

Sybille Kaiser Girardot.
Nurse specialist in family and community medicine.
Centro de Salud Adeje, Primary Care of Tenerife. Canary Islands. Spain.



Self-monitoring of blood glucose in people with type 2 diabetes mellitus treated with insulin

Despite the emergence and development of continuous glucose monitoring (CGM) technologies, self-monitoring of blood glucose (SMBG) continues to play a relevant role in the management of people with type 2 diabetes (T2DM) treated with insulin. More than a secondary option, it remains a useful clinical tool to support glycemic control and contribute to the prevention of acute and chronic complications that affect patients' health and quality of life.

Although the American Diabetes Association (ADA), in its Standards of Care in Diabetes 2026, prioritizes the use of CGM in people with T2DM under intensive insulin regimens, poor metabolic control, or pregnancy as the ideal recommendation, the real-world healthcare setting presents a different scenario: in Spain, 76% of glucose monitoring expenditure still corresponds to blood glucose test strips (Spanish Ministry of Health, 2024).

This context raises a central question: is self-monitoring of blood glucose still a valid tool, or is it an obsolete clinical strategy?

Evidence suggests that its relevance remains. Its continued use is justified not by system inertia, but by strong clinical arguments such as principles of equity in access to healthcare and recognized therapeutic effectiveness.

EQUITY VS THE REAL DIGITAL GAP

First, the digital divide should not be understood solely as the lack of access to a mobile phone, but also as the existence of functional limitations in managing Bluetooth pairing, application updates, or complex alarm systems. In this context, and considering that 59% of people over 65 years of age lack basic digital skills (INE, 2023), self-monitoring of blood glucose becomes particularly relevant as an accessible and operational tool, usable without dependence on a mobile phone or third parties. Thus, it is configured as an option that promotes therapeutic equity by preserving patient autonomy and facilitating self-care free from technological exclusion.

WHAT INFORMATION DOES SELF-MONITORING PROVIDE?

On the other hand, self-monitoring of blood glucose should not be understood as an isolated figure. Each measurement, performed at the appropriate time, becomes highly valuable clinical information. Unlike glycated hemoglobin A1c (HbA1c), which provides a retrospective average of the last 2–3 months without reflecting what happens at each moment of the day, SMBG provides an immediate and contextualized response that allows action at the precise moment.

A SAFE AND HIGHLY ACCURATE TOOL

Similarly, although CGM has transformed self-management in specific populations, SMBG continues to be a standard of safety, reliability, and validity. In fact, it constitutes the reference tool for verifying data in cases of discordant alerts, contradictory clinical symptoms, or discrepancies between sensor readings and clinical reality. Moreover, this technology has evolved significantly and currently complies with demanding international standards such as ISO 15197:2013/2015, which establish accuracy criteria whereby at least 95% of measurements must fall within acceptable error margins compared with laboratory reference values.

In this regard, among its most relevant characteristics, the following stand out:

- Speed and simplicity: provides results within seconds and does not require calibration, facilitating its incorporation into the patient's daily routine. »

CHARACTERISTIC	SMBG (Self-monitoring of blood glucose)	CGM (Continuous glucose monitoring)
Measurement frequency	Spot measurements (recommendations: 3–7 per day).	Continuous measurements every 1–5 minutes (288–1440 readings/day).
Sample	Capillary blood (finger).	Subcutaneous interstitial fluid (arm/abdomen).
Metric	Readings in Range (RIR): proportion of spot measurements within the glycemic target.	Time in Range (TIR): percentage of the day that glucose remains between 70–180 mg/dL.
Trend detection	Limited; requires multiple measurements on consecutive days.	Real-time with trend arrows.
Alarms	Colorimetric, no alarms available.	Hypo-/hyperglycemia alerts.
Nocturnal data	Only if the patient wakes up to measure.	Fully automatic monitoring.
Cost	€0.29 per strip (variable).	€60–180/month depending on the system.
Accuracy	Meets ISO 15197: ≥95% of measurements with error <15% vs. laboratory.	Lag of 5–15 minutes compared to capillary glucose.
Accessibility/Equity	Universal, widely available.	Limited depending on autonomous community and coverage.
Learning curve	Low, simple technique.	Moderate–high, requires training.
Interferences	Hematocrit, altitude, contaminated hands, temperature.	Paracetamol, ascorbic acid (depending on model), sensor compression.

Comparison between self-monitoring of blood glucose (SMBG) and continuous glucose monitoring (CGM), understanding the differences (own elaboration).

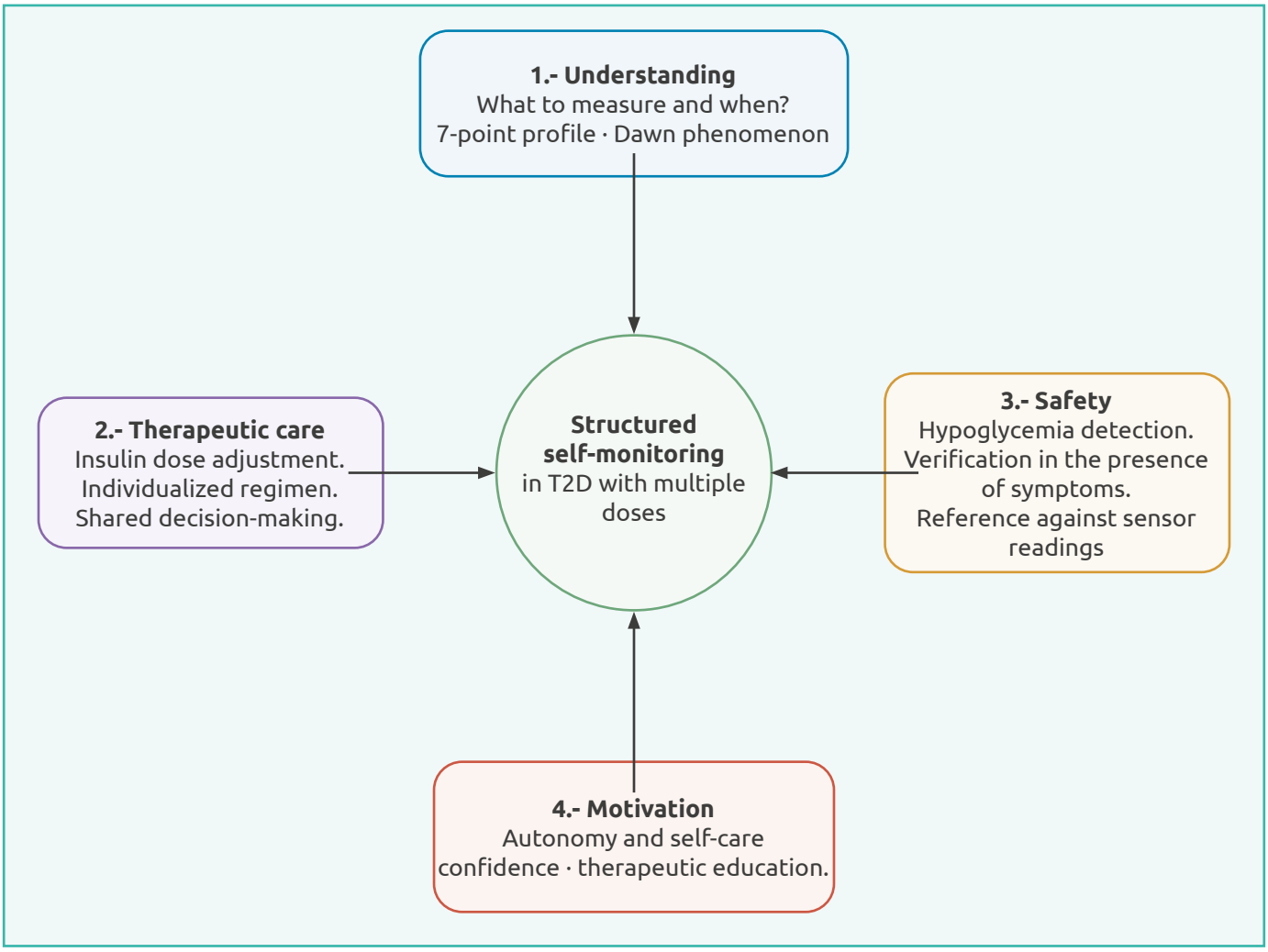


FIGURE. The 4 pillars of structured self-monitoring in people with T2DM treated with multiple daily insulin doses. Own elaboration.

- Visual support and immediate interpretation: some devices include easy-to-read screens and visual aid systems, such as color indicators that allow rapid classification of glucose values according to established targets, promoting faster interpretation and immediate decision-making.
- Connectivity and data structuring: in certain models, the glucometer can synchronize via Bluetooth with mobile applications capable of organizing readings and generating visual reports, facilitating understanding of results and transforming isolated data into structured and useful clinical information for follow-up.
- Graphical representation of readings within the target range: structured data recording allows visualization of the proportion of capillary glucose readings within established target values, facilitating an overall assessment of glycemic control.
- 24-hour modal curve: in systems that allow it, this facilitates analysis of medians and percentiles, contributing to the identification of daily glycemic variability and its possible repetition over time.
- Pattern identification: organized analysis of readings supports detection of trends or recurrent episodes, such as morning hyperglycemia or nocturnal hypoglycemia.
- Basic descriptive statistics: parameters such as mean and standard deviation provide useful complementary information for clinical interpretation and therapeutic adjustment guidance.

» Overall, this structured information serves as a basis for therapeutic decision-making by the healthcare team, such as dose adjustment, modification of insulin type, or redefinition of targets. At the same time, when patients understand the meaning of their own measurements and the context in which they occur, self-monitoring ceases to be a simple numerical record and becomes a central element of therapeutic education and the promotion of autonomy in self-care. This dimension is particularly relevant in people with T2DM treated with insulin, in whom the immediate accuracy of measurement is especially important for clinical safety.

Ultimately, the future of self-management in people with T2DM treated with insulin does not lie in choosing between advanced technology and traditional self-monitoring, but in ensuring an equitable and personalized approach to care. Regardless of age, socioeconomic level, or degree of digital literacy, it is essential to ensure that every individual has access to structured and high-quality therapeutic education, tools and recording systems suited to their abilities, ongoing professional support for data interpretation, and access to the necessary materials for self-monitoring. Without these elements, self-monitoring loses much of its potential and may be reduced to a simple collection of glucose data without practical utility.

Within this framework, self-monitoring of blood glucose maintains a clinically relevant role. By providing a "snapshot" of glucose levels in real time, it allows individuals with T2DM to understand the relationship between their habits and their glycemic values. When this information is integrated into an appropriate therapeutic education process, it promotes informed decision-making regarding diet, physical activity, and insulin treatment. In addition, it helps reinforce patients' sense of safety and control over the progression of their disease. D

CONCLUSIONS

1. Self-monitoring of glucose must be personalized and equitable.
2. Therapeutic education is essential for its effectiveness.
3. Self-monitoring of blood glucose remains clinically useful.
4. It helps relate lifestyle habits and glucose levels to support decision-making.

SELF-MONITORING OF BLOOD GLUCOSE SHOULD NOT BE UNDERSTOOD AS AN ISOLATED VALUE. EACH MEASUREMENT, PERFORMED AT THE APPROPRIATE TIME, BECOMES HIGHLY VALUABLE CLINICAL INFORMATION

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