



Nuances of Socioeconomic Status and Health Insurance Associations with HbA1c in Adults with Type 1 Diabetes

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Background

- Individual markers of lower SES (e.g., personal income) are associated with higher HbA1c in adults with type 1 diabetes (T1D)^{1,2}
- Markers of lower socioeconomic status (SES) occur in a *broader* community context (e.g., county-level income), which may *also* impact HbA1c, like other health outcomes^{3,4}
- Past research has typically examined SES in isolation or as a single composite score, and distinctions in insurance type (e.g., Medicaid grouped with Medicare) are sometimes lost

We aimed to:

- Understand *concurrent* associations of individual and community markers of SES
- Explore whether insurance type *changes* associations between county-level income and HbA1c

Methods

- Participants ($N = 9027$) were adults in the T1D Exchange Registry – an online longitudinal study of people with T1D – who completed Baseline Questionnaire items of demographics, diabetes history, markers of SES, and HbA1c.
- We used hierarchical linear regressions to examine concurrent associations of insurance type, markers of SES, demographics, and diabetes technology with self-reported HbA1c; then, we interactions between county-level income and insurance type on HbA1c.

Demographics

Table 1. Diabetes characteristics and sample demographics.

Diabetes Characteristics	Mean (SD)	Frequency (%)
HbA1c	7.33 (1.63)	
Pump Use (Yes)		6393 (70.8%)
CGM Use (Yes)		7530 (83.4%)
Demographics	Mean (SD)	Frequency (%)
Age	42.3 (14.5)	
Gender (female)		6936 (76.8%)
Race (non-white) ¹		697 (7.7%)
Ethnicity (Hispanic/Latino)		469 (5.2%)
Income (\leq \$50,000)		2748 (30.4%)
Education (High School or Less)		752 (8.3%)

¹Participants self-identified as Black/African American ($n = 178$, 2.0%), Asian ($n = 72$, 0.8%), Native American/Native Alaskan ($n = 36$, 0.4%), Native Hawaiian or Pacific Islander ($n = 9$, 0.1%), or mixed race ($n = 402$, 4.5%) and were collapsed into a single category, as individual group sizes were small.

Results

Table 2. Community (zip code) characteristics and insurance type.

Zip Code Characteristics	Mean (SD)	Frequency (%)
Residential Area (Nonmetro) ¹		1309 (14.5%)
County Median Income ²	7.71 (2.85)	
Health Insurance Type	Mean (SD)	Frequency (%)
Medicaid		836 (9.3%)
Medicare		848 (9.4%)
No Health Insurance (HI)		167 (1.9%)
Private ³		7176 (79.5%)

¹Nonmetro was defined as having a population less than 20,000.

²County median income in measurement units of \$10,000; thus, the median is \$77,100. Counties with median income of \$250,000+ was capped at \$250,000.

³Private insurance *included* participants who reported having insurance through the Affordable Care Act Marketplace.

Most variables were significantly associated with HbA1c in hierarchical regression models although magnitude varied.

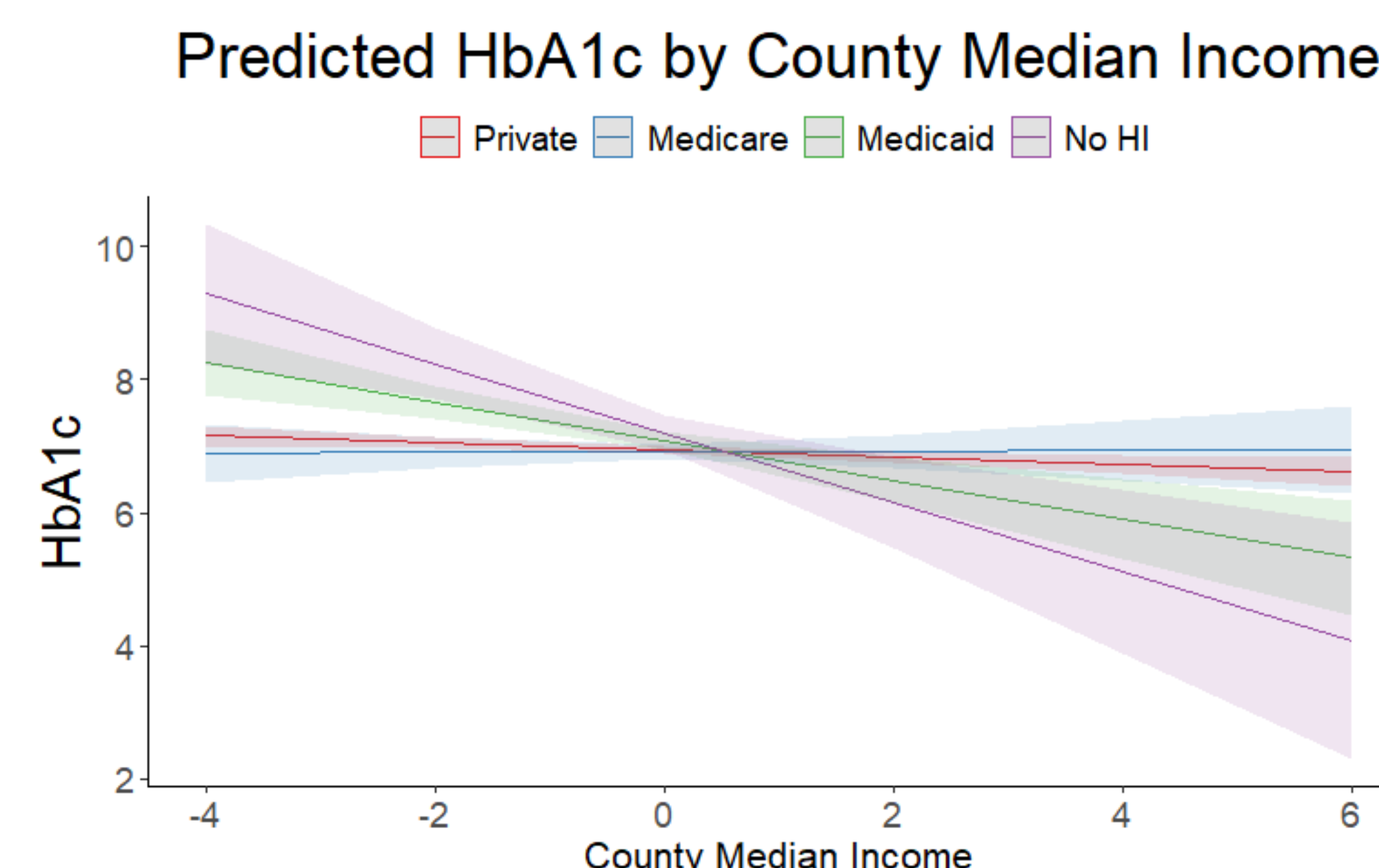
No significant association between HbA1c and: ethnicity ($p = .20$), Medicare ($p = .61$), and living in a non-metro area ($p = .07$).

Lower HbA1c	B (SE)	Higher HbA1c	B (SE)
Pump Use	-.51 (.04)	Female Gender	.12 (.04)
CGM Use	-.65 (.05)	Non-white Race	.21 (.06)
Age	-.01 (.001)	Medicaid Insurance	.24 (.06)
Income	-.08 (.01)	No Health Insurance	.41 (.12)
Education	-.16 (.01)		
Median County Income	-.06 (.02)		

Significant interactions between Medicaid/no HI on association between median county income and HbA1c.

People with Medicaid or no HI in lower average or lower income counties also had higher HbA1c.

Figure 1. Plot of interactions of health insurance type.



Note. Simple slope tests revealed significant slope and moderate estimates for Medicaid (est. = .29, SE = .07, $t = -4.30$, $p < .001$) and No Health Insurance (est. = -0.52, SE = .04, $t = 3.69$, $p < .001$). Private insurance also had a significant slope, but magnitude was too small to interpret (est. = -.05). Simple slope for Medicare recipients was *not significant* (est. = .00, SE = .05, $t = .08$, $p = .94$). Interactions were significant at below the mean, around the mean, and about +2.25 SD above the mean.

Key Findings

- While many markers of SES, demographics and diabetes characteristics are related to HbA1c, magnitude of effects are only modest-to-large for technology use, race, Medicaid, and no HI.
- Associations between county-level income and HbA1c are moderated by insurance type (Medicaid; no HI), suggesting these individuals may be more sensitive to county-level resources.

Limitations & Conclusions

Limitations

- Despite large sample size overall, some group sizes were small (e.g., ethnicity).
- Metro vs. non-metro (population $< 20,000$) may not have accurately captured rural vs. urban distinctions.
- Characteristics of sample (overall, high SES, high tech use, NH-White) may limit generalizability.

Conclusions

- Magnitude of estimate on HbA1c is greater for some diabetes and SES factors and is consistent with research in health inequities where multiple factors (e.g., race, lack of technology use) are often compounded⁵
- Results suggest a multifaceted approach to SES which includes community resources (e.g., median county income) may help to explain inequities in HbA1c and should be explored in future research.

References

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