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Caregiver reports of provider recommended frequency of blood glucose monitoring and actual testing frequency for youth with type 1 diabetes☆

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ABSTRACT

Aims: To identify demographic, family and clinical characteristics associated with provider recommended frequency of blood glucose monitoring (BGM), actual frequency of BGM, and concordance between these categories in youth with type 1 diabetes (T1D) as reported by child's caregiver.

Methods: Caregivers of 390 children 10-17 years were interviewed about their children's providers' recommendations for frequency of BGM and their child's frequency of performance of BGM.

Results: The majority (92%) of caregivers reported being told that their child should BGM ≥4 times per day and 78% reported their child checked that frequently. Caregivers of children who were younger, non-Hispanic White, from two-parent households, higher income households, and on insulin pumps were more likely to report being told by their provider to perform BGM ≥6 times per day and more likely to report that their child performed BGM ≥6 times per day. Younger children and those with private health insurance were more likely to adhere to reported recommendations. Children whose caregivers reported that their child met/exceeded their provider recommendations had lower A1c values than those who did not.

Conclusions: These findings may help clinicians identify subgroups of youth at-risk for poor diabetes management and provide further education in order to improve outcomes.

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1. Introduction

Given the complexity and demanding nature of modern-day treatment regimens for type 1 diabetes, it is not surprising that reported adherence to treatment recommendations among youth with diabetes is low, particularly among adolescents [1,2]. Understanding the factors that are related to adherence is critical. Studies have clearly demonstrated that persons with higher levels of adherence to their treatment regimens have better glycemic control [3,4]. Since sub-optimal glycemic control is associated with an increased risk for the development of diabetes-related complications [5], youth with T1D should strive to achieve and maintain good glycemic control, even at an early age. However, optimal glycemic control in youth is not often achieved, particularly by older youth [6,7].

Based on the findings of the Diabetes Control and Complications Trial [8], frequent blood glucose monitoring (BGM) has become a cornerstone of optimal diabetes management. Adherence to frequent BGM has been found to be an integral factor in achieving optimal glycemic control [1,9]. Greater BGM has been reported to be associated with younger age and insulin pump use [9,10]. In most cases, a linear increase in BGM per day resulted in improvements in glycated hemoglobin (A1c) [1], but recent analyses have suggested that this effect may peak at five times per day [10].

While previous research has shown that BGM is an important contributor to glycemic control, little is known about whether BGM by children with type 1 diabetes corresponds with the frequency of BGM recommended by their health care providers. Using data from the SEARCH for Diabetes Study, these analyses explore demographic, family and clinical characteristics associated with provider recommended frequency of BGM, actual frequency of BGM, and concordance between these categories in children with T1D as reported by child's caregiver. Additionally we explore the associations between recommended and reported frequency of BGM and A1c measurements.

2. Materials and methods

2.1. Study sample

SEARCH for Diabetes in Youth is a multicenter study that conducts population-based ascertainment of youth with clinically diagnosed, non-gestational diabetes who are <20 at the time of diagnosis [11]. SEARCH has enrolled youth newly diagnosed with diabetes from 2002 through the present. Cases are ascertained from geographically defined populations in Ohio, Colorado, South Carolina and Washington, Indian Health Service beneficiaries from four American Indian populations, and enrollees in several health plans in California and Hawaii. Youth whose diabetes is not secondary to other conditions are invited to a SEARCH study visit. After obtaining informed consent and assent, physical measurements and fasting blood samples are collected from metabolically stable children, and questionnaires are administered. Youth whose diabetes was incident in 2002 through 2005 and who completed a baseline study visit were invited to return for follow-up visits.

The data included in this analysis are from children with T1D who were 10 through 17 years of age and their parent/guardian (''caregivers'') who accompanied them at their 24-month SEARCH follow-up visit where questions about their child's provider recommendation for frequency of BGM and their child's actual frequency of BGM were asked. The response rate for this follow-up visit was 52%. Of the 390 participants who completed a follow-up visit, 94% ($n = 385$) completed the survey which included the questions about BGM.

2.2. Measures

Demographic variables included age at study visit, sex, race/ethnicity, and insurance status. Insurance was categorized as private, state-funded (Medicaid/Medicare, etc.), other (which included student health clinics, military, Indian Health Services), or none. *Family variables* included family income which was categorized as <$25K, $25–49K, $50–74K, $75K+, do not know/refused, and family composition which was categorized as 2-parent household, 1-parent household, or other/unknown composition.

Clinical variables included duration of diabetes since diagnosis, insulin regimen, depression, and glycemic control. Duration of diabetes was the length of time between date of diagnosis and the 24-month visit. Insulin regimen was categorized as (1) basal-bolus using the insulin pump, (2) basal-bolus with glargine plus rapid-acting insulin, (3) multiple daily injections (MDI) with ≥3 injections/day, using glargine plus more than/or other than rapid-acting insulin type, (4) MDI with ≥3 injections/day, using any insulin types excluding basal insulin, or (5) 1–2 injections/day, excluding glargine [6]. Detemir and glulisine were not in clinical use during the data collection period. Depression was assessed based on the child's responses on the Center for Epidemiologic Studies Depression scale (CES-D) [12]. This 20-item scale is a commonly used measure of depressive symptomatology in children age 10 years and older [13,14]. For these analyses, we categorized the scores as minimally (0–15), mildly (16–23), and moderately/severely (24–60) depressed mood [15,16].

Glycemic control was assessed using blood samples shipped to a central laboratory (Northwest Lipid Research Laboratories, Seattle, WA) for analysis. An ion exchange unit (Variant II; Bio-Rad Diagnostics, Hercules, CA) quantified the glycated hemoglobin (A1c) levels. Optimal age-specific goals for A1c in children are <8.0% for 10–12 year olds, and <7.5% for 13–18 year olds [17].

2.3. BGM recommendations, behaviors, and adherence

Caregivers of children with T1D were asked to report the frequency of BGM recommended by their child's health care provider and the number of times per day their child conducted BGM over the last 3 months. Response options for both questions were 6 or more times daily, 4–5 times daily, 2–3 times daily, at least once daily, or do not know. Adherence to recommendations was determined by comparing their responses to questions about recommended and actual BGM frequency, and categorized as exceeded (child monitored more than recommended by provider), met (child monitored