Continuous Glucose Monitoring in Patients With Type 1 Diabetes Using Insulin Injections

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Continuous glucose monitoring (CGM) has been demonstrated in randomized trials to improve glucose control in patients with type 1 diabetes (T1D) (1–3); however, most of the participants in these trials have used a pump for insulin delivery, and the use of CGM in T1D patients receiving insulin by injection has not been well studied.

We used the T1D Exchange registry database to assess the impact of CGM on HbA_{1c} in insulin injection users. Details on the informed consent process, eligibility criteria, and data collection methods have been previously published (4). Participants were defined as CGM users if CGM was used for real-time diabetes management during the 30 days prior to the clinic visit.

Among the 17,731 registry participants with T1D duration >1 year who had a clinic visit between June 2014 and October 2015, 6,222 (35%) used injections alone, 8,783 (50%) used pump alone, 2,316 (13%) used pump with CGM, and 410 (2%) used injections with CGM. A Dexcom CGM was being used by 97% of the injection + CGM users and by 58% of the pump + CGM users. Of the 2,726 participants using CGM, 85% were receiving pump treatment, and only 15% were receiving injections. The median number of boluses of short-acting insulin per day was 3 (interquartile range 3, 4) in both participants using injections alone and participants using injections with CGM. Participant and clinical characteristics by insulin method and CGM use are available at http://email.t1dxresearch.org/mdicgi/Supplemental%20Table%20S1.pdf.

Among CGM users, mean HbA_{1c} was similar in injection and pump users (7.6 ± 1.3% vs. 7.7 ± 1.1%, *P* value from a linear mixed model adjusted for age, diabetes duration, race/ethnicity, education level, insurance status, annual income, and blood glucose meter testing frequency = 0.82) and lower in CGM users than in non-CGM users in the pump group (8.3 ± 1.5%, adjusted $P < 0.001$) and in the injection group (8.8 ± 1.9%, adjusted $P < 0.001$). As shown in Fig. 1, this pattern was seen in both adults and youth.

In this analysis of T1D Exchange registry data, CGM users, irrespective of insulin delivery method, had lower HbA_{1c} levels than non-CGM users even after adjustment for potential confounding factors. Importantly, CGM users who were using injection for insulin delivery had HbA_{1c} levels

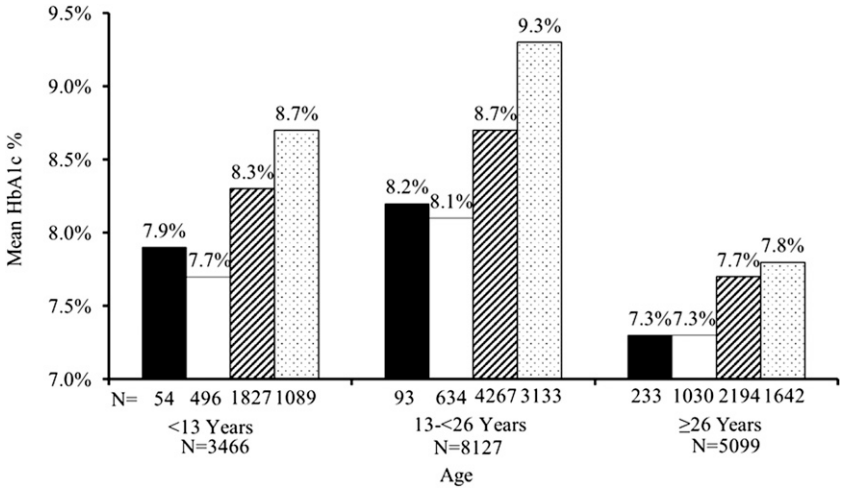

Figure 1—Mean HbA_{1c} according to insulin modality/CGM use status. Solid black bar, injection + CGM; solid white bar, pump + CGM; black and white striped bar, pump only; black dotted bar, injection only.

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similar to those of CGM users using an insulin pump. This is consistent with the results from the JDRF CGM randomized controlled trial in which 9 adult injection/CGM users had a magnitude of HbA_{1c} improvement similar to that of 41 adult pump/CGM users (−0.54 vs. −0.50) (2).

Although the results of this study appear to make a compelling case for greater use of CGM in injection users, cross-sectional analyses such as this one are subject to potential bias. For instance, we do not have information on how many injection users tried CGM and discontinued it, and thus, the cohort of injection + CGM users in the study may be self-selected to be those who are more likely to have lower HbA_{1c} levels. Nevertheless, the results of the study suggest that CGM can be beneficial for insulin injection users across all age-groups to achieve optimized metabolic control of T1D. However, the critical information needed to assess the benefit of CGM for injection users will require a randomized trial focusing on injection users.

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