CLINICAL AND LABORATORY STANDARDS INSTITUTE®

2nd Edition

POCT05

Performance Metrics for Continuous Interstitial Glucose Monitoring

This guideline provides consensus guidelines for health care professionals, *in vitro* diagnostic and medical device manufacturers, and regulatory agencies regarding the use of continuous glucose monitoring (CGM) systems and data obtained from CGM systems. This guideline covers how CGM data should be assessed for accuracy, how CGM systems should be assessed for factors that can decrease accuracy, and how CGMs should be operated for optimal performance.

A guideline for global application developed through the Clinical and Laboratory Standards Institute consensus process.

Clinical and Laboratory Standards Institute

Setting the standard for quality in medical laboratory testing around the world.

The Clinical and Laboratory Standards Institute (CLSI) is a not-for-profit membership organization that brings together the varied perspectives and expertise of the worldwide laboratory community for the advancement of a common cause: to foster excellence in laboratory medicine by developing and implementing medical laboratory standards and guidelines that help laboratories fulfill their responsibilities with efficiency, effectiveness, and global applicability.

Consensus Process

Consensus—the substantial agreement by materially affected, competent, and interested parties—is core to the development of all CLSI documents. It does not always connote unanimous agreement but does mean that the participants in the development of a consensus document have considered and resolved all relevant objections and accept the resulting agreement.

Commenting on Documents

CLSI documents undergo periodic evaluation and modification to keep pace with advances in technologies, procedures, methods, and protocols affecting the laboratory or health care.

CLSI's consensus process depends on experts who volunteer to serve as contributing authors and/or as participants in the reviewing and commenting process. At the end of each comment period, the committee that developed the document is obligated to review all comments, respond in writing to all substantive comments, and revise the draft document as appropriate.

Comments on published CLSI documents are equally essential and may be submitted by anyone, at any time, on any document. All comments are managed according to the consensus process by a committee of experts.

Appeal Process

When it is believed that an objection has not been adequately considered and responded to, the process for appeal, documented in the CLSI *Standards Development Policies and Processes,* is followed.

All comments and responses submitted on draft and published documents are retained on file at CLSI and are available upon request.

Get Involved—Volunteer!

Do you use CLSI documents in your workplace? Do you see room for improvement? Would you like to get involved in the revision process? Or maybe you see a need to develop a new document for an emerging technology? CLSI wants to hear from you. We are always looking for volunteers. By donating your time and talents to improve the standards that affect your own work, you will play an active role in improving public health across the globe.

For additional information on committee participation or to submit comments, contact CLSI.

Clinical and Laboratory Standards Institute
P: +1.610.688.0100
F: +1.610.688.0700
www.clsi.org
standard@clsi.org

POCT05-Ed2
November 2020
Replaces POCT05-A

Performance Metrics for Continuous Interstitial Glucose Monitoring

David C. Klonoff, MD, FACP, FRCP (Edin), Fellow AIMBE
James R. Petisce, PhD
Timothy S. Bailey, MD, FACE, FACP, CPI
Andrea Bell-Vlasov, PhD
Marc Breton, PhD
Andrew Dehennis, PhD
Rolf Hinzmann, MD, PhD
David L. Horwitz, MD, PhD, FACP
Shridhara Alva Karinka, PhD
Neeta Sharma, MS
Peter Simpson, MS
Robert A. Vigersky, MD
Yiduo Wu, PhD

Abstract

Clinical and Laboratory Standards Institute guideline POCT05—*Performance Metrics for Continuous Interstitial Glucose Monitoring* provides consensus information for health care professionals, *in vitro* diagnostic and medical device manufacturers, and regulatory agencies regarding how continuous glucose monitoring (CGM) data should be assessed for accuracy, how CGM systems should be assessed for factors that can decrease accuracy, and how CGMs should be operated for optimal performance. This guideline defines and explores multiple aspects of CGM performance, including use cases, point and trend accuracy, evaluation of threshold alerts, system stability and reliability, clinical studies for assessing CGM performance, calibration, measurement traceability, and special considerations such as shelf life, cybersecurity, and product labeling.

Clinical and Laboratory Standards Institute (CLSI). *Performance Metrics for Continuous Interstitial Glucose Monitoring*. 2nd ed. CLSI guideline POCT05 (ISBN 978-1-68440-100-0 [Print]; ISBN 978-1-68440-101-7 [Electronic]). Clinical and Laboratory Standards Institute, 2020.

CLINICAL AND LABORATORY STANDARDS INSTITUTE®

Suggested Citation

CLSI. *Performance Metrics for Continuous Interstitial Glucose Monitoring*. 2nd ed. CLSI guideline POCT05. Clinical and Laboratory Standards Institute, 2020.

Previous Editions:
March 2008, December 2008

POCT05-Ed2
ISBN 978-1-68440-100-0 (Print)
ISBN 978-1-68440-101-7 (Electronic)
ISSN 1558-6502 (Print)
ISSN 2162-2914 (Electronic) Volume 40, Number 14

Committee Membership

Consensus Council

James R. Petisce, PhD
Chairholder
BD Diagnostic Systems
USA

Mary Lou Gantzer, PhD, FACB
Vice-Chairholder
USA

Anne T. Daley, MS, MT(ASCP)DLM, CMQ/OE(ASQ)CSBB
ARUP Laboratories
USA

Avis Danishefsky, PhD
FDA Center for Devices and Radiological Health
USA

Collette Fitzgerald, PhD
Centers for Disease Control and Prevention
USA

Loralie J. Langman, PhD, DABCC, FACB, F-ABFT
Mayo Clinic
USA

Michelle McLean, MS, MT(ASCP), BS
Greiner Bio-One, Inc.
USA

Tania Motschman, MS, MT(ASCP)SBB
Laboratory Corporation of America
USA

M. Laura Parnas, PhD, DABCC
Roche Diagnostics
USA

Robert Rej, PhD
New York State Department of Health – Wadsworth Center
USA

Matthew A. Wikler, MD, FIDSA, MBA
IDTD Consulting
USA

Document Development Committee on Continuous Glucose Monitoring

David C. Klonoff, MD, FACP, FRCP (Edin), Fellow AIMBE
Chairholder
Mills-Peninsula Medical Center
USA

James R. Petisce, PhD
Vice-Chairholder
BD Diagnostic Systems
USA

Andrea Bell-Vlasov, PhD
FDA Center for Devices and Radiological Health
USA

Marc Breton, PhD
University of Virginia Medical Center
USA

Kong Y. Chen, PhD, MSCI
National Institutes of Health, Department of Laboratory Medicine
USA

Andrew Dehennis, PhD
Senseonics Incorporated
USA

Rolf Hinzmann, MD, PhD
Roche Diabetes Care GmbH
Germany

David L. Horwitz, MD, PhD, FACP
DLH Biomedical Consulting LLC
USA

Steve Scott, BSc
Abbott Diabetes Care
USA

Shinjiro Sekimoto
ARKRAY, Inc.
USA

Peter Simpson, MS
Dexcom
USA

Robert A. Vigersky, MD
Medtronic Diabetes
USA

Expert Panel on Point-of-Care Testing

Staff

Acknowledgment

CLSI, the Consensus Council, and the Document Development Committee on Continuous Glucose Monitoring gratefully acknowledge the following volunteers for their important contributions to the revision of this guideline:

Timothy S. Bailey, MD, FACE, FACP, CPI
AMCR Institute Inc.
USA

Shridhara Alva Karinka, PhD
Abbott Diabetes Care
USA

Neeta Sharma, MS
Dexcom
USA

Yiduo Wu, PhD
FDA Center for Devices and Radiological Health
USA

Contents

Contents (Continued)

Foreword

Continuous glucose monitoring (CGM) systems are medical devices that measure glucose in the interstitial fluid just under the skin and use algorithms to predict blood glucose values from the measurement. This guideline applies to such devices; however, similar concepts might be applicable to noninvasive or minimally invasive devices. This guideline covers how CGM data should be assessed for accuracy, how CGM systems should be assessed for factors that can decrease accuracy, and how CGM systems should be operated for optimal performance.

The CGM market is experiencing strong growth as accuracy, convenience, sensor duration, and data management capabilities improve and as patients, health care professionals, and payers see the benefits that these devices can provide in the management of glucose levels. Many clinical trials comparing CGM with other blood glucose monitoring methods have demonstrated decreases in mean glycemia, glycemic variability, and the incidence of hypoglycemia. Optimal CGM system performance, as well as practical data comparisons between sensors, can be obtained by following the technical specifications presented in this guideline.

NOTE: To facilitate the readability of this guideline, mg/dL is used as the unit of measure. This preference does not constitute a recommendation for mg/dL over mmol/L. If needed, the following formula can be used to convert mg/dL to mmol/L:

$$\text{mmol/L} = \frac{\text{mg/dL}}{18} \quad (1)$$

Overview of Changes

This guideline replaces the previous edition of the approved guideline, POCT05-A, published in 2008. Several changes were made in this edition, including:

- Extensively revising every chapter
- Adding new chapters that discuss:
  - CGM device use cases
  - Cybersecurity for CGM devices
  - CGM device labeling
- Rearranging subchapters and appendixes, including:
  - Changing stand-alone chapter on lag time to become part of Chapter 8
  - Including text describing establishing measurement traceability in Chapter 4
  - Replacing appendix on clinical studies with Chapter 9
  - Replacing appendix on rate deviation with Subchapters 6.3.1, 6.3.2, and 6.4
- Eliminating appendix covering continuous glucose-error grid analysis

NOTE: The content of this guideline is supported by the CLSI consensus process and does not necessarily reflect the views of any single individual or organization.

Key Words

Accuracy, bias, calibration, continuous, diabetes, glucose, lag, metrics, monitoring, sensor, stability, trueness

Performance Metrics for Continuous Interstitial Glucose Monitoring

Chapter 1: Introduction

This chapter includes:

- Guideline's scope and applicable exclusions
- Background information pertinent to the guideline's content
- Standard precautions information
- Terminology information, including:
  - Terms and definitions used in the guideline
  - Abbreviations and acronyms used in the guideline

1.1 Scope

This guideline provides recommendations for methods used to determine analytical and clinical metrics of continuous glucose monitoring (CGM) as an indicator of blood glucose values. It discusses use cases, point accuracy, trend accuracy, evaluation of threshold alerts, system stability and reliability, clinical studies for assessing CGM performance, calibration, traceability of measurement, cybersecurity, and device labeling.

The intended users of this guideline are *in vitro* diagnostic and medical device manufacturers, regulatory agencies, and health care professionals. This guideline is not intended for use by patients and does not discuss devices that do not meet the definitions of continuous, interstitial, and glucose monitoring.

1.2 Background

The use of self-monitoring of blood glucose (SMBG) devices or glucose meters has led to more normal glucose levels and lower risk of cardiovascular and long-term complications in both type 1 and type 2 diabetes. Patients typically use SMBG devices to test blood glucose levels several times a day to plan diet and/or exercise, to manage diabetes medications, including insulin dosages, and to correct abnormal blood glucose values. Although these devices are easier to use than in the past, many diabetes patients do not comply with SMBG testing at the frequency recommended by their physician because of the cost of testing supplies, the pain of repeated SMBG measurements, the environmental drawbacks of blood and sharps waste, and the overall inconvenience of monitoring.