Racial Disparities In The Treatment and Outcomes of Pediatric Type 1 Diabetes

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Background and Introduction:

Approximately 1.6 million people in the United States (U.S.) are living with type 1 diabetes (T1D); 187,000 are children/adolescents[1] with prevalence steadily increasing in the US and worldwide, especially amongst racial/ethnic minorities. By 2050, projections indicate 600,000 adolescents >20 years will be diagnosed; a majority being racial/ethnic minorities.[2] Racial health disparities among U.S. children has been described by the American Academy of Pediatrics as being "extensive, pervasive, and persistent,"[4] multi-faceted, and across numerous dimensions, has worsened over time, and most apparent in rates/management of chronic disease and mortality.[4] Factors that contribute to these disparities are social determinants of health and provider bias, which leads to variances in quality of care based on race/ethnicity. Inequities increase risk of complications and adverse health outcomes.

There is still limited data on how race impacts treatment and clinical outcomes. A thorough analysis is needed to properly understand constructs. The goal of this research is to highlight disparities in treatment that burden racial minorities and educate providers on systems of oppression that exist within T1D treatment to provide better health outcomes for pediatric patients.

T1D treatment

> Hemoglobin A1c (HbA1c) is used as an index to identify glycemic control, indicate the risk of developing T1D complications, and to inform care. T1D: HbA1c of ≥6.5% (with normal being less than 5.7% and prediabetes being 5.7% to 6.4%).[7]

> Primary therapy: Exogenous insulin, which is administered via syringe/needles, injector devices, insulin pumps, inhaled insulin[13]

> diet modification[13]

> Continuous Glucose Monitors[13]

Methods:

Three searches conducted via Pubmed on the topic of racial disparities existing in treatments and outcomes of pediatric patients with T1D. The terms "disparity and race and type 1 diabetes", "outcome and disparity and type 1 diabetes", "race and disparity and child or pediatric and type one diabetes" were used. Publications between November 2010 and March 2021 were included, consisted of qualitative studies and meta-analyses. 102 publications were reviewed, and 28 articles were referenced.

Treatment Disparities

HbA1c highlights racial disparities

> A study by Willi et al. found that Black children had significantly higher HbA1cs (9.6 +/- 1.9%) compared to white children (8.4 +/- 1.4%) and differences persisted even after adjusting for socioeconomic status.[5]

> Evaluating HbA1c independent from mean blood glucose (MBG), Kamps et al., Black participants had statistically higher HbA1c, even after accounting for age, duration of diabetes, and MBG. HbA1c independent of MBG contributes to increased risk of microvascular complications.[11]

Table 1—*Results of ANOVA/ANCOVA (controlling for MBG, participant age, and diabetes duration) evaluating differences in A1C and HGI between African American and Caucasian participants*

	African American	Caucasian
n	78	198
Unadjusted (mean ± SD)		
A1C (%)	9.4 ± 1.5	8.2 ± 1.0*
HGI (%)	0.65 ± 1.44	−0.15 ± 0.79*
Adjusted (mean ± SEM)		
A1C (%)	9.1 ± 0.1	8.3 ± 0.1*
HGI (%)	0.64 ± 0.11	−0.15 ± 0.07*

*$P < 0.001$; values within a row are significantly different.

Kamps et al.[11]

MBG independent of HbA1c

> A study by Chalew et al. indicates that Black patients had higher MBG's than their white counterparts (Black: 255mg/dL; white: 198 mg/dL) after adjusting for age and gender.[12]

Social Determinants of Health (SDOH)

SDOH has a prevailing influence on health outcomes. SDOH is defined as "conditions in which people are born, grow, work and age, and the systems put in place to deal with illness."[19]

> income, socioeconomic status (SES), and education can alter the course of future health outcomes and is impacts critical development during childhood.[19]

> microvascular disease beings to appear during adolescence → sets stage for risk of complications.[19]

> Cummings et al. found an association between SDOH and early renal risk in adolescents. Those exposed to poorer SDOH are at higher risk of early vascular dysfunction and poorer overall health outcomes.

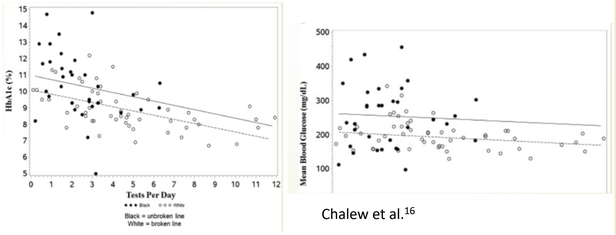
SDOH seen as "third arm of T1D complication risk"[19]

Provider Bias

Disparities persist after controlling for social determinants (SES, age, education). Research indicates that provider bias, preconceived stereotypes, and prejudices contribute to disparities in healthcare.[14]

American Diabetes Association established guidelines conclude that basal/bolus treatment regimens and frequent blood glucose (BG) testing are essential to maintain a state of euglycemia.[15] Disparities in regimen are directly associated with detrimental health outcomes.[15]

➢ A study by Chalew et al. investigated social and biological factors involved in glycemic control to determine if connections between variables (psychological factors, frequency of blood glucose checks using meter, and HbA1c) and race differences, specifically between Black and white pediatric patients exist. White patients performed twice as many BGs/day than Black patients



Chalew et al.[16]

Perceptions of patient's race is a pivotal factor in provider bias

> A study by Valenzuela et al. connected race with how diabetes regimens are prescribed. **Black patients were more likely to be on insulin injections; less likely to be prescribed 4 or more BG tests per day, less likely to be on sliding scales, lowest regimen intensities. white pts more likely to be on pump therapy, sliding carb scales and highest regimen intensities[15]**

Table 2. Components of regimen intensity score by race/ethnicity (N = 178)

Regimen characteristic	Regimen intensity score	White, non-Hispanic (N = 35) %	Black, non-Hispanic (N = 18) %
Insulin regimen type			
Injections (no basal)	0	31.4	82.4
Injections (basal glargine)	1	17.1	17.6
Pump therapy	2	51.4	0.0
Blood glucose monitoring			
<3 BG tests daily	0	8.6	22.2
4 BG tests daily	1	51.4	72.2
>4 BG tests daily	2	40.0	5.6
Sliding scale type			
No scale	0	3.0	11.1
Blood glucose scale	1	18.2	88.9
Carbohydrate scale	2	78.8	0.0

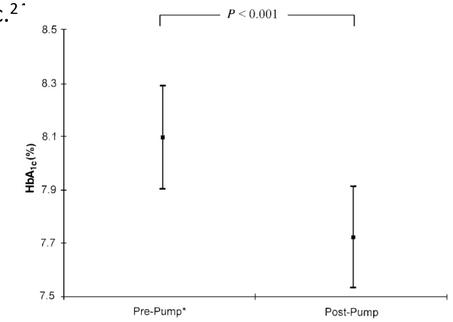
BG, blood glucose.

Valenzuela et al.[15]

Interventions

Diabetes technologies, like CGM and pumps provide better glycemic control.

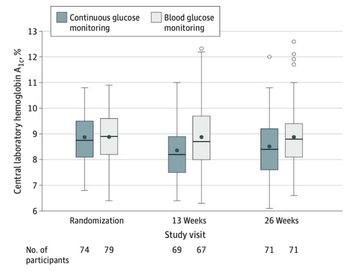
> A study by Plotnick et al. investigated the efficacy and safety of pump therapy and was found to be effective in reducing the number of hypoglycemic events, and lowered HbA1c.[2*]



Plotnick et al.[24]

> A study by Laffel et al. found a drop in HbA1c in the CGM group whereas in the meter group had no statistically significant change.[25]

Figure 2. Hemoglobin A_{1c} Levels During a Study of the Effect of Continuous Glucose Monitoring on Glycemic Control in Adolescents and Young Adults With Type 1 Diabetes



The top and bottom of the boxes denote the 25th and 75th percentile, the line represents the median, and the dot represents the mean. The whiskers represent the minimum and maximum values after removing outliers.

What to do about Provider bias

Pump therapy and CGM are effective technologies for management of T1D, yet Black patients are less likely to be prescribed diabetes technologies

> white children are 3.6 times more likely to be on a pump compared to black children across all SES levels; black children of a household income of at least $100,000 were using pumps at the same proportion white children of a household income of $50,000.[5]

Solution: Increase the proportion of minority providers (specifically Black providers) & mandatory bias training/education