Racial and Ethnic Disparities in Rates of Continuous Glucose Monitor Initiation and Continued Use in Children With Type 1 Diabetes

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OBJECTIVE

Racial/ethnic disparities in continuous glucose monitor (CGM) use exist among children with type 1 diabetes. It is not known whether differential rates of device initiation or sustained use are the cause of this disparity. Our objective was to compare CGM initiation rates and continued use among non-Hispanic White (NHW), non-Hispanic Black (NHB), and Hispanic children.

RESEARCH DESIGN AND METHODS

We conducted a retrospective review including children with type 1 diabetes attending the Children's Hospital of Philadelphia between 1 January 2015 and 31 December 2018.

RESULTS

Of 1,509 eligible children, 726 (48%) started CGM during the study period. More NHW (54%) than NHB (31%) and Hispanic (33%) children started CGM ($P < 0.001$). One year after starting, fewer NHB (61%) than NHW (86%) and Hispanic (85%) children were using CGM ($P < 0.001$).

CONCLUSIONS

Lower CGM use in NHB children was due to lower rates of device initiation and higher rates of discontinuation. Interventions to address both of these barriers are needed to reduce disparities in CGM use.

Continuous glucose monitor (CGM) use in children with type 1 diabetes has increased exponentially, from 6 to 38%, between 2011 and 2018 (1). Multiple cross-sectional studies have demonstrated racial disparities in CGM use, with non-Hispanic White (NHW) children using CGM 3.0–6.0 times more often than non-Hispanic Black (NHB) and 1.5–3.0 times more often than Hispanic children (1–3). The aim of this study was to determine whether racial/ethnic disparities in CGM use were the result of decreased rates of initiation, higher rates of discontinuation, or both.

RESEARCH DESIGN AND METHODS

A retrospective chart review was performed including children who attended the Children's Hospital of Philadelphia, including satellite locations, between 1 January 2015 and 31 December 2018. The Institutional Review Board at the Children's Hospital of Philadelphia approved this study.

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Population

Children with a clinical diagnosis of type 1 diabetes not using CGM, and <17 years old at the beginning of the study period, were included. Only children with an address in PA were eligible, as all children with type 1 diabetes living in PA have equal access to CGM.

Analyses of rates of CGM initiation by race and ethnicity were based on the entire eligible population. Analyses of continued use of CGM by race and ethnicity were limited to children who were <17 years old at time of CGM initiation, in order to ensure sufficient follow-up in our center to assess outcomes at 1 year.

Data Extraction

Clinical characteristics were extracted from the electronic health record for all children through 31 December 2019. Children were defined as having started CGM if a Dexcom (San Diego, CA) or Medtronic (Minneapolis, MN) CGM device was initiated. For those who started CGM, hemoglobin A_{1c} (HbA_{1c}) and frequency of CGM use by clinician documentation or CGM online portal were extracted at baseline, 6 months, and 1 year. Data from the online portal were used if clinician documentation and online portal data differed. Baseline HbA_{1c} was designated as the level obtained closest to the CGM start date (within 3 months before or 1 month after start). CGM use data were extracted from the visit closest to 6 months and 1 year after CGM was started, ±3 months.

Statistical Analysis

A Bonferonni adjustment was applied to analyses with three comparisons by multiplication of the *P* value by 3. With this adjustment, a two-sided *P* value of <0.05 was considered statistically significant. Reported 95% CIs are Bonferonni adjusted where appropriate. Continuous variables were compared using Kruskal-Wallis and Mann-Whitney *U* tests and categorical variables were compared using χ^2 test—both with Bonferonni adjustment. Binomial logistic regression was performed for ascertainment of effects of race/ethnicity, type of insurance, age of diagnosis, and sex on likelihood of CGM initiation and continuation. Descriptive statistics were reported as median and interquartile ranges (IQR).

RESULTS

There were 1,509 children (73% NHW, 18% NHB, 8% Hispanic) eligible for inclusion. Of these, 726 (48%) started CGM (600 NHW, 85 NHB, 41 Hispanic). Baseline and demographic information is shown in Supplementary Table 1.

Racial/Ethnic Disparities in CGM Initiation

A higher proportion of NHW (600 of 1,105 [54%]) than NHB (85 of 279 [31%]) and Hispanic (41 of 125 [33%]) children started CGM ($P < 0.001$) (Supplementary Table 1). Odds ratio for NHW children starting CGM was 2.7 (95% CI 1.9–3.8) when compared with NHB and 2.4 (95% CI 1.5–3.9) when compared with Hispanic children. NHW children were approximately two times more likely than NHB and Hispanic children to start CGM, regardless of insurance type (Table 1). In children starting CGM >1 year after diagnosis of type 1 diabetes, NHB children had a higher median HbA_{1c}, 8.9% (IQR 8.0, 10.7), than NHW children, 8.1% (7.3, 8.8), at the start of CGM ($P < 0.001$). There was no significant difference in duration of diabetes or age at CGM start between racial/ethnic groups.

Binomial logistic regression was performed with CGM initiation as the dependent variable and race/ethnicity, insurance type, age of diagnosis, and sex as independent variables (Supplementary Table 2). With other variables held constant, NHW children were 2.2 times (95% CI 1.6–3) more likely than NHB and 2.0 times (95% 1.3–3) more likely than Hispanic children to start CGM.

Racial/Ethnic Disparities in Continued Use of CGM

Of those who started CGM before age 17 years (n = 486 NHW, 76 NHB, 33 Hispanic), 83% of children were still using CGM 1 year later. Fewer NHB children continued using CGM at 1 year (86% of NHW, 61% of NHB, and 85% of Hispanic [$P < 0.001$]). In those who started CGM, NHW children were 4.1 times (95% CI 2.1–7.7) as likely as NHB children to be using CGM at 1 year. Commercially insured NHW children were 4.2 times (95% CI 1.7–10.6) as likely, and government-insured NHW children were 3.4 times (95% 1.2–9.3) as likely, as NHB children to still be using CGM at 1 year.

Binomial logistic regression analysis was performed with continued CGM use at 1 year as the dependent variable. With other variables held constant, NHW children were 3.9 times (95% CI 2.2–6.9) more likely than NHB children to be using CGM at 1 year.

CONCLUSIONS

We have shown that CGM is initiated in NHW children with type 1 diabetes at much higher rates than NHB and Hispanic children. In those who started CGM, NHB children were more likely to discontinue CGM use within the 1st year. These differences persist even after stratifying and controlling for insurance status. The finding that NHB children were more likely than NHW and Hispanic children to stop using CGM within the 1st year, and usually within 6 months of starting, has not previously been reported.

Strengths of this study include a large, diverse population and standardized data collection of CGM use during office visits. Insurance-mediated discontinuation of CGM described elsewhere (4) was ameliorated in our study due to similar

Table 1—Odds ratio (Bonferroni-adjusted 95% CI) for CGM initiation and continued use at 6 months and 1 year in NHW, NHB, and Hispanic children with type 1 diabetes

	NHW vs. NHB	Hispanic vs. NHB	NHW vs. Hispanic
All children			
CGM start (n = 726)	2.7 (1.9–3.8)	1.1 (0.6–1.9)	2.4 (1.5–3.9)
CGM use at 6 months (n = 598)	3.0 (1.6–5.8)	2.9 (0.8–10.6)	1 (0.3–3.4)
CGM use at 1 year (n = 596)	4.1 (2.1–7.7)	3.6 (1–13)	1.1 (0.3–3.8)
Commercial insurance			
CGM start (n = 556)	2.3 (1.5–3.5)	1.2 (0.5–3)	1.9 (0.9–4)
CGM use at 6 months (n = 451)	1.8 (0.6–4.9)	1.8 (0.2–14.5)	0.95 (0.1–6.1)
CGM use at 1 year (n = 448)	4.2 (1.7–10.6)	3.7 (0.5–27.7)	1.1 (0.2–7.3)
Government insurance			
CGM start (n = 170)	2 (1.2–3.4)	1.1 (0.5–2.2)	1.9 (1–3.7)
CGM use at 6 months (n = 147)	4.6 (1.6–13.2)	4.0 (0.7–21.4)	1.2 (0.2–6.2)
CGM use at 1 year (n = 148)	3.4 (1.2–9.3)	3.5 (0.7–18.6)	1 (0.2–5)

Data are stratified according to insurance status as a proxy for socioeconomic status.

insurance access to CGM through universal Medicaid coverage of children in PA with type 1 diabetes through primary or secondary insurance. Limitations include inability to analyze whether advances in CGM technology have influenced rates of sustained use and the single-center nature of the study that may limit generalizability to other institutions. However, the disparities noted in this study have been described in other multicenter studies (1,5). This retrospective study of active clinical care may have an advantage over prospective studies, as recruitment and consent may introduce bias in research aimed at identifying disparities.

Starting CGM is a low-risk intervention that may improve quality of life (6) and glycemic control (7) in children with type 1 diabetes. Racial/ethnic disparities in the use of this technology may widen disparities in outcomes. We have highlighted that unequal rates of both initiation and continued use of CGM contribute to the lower rates of CGM use described among NHB children in cross-sectional studies. Known barriers to continued technology use in children with type 1 diabetes (8–11) may disproportionately affect NHB children. There also may be additional barriers to CGM use in NHB children such as provider biases, structural racism, and social determinants of health. Further study and understanding of the role of these barriers will help in designing interventions, including community-based interventions (12), to ensure equitable technology use in all children with type 1 diabetes.

Duality of Interest. No potential conflicts of interest relevant to this article were reported.
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