

Psychosocial Factors and Adherence to Continuous Glucose Monitoring in Type 1 Diabetes

Signe Schmidt, M.D.,¹ Anne Katrine Duun-Henriksen, M.S.,²
and Kirsten Nørgaard, M.D., D.M.Sc.¹

Several studies have demonstrated beneficial effects of continuous glucose monitoring (CGM) in patients with type 1 diabetes mellitus (T1DM).¹⁻³ In most of the studies, however, a subgroup of patients uses CGM less than recommended or discontinues use. To facilitate treatment adherence in this patient group, thorough understanding of motives for CGM termination is a prerequisite, but only little is known about mechanisms underlying patient adherence to CGM.⁴⁻⁶

Psychosocial factors may affect CGM use because of the constant efforts required of the user to benefit from CGM. To pursue this hypothesis, we invited 24 adults with T1DM from our clinic to take part in a focus group study. Twenty-five $\pm$ four months previously, patients had participated in the multicenter Eurythmics Trial² and started using sensor-augmented pumps (SAPs) during (intervention group) or immediately after completion of the trial (control group). Sensor-augmented pump costs were covered by the Danish health care system. Sixteen patients agreed to participate in the focus group study (Table 1). Twelve were still using SAPs, while four had chosen to cease CGM and continue insulin pump treatment only. Three focus groups were formed based on self-reported CGM use: two groups of current CGM users (six persons in each) and one group of former CGM users (four persons). "CGM use" was defined as sensor use $>60\%$ of the time in the past three months.

The most notable observation during the focus group sessions was that personal ambitions for metabolic control clearly differed between former and current CGM users. Patients who had discontinued CGM utilization were aware that they could have better metabolic control using CGM; nevertheless, they chose not to. A former user stated: "I know that the sensor improves my hemoglobin A1c (HbA1c)... Intellectually I know that I should wear it. Why don't I? Now that's a good question." Conversely, none of the current users were willing to stop CGM at the expense of a rise in HbA1c. "I want to live a little longer, and I want to be free of all the late complications, so in that respect I don't think that I have much to negotiate with," a current CGM user said.

All participants praised the glucose curve on the pump display and the arrows indicating rises and falls, but a major complaint coming from both current and former SAP users was CGM inaccuracy. The expression "false security" was used, and two SAP users stated: "I don't trust it 100% any longer." "Neither do I. I use it mostly as a guideline." Continuous glucose monitoring alarms were also vigorously discussed. In particular, alarms caused by inaccurate sensor readings were considered irrelevant interruptions, but also hypo- and hyperalarms that continued after the

Author Affiliations: ¹Department of Endocrinology, Hvidovre University Hospital, Hvidovre, Denmark; and ²Department of Informatics and Mathematical Modeling, Technical University of Denmark, Kongens Lyngby, Denmark

Abbreviations: (CGM) continuous glucose monitoring, (HbA1c) hemoglobin A1c, (SAP) sensor-augmented pump, (T1DM) type 1 diabetes mellitus

Keywords: continuous glucose monitoring, focus group, insulin pump treatment, treatment adherence, type 1 diabetes

Corresponding Author: Signe Schmidt, M.D., Department of Endocrinology, Hvidovre University Hospital, Kettegård Allé 30, 2650 Hvidovre, Denmark; email address signe.schmidt@regionh.dk

Table 1.
Patient Characteristics^a

	SAP users	Former SAP users
<i>n</i>	12	4
Female sex	5 (41.7)	3 (75.0)
Age (years)	40 ± 13	39 ± 13
White race	12 (100)	4 (100)
Diabetes duration (years)	22 ± 12	18 ± 4
HbA1c (%)	7.1 ± 0.6	7.3 ± 0.3
Length of insulin pump treatment (months)	24 ± 4	27 ± 1
Length of CGM use (months)	24 ± 4	8 ± 5

^a Data are *n* (%) or means ± standard deviation.

blood glucose had been corrected due to the inherent time lag of the sensor. Interestingly, former and current users reported different ways of coping with CGM alarms, and the current users seemed less disturbed by alarms. A SAP user explained: "I mute it. You can still follow [the glucose curve] on the display." In contrast, a former user said: "These nightly alarms...I think you can turn them off, but I never figured out how."

A third important point was that body image played a crucial role for patients in all groups, and to some, it was the most limiting factor of CGM use.

Based on this focus group study, we propose that pre-CGM counseling focusing on patient motivation, alarm coping strategies, and body image may increase CGM adherence.

Acknowledgements:

We recognize the efforts of the patients and thank them for their participation. Special thanks to Merete Meldgaard, R.N., Hvidovre University Hospital, for contributing to the development of the focus group topics and questioning route, and to Birthe Gade-Rasmussen, M.D., Hvidovre University Hospital, for verifying agreement between focus group transcripts and the summary presented in this letter.

References:

1. Bergenstal RM, Tamborlane WV, Ahmann A, Buse JB, Dailey G, Davis SN, Joyce C, Peoples T, Perkins BA, Welsh JB, Willi SM, Wood MA; STAR 2 Study Group. Effectiveness of sensor-augmented insulin-pump therapy in type 1 diabetes. *N Engl J Med*. 2010;363(4):311–20. Epub 2010 Jun 29.
2. Hermanides J, Nørgaard K, Bruttomesso D, Mathieu C, Frid A, Dayan CM, Diem P, Fermon C, Wentholt IM, Hoekstra JB, DeVries JH. Sensor-augmented pump therapy lowers HbA(1c) in suboptimally controlled Type 1 diabetes; a randomized controlled trial. *Diabet Med*. 2011;28(10):1158–67. doi: 10.1111/j.1464-5491.2011.03256.x.
3. Pickup JC, Freeman SC, Sutton AJ. Glycaemic control in type 1 diabetes during real time continuous glucose monitoring compared with self monitoring of blood glucose: meta-analysis of randomised controlled trials using individual patient data. *BMJ*. 2011;343:d3805. doi: 10.1136/bmj.d3805.
4. Juvenile Diabetes Research Foundation Continuous Glucose Monitoring Study Group, Beck RW, Buckingham B, Miller K, Wolpert H, Xing D, Block JM, Chase HP, Hirsch I, Kollman C, Laffel L, Lawrence JM, Milaszevski K, Ruedy KJ, Tamborlane WV. Factors predictive of use and of benefit from continuous glucose monitoring in type 1 diabetes. *Diabetes Care*. 2009;32(11):1947–53. Epub 2009 Aug 12.
5. Ramchandani N, Arya S, Ten S, Bhandari S. Real-life utilization of real-time continuous glucose monitoring: the complete picture. *J Diabetes Sci Technol*. 2011;5(4):860–70.
6. Ritholz MD, Atakov-Castillo A, Beste M, Beverly EA, Leighton A, Weinger K, Wolpert H. Psychosocial factors associated with use of continuous glucose monitoring. *Diabet Med*. 2010;27(9):1060–5.