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Objective and Subjective Measures of Socioeconomic Status and Cardiovascular Risk Control in Adults with Diabetes

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Abstract

OBJECTIVE—To examine the association between subjective (SSS) and objective (OSS) social status and cardiovascular disease (CVD) risk factors in adults with type 2 diabetes.

METHODS—Adult study participants (N=358) were recruited from 2 primary care settings. CVD risk factors included hemoglobinA1c (HbA1c), systolic (SBP) and diastolic (DBP) blood pressure and low-density lipoprotein-cholesterol (LDL-C). Objective social status was assessed by income, education and employment. Subjective social status was measured using the validated MacArthur Scales of Subjective Social Status to demarcate self-reported perceptions of having the most money, education, and respected job using a ladder scale (1=rung 1, 10=rung 10). Multiple linear regression was used to examine associations between CVD risk factors and subjective and objective social status controlling for age, gender, race/ethnicity, marital status, employment status, income, study site, comorbidity, education, and insurance status.

RESULTS—Fully adjusted models showed that rung 2 (p=0.029), rung 3 (p=0.032), rung 8 (p=0.049), and rung 9 (p=0.032) of the subjective social status were significantly associated with poorer DBP. Annual income ≥ $75, 000 was significantly associated with lower LDL-C (p=0.021). Employment was associated with lower HbA1c (p=0.036), but higher LDL-C (p=0.002).

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CONCLUSIONS—Subjective and objective social status levels are differentially associated with HbA1c, DBP, and LDL-C. Findings provide new information about patients' perspectives of the relationship between social status and diabetes-related outcomes.

Keywords

subjective social status; objective socioeconomic status; diabetes; cardiovascular risk factor control; adults

Introduction

Type 2 diabetes (T2DM) has increased in prevalence and is a major health concern in the United States (U.S.) and globally.[1–2] It is characterized by either impaired insulin production or decreased sensitivity to insulin resulting in impaired glucose homeostasis. Over 29 million people in the U.S. have been diagnosed with T2DM, and the number continues to grow.[1] Complications attributed to T2DM include chronic kidney disease, blindness, and non-traumatic lower limb amputations, in addition to numerous other complications and adverse outcomes. T2DM is also associated with higher health care costs and decreased quality of life.[1, 3] In 2012, direct costs such as hospital inpatient care, prescription medications and supplies and physician office visits were estimated to be $245 billion, and indirect costs including work absenteeism and decreased productivity were estimated to be $69 billion.[1,3]

Traditionally, objective social status (OSS) has been determined using annual household income, education level, and current employment status. These factors have been shown to have a significant relationship with health outcomes, where those in lower socioeconomic status categories have poorer health outcomes and those with higher socioeconomic status have better health outcomes.[4] These objective measures for social status have been shown to have a relationship with health outcomes related to chronic illness.[5,6] In the T2DM patient population, studies have shown that patients of a higher socioeconomic (SES) have better risk factor control and health outcomes.[7–10] Particularly in individuals with T2DM, the literature has shown that individuals of lower SES have untreated depression, greater sensitivity to out-of-pocket costs, lower trust in physicians, adverse neighborhood environments, and more risk factors associated with cardiovascular disease (CVD).[9,10]

Subjective social status (SSS), an individual's perception of their socioeconomic status, has been shown to be significantly associated with physical functioning and health outcomes in various patient populations.[11] The literature has shown that psychosocial origins of health inequality, suggesting that the value of socioeconomic status lies in how resources are perceived by individuals.[12,13] Thus, individuals can negatively internalize perceptions of their social status characterized as education, wealth, and employment status, which can mediate poor health outcomes.[14] Furthermore, Singh-Manoux and colleagues found that subjective social status is a better predictor of health status and decline in overall health.[13] Thus, the influence of psychosocial variables as predictors of diabetes outcomes is continually increasing[15–17] and recent research has shown that SSS may affect diabetes and other health-related outcomes.[7–9]

However, it is unclear which measure of social status best predicts health outcomes. Studies have found that subjective social status was a consistent predictor of health outcomes.[4,11,19,20] Yet, contrary to these findings, a study by McLeod and colleagues found that objective social status better predicts health status and outcomes than subjective social status.[21] Whereas, Sakurai and colleagues found that objective and subjective social status differentially affects health outcomes.[22] Additional studies have shown some indication that patients who are of higher OSS and SSS have better clinical outcomes than those of lower OSS and SSS.[18,23–25] However, not much is known about the relationship between SSS and OSS on diabetes-related health outcomes.

Specifically for T2DM, there is conflicting evidence to determine whether OSS or SSS is a better predictor of health outcomes. One study showed that OSS has a greater impact on health outcomes than SSS,[21] while others have shown that SSS is a better predictor of health outcomes.[13,18,24] Thus, more evidence is needed, especially in patients with T2DM. Therefore, the first objective of this study is to assess the relationship between SSS, OSS and risk factors for CVD in patients diagnosed with T2DM. The second objective is to examine which measure of social status, OSS or SSS, is the best predictor of poor health outcomes in patients with T2DM. We hypothesize that objective social status measures will be better indicators of health outcomes in this patient population.

Methods

Research Design, Sample Characteristics, and Setting

A convenience sample of patients 18 years of age and older with T2DM (N=358) were recruited from two primary care clinics: an academic Internal Medicine clinic and a Veteran Affairs Medical Center (VAMC) primary care clinic. At academic medical center, at the beginning of each week, a member of the research team printed out the internal medicine clinic schedule and identified adults with type 2 T2DM by cross checking the electronic clinic schedule with patients' medical history. Eligible patients were approached to participate in the study. At the VA medical center, a member of the research team approached patients in the waiting room to ask if they had T2DM. If patients indicated they had been diagnosed with T2DM, they were asked if they were interested in participating in the study. Patients who chose to participate were given verbal and written instructions on how to complete each section of the survey. Additionally, each participant had the option to complete the survey on his or her own or to have it administered by a member of the research team. Each survey was a compilation of 7 validated self-report surveys to assess stress, anxiety, perception of patient-centered care, depression, self-care management, comorbidities, and socioeconomic/demographic information. For the purposes of this study we used demographic information, socioeconomic status, and subjective social status. CVD risk factor values were extracted from the electronic medical records.

For the purposes of this study, the primary predictors were subjective and objective social status. The outcomes of interest were CVD risk factors which included hemoglobin A1c (HbA1c), blood pressure (BP) and low density lipoprotein cholesterol (LDL-C).[26,27] A priori timeframes for extraction from the medical records were determined for the CVD risk factors prior to study commencement and were the previous 6 months for HbA1c and the

previous 12 months for all remaining CVD risk factors (SBP, DBP, LDL-C). For labs that were not collected during the previously established a prior dates, no lab was extracted from the charts. For each of these cases, missing values were accounted for in the data analyses. Prior to study commencement, this research was approved by the Institutional Review Board (IRB).

Study Variables

Demographic characteristics—Demographic variables collected for this study included age, gender, race/ethnicity, marital status, educational level, employment status, annual income level, and health insurance.[28]Age was categorized into four age categories: 18–49 years, 50–64 years, 65–74 years, and 75–89 years old. Gender was dichotomized into two groups: men and women. Marital status was categorized into five groups: 1) never married, 2) married, 3) separated, 4) divorced, or 5) widowed. Ethnicity was based on self-report as either: 1) Hispanic/Asian/American Indian, 2) non-Hispanic White (NHW), or 3) non-Hispanic Black (NHB). Years of education was categorized into four groups: 1) <high school, 2) high school, 3) college, or 4) graduate level education. Eight income levels were defined: 1) $0 – $9,999; 2) $10,000 – $14,999; 3) $15,000 – $19,999; 4) $20,000 – $24,999; 5) $25,000 – $34,999; 6) $35,000 – $49,999; 7) $50,000 – $74,999; 8) >$75,000. Insurance status was divided into six groups: 1) no insurance, 2) private insurance, 3) Medicare, 4) Medicaid, 5) VA/military insurance, or 6) other insurance.

Instruments

Subjective Social Status—The MacArthur Scales of Social Subjective Status[18, 29] is a validated instrument that was used to assess the participants' perceptions of their social status. The scale is depicted as a ladder and asks individual participants to place an "X" on the rung of the ladder which they feel best reflects their social status.[18, 29] The ladder is scored from 1–10, with 1 being those who perceive they have the least amount of money, least education, and the least respected jobs or no job compared to others on the ladder, and 10 being those with the perception of having the most money, most education, and most respected jobs.[18,29] The score ranges from 1 to 10 based on where the participant indicated with an "X" their perception of their respective social status.

Objective Socioeconomic Status—To assess objective socioeconomic status (OSS), participants indicated their annual household income, highest level of education, and current employment status using previously validated questions.[30]

Statistical Analyses

The statistical analyses were performed in four steps. First, Student's t-test, chi-square and one-way ANOVA were used to examine sample characteristics. Next, mean scores for CVD risk factors (HbA1c, systolic blood pressure (SBP), diastolic blood pressure (DBP), and LDL-C) were calculated. Then, multiple linear regression models were used to assess the relationship between each CVD risk factor and individual subjective social status and objective social status variables. For these models, each CVD risk factor was the outcome variable. For the subjective social status instrument, each rung on the ladder served as the primary independent variable. To assess the relationship with objective social status

variables, education, annual income, and employment status were the primary independent variables. Age, gender, race/ethnicity, marital status, insurance, study site and comorbidity were included into each model as covariates. Lastly, to assess the independent relationships of the subjective social status and objective social status variables on CVD risk factors, multivariable regression models were run with each CVD risk factor variable as the outcome, the subjective social status and objective social status variables as primary independent variables and age, gender, race/ethnicity, marital status, insurance, study site and comorbidity as covariates. This model allowed for simultaneous inclusion of the subjective social status variable and the objective social status variables into the same model, while controlling for covariates. The Variance Inflation Factor (VIF) was used to test for collinearity. All analyses were completed using Stata version 13 statistical software.[31]

Results

There were 358 completed surveys from study participants. Table 1 shows the demographic characteristics of the sample population by the site of recruitment. There were statistically significant site differences by age, gender, marital status, educational level, employment status, annual income, and health status. In addition, the sites differed significantly by one CVD risk factor: systolic blood pressure (137.4±18.7 in the academic clinic vs.128.9±17.7 in the VAMC; $p<0.001$). There were no significant differences in the remaining CVD risk factors: HbA1c, SBP, or LDL-C. Overall, most of the CVD risk factors of the sample participants were generally well-controlled having a mean SBP of 133 mmHg, DBP of 75 mmHg, and LDL-C of 96 mg/dL. The mean HbA1c for the sample was 7.6%. Furthermore, there were no statistically significant differences in the sample population by social status ($p=0.86$). Table 2 shows mean scores of CVD risk factors by subjective social status and objective socioeconomic status variables. There was a significant association between LDL-C levels by employment status ($p = 0.002$) where those who were employed had higher LDL-C levels. There were no other significant associations between subjective or other objective social status variables and clinical outcomes.

Table 3 shows the adjusted multiple linear regression model of CVD risk factors and subjective social status and each objective socioeconomic status variable. Participants at the lowest and highest rungs of the SSS ladder showed higher DBP values: rung 2 (β= 11.95, 95% CI 1.06 to 22.83, $p = 0.032$), rung 3 (β= 11.40, 95% CI 0.88 to 21.92, $p = 0.034$), rung 9 (β= 12.01, 95% CI 0.96 to 23.06, $p = 0.033$), and rung 10 (β= 5.75, 95% CI −3.67 to 15.19, $p = 0.023$). The DBP of participants in rung 8 showed marginal significance (β= 9.21, 95% CI −0.13 to 18.55, $p = 0.053$). In terms of OSS, participants whose annual income was ≥ $75,000 had lower LDL-C levels (β= −25.65, 95% CI −51.08 to −0.22, $p = 0.048$). Participants who were employed had lower HbA1C levels (β= −0.59, 95% CI −1.14 to −0.04, $p = 0.037$) and higher LDL-C levels (β= 19.96, 95% CI 5.98 to 33.93, $p = 0.005$). No statistically significant associations were observed between SBP and subjective or objective social status variables.

Table 4 shows the adjusted multivariable regression model of CVD risk factors and subjective social status and each objective socioeconomic status variable. Participants who were on the lower rungs of the SSS ladder (rungs 2 and 3) as well as those at higher rungs of

the ladder (rungs 8 and 9) had significantly higher DBP levels: rung 2 (β= 12.14, 95% CI 1.22 to 23.04, p = 0.029), rung 3 (β= 11.53, 95% CI 1.00 to 22.06, p = 0.032), rung 8 (β= 9.40, 95% CI 0.029 to 18.76, p = 0.049), and rung 9 (β= 12.12, 95% CI 1.05 to 23.18, p = 0.032). In terms of OSS, participants who made ≥$75,000 annually had significantly lower LDL-C levels (β= −32.54, 95% CI −60.18 to −4.91, p = 0.021). For those who had an annual income range of $35,000–$49,999 (β= −24.22, 95% CI −48.94 to 0.51, p = 0.055), there was a marginally significant association between OSS and LDL-C. Those who were employed showed significantly lower HbA1C levels (β= −0.62, 95% CI −1.19 to −0.04, p = 0.036) and significantly higher LDL levels (β= 23.56, 95% CI 8.78 to 38.35, p = 0.002). As in the linear regression modeling, no statistically significant associations were found between SBP and social status.

Discussion

In this sample of adults with T2DM, both SSS and indicators of OSS were differentially associated with CVD risk factors. In the adjusted multiple linear regression, the lowest and highest rungs of SSS were significantly associated with higher DBP levels. For OSS, income level and employment status were both significantly associated with CVD risk factors. Those with the highest income level had lower LDL-C levels, and those who were employed had lower HbA1c and higher LDL-C levels. In the adjusted multivariable regression, similar patterns of association were shown. Those who perceived themselves in the lowest and higher rungs had statistically significant associations with CVD risk factors. We found that higher DBP levels, income level, and employment status remained significantly associated with CVD risk factors when subjective and objective social status variables were included in the same models controlling for relevant covariates, which included site of recruitment, where no statistically significant differences in social status were noted. These findings suggest that social status is associated with cardiovascular risk factors in adults with T2DM. However, our findings show that the associations are different based on the measure of social status that is used suggesting that OSS and SSS may need to be used in future research.

Our findings are consistent with the literature that suggests objective social status predicts health outcomes.[5,6] Adler and Ostrove found that individuals in lower socioeconomic status have poorer health outcomes and those with higher socioeconomic status have better health outcomes.[4] In the T2DM patient population, studies have shown that patients of a higher OSS have better risk factor control and health outcomes.[7–10] Additional studies have found that individuals of lower OSS have higher risk factors associated with cardiovascular disease (CVD).[9,10,32]

Furthermore, our findings support the literature that suggests subjective social status is significantly associated health outcomes.[11] Singh-Manoux and colleagues found in a study of over 5,000 middle-aged individuals, subjective social status was a better predictor of health status.[13] Still, our findings are consistent with other studies showing mixed results in terms of which measures of SES are better predictors of health outcomes. Some studies indicate that OSS has a slightly greater effect on CVD risk factor control than SSS,[21] whereas other studies demonstrate SSS as a better predictor of health outcomes than

OSS.[13,18,24] Further research is needed to determine whether SSS or OSS is a better predictor of poor health outcomes in patients with T2DM.

Several studies have observed the relationship between SSS and OSS in regard to health outcomes.[13,18,21,24] Our findings are supported by evidence from previous studies evaluating SSS, OSS, and CVD risk. In a study of 5,436 middle-aged individuals to compare health status based on SSS and OSS, both measures were significantly associated with health outcomes. Similarly, in a study by Ghaed and colleagues to assess SSS, OSS, and CVD risk in 92 women, SSS was more indicative of health status than was OSS.[33] Previous studies have shown that patients of a higher OSS have better CVD risk factor outcomes than those of a lower OSS.[7–10]

There are study limitations that should be noted. First, we used a sample of diabetes patients from a specific region of the country, which limits the generalizability of the results to other regions of the nation. Second, the study has a cross-sectional design, which does not allow for causal inferences. Third, we did not collect information regarding medication adherence, number of medications each patient had been prescribed, severity of T2DM, nor duration of T2DM diagnoses. Lastly, the vast majority of the study population had some form of insurance (96%), which may be not generalizable to the U.S. population, as a whole.

Conclusions

The results of this study are important and provide information about the relationship between social status and CVD risk factors in patients with T2DM. In this sample of adults, both SSS and indicators of OSS were associated with CVD risk. These findings provide areas for future research on the impact of social status on T2DM-related clinical outcomes, including understanding the potential mediators resulting in differential effects on outcomes found in this study. Moreover, regardless of the better predictor, it is imperative that interventions are developed and implemented that target patients with lower OSS and SSS to avoid poor T2DM-related health outcomes.

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Abbreviations

CVD	Cardiovascular disease
DBP	Diastolic blood pressure
HbA1c	Hemoglobin A1c
LDL-C	Low-density lipoprotein cholesterol
NHB	Non-Hispanic Black

NHW	Non-Hispanic White
OSS	Objective social status
SBP	Systolic blood pressure
SES	Socioeconomic status
SSS	Subjective social status
T2DM	Type 2 diabetes mellitus

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Table 1

Sample Characteristics by Site (n=358)

	Academic Clinic	VAMC	P-value
Age			0.01*
18–49 years	15.9	5.1	
50–64 years	38.8	47.4	
65–74 years	26.8	31.4	
75–89 years	18.6	16.0	
Gender/Sex			<0.001*
Women	64.1	2.3	
Men	35.9	97.7	
Race/Ethnicity			0.09
Non-Hispanic White	38.0	35.6	
Non-Hispanic Black	57.1	63.3	
Hispanic/Asian/American Indian	4.9	1.1	
Marital status			0.002*
Never married	17.5	8.5	
Married	39.9	54.8	
Separated	9.8	6.8	
Divorced	15.3	20.9	
Widowed	17.5	9.0	
Educational level			<0.001*
Less than HS graduate	22.8	8.5	
HS graduate	25.0	41.8	
College	38.6	42.4	
Grad education	13.6	7.3	
Employment status			<0.001*
Not employed	69.6	87.0	
Employed	30.4	13.0	
Annual income level			<0.001*
$0–$9,999	30.4	6.8	
$10,000–$14,999	14.1	13.0	
$15,000–$19,999	6.5	17.0	
$20,000–$24,999	6.0	13.6	
$25,000–$34,999	7.6	22.6	
$35,000–$49,999	9.2	11.3	
$50,000–$74,999	11.4	7.3	
>$75,000	14.7	8.5	
Health insurance			<0.001*
None	4.4	2.3	
Private	19.0	1.7	

	Academic Clinic	VAMC	P-value
Medicare	24.5	9.0	
Medicaid	32.1	2.8	
VA	6.0	76.8	
Other	14.1	7.3	
Social Status Ladder			0.86
Rung 1	2.9	3.2	
Rung 2	4.7	2.5	
Rung 3	4.7	5.1	
Rung 4	8.1	10.1	
Rung 5	18.6	18.4	
Rung 6	15.1	21.5	
Rung 7	17.4	12.7	
Rung 8	14.0	13.9	
Rung 9	4.7	3.8	
Rung 10			
Cardiovascular Disease Risk Factors			
Hemoglobin A1c	7.6±1.9	7.5±1.8	0.39
Systolic Blood Pressure	137.4±18.7	128.9±17.7	<0.001 *
Diastolic Blood Pressure	75.8±11.9	73.4±13.6	0.07
Low-density Lipoprotein Cholesterol	94.4±55.3	96.5±36.9	0.69

All numbers represent percentages or mean ± standard deviation.

* Statistically significant difference, P<0.05

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Table 2

Mean Scores of CVD Risk Factors by Subjective Social Status and Objective Socioeconomic Status Variables

	HbA1c Mean ± SD	P value	Systolic BP Mean ± SD	P value	Diastolic BP Mean ± SD	P value	LDL Cholesterol Mean ± SD	P value
Subjective Social Status		0.356		0.435		0.282		0.724
1	7.7 ± 1.6		132.2 ± 25.5		71.3 ± 15.6		106.9 ± 46.5	
2	8.4 ± 2.1		139.3 ± 24.1		83.2 ± 12.0		103.6 ± 35.7	
3	7.7 ± 1.4		137.8 ± 22.0		79.7 ± 11.9		91.9 ± 36.8	
4	7.8 ± 1.7		133.9 ± 22.5		72.9 ± 14.0		89.7 ± 33.4	
5	7.2 ± 1.9		131.0 ± 16.5		74.5 ± 12.5		95.1 ± 31.1	
6	7.2 ± 1.8		131.9 ± 21.4		73.5 ± 16.2		92.2 ± 52.4	
7	7.7 ± 1.7		135.6 ± 17.8		74.4 ± 11.8		92.8 ± 42.7	
8	7.9 ± 2.3		129.9 ± 13.1		74.8 ± 11.4		109.8 ± 79.1	
9	7.6 ± 1.3		139.2 ± 16.2		77.8 ± 11.3		92.6 ± 36.5	
10	7.8 ± 2.0		128.1 ± 13.7		71.7 ± 10.0		88.5 ± 28.1	
Objective Socioeconomic Status								
Income		0.163		0.193		0.542		0.862
$0–9,999	7.9 ± 2.1		138.7 ± 19.7		77.4 ± 12.7		97.8 ± 59.2	
$10,000–14, 999	7.7 ± 2.0		135.7 ± 24.0		74.8 ± 13.2		92.5 ± 40.0	
$15,000–$19,999	7.3 ± 2.0		130.9 ± 17.2		76.2 ± 16.5		98.2 ± 25.9	

	HbA1c Mean ± SD	P value	Systolic BP Mean ± SD	P value	Diastolic BP Mean ± SD	P value	LDL Cholesterol Mean ± SD	P value
$20,000–$24,999	7.5 ± 1.6		131.2 ± 18.4		73.0 ± 13.6		88.4 ± 34.5	
$25,000–$34,999	7.0 ± 1.3		132.4 ± 17.0		73.1 ± 11.2		96.1 ± 29.7	
$35,000–$49,999	8.0 ± 2.3		130.2 ± 16.5		37.5 ± 12.0		92.4 ± 34.5	
$50,000–$74,999	7.7 ± 1.5		132.6 ± 15.3		73.4 ± 11.6		106.8 ± 63.7	
≥$75,000	7.4 ± 1.4		130.1 ± 17.3		73.5 ± 11.1		92.4 ± 66.7	
Education Level		0.567		0.459		0.866		0.616
<High school	7.7 ± 1.9		134.6 ± 16.7		73.8 ± 11.7		98.0 ± 54.1	
High school	7.5 ± 1.8		133.9 ± 18.9		74.9 ± 13.5		90.9 ± 32.4	
College	7.6 ± 2.0		133.3 ± 19.5		75.0 ± 13.3		97.2 ± 47.3	
Graduate School	7.2 ± 1.3		128.8 ± 17.9		73.5 ± 9.9		100.6 ± 66.9	
Employment Status		0.567		0.591		0.116		0.002 *
Employed	7.4 ± 1.7		134.3 ± 17.8		76.7 ± 11.5		110.9 ± 61.6	
Unemployed	7.6 ± 1.9		133.0 ± 18.9		74.1 ± 13.1		91.3 ± 40.6	

* statistically Significant, $p<0.05$. All numbers represent mean ± standard deviation.

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Table 3

Adjusted Multiple Linear Regression Model of CVD Risk Factors and Subjective Social Status and each Objective Socioeconomic Status Variable

	HbA1c		Systolic BP		Diastolic BP		LDL-Cholesterol	
	Coefficient (95% CI)	**P value**	**Coefficient (95% CI)**	**P value**	**Coefficient (95% CI)**	**P value**	**Coefficient (95% CI)**	**P value**
Subjective Social Status								
2	1.15 (−0.55, 2.84)	0.186	8.06 (−8.32, 24.46)	0.333	11.95 (1.06, 22.83)	0.032*	11.20 (−31.85, 54.24)	0.609
3	0.65 (−1.01, 2.31)	0.443	6.68 (−9.15, 22.51)	0.407	11.40 (0.88, 21.91)	0.034*	−6.16 (−48.39, 36.08)	0.774
4	0.70 (−0.80, 2.20)	0.357	3.56 (−11.10, 17.81)	0.648	5.08 (−4.53, 14.68)	0.299	−5.50 (−43.86, 32.86)	0.778
5	−0.04 (−1.44, 1.35)	0.952	0.07 (−13.37, 13.51)	0.992	5.77 (−3.16, 14.69)	0.204	1.23 (−34.08, 36.56)	0.945
6	0.16 (−1.24, 1.55)	0.824	3.47 (−10.00, 16.95)	0.612	7.18 (−1.77, 16.13)	0.115	−4.87 (−40.52, 30.77)	0.788
7	0.43 (−0.99, 1.85)	0.550	6.59 (−7.10, 20.28)	0.344	5.69 (−3.40, 14.78)	0.219	−9.56 (−45.62, 26.50)	0.602
8	0.73 (−0.72, 2.19)	0.322	0.62 (−13.44, 14.69)	0.931	9.21 (−0.13, 18.55)	0.053	1.51 (−35.67, 38.70)	0.939
9	0.82 (−0.91, 2.54)	0.352	11.05 (−5.58, 27.69)	0.192	12.01 (0.96, 23.06)	0.033*	−3.36 (−47.00, 40.27)	0.880
10	0.78 (−0.70, 2.26)	0.301	−0.15 (−14.37, 14.06)	0.983	5.75 (−3.67, 15.19)	0.023*	−3.77 (−41.55, 34.00)	0.844
Objective Socioeconomic Status								
Income								

	HbA1c		Systolic BP		Diastolic BP		LDL-Cholesterol	
	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value
$10,000–14, 999	−0.17 (−0.92, 0.58)	0.649	1.74 (−5.64, 9.14)	0.642	−2.77 (−7.61, 2.06)	0.260	−14.50 (−34.01, 5.02)	0.145
$15,000–$19,999	−0.55 (−1.38, 0.29)	0.198	−1.91 (−10.09, 6.27)	0.646	−1.05 (−6.40, 4.29)	0.699	−13.89 (−35.87, 8.08)	0.214
$20,000–$24,999	−0.26 (−1.11, 0.59)	0.554	−1.72 (−10.12, 6.69)	0.688	−3.22 (−8.71, 2.28)	0.251	−16.92 (−38.85, 5.00)	0.130
$25,000–$34,999	−0.76 (−1.56, 0.04)	0.061	0.82 (−7.06, 8.70)	0.839	−2.88 (−8.03, 2.27)	0.272	−15.34 (−36.25, 5.57)	0.150
$35,000–$49,999	0.18 (−0.70, 1.06)	0.684	−1.44 (−10.15, 7.26)	0.745	−3.11 (−8.80, 2.58)	0.283	−18.02 (−40.65, 4.62)	0.118
$50,000–$74,999	0.03 (−0.89, 0.94)	0.952	0.64 (−8.39, 9.66)	0.890	−2.04 (−7.94, 3.86)	0.496	−5.80 (−29.45, 17.85)	0.630
≥$75,000	−0.29 (−1.27, 0.68)	0.554	−0.11 (−9.73, 9.52)	0.983	−3.02 (−9.31, 3.28)	0.346	−25.65 (−51.08, -0.22)	0.048*
Education Level								
High school	−0.20 (−0.82, 0.42)	0.520	3.78 (−2.35, 9.91)	0.226	1.32 (−2.69, 5.32)	0.518	−8.42 (−24.26, 7.38)	0.295
College	0.02 (−0.61, 0.66)	0.941	2.71 (−3.57, 8.99)	0.396	1.88 (−2.22, 5.99)	0.368	1.67 (−14.60, 17.93)	0.840
Graduate School	−0.42 (−1.33, 0.49)	0.361	−1.73 (−10.66, −.20)	0.703	1.72 (−4.12, 7.55)	0.563	5.90 (−17.19, 28.99)	0.615
Employment Status								
Employed	−0.59 (−1.14, −0.04)	0.037*	−0.81 (−6.28, 4.66)	0.772	−1.04 (−4.62, 2.53)	0.567	19.96 (5.98, 33.93)	0.005*

* statistically significant at $p < 0.05$

Reference groups: Subjective Social Status—Rung 1; Objective Socioeconomic Status— income level $0–9,999, education <high school, and being unemployed.

Covariates include age, gender, race/ethnicity, marital status, insurance, study site and comorbidity.

Multicollinearity was tested for each model using Variance Inflation Factor (VIF). The range of VIF in our analyses was from 3.71 to 4.25. VIF>10 may indicate collinearity between variables.

Table 4

Adjusted Multivariate Regression Model of CVD Risk Factors and Subjective Social Status and each Objective Socioeconomic Status Variable

	HbA1c		Systolic BP		Diastolic BP		LDL Cholesterol	
	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value
Subjective Social Status								
2	1.23 (−0.46 – 2.92)	0.153	8.07 (−8.37 – 24.51)	0.335	12.14 (1.22 – 23.04)	0.029*	7.63 (−34.75 – 50.01)	0.723
3	0.72 (−0.93 – 2.37)	0.395	6.68 (−9.19 – 22.55)	0.408	11.53 (1.00 – 22.06)	0.032*	−9.33 (−50.89 – 32.24)	0.659
4	0.83 (−0.66 – 2.32)	0.276	3.36 (−11.17 – 17.89)	0.649	5.35 (−4.29 – 14.99)	0.276	−10.82 (−48.66 – 27.04)	0.574
5	0.05 (−1.33 – 1.44)	0.942	0.07 (−13.41 – 13.56)	0.992	5.96 (−2.99 – 14.90)	0.191	−2.89 (−37.71 – 31.93)	0.870
6	0.22 (−1.17 – 1.61)	0.752	3.48 (−0.04 – 16.99)	0.613	7.33 (−1.64 – 16.29)	0.109	−7.80 (−42.89 – 27.29)	0.662
7	0.54 (−0.87 – 1.96)	0.450	6.60 (−7.15 – 20.35)	0.346	5.93 (−3.20 – 15.05)	0.202	−14.19 (−42.89 – 27.29)	0.433
8	0.83 (−0.62 – 2.28)	0.262	0.63 (−13.49 – 14.74)	0.930	9.40 (0.029 – 18.76)	0.049*	−2.91 (−39.57 – 33.74)	0.876
9	0.87 (−0.57 – 2.39)	0.321	11.06 (−5.62 – 27.73)	0.193	12.12 (1.05 – 23.18)	0.032*	−5.89 (−48.81 – 37.03)	0.787
10	0.91 (−0.57 – 2.39)	0.226	−0.15 (−14.44 – 14.15)	0.984	6.05 (−3.43 – 15.54)	0.210	−9.47 (−46.77 – 27.84)	0.618
Objective Socioeconomic Status								
Income								

	HbA1c		Systolic BP		Diastolic BP		LDL Cholesterol	
	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value	Coefficient (95% CI)	P value
$10,000–14,999	−0.17 (−0.97 – 0.63)	0.674	2.19 (−8.37 – 24.51)	0.577	−3.23 (−8.36 – 1.89)	0.215	−17.28 (−37.95 – 3.39)	0.101
$15,000–$19,999	−0.29 (−1.19 – 0.61)	0.525	−0.63 (−9.28 – 8.03)	0.887	−0.55 (−6.30 – 5.19)	0.849	−18.84 (−42.53 – 4.84)	0.118
$20,000–$24,999	−0.13 (−1.06 – 0.80)	0.782	2.05 (−6.92 – 11.03)	0.652	−2.42 (−8.37 – 3.54)	0.426	−22.73 (−46.59 – 1.12)	0.062
$25,000–$34,999	−0.61 (−1.49 – 0.61)	0.173	3.15 (−5.33 – 11.64)	0.465	−3.20 (−8.83 – 2.43)	0.264	−18.29 (−41.18 – 4.60)	0.117
$35,000–$49,999	0.40 (−0.56 – 1.35)	0.412	−2.17 (−11.44 – 7.12)	0.646	−3.50 (−9.66 – 2.65)	0.264	−24.22 (−48.94 – 0.51)	0.055
$50,000–$74,999	0.13 (−0.85 – 1.11)	0.790	0.91 (−8.60 – 10.42)	0.850	−1.57 (−7.88 – 4.74)	0.624	−8.33 (−33.59 – 16.94)	0.517
≥$75,000	−0.07 (−1.13 – 1.00)	0.899	1.93 (−8.34 – 12.20)	0.711	−2.20 (−9.01 – 4.62)	0.526	−32.54 (60.18 – −4.91)	0.021*
Education Level								
High school	−0.49 (−1.17 – 0.19)	0.157	3.87 (−2.74 – 10.48)	0.251	0.43 (−3.96 – 4.82)	0.847	−8.36 (−25.85 – 9.14)	0.348
College	−0.29 (−0.97 – 0.39)	0.403	2.62 (−4.02 – 9.25)	0.438	0.64 (−3.77 – 5.03)	0.776	0.04 (−17.71 – 17.78)	0.997
Graduate School	−0.93 (−1.90 – 0.04)	0.060	−1.50 (−10.87 – 7.87)	0.753	0.45 (−9.01 – 4.61)	0.888	7.78 (−17.27 – 32.83)	0.541
Employment Status								
Employed	−0.62 (−1.19 – −0.04)	0.036*	−0.03 (−5.56 – 5.51)	0.993	−1.29 (−4.97 – 2.38)	0.489	23.56 (8.78 – 38.35)	0.002*

*Statistically significant at $p < 0.05$

Reference groups: Subjective Social Status—Rung 1; Objective Socioeconomic Status— income level $0–9,999, education <high school, and being unemployed.

Covariates include subjective social status, income, objective social status (education, employment), age, gender, race/ethnicity, marital status, insurance, study site and comorbidity. Multicollinearity was tested for each model using Variance Inflation Factor (VIF). The range of VIF in our analyses was from 3.71 to 4.25. VIF>10 may indicate collinearity between variables.