve care using the best evidence. Finally, we support large scale quality improvements by working with our partners to facilitate ways for health care providers to learn from each other and share innovative approaches.

## Why It Matters

We recognize that, as a system, we have much to be proud of, but also that it often falls short of being the best it can be. Plus certain vulnerable segments of the population are not receiving acceptable levels of attention. Our intent at Health Quality Ontario is to continuously improve the quality of health care in this province regardless of who you are or where you live. We are driven by the desire to make the system better, and by the inarguable fact that better has no limit.

Health Quality Ontario  
130 Bloor Street West, 10<sup>th</sup> Floor  
Toronto, Ontario  
M5S 1N5  
Tel: 416-323-6868  
Toll Free: 1-866-623-6868  
Fax: 416-323-9261  
Email: [EvidenceInfo@hqontario.ca](mailto:EvidenceInfo@hqontario.ca)  
[www.hqontario.ca](http://www.hqontario.ca)

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