THE ASSOCIATION OF OPTIMISM WITH TYPE 2 DIABETES BY AGE AMONG AFRICAN AMERICAN MEN AND WOMEN IN THE JACKSON HEART STUDY

By

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ABSTRACT

African American adults are twice as likely to develop type 2 diabetes (T2D) compared to Non-Hispanic White individuals. Positive psychosocial resources (optimism) are associated with reduced cardiovascular disease (CVD) risk in African American individuals. However, little data exist on the relationship between optimism and T2D among African American individuals by age. We hypothesize that high levels of optimism and younger individuals will be negatively associated with T2D. This study examines the association of optimism with T2D prevalence among African American men and women stratified by age categories, using data from the Jackson Heart Study (JHS). Optimism was measured using the 6-item Life Orientation Test-Revised (LOT-R) scale. Using multivariable Poisson regression analysis, we estimated the prevalence ratios (PR, 95% confidence interval-CI) of diabetes (yes/no) by tertiles of optimism (low, medium, high), adjusting for age, sex, socioeconomic status, and behaviors. A greater percentage of participants with high optimism were younger, male, high SES, and not depressed ($p<0.05$). Optimism, as measured in standard deviation units, showed a significant inverse relationship between levels of optimism and diabetes (0.94 95% CI 0.90-0.99). The association attenuated after full adjustment. High (vs. low) total optimism was more protective against diabetes for participants less than 45 years of age (PR 0.49, 95% CI 0.30-0.79) than older participants after full adjustment. The results from this study demonstrate that interventions that focus on positive psychosocial well-being in Black adults may help to reduce the risk of diabetes in an aging population.

ACKNOWLEDGMENTS

I would like to thank Dr. Alain Bertoni and Dr LáShauntá Glover for providing continuous input in regard to the goals and methodology of this project.

I would like to thank the Jackson Heart Study for providing the data for which this project would not have been possible.

I would like to thank my parents for their continuous support, encouragement, and advice throughout this project. Even when it drove me crazy.

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Introduction

In 2018, nearly 1.5 million US adults were diagnosed with type 2 diabetes (T2D) which had increased by 4.8% annually from 2002 to 2015 (1). Findings in 2017 show that the rate of diagnosed diabetes was 12.1% among black adults compared to 7.4% among white adults (6). This racial disparity in T2D is a major driver in the overall disparity in cardiovascular disease (CVD). This disparity is also attributed to social determinants of health (e.g., stress, socioeconomic position) which disproportionately affect African American individuals in comparison to White individuals (13).

Research has also shown that positive psychosocial resources have been associated with reduction of chronic diseases such as CVD and T2D (7, 8, 14). However, few studies have examined the relationship between optimism and prevalent T2D. Puig-Perez et al. (2017) found that lower optimism generally correlated with poorer self-reported mental and physical health and, more specifically, that optimism may help modulate stress-related autonomic and neuroendocrine dysregulation for those with T2D (7). Glover et al. (2019) examined optimism and select resilience measures (religiosity and social networks) and found that greater levels of social support reduced the prevalence of T2D among both men and women (12), and higher optimism was associated with a 20% lower prevalence of T2D (12). Ultimately, the study concluded that positive psychosocial factors (social support and networks) and optimism could play a major role as a preventative measure against T2D in African American adults (12).

Glover et al. did not examine the optimism-diabetes relationship by age group, which may reveal the extent to which positive psychosocial well-being may mitigate prevalent diabetes across the spectrum among younger, middle-age and older participants. For this reason, this

study examines the relationship between optimism and prevalent T2D and how this association varies by age.

This study is a secondary data analysis of baseline data from the Jackson Heart Study (JHS) that examined the association of optimism with prevalent Type 2 diabetes (T2D) among African American men and women stratified by age categories. The central hypothesis is that optimism will be inversely associated with prevalent diabetes, where associations will vary by age groups. Specifically, it is hypothesized that high levels of optimism, and younger age groups, will be negatively associated with T2D in contrast with older age groups and low levels of optimism.

Methods

Study Population

The Jackson Heart Study (JHS) is a community-based cohort study of the etiology of CVD among African American men and women living in the tri-county area (Hinds, Madison and Rankin counties) of Jackson, Mississippi. Baseline recruitment (2000–2004) included 5,306 non-institutionalized, African American people whose ages ranged from 35–84 years old. The JHS gathered data related to CVD risk factors, genetics, demographics, health conditions and social determinants of health (stress, optimism, socioeconomic status) from its participants. JHS was funded by the National Institute on Minority Health and Health Disparities (NIMHD) and the National Heart, Lung and Blood Institute (NHLBI).

Exam 1 data were collected via in-home interview and clinic examination, where trained staff administered questionnaires to collect self-reported information on demographics (age, sex), psychosocial measures (stress), cardiovascular risk factors, and behaviors (hypertension,

physical activity, medications). Trained staff also collected blood and urine samples and measured height, weight, and blood pressure (BP).

In order to gain access to the JHS data, prospective lead authors must submit a manuscript proposal detailing the hypotheses they propose to test, and a methodological overview of the research they propose to conduct. Approval from the JHS Publications Presentations Procedures (PPS) is required, where the lead author must submit a formal manuscript proposal to be reviewed by the JHS PPS. Only once a given proposal has been approved by PPS, may the lead author then make a formal request of the data. In terms of requirements for the Capstone Project for the UCR honors program alone, only an approved manuscript proposal is necessary as it is the only requirement for the data analyzed within this study. However, in order to fully submit and publish a completed peer-reviewed manuscript, further abstract and manuscript approvals by the JHS must also be met. This serves as a secondary objective to completing the main capstone project for the UCR honors program. A manuscript draft conforming to accepted JHS formatting has already been generated, but that manuscript does not demand the detailed explanation of the JHS history and data request methodology, whereas those details are presented here for completeness and clarity. The manuscript draft already completed with Dr. Mario Sims of the UCR School of Medicine will be combined with additional analyses of the data summarized here. These additional data and analyses will result in a manuscript to be submitted to the JHS Publications. However, these additional objectives will be completed after Spring 2024 in order to accommodate the URC Honors capstone timetable and submission requirements.

This study focuses strictly on T2D metrics, optimism data, and participant information including age, sex, education, income, depressive symptoms, and behaviors such as physical

activity and diet. Further details about recruitment, data collection, and study variables are described elsewhere (15,16). The use of the JHS study data was approved by the institutional review boards of the University of Mississippi Medical Center, Jackson State University, and Tougaloo College before the data request for study was submitted. All participants provided written informed consent.

Measures

Outcomes.

For this study, the only outcome data will be the prevalent T2D of participants, measured as a binary variable (Yes=1, No=0). Prevalent T2D status (yes/no) was defined by the 2010 ADA guidelines. Participants with T2D were those who had a fasting glucose ≥126 mg/dL, or HbA1c ≥ 6.5% during examination by the JHS, or those who explicitly reported use of diabetic medication within 2 weeks prior to the clinic visit. Note, this study uses TD2 prevalence as opposed to incidence. Incidence being a representation of the number of subjects newly diagnosed with a given disease and prevalence being a representation of already existing cases of a given disease. The distinction between incidence and prevalence is subtle but critical to the interpretation of the data presented here. Prevalence was used as the outcome measure of this study, in part due to the availability of data from the JHS, as well as due to the fact that my faculty mentor and I believed it was a more appropriate representation of T2D in our population; minimizing potentially confounding instances of newly diagnosed diabetes and extreme instances of the disease. It is for these reasons that mortality was not utilized as an outcome as well.

Predictors.

The predictor data is the level of optimism reported by participants, which is measured using the Life Orientation Test-Revised (LOT-R), a survey completed during the first annual follow-up interview of JHS participants (2000-2004). The LOT-R produces a scaled "score" that accurately measures dispositional optimism of participants. The Life Orientation Test-Revised (LOT-R) instrument was used to measure dispositional optimism of participants on a scale from 6 (least optimistic) to 24 (most optimistic). The LOT-R is a self-administered 6-item scale, where participants responded to 3 positively worded statements (e.g., "In uncertain times I expect the best") and 3 negatively worded statements. (e.g., "I rarely count on good things happening to me"). Total 6-item optimism scores were calculated by adding all six statement items after the three *negatively-worded* items were reverse coded. The total composite score was classified into tertiles (low, medium, high) to assess for threshold effects and continuously in standard deviation (SD) units. The three *positively-worded* items and three negatively-worded items will be analyzed separately in a secondary analysis as 3-item measures of optimism and pessimism, and will be classified into tertiles (low, medium, high) and in SD units.

Covariates

All JHS covariate data were collected at baseline (2000-2004). Covariates include sex (male=1, female=0), age (continuous), age categories (≤45 46-55, 56-64, ≥65), education, income, depressive symptoms, physical activity, and diet. Age was categorized as follows: with younger aged adults (≤45), younger middle-aged adults (46-55), older middle-aged adults (56-64), and older adults (≥65). These age categories were specifically chosen in order to provide the greatest amount of detailed data while working in line with the participants of the JHS that provided optimism data. Of all the participants in the JHS, some were significantly younger than

any of these age categories. However, optimism data were not available for these participants. Educational attainment was classified as less than high school, high school graduate to some college, or college graduate and above. Income was classified as affluent, upper-middle, lower-middle, and poor as a self-reported scale. Depressive symptoms, as a measure of psychosocial ill-being, was measured by the 20-item Centers for Epidemiologic Studies Depression Scale (CES-D) (10), where participants respond to statements to determine their mood in the past week (e.g., "I was bothered by things that usually don't bother me."). Item responses were scored from 0 (rarely or none of the time) to 3 (most or all the time) and the total summed score ranged from 0 to 60 (α=0.82). All covariates analyzed were self reported by participants of the JHS.

Statistical Analysis

All data have been analyzed using Stata version 18.0 (College Station, TX) statistical analysis program. Sample descriptive statistics were assessed by the total sample and by age groups. Any differences between sex were analyzed through using chi-square tests for categorical variables and ANOVA tests for continuous variables. Age groups were analyzed in the same manner. The association of optimism levels (and in SD units) with prevalent T2D will be examined using Poisson regression analysis to estimate prevalence ratios (PR, 95% confidence interval-CI) of T2D (yes/no).

Hierarchical covariate adjustment was performed in all regression analysis in the following manner: model 1 adjustment for age and sex; model 2 added SES (education and income); model 3 added depressive symptoms; model 4 added behaviors (physical activity and diet). Before stratifying models by age, testing was conducted for effect modification by age to assess whether there is a significant p-value for interaction ($p<0.05$) in fully-adjusted models.

Associations of optimism and diabetes were then estimated across the following age categories: less than 35 years; 36-54 years old; and 55 years and older. For each category, estimates of the above hierarchical models were explained as above. As a secondary analysis, "Prevalence regression" was used to estimate the associations of *optimism only* and *pessimism only* separately, with prevalent T2D adjusted for covariates. Hierarchical covariate adjustment was performed in the same manner discussed above. All reported *p-values* correspond to two-tailed tests and were significant at the 0.05 level. All Analyses were performed using Stata, version 18.0 (College Station, TX).

Results

Variables with missing values are as follows: total optimism score (n=682), education (n=20), income (n=818), physical activity (n=5), nutrition (n=509), depression (n=1894). Despite high numbers of missing data, a missing category was included for income and depressive symptoms and retained in the analysis to ensure unbiased estimates. In previous work, Sims et al. confirmed that there was little variation in the results between those included (or responded to the optimism questionnaire) and excluded (participants who did not respond) in analysis (14).

Table 1 shows sample characteristics by levels of optimism. Participants who reported higher levels of optimism were younger, female sex, highly educated, affluent, reported ideal physical activity, and were non-diabetic ($p<0.001$). Table 2 presents sample characteristics by age categories. Mean optimism was higher in younger participants (less than 45 years old), who were also more educated, affluent, reported higher depressive symptom scores, reported greater ideal physical activity, and had lower prevalence of diabetes than older participants ($p<0.001$).

Table 3 presents prevalence regressions of the association of type 2 diabetes by levels of total optimism, optimism only, and pessimism. Overall, there was a protective (though

nonsignificant) effect between medium and high (vs. low) total optimism and diabetes for models 1 and 2. For example, after adjustment for age and sex, the prevalence ratio of prevalent diabetes was 0.93 for participants who reported high (vs. low) optimism (95% CI 0.82-1.06). When considering optimism as a continuous variable, each standard deviation (SD) increase in optimism was significantly associated with a six percent reduced prevalence of diabetes (PR 0.94, 95% CI 0.90-0.99). After adjustment for the remaining risk factors, SD models remained protective but were non significant.

In an analysis where participants reported ***optimism only*** prevalence ratios were non-significant. However, as measured in SD units, there was a significant inverse relationship between optimism and prevalent diabetes (PR 0.94, 95% CI 0.90-0.99) in models 1 and 4). In an analysis that explored participants who reported ***pessimism only***, higher levels of pessimism were associated with increased prevalent diabetes (hypothesized direction) but most estimates were non-significant. As measured in SD units, participants with higher levels of pessimism had a 4% increased prevalence of diabetes (PR 1.04, 95% CI 0.99-1.09) after adjustment for age and sex. However, estimates attenuated after further adjustment for SES, depressive symptoms and behaviors.

Models were stratified by age categories after the interaction of age with optimism was significant in fully-adjusted models (p value for interaction = 0.01). This secondary analysis in Table 4 shows that high (vs. low) ***total optimism*** is more protective of prevalent diabetes for participants less than 45 years of age (PR 0.49, 95% CI 0.30-0.79) after full adjustment for confounders. Participants who are less than 45 years of age and reported higher ***optimism only***

Table 1: Sample characteristics by levels of optimism, JHS (2000–2004; n = 4734).				
Sample Characteristics	Tertiles of Optimism			p value
	Low	Medium	High	
Mean Age in Years (SD)	56.0 (12.9)	53.5 (12.6)	53.0 (11.8)	<0.001
Sex %				<0.001
Women	66.47	63.91	62.41	
Men	33.52	36.09	37.59	
Education %				<0.001
Less than high school	23.51	14.22	9.22	
HS grad- some college	22.72	19.22	15.13	
College grad or more	53.77	66.56	75.63	
Income %				<0.001
Poor	6.07	4.28	3.02	
Middle	9.61	6.55	5.74	
Upper-Middle	9.48	9.82	9.90	
Affluent	7.57	10.98	13.26	
Mean Score Depressive Symptoms (SD)				<0.001
	13.1 (8.8)	9.9 (7.0)	8.5 (6.5)	
Physical Activity				<0.001
Non-Ideal	84.06	80.23	75.35	
Ideal	15.94	19.77	24.65	
Diet				0.113
Non- Ideal	98.90	98.31	97.99	
Ideal	1.10	1.69	2.01	
Diabetes Status (%)				0.001
No	69.17	71.81	72.90	
Yes	30.83	28.19	27.10	

Table 2: Sample characteristics by levels of optimism, JHS (2000–2004; n = 4734).					
Sample Characteristics	Age Categories				p value
	≤45	46-55	56-64	≥65	
Mean Score Total Optimism (SD)	18.80 (2.49)	18.78 (2.56)	18.3 (2.68)	18.45 (2.64)	<0.001
Sex %					0.014
Women	60.17	63.10	65.25	65.49	
Men	39.83	36.90	34.75	34.51	
Education %					<0.001
Less than high school	4.12	6.94	20.78	42.65	
HS grad- some college	17.66	18.60	23.83	20.63	
College grad or more	78.22	74.46	55.39	36.72	
Income %					<0.001
Poor	14.57	9.55	11.03	2.49	
Middle	16.16	15.87	20.15	4.35	
Upper-Middle	30.59	25.65	25.25	2.58	
Affluent	23.59	32.90	28.97	2.35	
Mean Score Depressive Symptoms (SD)					<0.001
	11.68 (8.75)	11.19 (8.67)	10.21 (7.54)	10.66 (6.95)	
Physical Activity					<0.001
Non-Ideal	74.31	78.63	84.02	86.97	
Ideal	25.69	21.37	15.98	13.03	
Diet					<0.001
Non-Ideal	99.83	98.58	97.83	97.74	
Ideal	0.17	1.42	2.17	2.26	
Diabetes Status %					<0.001
No	89.73	79.86	69.10	66.38	
Yes	10.27	20.14	30.90	33.62	

Table 3: Prevalence ratios (PR 95% CI) of T2D by Optimism, JHS (2000–2004; n = 4734).				
Total Optimism	Model 1	Model 2	Model 3	Model 4
Low(referent)	1.0	1.0	1.0	1.0
Medium	0.96 (0.84-1.09)	0.99 (0.87-1.13)	1.00 (0.88-1.14)	1.01 (0.88-1.16)
High	0.93 (0.82-1.06)	0.98 (0.87-1.13)	1.01 (0.88-1.15)	1.03 (0.90-1.18)
SD	**0.94 (0.90-0.99)**	0.97 (0.92-1.02)	0.97 (0.92-1.03)	0.97 (0.92-1.03)
Optimism Only				
Low(referent)	1.0	1.0	1.0	1.0
High	1.08 (0.97-1.20)	1.05 (0.94-1.17)	1.04 (0.93-1.16)	1.06 (0.94-1.19)
SD	**0.94 (0.90-0.99)**	0.95 (0.91-1.00)	0.96 (0.91-1.00)	**0.95 (0.90-0.99)**
Pessimism Only				
Low(referent)	1.0	1.0	1.0	1.0
Medium	1.05 (0.93-1.19)	1.02 (0.90-1.16)	1.02 (0.90-1.15)	1.03 (0.90-1.17)
High	1.07 (0.94-1.22)	1.01 (0.88-1.15)	0.99 (0.87-1.13)	0.98 (0.85-1.13)
SD	**1.04 (0.99-1.09)**	1.01 (0.96-1.07)	1.00 (0.95-1.06)	1.00 (0.95-1.06)

Footnote: Model 1 adjusted for age and sex. Model 2 adjusted for model 1 and SES (education and income). Model 3 adjusted for model 2 and depressive symptoms. Model 4 adjusted for model 3 and behaviors (physical activity/diet).
Bold indicates statistically significant at p<0.05.

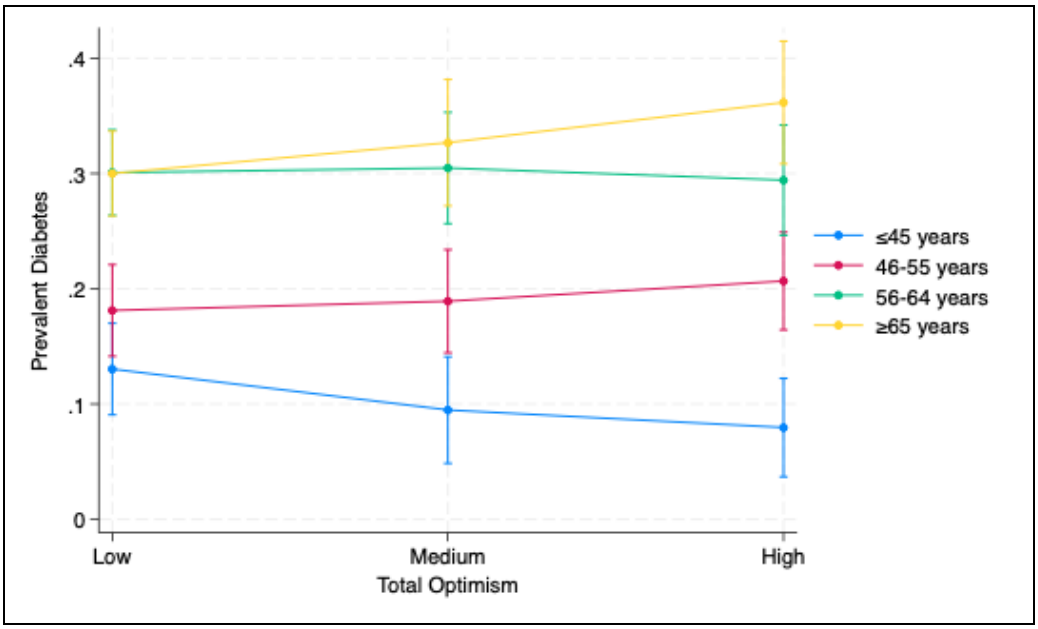
have a 52% increased prevalence of diabetes (PR 1.52, 95% CI 1.05-2.22). Optimism only (as measured in SD units) was significantly protective of diabetes. Associations between continuous optimism only and diabetes were protective among older age groups but nonsignificant. Participants who are 45 years or younger and reported high (vs low) ***pessimism*** had 111 percent increased prevalence of diabetes (PR 2.11 95% CI 1.35-3.31). A similar association was found when pessimism was measured in SD units for participants less than 45 years of age. Whereas estimates were nonsignificant among older participants, in those who are 65 years and older the association was protective and significant.

Table 3.1: Test for interaction of age in fully-adjusted model (model 4), JHS (2000–2004; n = 4734).	
Total Optimism	Model 4
Low (referent)	1.0
Medium	1.01 (1.00-1.02) P=0.12
High	**1.01 (1.00-1.03) P=0.01**
SD	**1.01 (1.00-1.01) P<0.001**

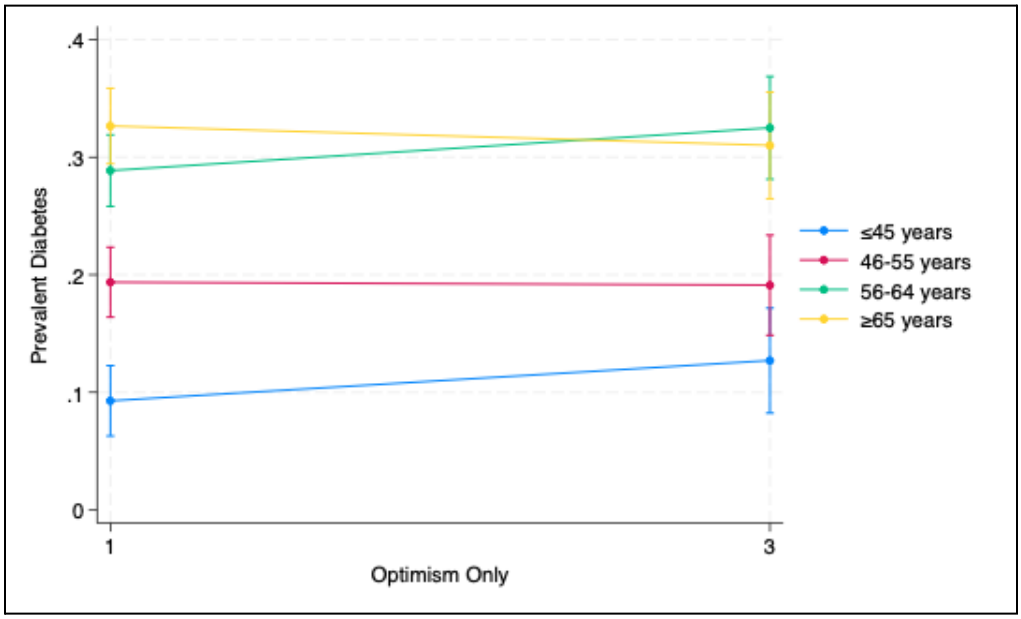
Table 4: Age stratified tables (with total optimism, optimism only, pessimism only) – fully-adjusted models (Model 4), JHS (2000–2004; n = 4734).				
Total Optimism	≤45 years	46-55 years	56-64 years	≥65 years
Low(referent)	1.0	1.0	1.0	1.0
Medium	0.67 (0.43-1.04)	1.08 (0.79-1.47)	1.05 (0.83-1.32)	1.07 (0.86-1.35)
High	**0.49 (0.30-0.79)**	1.19 (0.88-1.62)	1.01 (0.80-1.27)	1.19 (0.96-1.48)
SD units	**0.69 (0.58-0.81)**	0.99 (0.87-1.15)	0.99 (0.90-1.09)	1.05 (0.96-1.15)
Optimism Only				
Low(referent)	1.0	1.0	1.0	1.0
High	**1.52 (1.05-2.22)**	0.97 (0.74-1.26)	1.10 (0.91-1.34)	0.96 (0.80-1.16)
SD units	**0.78 (0.64-0.95)**	0.99 (0.87-1.13)	0.94 (0.86-1.03)	0.96 (0.89-1.03)
Pessimism Only				
Low(referent)	1.0	1.0	1.0	1.0
Medium	1.27 (0.81-1.98)	0.97 (0.72-1.31)	1.12 (0.90-1.34)	0.90 (0.73-1.11)
High	**2.11 (1.35-3.31)**	1.00 (0.72-1.39)	0.98 (0.77-1.24)	**0.77 (0.62-0.97)**
SD units	**1.42 (1.19-1.69)**	0.99 (0.86-1.14)	0.98 (0.90-1.07)	0.93 (0.85-1.02)

Model 4 adjusted for age, sex, SES (education and income), depressive symptoms, and behaviors (physical activity/diet).
Bold indicates statistically significant at p<0.05.

(A)


Prevalent Diabetes
.4
.3
.2
.1
0
Low
Medium
High
Total Optimism
≤45 years
46-55 years
56-64 years
≥65 years

(B)


Prevalent Diabetes
.4
.3
.2
.1
0
1
3
Optimism Only
≤45 years
46-55 years
56-64 years
≥65 years

(C)

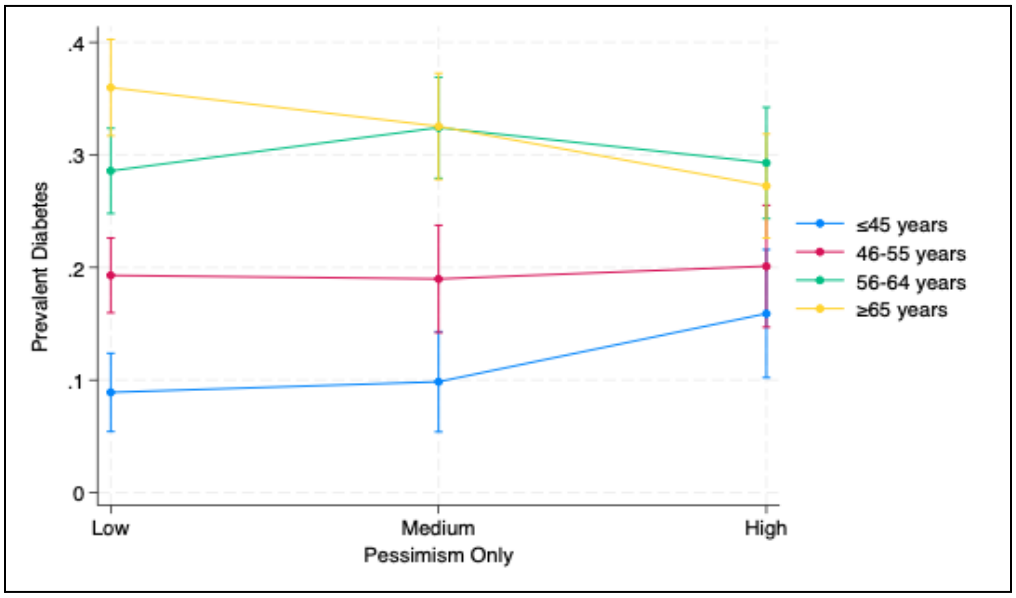


Figure 1. Predictive Associations of TD2 Prevalence ratios (PR 95% CI) by Total Optimism (A), Optimism Only (B), Pessimism (C), JHS (2000–2004; n = 4734). All predicted models are adjusted for age, sex, SES (education and income), depressive symptoms, and behaviors (physical activity/diet).

Discussion

This study examined the associations of optimism with prevalent diabetes where associations varied by age. High (vs. low) optimism was protective of prevalent diabetes, after minimal adjustment. However, measured as a continuous variable, high levels of optimism were significantly protective of prevalent diabetes ($p<0.05$) after adjustment for age and sex, but attenuated after further adjustment. In the age-stratified analysis, we found that high *optimism* (measured in tertiles and continuously) was significantly associated with reduced prevalent diabetes for participants 45 years or younger. In secondary analysis, *optimism only* and *pessimism only* had similar significant trends for participants 45 or younger. In an unexpected finding, high vs low pessimism was significantly associated with reduced prevalence of diabetes. Thus, partial support for our hypothesis was found in that optimism was protective of prevalent diabetes, especially among younger participants.

Sims et al. (14) examined the associations of psychosocial resources (including optimism) with prevalent diabetes using the JHS, and found that high (vs low) optimism was associated with a reduced prevalent TD2 after adjustment for age. We found optimum measured in SD units was protective in fully adjusted models. Sims et al also found that greater optimism was associated with greater prevalence of ideal (vs. poor) physical activity, akin to our findings.

Other related studies of optimism and chronic diseases concur with our results. Amonooet al. (9), Kubzansky et al. (8), and Hernandez et al. (18) lend further credence to the association between ideal physical health, associated with reduced diabetes prevalence, and greater levels of optimism. Hernandez et al (18) found that higher levels of optimism were associated with intermediate and ideal CVH (diet, physical activity, body mass index, smoking, blood sugar, and total cholesterol) when compared to those with lower levels of optimism. This study used multinomial logistic regression to examine these associations. Kubzansky et al. (8) found that alongside biological and behavioral pathways, Optimism, found within Psychosocial Pathways and Stress Buffering, may have a positive effect on CVD because optimistic individuals have larger social networks and are more likely to seek social support. Through this, they theorize that optimism and other facets of psychological well-being may also help buffer against harmful effects of stress. Amonoo et al. (9) noted specifically that optimism is associated with positive health behaviors such as higher levels of physical activity, smoking cessation, and dietary choices linked to improved CVD outcomes, utilizing multiple different observational and clinical studies in their conclusions contrasting with the demographic focus that this study encompasses. These studies show an important distinction that optimism is often not directly correlated with better CVD outcomes, but rather it is associated with positive health behaviors like physical activity, ideal diet, and smoking cessation, which in themselves lead to better

cardiovascular health. Though TD2 does not have a specific focus in these studies, better TD2 outcomes can be extrapolated from the better CVD outcomes these studies analyze. These conclusions contribute further to a greater understanding of the correlation between optimism and health behaviors that are preventative of TD2.

In contrast, Boehm et al. (4) found that life satisfaction and emotional vitality, and not optimism, were associated with reduced diabetes prevalence. While this may seem like a contradictory point, it is similar to the findings of our study. Optimism as measured in standard deviation units showed a significant inverse relationship between levels of optimism and prevalent diabetes. However, after adjustment for SES, depressive symptoms and behaviors, prevalence ratios attenuated. This demonstrates that ideal physical activity potentially mediates the association of optimism and diabetes. An important element to note about the study of Boehm et al. (4), is that their study population consisted of 7,800 middle-aged British men and women versus our study of middle-age and elderly African American men and women. Whether the specific demographics of age, race, and nationality contributed to different analytical outcomes cannot be determined within the scope of this study, but could potentially have an effect, and may serve as a point of analysis in further research.

There are potential mechanisms in the pathway that contribute to the protective effect optimism has on prevalent diabetes. One mechanism includes the *behavioral pathway.* It is likely that highly optimistic persons have more favorable health behaviors that lead to favorable glucose and HbA1c levels. This occurs especially through younger persons who are more physically active and get more sleep than older persons, as seen in our age-stratified analysis. According to Krittanawong et al. "individuals who are happier or more optimistic tend to sleep better, exercise more, eat more healthily, [are] more physically active…" (17). Krittanawong et

al. (17) explain that diet specifically can be positively affected by optimism through habituating favorable dietary patterns leading to reduced hypercholesterolemia and in turn reduced TD2 prevalence. Boehm et al. (19) point out that optimism may act as a buffer and mediator on the negative effects of psychological risk factors (stress and depression), which are themselves associated with poorer CVD and TD2 outcomes. Another mechanism that impacts the association of optimism and diabetes includes the *biological pathway*. More specifically, optimism may influence risk factors for CVD biologically via neurohormonal regulatory processes associated with psychological factors. (17) Krittanawong et al (17) note that psychological distress (e.g., anger, anxiety, depression, post-traumatic stress disorder) is associated with activation of the hypothalamic-pituitary-adrenal (HPA) axis, leading to the risk of developing CVDs such as diabetes. A pessimistic disposition may also lead to downstream CVD risk factors through this pathway, which may explain our pessimism findings (Sims et al., 2019) (14). Optimism is protective of this biologically adverse pathway which means that it is associated with improved TD2 outcomes.

This analysis contains the following limitations. This study uses a cross-sectional design, which limits the ability to draw causal inferences. Additionally, this study is a single site study contained to a single metropolitan area and may be limited in its ability to generalize to other African American populations. The description of variables of diabetes prevalence and ideal health in the forms of physical activity and nutrition were recorded in a binary manner. Diabetes prevalence was determined by fasting plasma glucose, medical evaluation of diabetes status, normal Ha1c, etc. Ideal health variables were organized by whether or not classifications of health were ideal. Physical activity and diet were categorized as ideal or not based on life's simple 7 classification. Additionally, conclusions made using these variables may skew the

representation of optimism data due to this binary simplicity. This study was conducted using data collected in a single metropolitan area, the tri-county area (Hinds, Madison and Rankin counties) of Jackson, Mississippi and trends within this population may not be accurately descriptive of other African American adult populations. The strengths of this study include utilizing data from the JHS, which represents the largest population of data regarding CVD in an African American community. This study utilized an age-stratified design, that allowed detailed examination of the effects of optimism by age category, and discovered more specific data by demographic. The use of optimism only, in addition to the more common total optimism, is a novel analysis that extracts 3 items from the total 6 item scale of total optimism. This allows the observation of optimism without the effects of pessimism, showing specific effects independent of the other construct. Usually studies use combined scores limiting the capacity for association with optimism specifically. The same procedures were also performed with pessimism only values. Although there was an anomalous finding where pessimism was protective of diabetes among persons 65 years and older. This may have been due to small sample size as well, or other factors may need to be considered in future work, such as adjustment for psychosocial resources (social networks, religiosity) that may mitigate or buffer the effect pessimism has on health outcomes such as diabetes.

Conclusion

This study provides some understanding of the association of positive psychological well-being with type 2 diabetes, and shows that having an optimistic disposition may be central to understanding and combating CVD related disparities in African American adults. Optimism was positively associated with prevalent diabetes after minimal adjustment; however, after full adjustment the association weakened and became nonsignificant, which suggests that SES and

behaviors are potential mediators in the association. We also found that the association of optimism with diabetes varied by age and showed optimism was more protective of diabetes among younger participants. Findings from this research may provide the extent to which positive psychological well-being may reduce the prevalence and risk of T2D among different age groups in an at-risk population. Results from this research may also provide insights on how targeted interventions may focus on positive psychosocial well-being that produces optimal diabetes outcomes at select ages to facilitate healthy aging.

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