

# Efficacy of a Behavioral Intervention for Pediatric Type 1 Diabetes Across Income



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**Introduction:** Youth with Type 1 diabetes and lower family income typically have poorer glycemic control. This post hoc analysis examines whether a family-oriented behavioral intervention for this population is differentially effective across income levels.

**Methods:** Families of youth aged 9–15 years with Type 1 diabetes (N=390; 49.2% female; age, 12.4 [1.7] years; hemoglobin A1c [HbA1c], 8.4 [1.2]; pump, 33.8%) at four U.S. pediatric endocrinology clinics participated in a 2-year RCT (data collected 2006–2011) of a clinic-integrated behavioral intervention designed to improve diabetes management by facilitating problem-solving skills, communication skills, and responsibility sharing. HbA1c was analyzed centrally. Family income was categorized as <\$50,000 (low); \$50,000 to <\$100,000 (middle); and ≥\$100,000 (high). Treatment effect was defined as the change in HbA1c from baseline to 2-year follow-up. A linear model tested the interaction of treatment effect with family income, controlling for race, insulin regimen, and site (analyzed in 2014).

**Results:** Baseline HbA1c was significantly poorer ( $p=0.004$ ) in the low-income group. There was a significant overall effect of treatment group on change in HbA1c from baseline to follow-up ( $p=0.04$ ). The interaction term for treatment by income group was not significant ( $p=0.44$ ). Within each income category, a smaller deterioration in glycemic control was observed for the treatment group relative to controls.

**Conclusions:** This clinic-integrated behavioral intervention was similarly effective in improving glycemic control among youth with Type 1 diabetes across income levels. This family-oriented problem-solving approach offers flexibility in addressing families' needs and may optimize impact on health outcomes across income groups.

(Am J Prev Med 2015;49(6):930–934) Published by Elsevier Inc. on behalf of American Journal of Preventive Medicine

## Introduction

Consistent with general trends in health disparities research, youth with Type 1 diabetes who experience lower family income have poorer glycemic control,<sup>1,2</sup> increasing risk for long-term diabetes complications.<sup>3</sup> Behavioral interventions have demonstrated efficacy in improving diabetes management.<sup>4–8</sup> Extending from the inverse equity hypothesis,<sup>9</sup> people experiencing higher income may be better equipped to benefit from such interventions, inadvertently exacerbating health disparities.

However, the impact of socioeconomic factors on behavioral intervention effectiveness is rarely examined.

“WE-CAN manage diabetes” is a clinic-integrated behavioral intervention designed to improve families' Type 1 diabetes management by facilitating problem-solving skills, communication skills, and appropriate responsibility sharing. This intervention targeted families of preadolescents and adolescents, who typically experience deterioration in glycemic control.<sup>10,11</sup> The intervention was effective in improving glycemic control relative to standard care.<sup>8</sup> The objective of this post hoc analysis is to examine whether the intervention effect differs across income levels.

## Methods

### Participants

Child inclusion criteria included age 9–14.9 years; Type 1 diabetes diagnosis ≥ 3 months; daily insulin usage ≥ 0.5 μ/kg/day for those diagnosed ≥ 1 year or 0.2 μ/kg/day for those diagnosed < 1 year,

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0749-3797/\$36.00

<http://dx.doi.org/10.1016/j.amepre.2015.05.006>

with two or more injections or insulin pump use; most recent hemoglobin A1c (HbA1c) >6.0% and <12.0% for those diagnosed  $\geq 1$  year and >6.0% for those diagnosed <1 year at any time post-diagnosis; and no other major chronic disease (except well-controlled thyroid disease, asthma, and celiac), cognitive impairments, or psychiatric diagnosis. Additional parent/family inclusion criteria included home telephone access, English fluency, attendance of two or more clinic visits in the past year, and no psychiatric diagnoses in participating parents. Sample size was based on detecting meaningful differences in HbA1c between intervention and control conditions and has been reported previously.<sup>8</sup>

## Design and Procedures

This clinical trial employed a multicenter, parallel-group study with equal randomization. Participants were recruited during routine clinic visits from four large, geographically dispersed, pediatric endocrinology clinics in the U.S.; data were collected from 2006 to 2011. Families were randomized to intervention or usual care, stratified by age ( $\geq 9$  to <12 years and  $\geq 12$  to <15 years) and HbA1c ( $\leq 8.3\%$  and  $>8.3\%$ ). A system of random permuted blocks within strata was prepared by the study coordinating center by a person uninvolved with data collection. A separate randomization list was prepared for each stratum; lists were transferred to a sequence of sealed envelopes, each containing the assignment of intervention or usual care. Families were enrolled in the study for 2 years; brief questionnaire and biomedical assessments were administered at each clinic visit (typically every

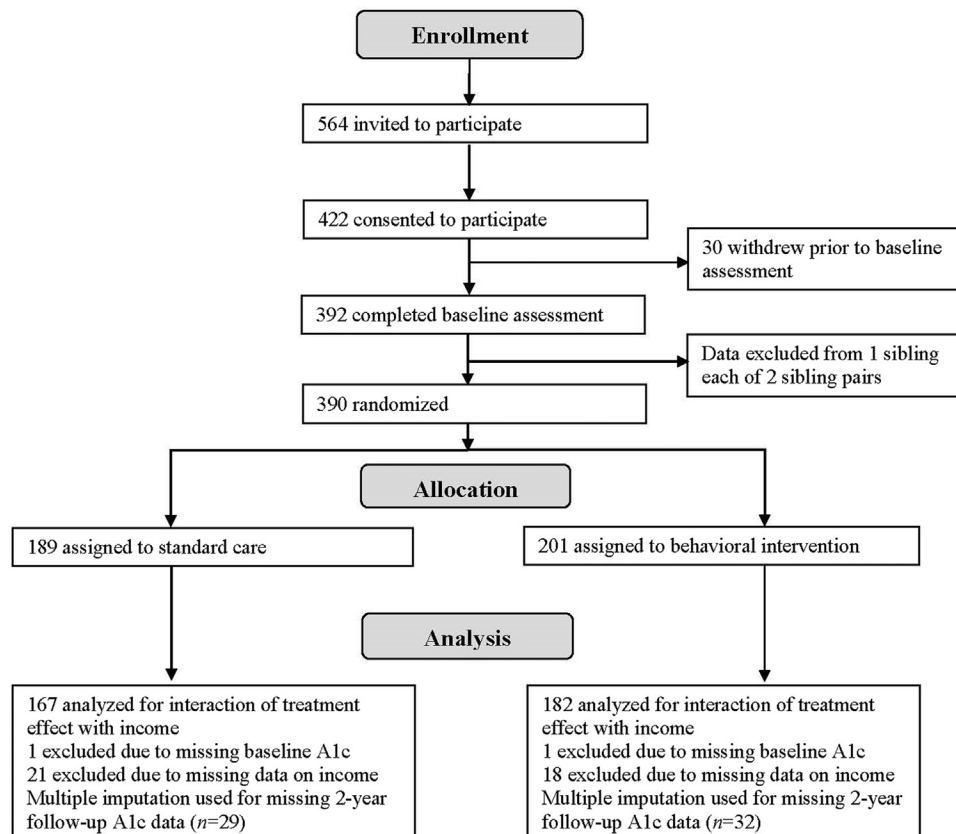
3–4 months). Intervention contacts occurred at each clinic visit for 21 months, with a final assessment at the following visit. The study protocol was approved by the IRBs of each participating institution.

## Behavioral Intervention

The intervention was designed to improve diabetes management by facilitating constructive collaboration between youth and parents and enhancing individual and family problem-solving skills. Grounded in social cognitive theory,<sup>12</sup> self-regulation models,<sup>13,14</sup> and systems theory,<sup>15</sup> the WE-CAN manage diabetes intervention was delivered by specially trained nonprofessionals at each routine clinic visit for approximately 21 months (described in the [Appendix](#)). Briefly, at each visit, families identified a specific diabetes management problem and developed a behavioral plan targeting this issue. Sessions were structured by the WE-CAN problem-solving approach, a mnemonic representing the steps in the problem-solving process.

## Measures

Blood samples were obtained at each visit and shipped to a central laboratory for HbA1c assay (Tosoh A1c 2.2 Plus Glycohemoglobin Analyzer™, Tosoh Medics, South San Francisco, CA), reference range, 4%–6%. Simultaneous samples were processed with the DCA-2000 (Siemens Healthcare Diagnostics, Deerfield, IL) on site.



**Figure 1.** Participant flow through study.

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