Title

Racial/Ethnic Discrimination and Diabetes-Related Outcomes Among Latinos with Type 2 Diabetes

Journal

Journal of Immigrant and Minority Health, 21(1)

ISSN

1557-1912

Authors

LeBrón, Alana MW
Spencer, Michael
Kieffer, Edith
et al.

Publication Date

2019-02-01

DOI

10.1007/s10903-018-0710-0

Journal of Immigrant and Minority Health (2019) 21:105–114
https://doi.org/10.1007/s10903-018-0710-0

ORIGINAL PAPER

Racial/Ethnic Discrimination and Diabetes-Related Outcomes Among Latinos with Type 2 Diabetes

Alana M. W. LeBrón[1,2] · Michael Spencer[3] · Edith Kieffer[3] · Brandy Sinco[3] · Gloria Palmisano[4]

Published online: 12 February 2018

Abstract
Discrimination is associated with adverse health outcomes, but few studies have examined the association of discrimination with diabetes-related outcomes including mental health and glycemic control, particularly for immigrant and US-born Latinos. We analyzed survey data (n = 222) collected at baseline of a diabetes intervention. Using multiple linear regression, we examined the association of racial/ethnic discrimination with depressive symptoms, diabetes-related distress, and HbA1c, and variation in these associations by nativity and, for immigrants, length of US residence. Racial/ethnic discrimination was positively associated with depressive symptoms (b = 2.57, SE = 0.45, p < 0.01) and diabetes-related distress (b = 0.30, SE = 0.09, p < 0.01). We could not reject the null hypothesis of no cross-sectional association of racial/ethnic discrimination with HbA1c (b = − 0.27, SE = 0.18, p = 0.14). Although racial/ethnic discrimination did not directly affect HbA1c, racial/ethnic discrimination had a significant mediating effect on HbA1c through diabetes-related distress (p = 0.02). Results suggest that racial/ethnic discrimination is detrimental for health for Latinos with diabetes.

Keywords Latinos · Hispanics · Discrimination · Unfair treatment · Diabetes · Depressive symptoms · Diabetes-related distress

Introduction

Type 2 diabetes is more prevalent among Latinos than non-Latino Whites [1]. Latinos with type 2 diabetes represent an estimated 12.1% of the US Latino population or 6.5 million persons [1]. This population burden of diabetes is likely higher, as estimates indicate that diabetes is underdiagnosed among Mexican immigrants [2]. Relative to non-Latino White adults with diabetes, a greater proportion of Latino adults with diabetes have worse glycemic control [3, 4] and diabetes-related distress [3, 5], exacerbating racial inequalities in diabetes-related outcomes.

A robust literature documents associations of self-reported discrimination with poorer mental health and some indicators of physical health [6–8], though few studies have examined the association of discrimination with diabetes-related outcomes. Prior studies indicate that discrimination (regardless of the social status to which individuals attributed their experience of discrimination) is positively associated with depressive symptoms [9, 10] and diabetes-related distress [9] for Latinos with type 2 diabetes, outcomes that are associated with worse diabetes self-management [11] and glycemic control [12–16]. Accordingly, discrimination may be one mechanism by which mental health and glycemic control may be worsened for Latinos with type 2 diabetes. These studies suggest that discrimination, regardless of status-specific attribution, is detrimental for mental wellbeing for Latinos with diabetes. However, less is known about associations of discrimination attributed to race/ethnicity with diabetes-related outcomes for Latinos.

Some studies have reported associations between status-specific self-reported discrimination and diabetes-related

✉ Alana M. W. LeBrón
alebron@uci.edu

1 Department of Population Health & Disease Prevention, University of California, Irvine, 653 E. Peltason Drive, Anteater Instruction and Research Building (AIRB) 2026, Irvine, CA 92697-3957, USA

2 Department of Chicano/Latino Studies, University of California, Irvine, 3151 Social Science Plaza, Irvine, CA 92697-5100, USA

3 School of Social Work, University of Michigan, 1080 S. University Ave., Ann Arbor, MI 48109, USA

4 Community Health and Social Services Center, Inc., 5635 W Fort St., Detroit, MI 48209, USA

outcomes, including hemoglobin A1c (HbA1c), an indicator of glycemic control, though few such studies have examined these associations for Latinos with diabetes. Potter et al. [17] reported a positive association between weight-based discrimination and diabetes-related distress and HbA1c for a sample of predominantly non-Latino White adults with diabetes. Similarly, Tsenkova et al. [18] reported that weight-based discrimination exacerbated the positive association of waist-to-hip ratio with HbA1c for a predominantly non-Latino White sample of adults who did not have diabetes. Among non-Latino Black and non-Latino White adults with diabetes, Reynolds et al. [19] found that discrimination based on education—but not race, gender, or language use—was associated with poor glycemic control. The evidence linking racial discrimination to diabetes outcomes for non-Latino Black and non-Latino White adults with diabetes is mixed. Dawson et al. [20] report no direct association of racial discrimination with HbA1c for a sample of predominantly non-Latino Black and non-Latino White adults with type 2 diabetes. In contrast, Wagner et al. [21, 22] report an association of racial discrimination with insulin resistance, and a stronger association of racial discrimination and continuous glucose for non-Latina White women with diabetes relative to their non-Latina Black counterparts.

Together, these findings suggest an association of weight-based discrimination and HbA1c for non-Latino Whites, class-based discrimination with HbA1c for samples that include non-Latino White and non-Latino Black adults, a racial minority group also burdened with a high prevalence of diabetes [1], and racial discrimination with glycemic control and insulin resistance for non-Latino White adults with diabetes, and mixed patterns for non-Latino Black adults with diabetes. At issue is whether other dimensions of discrimination, such as discrimination based on race/ethnicity, exacerbate diabetes-related outcomes for racial/ethnic minority groups such as Latinos.

Our interest focuses on the association of racial/ethnic discrimination with diabetes-related co-morbidities and outcomes for Latinos in Detroit, Michigan with type 2 diabetes. Previous studies have demonstrated variations in self-reported discrimination amongst Latinos by immigrant generation, nativity, length of US residence, and age of migration to the US [23, 24], suggesting an effect of nativity, immigrant cohort (i.e. timing and context of migration to the United States), and/or length of exposure to the US racial/ethnic structure on experiences or reporting of discrimination [25]. This literature indicates that it is important to consider differences in reported discrimination by nativity and length of US residence for samples that include Latinos.

In this paper, we examine the association between racial/ethnic discrimination and depressive symptoms, diabetes-related distress, and HbA1c for Latinos with type 2 diabetes, and variations in these associations by nativity and, for immigrants, length of US residence. Accordingly, we evaluated two research questions. First, we examined the association between self-reported racial/ethnic discrimination and depressive symptoms, diabetes-related distress, and HbA1c for Latinos with type 2 diabetes. Consistent with prior studies based on general and status-specific reports of discrimination, we hypothesized that racial/ethnic discrimination would be positively associated with depressive symptoms and diabetes-related distress, in separate regression models. Extending evidence indicating a positive association of weight- and class-based discrimination with HbA1c for non-Latino Whites and non-Latino Blacks, respectively, and mixed studies suggesting an association of racial discrimination with higher HbA1c, we hypothesized that racial/ethnic discrimination would be positively associated with HbA1c. Second, building on the patterning of discrimination by nativity and length of US residence, as described above, we examined whether the hypothesized association of racial/ethnic discrimination and depressive symptoms, diabetes-related distress, and HbA1c varied by nativity and length of US residence. Given the paucity of literature examining variation in associations of discrimination with health among Latinos by nativity and length of US residence, this question was exploratory.

Methods

Sample

Data for this analysis are drawn from the third cohort (n = 222) of the REACH Detroit Partnership community health worker diabetes intervention study. This intervention was conducted by a longstanding community-based participatory research partnership of community organizations, health care systems, and academic institutions to improve diabetes outcomes in Detroit [26–30]. Participants were recruited from a Latino-centered Federally Qualified Health Center (FQHC) where they received health care. Intervention participants were age 18 or older; lived in Southwest Detroit; identified as Hispanic or Latina/o; received medical care from the FQHC; had physician-diagnosed type 2 diabetes; and did not have severe conditions that might limit their participation in the intervention, including blindness, deafness, treatment for cancer, or a terminal illness. Data for this analysis were derived from laboratory measurements and baseline interviews that were conducted between 2009 and 2013 in the participant's preferred language (Spanish or English) prior to the implementation of the intervention. This analysis was based on baseline data from the intervention. The University of Michigan Institutional Review Board approved all study protocols prior to data collection.

Measures

Depressive Symptoms

The nine-item Patient Health Questionnaire (PHQ-9) assessed depressive symptoms over the past 2 weeks [31]. Example items included feeling down, depressed, or hopeless; having little interest or pleasure in doing things; having trouble sleeping; and feeling tired or having little energy. Responses ranged from not at all (0) to nearly every day (3). The depressive symptoms score was calculated as the sum of the nine items (Cronbach's alpha = 0.83). The score ranged from 0 to 27, with higher scores indicating higher levels of depressive symptoms.

Diabetes-Related Distress

Diabetes-related distress was measured using the Diabetes Distress Scale (DDS) [32]. The DDS is a 17-item questionnaire assessing emotional distress in managing and coping with diabetes in the past month. Example items include feeling overwhelmed by the demands of living with diabetes, worrying about the possibility of serious diabetes-related complications, and feeling that you are failing in managing diabetes. Responses were recoded such that they ranged from not a problem (1) to a very serious problem (6). The score for the diabetes-related distress scale was the mean of the responses to these 17 items (range 1–5.18; Cronbach's alpha = 0.93). Higher scores indicated greater diabetes-related distress.

HbA1c

HbA1c assesses a person's average blood glucose or blood sugar over the past 2–3 months [33]. The American Diabetes Association currently classifies diagnosed diabetes as HbA1c ≥ 6.5% [34]. HbA1c levels, as measured with a Bayer DCA2000+ Analyzer, were collected at the time of randomization [26]. In accordance with the National Diabetes Data Group guidelines, this assay has a test coefficient variation < 5% [35]. On average, HbA1c laboratory tests were performed 8.7 days (SD = 9.2 days) before the baseline interview (range 54 days pre-interview to 11 days post-interview).

Self-reported Racial/Ethnic Discrimination

Self-reported racial/ethnic discrimination, the independent variable, was adapted from the Everyday Unfair Treatment scale [36], which assesses the occurrence and frequency of discrimination in day-to-day encounters. These questions were modified to assess experiences that participants attributed to their Hispanic or Latino racial/ethnic identity. Participants were asked how often in their day-to-day life they experienced any of five discriminatory situations that were linked to their Hispanic or Latino identity (i.e., "because you are Hispanic or Latino"). These items included: being treated with less respect than others, receiving poorer service than other people at restaurants or stores, people acting as if they think that you are not smart, being threatened or harassed, and being treated unfairly or badly. Responses were recoded such that they ranged from never (0) to always (4). The racial/ethnic discrimination scale was the mean of these five items (range 0–4; Cronbach's alpha = 0.84). Higher scores indicated more frequent experiences of reported racial/ethnic discrimination.

Nativity and Length of US Residence

Following the work of Finch et al. [37], nativity and length of US residence were assessed by a combined, three-level categorical variable based upon participant's report of country or territory of birth and, for immigrants, length of residence in the US (US-born Latinos [referent]; immigrants who lived in the US for < 15 years; and immigrants who lived in the US for ≥ 15 years).

Covariates

Social and economic characteristics included: age (< 40, 40–49, 50–59, and 60 years or older (referent)); gender (*woman* = 1; *man* = 0); relationship status (*married/living with a partner* = 1; *other relationship status* = 0); educational attainment (*high school education or higher* = 1, *less than high school education* = 0); and employment status (*employed* = 1, *not employed* = 0). In addition, we accounted for Latino identity (*Mexican, Mexican American, or Chicano* = 1, *another Latino subgroup* = 0), and Spanish language preference. Spanish language preference was assessed by a question that asked participants the language in which they felt most comfortable speaking. Response options were: Spanish, English, Spanish and English about the same, and neither English nor Spanish. We then created a binary variable: persons who are more comfortable speaking Spanish (1) and those comfortable speaking English, either, or neither (0). Diabetes self-management, based on the eight-item Diabetes Self-Care Activities scale, includes conducting regular glucose tests and foot checks, taking antihyperglycemic medications, following a healthy eating plan, and engaging in physical activity, and was included as a covariate [38].

Analysis

Exploratory data analysis techniques were used to assess the distribution of the independent variables and to investigate multicollinearity. Means and frequencies were calculated to

determine the best strategy to incorporate variables into the models. In separate models, ordinary least squares regression was used to assess the association between racial/ethnic discrimination and the three outcome variables: depressive symptoms, diabetes-related distress, and HbA1c. To address each research question, using baseline intervention data, in separate models the outcome variable (i.e. depressive symptoms, diabetes-related distress, or HbA1c) was regressed on racial/ethnic discrimination, controlling for social and economic characteristics and diabetes self-management. In models that regressed HbA1c on racial/ethnic discrimination, depressive symptoms and diabetes-related distress were included as covariates given previous studies establishing a correlation between depressive symptoms and diabetes-related distress and the explanatory and outcome variables [9, 12, 13, 39]. For the HbA1c model, the Akaike and Bayesian information criteria (AIC and BIC) were used to compare models with diabetes-related distress and depressive symptoms as additional independent variables. Based on the AIC and BIC criteria, the best fitting HbA1c model included diabetes-related distress and depressive symptoms. For both diabetes-related distress and depressive symptoms, the mediation between discrimination and each of these variables on HbA1c was assessed with the Sobel–Goodman mediation test. We then evaluated whether the association of racial/ethnic discrimination with each outcome variable varied by nativity or length of US residence by including an interaction of discrimination (mean-centered) and nativity and length of US residence in the models. We compared the fit of the models by comparing the information criteria (AIC and BIC). To facilitate a comparison of the association of racial/ethnic discrimination with each of the three outcome variables, we also conducted analyses using standardized regression (Table 3). Standardized regression variables were computed by subtracting the mean of each variable and dividing by the standard deviation. To check that multicollinearity was not distorting any results, all regression output included the variance inflation factor (VIF) and it was always < 10. All analyses were conducted using Stata 14.2.

Results

Presented in Table 1 are participant characteristics. The average age was 48.9 years (SD = 10.6 years). Sixty percent of participants were women (60.8%). Nearly one-third of participants had a high school education or higher (30.6%) and 42.8% were employed. The majority were married or living with a partner (70.3%) and were more comfortable speaking Spanish (80.6%). Eighty percent (80.2%) of participants identified as Mexican, Mexican American, or Chicano, and 19.8% identified with another Latino subgroup. The US territory of Puerto Rico and Central American countries were among other common Latin American regions with which participants identified. The majority of participants were immigrants (81.5%). Among immigrants, 51.4% resided in the US for < 15 years and 48.6% for ≥ 15 years.

Table 1 Sample characteristics, REACH Community Health Worker Diabetes Intervention Study, Detroit, MI, 2009–2013 (n = 222)

	n	Percent	Mean	SD
Age (years)			48.85	10.58
Women	135	60.8		
Employed	95	42.8		
High school graduate	68	30.6		
Married or partnered	156	70.3		
Latino identity				
Mexican, Mexican American, or Chicano	178	80.2		
Other Latino origin or descent	44	19.8		
Place of birth				
US	39	17.5		
Mexico	152	68.4		
Other Latin American country	29	13.1		
Missing	2	1.0		
Length of US residence				
< 15 years	93	41.9		
15 years or more	88	39.6		
Lifetime	39	17.6		
Missing	2	0.9		
Most comfortable speaking Spanish	179	80.6		
Diabetes self-management			3.22	1.15
Racial/ethnic discrimination (continuous)[a]			0.73	0.75
Racial/ethnic discrimination (any experience)	152	68.5		
Depressive symptoms			5.67	5.19
Diabetes-related distress			2.07	1.00
HbA1c			7.83	1.88

[a]For each discrimination item, 0 = *never*, 1 = *hardly ever*, 2 = *sometimes*, 3 = *often*, 4 = *always*

The mean racial/ethnic discrimination score was 0.73 (SD = 0.75), with more than two-thirds (68.5%) of participants reporting racial/ethnic discrimination. The mean depressive symptoms and diabetes-related distress scores were 5.67 (SD = 5.19) and 2.07 (SD = 1.00), respectively. The average HbA1c was 7.83% (SD = 1.88). There was a moderate, though statistically significant correlation between depressive symptoms and diabetes-related distress (r = 0.39; p < 0.001), below the correlation reported by Fisher et al. [13] (r = 0.48, p < 0.001). In this sample, there was no correlation between depressive symptoms and HbA1c (r = 0.02; p = 0.74), contrary to findings reported by Fisher et al. [13] (r = 0.14, p = 0.002). Finally, there was a weak, though statistically significant correlation of diabetes-related distress

Table 2 Mental health & HbA1c regressed on racial/ethnic discrimination, nativity, and length of US residence, REACH Community Health Worker Diabetes Intervention Study, Detroit, MI, 2009–2013

	Depressive symptoms			Diabetes-related distress			HbA1c		
	Model 1			Model 2			Model 3		
	B	SE	p-value	B	SE	p-value	B	SE	p-value
Intercept	9.23	1.92	< 0.01	1.81	0.37	< 0.01	6.71	0.78	< 0.01
Discrimination	2.57	0.45	< 0.01	0.30	0.09	< 0.01	−0.27	0.18	0.14
< 15 years in US	0.03	1.40	0.98	−0.13	0.27	0.62	0.28	0.52	0.60
≥ 15 years in US	0.28	1.32	0.83	−0.10	0.25	0.68	0.53	0.49	0.28
Depressive symptoms							< 0.01	0.03	0.97
Diabetes-related distress							0.45	0.15	< 0.01
R-square	0.20			0.19			0.13		

Referent group is US-born Latinos. Models 1–3 adjust for age, gender, relationship status, educational attainment, employment status, country or territory of origin or descent, Spanish language preference, and diabetes self-management. Model 3 also adjusts for depressive symptoms and diabetes-related distress

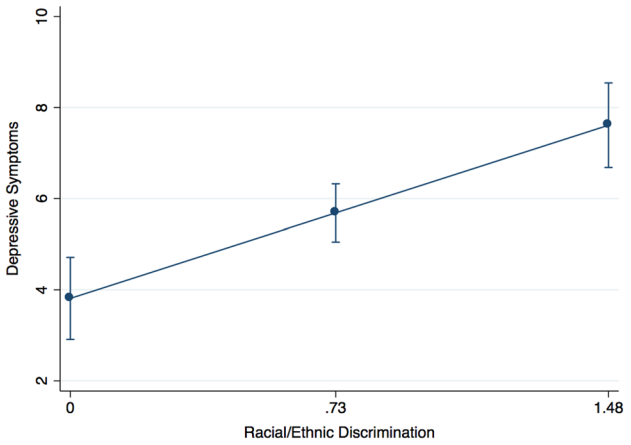

Fig. 1 Depressive symptoms regressed on racial/ethnic discrimination. Figure above illustrates the positive association of racial/ethnic discrimination with depressive symptoms, comparing associations for individuals reporting no racial/ethnic discrimination (0), the average level of racial/ethnic discrimination (0.73) in this sample, and the frequency of racial/ethnic discrimination one standard deviation above the sample mean (1.48)

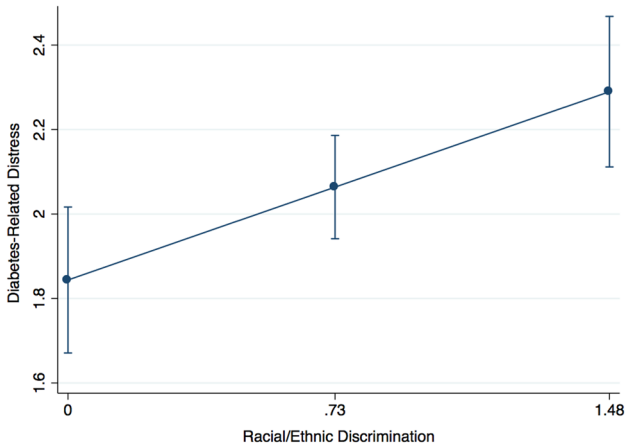

Fig. 2 Diabetes-related distress regressed on racial/ethnic discrimination. Figure above illustrates the positive association of racial/ethnic discrimination with diabetes-related distress, comparing associations for individuals reporting no racial/ethnic discrimination (0), the average level of racial/ethnic discrimination (0.73) in this sample, and the frequency of racial/ethnic discrimination one standard deviation above the sample mean (1.48)

and HbA1c (r = 0.14; p = 0.03), similar to reports by Fisher et al. [13] (r = 0.17, p = 0.001).

Racial/Ethnic Discrimination and Depressive Symptoms

We first examined the association of racial/ethnic discrimination with depressive symptoms (Table 2). Consistent with our hypothesis, more frequent reports of racial/ethnic discrimination were associated with significantly higher levels of depressive symptoms (b = 2.57, SE = 0.45, p < 0.01; Model 1; Fig. 1), after accounting for covariates. In tests of the second research question, the hypothesized association of reported racial/ethnic discrimination with depressive symptoms did not vary by nativity or length of US residence. Based on the information criteria, the model fit better without the interaction of discrimination with nativity and length of US residence.

Racial/Ethnic Discrimination and Diabetes-Related Distress

Next, we examined the association between reported racial/ethnic discrimination and diabetes-related distress. More frequent reports of racial/ethnic discrimination were significantly associated with elevated diabetes-related distress (b = 0.30, SE = 0.09, p < 0.01; Table 2, Model 2; Fig. 2), after accounting for covariates. The association of self-reported racial/ethnic discrimination with diabetes-related distress did not vary by nativity or length of US residence.

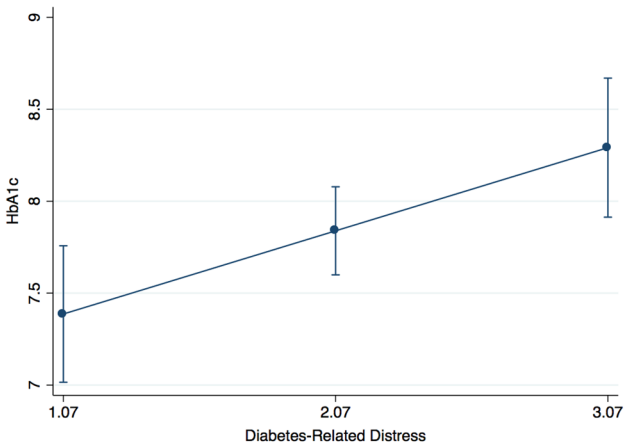

Fig. 3 HbA1c regressed on diabetes-related distress. Figure above illustrates the positive association of diabetes-related distress with HbA1c, comparing associations for individuals with diabetes-related distress one standard deviation below the sample mean (1.07), the mean level of diabetes-related distress (2.07) in this sample, and diabetes-related distress one standard deviation above the sample mean (3.07). Diabetes-related distress significantly mediated the association of racial/ethnic discrimination and HbA1c

The information criteria indicated that the model without the interaction term was the best fit of the data.

Racial/Ethnic Discrimination and HbA1c

We did not find evidence to support the hypothesis of a direct association between self-reported racial/ethnic discrimination and HbA1c (b = − 0.27, SE = 0.18, p = 0.14; Table 2, Model 3). The Sobel–Goodman test for mediation indicated that diabetes-related distress significantly mediated the association of racial/ethnic discrimination with HbA1c, with approximately 62% of the total effect being mediated (proportion of total effect that is mediated: −0.62, p = 0.02). The positive association of diabetes-related distress with HbA1c, a mediator of the association of racial/ethnic discrimination and HbA1c, is presented in Fig. 3. Depressive symptoms did not mediate the association of racial/ethnic discrimination with HbA1c (p = 0.42). Again, the model information criteria indicated that the regression model without the interaction of discrimination with nativity and length of US residence was a best fit of the data.

Finally, we evaluated the relative association of racial/ethnic discrimination with each of the three dependent variables (Table 3). Results suggest that a one-standard deviation increase in racial/ethnic discrimination has a greater relative magnitude of association with depressive symptoms compared to diabetes-related distress (Table 3, Models 1 and 2). However, the 95% confidence intervals overlapped, indicating that these differences were not statistically significant.

Table 3 Standardized regression coefficients for mental health & HbA1c regressed on racial/ethnic discrimination, nativity, and length of US residence, REACH Community Health Worker Diabetes Intervention Study, Detroit, MI, 2009–2013

	Depressive Symptoms				Diabetes-Related Distress				HbA1c			
	Model 1				Model 2				Model 3			
	B	Lower 95% CI	Upper 95% CI	p-value	B	Lower 95% CI	Upper 95% CI	p-value	B	Lower 95% CI	Upper 95% CI	p-value
Intercept	< 0.01	− 0.12	0.12	1.00	< 0.01	− 0.12	0.13	0.95	< 0.01	− 0.13	0.13	0.98
Discrimination	0.37	0.24	0.50	< 0.01	0.23	0.11	0.36	< 0.01	− 0.11	− 0.26	0.03	0.12
< 15 years in US	0.02	− 0.23	0.27	0.88	− 0.14	− 0.39	0.12	0.29	0.11	− 0.16	0.37	0.42
≥ 15 years in US	0.04	− 0.20	0.28	0.73	− 0.11	− 0.35	0.12	0.35	0.17	− 0.08	0.42	0.18
Depressive symptoms									0.23	0.08	0.38	< 0.01
Diabetes-related distress									< 0.01	− 0.15	0.16	0.95
R-square	0.20				0.20				0.13			

Referent group is US-born Latinos. Models 1–3 adjust for age, gender, relationship status, educational attainment, employment status, country or territory of origin or descent, Spanish language preference, and diabetes self-management. Model 3 also adjusts for depressive symptoms and diabetes-related distress

Discussion

We used data from an urban US sample of middle-aged Latino adults with type 2 diabetes to examine the association between self-reported racial/ethnic discrimination and depressive symptoms, diabetes-related distress, and HbA1c. There are three key findings from this study. First, in this sample, approximately two-thirds of Latinos reported experiencing racial/ethnic discrimination. Notably, the high level of reported racial/ethnic discrimination in this sample is double the prevalence of discrimination reported by a similar population of Latinos from the same Detroit community 4–8 years prior [9], suggesting heightened discrimination for Latinos with diabetes in this urban community over time. Second, reported racial/ethnic discrimination was significantly associated with depressive symptoms and diabetes-related distress, regardless of nativity and length of US residence. Third, diabetes-related distress mediated the association of racial/ethnic discrimination with HbA1c. Below, we discuss each of these findings in greater detail.

The higher prevalence of reported racial/ethnic discrimination in this sample, relative to reports of personally-mediated discrimination regardless of attribution for a cohort of Detroit residents with diabetes 4–8 years earlier, suggests that Latinos in this Midwest urban community experienced a heightened context of racism at the time of this study. In 2009–2013, when the REACH diabetes intervention was underway, Latino and immigrant communities in Detroit, MI navigated a shifting context of institutional and personally-mediated racism, including heightened immigration enforcement and enhanced collaborations between local law enforcement agencies and immigration enforcement. Additionally, the state of Michigan began denying driver's licenses and state IDs to immigrants who could not prove their documented status. These processes limit undocumented immigrants' and their network members' access to health-promoting resources and enhance exposure to racialized stressors [41–43]. Previous studies link immigration enforcement with declines in health and health care utilization for US-born and immigrant Latinos [45–49]. Accordingly, racial/ethnic discrimination experienced by Latino immigrants and US-born Latinos in this sample may have reflected different forms or intensity over the study period.

Our finding of a positive association of more frequent reports of racial/ethnic discrimination with depressive symptoms for Latinos with diabetes builds on other studies [9, 10] involving general (i.e. not race/ethnicity-specific) measures of discrimination assessed by the Everyday Unfair Treatment scale [36]. The results presented here align with a broader literature linking reported discrimination with depressive symptoms for persons who do not have diabetes [6, 50, 51] and extend this literature to discrimination that respondents attributed to their race/ethnicity. Further, results indicating a significant association of more frequent reports of racial/ethnic discrimination with diabetes-related distress are consistent with those found for another sample involving Latinos with type 2 diabetes [9]. Understanding the health implications of discrimination attributed to race/ethnicity, rather than discrimination more broadly, facilitates the identification of mechanisms by which discrimination linked with marginalized social statuses may shape health. Indeed, previous literature suggests that the status(es) to which individuals attribute their experiences of discrimination may shape health differently [19]. The significant patterning of racial/ethnic discrimination with these indicators of mental distress suggests that racialization-related stressors may exacerbate mental health comorbidities for Latinos with type 2 diabetes, factors that are associated with worse diabetes management [11] and glycemic control [12–16].

Diabetes-related distress mediated the association of racial/ethnic discrimination with HbA1c, suggesting the need to consider complex associations of chronic stressors such as discrimination with multiple, interconnected diabetes-related outcomes. Despite previous studies indicating that reports of personally-mediated discrimination for Latinos vary by immigrant generation, nativity, length of US residence, and age of migration to the US [23, 24], tests of model fit indicated that models examining the main effect of racial/ethnic discrimination, rather than effect modification by nativity and length of US residence, were the best fit of the data. These findings suggest the importance of considering mechanisms by which chronic stressors shape physical and mental health outcomes. The results presented here suggest that as a chronic stressor, racial/ethnic discrimination may impair glucose control and exacerbate diabetes progression. Indeed, evidence indicates that physiologic responses to chronic stressors contribute to protracted elevation of cortisol levels and enhanced metabolic stress, dysregulating glucose control [52, 53]. These findings further contextualize mechanisms by which discrimination may exacerbate racial/ethnic inequities in diabetes, including through mental health and pathways from mental health to impairment of glucose levels.

The results reported here join a mixed literature regarding the association of discrimination with HbA1c. Studies have reported a positive association of weight-based discrimination [17, 18] and education-based discrimination with HbA1c for non-Latino Black and non-Latino White adults [19]. Other studies suggest mixed findings regarding the association of racial discrimination with HbA1c or insulin resistance for non-Latino Black and non-Latino White adults with type 2 diabetes [21, 22]. Our assessment

of these associations indicates that racial/ethnic discrimination is associated with poorer mental well-being, namely depressive symptoms and diabetes-related distress, and with HbA1c through its association with diabetes-related distress. While these findings are not causal, they suggest that racial/ethnic discrimination is cross-sectionally patterned with poor mental and physical health for Latinos with diabetes.

Future studies are warranted that investigate these patterns within larger samples of Latinos, other Latino subgroups, as well as multi-racial samples. Studies are needed that examine the longitudinal association of discrimination with the diabetes-related outcomes examined here, whether these associations vary by discrimination attribution(s) (e.g., race/ethnicity, other social statuses, multiple social statuses), and the mechanisms by which discrimination influences diabetes outcomes.

Limitations and Strengths

These findings should be understood in the context of several limitations. First, the independent variable, self-reported racial/ethnic discrimination, assessed reports of a particular set of personally mediated forms of discrimination that participants attributed to their Hispanic or Latino race/ethnicity. As racism is a dynamic and relational process [54, 55], this scale may not capture the full range of experiences of racial/ethnic discrimination in the twenty-first century, the institutions and systems that magnify and reinforce racism, nor discrimination linked with other racialized statuses (e.g., place of birth, language use [56]). Further, as experiences are often shaped by multiple social statuses and identities [55, 57, 58], restricting experiences of discrimination to those that participants attributed to their Hispanic or Latino identity may contribute to an underestimation of discrimination linked with a complex set of social statuses. Second, the moderate sample size prevented the use of more sophisticated measures of social characteristics. For example, while it was important to account for Latino identity and educational attainment, the limited number of participants in some subgroups precluded the use of more nuanced measures of social status or the examination of variations in these associations by multiple social statuses. Third, the different temporal periods encompassed by the dependent variables precludes direct comparisons of the relative associations of racial/ethnic discrimination with depressive symptoms, diabetes distress, and HbA1c. However, the reporting of standardized regression coefficients (Table 3) offers an opportunity to compare the relative associations across models. Fourth, in this cross-sectional analysis, the association of racial/ethnic discrimination with depressive symptoms, diabetes-related distress, and HbA1c should not be interpreted as causal. Finally, participants received high-quality health care and social services from the local FQHC specialized in serving the diverse Latino community in Detroit, Michigan, where experiences of discrimination may be more limited. Controlling for the impact of level of diabetes self-management may only partially account for these factors.

Despite these limitations, this study is also characterized by several strengths. First, this study extends the limited literature examining the association of discrimination with HbA1c and diabetes-related distress and depressive symptoms among persons with diabetes [9, 10, 19] by examining the implications of racial/ethnic discrimination for diabetes-related outcomes for Latinos with type 2 diabetes, an area that has been understudied for Latinos. Second, reflecting heterogeneity in the Latino population, this study considered variations in these associations by nativity and length of US residence. Third, these findings are based upon validated measures of discrimination [36], mental wellbeing [31, 32], and standardized laboratory assessment of HbA1c [35].

Conclusions

The present study examined the patterning of self-reported racial/ethnic discrimination with mental wellbeing and HbA1c among an urban sample of Latinos with type 2 diabetes. The findings from this study indicate that racial/ethnic discrimination is an important stressor influencing the day-to-day lives and mental and physical wellbeing among Latinos with diabetes. Results reported here suggest that racial/ethnic discrimination may exacerbate depressive symptoms and diabetes-related distress among Latinos with diabetes, which literature links with glycemic control [3, 12–15]. The mediating role of diabetes-related distress on the association of racial/ethnic discrimination with HbA1c suggests a need to examine the health implications of discrimination for Latinos through a framework that considers the interconnected associations with multiple diabetes-related outcomes. Findings indicate a need to reduce and eliminate racialized stressors, and to factor the racialized experiences of Latinos into diabetes interventions and treatment. If we are to successfully reduce diabetes-related inequities, we must develop policy and programmatic interventions to disrupt the processes that contribute to racial/ethnic discrimination and the institutionalization of racism.

Acknowledgements We thank the Community Health and Social Services (CHASS) and REACH Detroit Partnership staff, the REACH Detroit Partnerships Steering Committee (http://www.reachdetroit.org), and the REACH Detroit Family Intervention Participants for their involvement in this study. The REACH Detroit Partnership is affiliated with the Detroit Community-Academic Urban Research Center (http://www.sph.umich.edu/URC). This research was supported by the National Institute of Diabetes and Digestive and Kidney Disease (R18DK0785501: Spencer, PI), Peers for Progress grant from the American Association of Family Physicians Foundation (Grant P30DK092926) (Michigan Center for Diabetes Translational

Research), and by the Centers for Disease Control and Prevention (Cooperative Agreement No. U50/CCU417409). The results presented here are solely the responsibility of the authors and do not necessarily represent the views of the funding sources.

Compliance with Ethical Standards

Conflict of interest The authors declare no conflict of interest.

Ethical Approval The University of Michigan Institutional Review Board approved all study protocols prior to data collection.

References

1. Centers for Disease Control and Prevention. National Diabetes Statistics Report, 2017: Estimates of Diabetes and Its Burden in the United States. Atlanta, GA; 2017. https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf.
2. Barcellos SH, Goldman DP, Smith JP. Undiagnosed disease, especially diabetes, casts doubt on some of reported health "advantage" of recent Mexican immigrants. Health Aff. 2012;31:2727–37.
3. Heisler M. Mechanisms for racial and ethnic disparities in glycemic control in middle-aged and older Americans in the health and retirement study. Arch. Intern. Med. 2007;167:1853. http://www.ncbi.nlm.nih.gov/pubmed/17893306.
4. Ali MK, Bullard KM, Imperatore G, Barker L, Gregg EW. Characteristics associated with poor glycemic control among adults with self-reported diagnosed diabetes—National Nutrition Examination Survey, United States, 2007–2010. Mortal Morb Wkly Rep. 2012;61:32–7.
5. Spencer MS, Kieffer EC, Sinco BR, Palmisano G, Guzman JR, James S, et al. Diabetes-specific emotional distress among African Americans and Hispanics with type 2 diabetes. J Health Care Poor Underserved. 2006;17:88–105.
6. Paradies Y, Ben J, Denson N, Elias A, Priest N, Pieterse A, et al. Racism as a determinant of health: a systematic review and meta-analysis. PLoS ONE. 2015;10:e0138511.
7. Lewis TT, Cogburn CD, Williams DR. Self-reported experiences of discrimination and health: scientific advances, ongoing controversies, and emerging issues. Annu. Rev. Clin. Psychol. 2015. http://www.ncbi.nlm.nih.gov/pubmed/25581238.
8. Williams DR, Mohammed SA. Racism and health: pathways and scientific evidence. Am Behav Sci. 2013;57:1199–216.
9. LeBron AMW, Valerio MA, Kieffer E, Sinco B, Rosland A-M, Hawkins J, et al. Everyday discrimination, diabetes-related distress, and depressive symptoms among African Americans and Latinos with diabetes. J Immigr Minor Health. 2014;16.
10. March D, Williams J, Wells S, Eimicke JP, Teresi JA, Almonte C, et al. Discrimination and depression among urban hispanics with poorly controlled diabetes. Ethn Dis. 2015;25:130–7.
11. Hernandez R, Ruggiero L, Riley BB, Wang Y, Chavez N, Quinn LT, et al. Correlates of self-care in low-income African American and Latino patients with diabetes. Health Psychol. 2014;33:597–607. http://www.ncbi.nlm.nih.gov/pubmed/24364373.
12. Fisher L, Skaff MM, Mullan JT, Arean P, Mohr D, Masharani U, et al. Clinical depression versus distress among patients with type 2 diabetes: not just a question of semantics. Diabetes Care. 2007;30:542–8.
13. Fisher L, Mullan JT, Arean P, Glasgow RE, Hessler D, Masharani U. Diabetes distress but not clinical depression or depressive symptoms is associated with glycemic control in both cross-sectional and longitudinal analyses. Diabetes Care. 2010;33:23–8.
14. Fisher L, Skaff MM, Mullan JT, Arean P, Glasgow R, Masharani U. A longitudinal study of affective and anxiety disorders, depressive affect and diabetes distress in adults with type 2 diabetes. Diabet Med. 2008;25:1096–101.
15. Leyva B, Zagarins SE, Allen NA, Welch G. The relative impact of diabetes distress vs depression on glycemic control in hispanic patients following a diabetes self-management education intervention. Ethn Dis. 2011;21:322–7. http://ezproxy.spu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip&db=cmedm&AN=21942165&site=ehost-live.
16. Tanenbaum ML, Ritholz MD, Binko DH, Baek RN, Erica Shreck MS, Gonzalez JS. Probing for depression and finding diabetes: a mixed-methods analysis of depression interviews with adults treated for type 2 diabetes. J Affect Disord. 2013;150:533–9.
17. Potter L, Wallston K, Trief P, Ulbrecht J, Juth V, Smyth J. Attributing discrimination to weight: associations with well-being, self-care, and disease status in patients with type 2 diabetes mellitus. J Behav Med. 2015;38:863–75.
18. Tsenkova VK, Carr D, Schoeller DA, Ryff CD. Perceived weight discrimination amplifies the link between central adiposity and nondiabetic glycemic control (HbA1c). Ann Behav Med. 2011;41:243–51.
19. Reynolds DB, Walker RJ, Campbell JA, Egede LE. Differential effect of race, education, gender, and language discrimination on glycemic control in adults with type 2 diabetes. Diabetes Technol Ther. 2015;17:243–7. http://www.scopus.com/inward/record.url?eid=2-s2.0-84925086728&partnerID=tZOtx3y1.
20. Dawson AZ, Walker RJ, Campbell JA, Egede LE. Effect of perceived racial discrimination on self-care behaviors, glycemic control, and quality of life in adults with type 2 diabetes. Endocrine. 2015;49:422–8.
21. Wagner JA, Tennen H, Feinn R, Finan PH. Racial discrimination and metabolic control in women with type 2 diabetes. Ethn Dis. 2013;23:421–7. http://www.ncbi.nlm.nih.gov/pubmed/24392603.
22. Wagner JA, Tennen H, Feinn R, Osborn CY. Self-reported discrimination, diabetes distress, and continuous blood glucose in women with type 2 diabetes. J Immigr Minor Health. 2015;17:566–73.
23. Pérez DJ, Fortuna L, Alegría M. Prevalence and correlates of everyday discrimination among U.S. latinos. J Community Psychol. 2008;36:421–33.
24. LeBrón AMW, Spencer M, Kieffer E, Sinco B, Piatt G, Palmisano G. Correlates of interpersonal ethnoracial discrimination among Latino adults with diabetes: findings from the REACH Detroit Study. J Ethn Cult Divers Soc Work. 2017;26:48–67.
25. Viruell-Fuentes EA. Beyond acculturation: Immigration, discrimination, and health research among Mexicans in the United States. Soc Sci Med. 2007;65:1524–35.
26. Tang TS, Funnell M, Sinco B, Piatt G, Palmisano G, Spencer MS, et al. Comparative effectiveness of peer leaders and community health workers in diabetes selfmanagement support: results of a randomized controlled trial. Diabetes Care. 2014;37:1525–34.
27. Kieffer EC, Willis SK, Odoms-Young AM, Guzman JR, Allen AJ, Feathers JT, et al. Reducing disparities in diabetes among African-American and Latino residents of Detroit: the essential role of community planning focus groups. Ethn Dis. 2004;14:S27–37.
28. Feathers JT, Kieffer EC, Palmisano G, Anderson M, Janz N, Spencer MS, et al. The development, implementation, and process evaluation of the REACH Detroit Partnership's Diabetes Lifestyle Intervention. Diabetes Educ. 2007;33:509–20. http://www.ncbi.nlm.nih.gov/pubmed/17570882.
29. Two Feathers J, Kieffer EC, Palmisano G, Anderson M, Sinco B, Janz N, et al. Racial and Ethnic Approaches to Community Health (REACH) Detroit partnership: improving diabetes-related

outcomes among African American and Latino adults. Am J Public Health. 2005;95:1552–60.
30. Spencer MS, Rosland A-M, Kieffer EC, Sinco BR, Valerio M, Palmisano G, et al. Effectiveness of a community health worker intervention among African American and Latino adults with type 2 diabetes: a randomized controlled trial. Am J Public Health. 2011;101:2253–60. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3222418&tool=pmcentrez&rendertype=abstract.
31. Huang FY, Chung H, Kroenke K, Delucchi KL, Spitzer RL. Using the Patient Health Questionnaire-9 to measure depression among racially and ethnically diverse primary care patients. J Gen Intern Med. 2006;21:547–52.
32. Polonsky WH, Fisher L, Earles J, Dudl RJ, Lees J, Mullan J, et al. Assessing psychosocial distress in diabetes: development of the diabetes distress scale. Diabetes Care. 2005;28:626–31.
33. Association AD. A1C and eAG. http://www.diabetes.org/living-with-diabetes/treatment-and-care/blood-glucose-control/a1c/. Accessed 17 Aug 2017.
34. American Diabetes Association. Diagnosing diabetes and learning about prediabetes. 2017. http://www.diabetes.org/diabetes-basics/diagnosis/?loc=db-slabnav. Accessed 20 Aug 2017.
35. Arsie MP, Marchioro L, Lapolla A, Giacchetto GF, Bordin MR, Rizzotti P, et al. Evaluation of diagnostic reliability of DCA 2000 for rapid and simple monitoring of HbA1c. Acta Diabetol. 2000;37:1–7.
36. Williams DR, Yu Y, Jackson JS, Anderson NB. Racial differences in physical and mental health: socio-economic status, stress and discrimination. J Health Psychol. 1997;2:335–51.
37. Finch B, Kolody B, Vega W. Perceived discrimination and depression among Mexican-origin adults in California. J Health Soc Behav. 2000;41:295–313.
38. Toobert DJ, Hampson SE, Glasgow RE. The summary of diabetes self-care activities measure: results from 7 studies and a revised scale. Diabetes Care. 2000;23:943–50.
39. Fisher L, Glasgow RE, Strycker LA. The relationship between diabetes distress and clinical depression with glycemic control among patients with type 2 diabetes. J Manag Care Pharm. 2010;33:1034–6. http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2858170&tool=pmcentrez&rendertype=abstract.
40. Miller T. Border patrol nation: dispatches from the front lines of homeland security. San Francisco: City Lights Books; 2014.
41. Cox AB, Miles TJ. Policing immigration. Univ Chicago Law Rev. 2013;80:87–136. http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=86925342&site=ehost-live.
42. LeBrón AMW, Lopez WD, Cowan K, Novak NL, Temrowski O, Ibarra-Frayre M, et al. Restrictive ID policies: implications for health equity. J Immigr Minor Health. 2017. https://doi.org/10.1007/s10903-017-0579-3.
43. LeBrón AMW, Schulz AJ, Mentz GB, Reyes A, Gamboa C, Israel BA, et al. Impact of change over time in self-reported discrimination on blood pressure: implications for inequities in cardiovascular risk for a multi-racial urban community. Ethn Health. 2018. https://doi.org/10.1080/13557858.2018.1425378.
44. Novak NL, Geronimus AT, Martinez-Cardoso AM. Change in birth outcomes among infants born to Latina mothers after a major immigration raid. Int J Epidemiol. 2017;46:839–49.
45. Lopez WD, Daniel J. Kruger J, Delva M, Llanes C, Ledon A, Waller, et al. Health implications of an immigration raid: findings from a Latino community in the midwestern United States. J Immigr Minor Health. 2016;19:702–8.
46. Rhodes SD, Mann L, Simán FM, Song E, Alonzo J, Downs M, et al. The impact of local immigration enforcement policies on the health of immigrant Hispanics/Latinos in the United States. Am J Public Health. 2015;105:329–37.
47. Kline N. Pathogenic policy: immigrant policing, fear, and parallel medical systems in the US South. Med. Anthropol. 2016;36:396–410.
48. Toomey RB, Umaña-Taylor AJ, Williams DR, Harvey-Mendoza E, Jahromi LB, Updegraff KA. Impact of Arizona's SB 1070 immigration law on utilization of health care and public assistance among mexican-origin adolescent mothers and their mother figures. Am J Public Health. 2014;104:S28–34.
49. Vargas ED. Immigration enforcement and mixed-status families: the effects of risk of deportation on Medicaid use. Child Youth Serv Rev. 2016;57:83–9.
50. Williams DR, Neighbors HW, Jackson JS. Racial/ethnic discrimination and health: findings from community studies. Am J Public Health. 2003;93:200–8.
51. Williams DR, Mohammed SA. Discrimination and racial disparities in health: evidence and needed research. J Behav Med. 2009;32:20–47.
52. Picard M, Juster R-P, McEwen BS. Mitochondrial allostatic load puts the "gluc" back in glucocorticoids. Nat. Rev. Endocrinol. 2014;10:303–10. http://www.nature.com/nrendo/journal/v10/n5/full/nrendo.2014.22.html.
53. McEwen BS, Wingfield JC. What is in a name? Integrating homeostasis, allostasis and stress. Horm Behav. 2010;57:105–11.
54. Ford CL, Airhihenbuwa CO. The public health critical race methodology: praxis for antiracism research. Soc Sci Med. 2010;71:1390–8.
55. Viruell-Fuentes EA, Miranda PY, Abdulrahim S. More than culture: structural racism, intersectionality theory, and immigrant health. Soc Sci Med. 2012;75:2099–106.
56. Viruell-Fuentes EA. "IT'S A LOT OF WORK": racialization processes, ethnic identity formations, and their health implications. Du Bois Rev. 2011;8:37–52.
57. Crenshaw K. Demarginalizing the intersection of race and sex: a black feminist critique of antidiscrimination doctrine, feminist theory and antiracist policies. Univ Chic Leg Forum. 1989;1989:139–67.
58. Collins PH. Black feminist thought: knowledge, consciousness, and the politics of empowerment. Boston: Unwin Hyman; 1990.