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Differential Effect of Race, Education, Gender, and Language Discrimination on Glycemic Control in Adults with Type 2 Diabetes

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Abstract

Background: Discrimination has been linked to negative health outcomes, but little research has investigated different types of discrimination to determine if some have a greater impact on outcomes. We examined the differential effect of discrimination based on race, level of education, gender, and language on glycemic control in adults with type 2 diabetes.

Patients and Methods: Six hundred two patients with type 2 diabetes from two adult primary care clinics in the southeastern United States completed validated questionnaires. Questions included perceived discrimination because of race/ethnicity, level of education, sex/gender, or language. A multiple linear regression model assessed the differential effect of each type of perceived discrimination on glycemic control while adjusting for relevant covariates, including race, site, gender, marital status, duration of diabetes, number of years in school, number of hours worked per week, income, and health status.

Results: The mean age was 61.5 years, and the mean duration of diabetes was 12.3 years. Of the sample, 61.6% were men, and 64.9% were non-Hispanic black. In adjusted models, education discrimination remained significantly associated with glycemic control ($\beta = 0.47$; 95% confidence interval, 0.03, 0.92). Race, gender and language discrimination were not significantly associated with poor glycemic control in either unadjusted or adjusted analyses.

Conclusions: Discrimination based on education was found to be significantly associated with poor glycemic control. The findings suggest that education discrimination may be an important social determinant to consider when providing care to patients with type 2 diabetes and should be assessed separate from other types of discrimination, such as that based on race.

Introduction

AS OF 2012, DIABETES AFFECTED 29.1 million people in the United States, or 9.3% of the population.[1] Diabetes is associated with an increased risk for a host of major health problems, including heart disease, stroke, blindness, kidney failure, and amputation of the lower limbs.[1,2] A major factor in reducing these complications is improved glycemic control. A reduction in hemoglobin A1c (HbA1c) level of 11% has been found to reduce the chance of complications due to diabetes by 12% over a 10-year period.[3]

Social determinants of health, or the social, economic, and physical conditions in which people are born, live, and work, have been found to influence the prevalence of major health problems, including diabetes.[4–6] Recent studies in type 2 diabetes have found that social determinants also influence health outcomes in patients already diagnosed.[7,8] The influence of social determinants on health is due not only to the direct day-to-day effects of socioeconomic status,[9] but also through pathways such as psychological factors, health behaviors, and access to health.[4,5,9]

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Perceived or self-reported discrimination is a social determinant linked to poor physical and mental health in chronic diseases such as hypertension, but has been rarely investigated in populations with type 2 diabetes.[10] Defined as a behavioral manifestation of a negative attitude, judgment, or unfair treatment toward members of a group, discrimination is a stressor that can broadly impact health owing to its uncontrollable and unpredictable nature.[10] Discrimination in the medical setting has been found to complicate outcomes in two ways: (1) physician bias in prescribing and referring treatment and (2) inadequate communication between doctor and patient causing problems with adherence and patient satisfaction.[11] Discrimination in daily life has been documented to negatively influence well-being[12] and glycemic control,[13,14] partially mediated through psychological distress.[15,16] Research has found a negative relationship between discrimination and an array of health outcomes.[17] Most studies have focused on racial or gender discrimination, but some studies have shown that discrimination based on language[18,19] and level of health literacy[19] can also lead to increased psychological stress in patients with diabetes. A recent meta-analysis called for analysis of different types of discrimination to determine if some have more detrimental effects than others.[10]

We sought to determine the differential effect of discrimination based on race, level of education, gender, and language on glycemic control in adults with type 2 diabetes. The study was designed to measure different types of discrimination in a large sample of African American and white patients.

Patients and Methods

Sample

We recruited 602 patients with type 2 diabetes from two adult primary care clinics in the southeastern United States (a Veteran's Affairs Medical Center and an academic medical center). All procedures were approved by the institutional review board. Eligible patients were sent letters of invitation or approached in clinic waiting rooms. Eligibility included 18 years of age or older, diagnosis of type 2 diabetes in their medical record, and ability to communicate in English. If research coordinators determined patients to be cognitively impaired (through interaction or chart documentation), they were ineligible for the study. Research coordinators provided an explanation of the study and consented patients. Patients then completed a survey with validated questionnaires capturing social determinants of health factors, demographic information, and self-care information based on the conceptual framework by Brown et al.[20] describing the relationship between social determinants and diabetes outcomes. HbA1c value was abstracted from the electronic medical record.

Demographic variables

Age and duration of diabetes were collected as continuous variables. Race was categorized as non-Hispanic black or non-Hispanic white. Marital status was categorized as married, separated/divorced, widowed, or never married. Household income was categorized into eight income levels: <$10,000, $10,000–14,999, $15,000–19,999, $20,000–24,999, $25,000–34,999, $35,000–49,999, $50,000–74,999, and ≥$75,000.[21] Years of education and number of hours worked per week were both collected as continuous variables.[21]

Health status

Health status was measured by the single general health item from the Medical Outcomes Survey, where response options included excellent, very good, good, fair, and poor.[22] It has been validated across different conditions and populations and found to be a reliable measure of perceived health.[23]

Perceived discrimination

Discrimination was evaluated using items previously validated by the DISTANCE survey.[24] Patients self-reported on how often in the past 12 months they felt they were treated poorly or made to feel inferior because of race/ethnicity, level of education, sex/gender, or language. Response options included never, sometimes, usually, and often. For the models, each type of discrimination was coded as a separate ordinal variable.

Glycemic control

The HbA1c value was abstracted from the electronic medical record using values within the previous 6 months.

Statistical analyses

A sample size of 602 adults provided 80% power to detect an association of at least $\rho = 0.3$, where ρ represents the population correlation between glycemic control and perceived discrimination, and to provide 80% power in fully adjusted models to detect between a small to moderate effect. We first calculated sample percentages for demographic variables and perceived discrimination variables. We used Pearson's correlation to test the association between each type of perceived discrimination and glycemic control and then ran an unadjusted linear regression model to assess the independent associations for each type of discrimination on glycemic control. Lastly, we ran a multiple linear regression model to assess the differential effect of each type of perceived discrimination while adjusting for relevant covariates. Glycemic control was the dependent variable, whereas racial, education, gender, and language discrimination were the independent variables in each regression model. Covariates included race, site, gender, marital status, duration of diabetes, number of years in school, number of hours worked per week, income, and health status and were selected for inclusion based on the current literature and clinical relevance. All analyses were performed using Stata version 13 (StataCorp, College Station, TX). A two-tailed α of 0.05 was used to assess statistical significance.

Results

In total, 602 patients with type 2 diabetes were enrolled in this study. Demographic characteristics are shown in Table 1. The mean age was 61.5 years, mean duration of diabetes was 12.3 years, mean number of years in school was 13.4, and mean number of hours worked per week was 12.3. Of the sample, 61.6% were men, and 64.9% were non-Hispanic black. Of our patient survey, 25.9% experienced race discrimination, 15.3% experienced education discrimination, 10.9% experienced gender discrimination, and 9.1% experienced language discrimination.

TABLE 1. SAMPLE DEMOGRAPHIC CHARACTERISTICS
($N = 602$)

Demographic	Value
Age (years)	61.5 ± 10.9
Gender	
Female	38.7
Race/ethnicity	
Non-Hispanic black	66.3
Marital status	
Never married	11.3
Married	49.3
Separated/divorced	28.3
Widowed	11.1
Number of years in school	13.4 ± 2.9
Number of hours worked per week	12.3 ± 18.9
Annual household income	
< $10,000	20.1
$10,000–14,999	11.5
$15,000–19,999	10.3
$20,000–24,999	10.1
$25,000–34,999	14.8
$35,000–49,999	13.4
$50,000–74,999	10.3
$75,000+	9.5
Site	
Academic medical center	51.8
Duration of diabetes (years)	12.3 ± 9.2
Health status	
Excellent	1.3
Very good	12.0
Good	38.9
Fair	38.2
Poor	9.6
Race discrimination	
Never	74.1
Sometimes	21.4
Usually	1.9
Often	2.6
Education discrimination	
Never	84.7
Sometimes	12.1
Usually	1.6
Often	1.6
Gender discrimination	
Never	89.1
Sometimes	8.8
Usually	1.0
Often	1.0
Language discrimination	
Never	90.9
Sometimes	6.9
Usually	1.0
Often	1.2

Data are percentages or mean ± SD values as indicated.

In unadjusted models (Table 2), only education discrimination was significantly associated with glycemic control ($\beta = 0.53$; 95% confidence interval, 0.07, 0.98). In adjusted models (Table 3), education discrimination remained significantly associated with glycemic control ($\beta = 0.47$; 95% confidence interval, 0.03, 0.92). Race, gender, or language discrimination was not significantly associated with glycemic control in either unadjusted or adjusted analyses.

TABLE 2. UNADJUSTED LINEAR REGRESSION MODEL FOR THE DIFFERENTIAL EFFECT OF RACE, EDUCATION, GENDER, AND LANGUAGE DISCRIMINATION ON GLYCEMIC CONTROL IN ADULTS WITH TYPE 2 DIABETES MELLITUS

	β	P value	95% CI
Race PD	−0.10	0.596	−0.48, 0.27
Education PD	0.53[a]	0.022	0.07, 0.98
Gender PD	−0.19	0.478	−0.73, 0.34
Language PD	0.04	0.869	−0.46, 0.55

[a]$P < 0.05$.
CI, confidence interval; PD, perceived discrimination.

Discussion

Consistent with our hypothesis, education discrimination was significantly associated with glycemic control, indicating more education discrimination is associated with worse health outcomes in patients with type 2 diabetes. Contrary to our hypothesis, however, racial, gender, or language discrimination was not associated with glycemic control, indicating that in this population discrimination on the basis of education was the strongest influence on diabetes outcomes.

The finding that discrimination on the basis of education is associated with glycemic control may be significant in improving approaches to diabetes care. In this analysis, individuals who reported perceived discrimination based on education had an average HbA1c level of approximately 0.5 percentage points higher than those without perceived education discrimination. This value runs in the range of HbA1c that has been shown to be clinically meaningful. Actual level of education has been found to be significantly associated with glycemic control,[8] and education has been associated with the presence and intensity of discrimination,[25] but this is one of the first studies to demonstrate an association between education discrimination and diabetes outcomes. Controlling for the association of education with health outcomes, discrimination based on education was still found to be significantly associated with glycemic control. This is a novel finding that could contribute to a better understanding of health disparities, as increasing evidence suggests perceived, or self-reported, discrimination is a stressor with implications for disparities.[17] Differences in education discrimination by race, gender, and socioeconomic status may further

TABLE 3. ADJUSTED LINEAR REGRESSION MODEL FOR DIFFERENTIAL EFFECT OF RACE, EDUCATION, GENDER, AND LANGUAGE DISCRIMINATION ON GLYCEMIC CONTROL IN ADULTS WITH TYPE 2 DIABETES MELLITUS

	β	P value	95% CI
Race PD	−0.25	0.198	−0.63, 0.13
Education PD	0.47[a]	0.036	0.03, 0.92
Gender PD	−0.08	0.763	−0.61, 0.44
Language PD	−0.13	0.601	−0.63, 0.36

The model is adjusted for race, site, gender, marital status, duration of diabetes, number of years in school, number of hours worked per week, income, and health status.
[a]$P < 0.05$.
CI, confidence interval; PD, perceived discrimination.

complicate the association. For example, in a study of Korean elders, the health impacts of education discrimination were the most prominent; however, men reported education discrimination more frequently than women.[26] Given that actual levels of education are lower in disadvantaged populations, they may also perceive more education discrimination. This is an interesting line of research and suggests education discrimination should be investigated in addition to racial or gender discrimination.

These findings also provide greater insight into understanding the role perceived, or self-reported, discrimination has on health outcomes in patients with type 2 diabetes. It has been well established that discrimination has a harmful impact on health outcomes, particularly its impact on mental health.[10,17] However, little is known about the relationship between discrimination and its impact on physical health, principally in ethnic minority populations with type 2 diabetes. This is one of the first studies to provide information on the impact of perceived, or self-reported, discrimination on physical health outcomes in populations with type 2 diabetes. Whereas racial, gender, or language discrimination was not found to be associated with glycemic control, the findings suggest that education discrimination may be an important factor to consider when providing care to patients with type 2 diabetes. Additionally, understanding the role that education discrimination may have on health outcomes in patients with type 2 diabetes could help inform barriers of communication between patient and physician that often complicate care.[11]

The strengths of this study include the large sample size allowing for well-adjusted models and consideration of multiple types of discrimination in one model and a diverse sample. However, there are some limitations that should be mentioned. First, the study was cross-sectional, which limits our ability to comment on causal pathways or the direction of the associations found. Second, there may be additional confounding factors such as disease severity and healthcare access that were not accounted for in this analysis. Third, HbA1c was collected through chart abstraction within the 6-month time frame of data collection and not at the time of visit. In addition, discrimination was a self-reported variable, which can be influenced by perception and recall bias. The variable is phrased and validated for occurrence of events in the prior year, limiting the influence of cohort effects and recall over a respondents' lifetime. Finally, this study was conducted in the southeastern United States and may not be representative of populations in other areas. Other regions may differ in the frequency of certain types of discrimination, or on the level of impact each has in populations with type 2 diabetes.

In conclusion, this study found that perceived education discrimination was associated with worse glycemic control in adults with type 2 diabetes. Whereas no association was found between race, gender, or language discrimination on health outcomes, the findings suggest that education discrimination may be an important factor to consider in future diabetes interventions.

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References

1. Centers for Disease Control and Prevention: National Diabetes Statistics Report: Estimates of Diabetes and Its Burden in the United States, 2014. Atlanta: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services, 2014.
2. American Diabetes Association: Diagnosis and classification of diabetes mellitus. Diabetes Care 2005;28(Suppl):S37–S42.
3. UK Prospective Diabetes Study (UKPDS) Group: Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. Lancet 1998;352:837–853. Erratum in Lancet 1999;354:602.
4. Marmot M: Social determinants of health inequalities. Lancet 2005;365:9464,1099–1104.
5. Healthy People. Secretary's Advisory Committee on Health Promotion and Disease Prevention Objectives for 2020. Healthy People 2020: An Opportunity to Address the Societal Determinants of Health in the United States. 6. www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=39 (accessed December 9, 2014).
6. McKinlay J, Marceau L: US public health and the 21st century: diabetes mellitus. Lancet 2000;356:757–761.
7. Walker RJ, Gebregziabher M, Martin-Harris B, Egede LE: Independent effects of socioeconomic and psychological social determinants of health on self-care and outcomes in type 2 diabetes. Gen Hosp Psychiatry 2014;36:662–668.
8. Walker RJ, Smalls BL, Campbell JA, Strom Williams JL, Egede LE: Impact of social determinants of health on outcomes for type 2 diabetes: a systematic review. Endocrine 2014;47:29–48.
9. Bierman AS, Dunn JR: Swimming upstream. J Gen Intern Med 2006;21:99–100.
10. Pascoe EA, Richman LS: Perceived discrimination and health: a meta-analytic review. Psychol Bull 2009;135:531–554.
11. Ashton DCM, Haidet P, Paterniti DA, Collins TC, Gordon HS, O'Malley K, Peterson LA, Sharf BF, Suarez-Almazor ME, Wray NP, Street RL: Racial and ethnic disparities in the use of health services. J Gen Intern Med 2003;18:146–152.
12. Perry BL, Harp KLH, Oser CB: Racial and gender discrimination in the stress process: implications for African American women's health and well-being. Sociol Perspect 2013;56:25–48.
13. Wagner JA, Tennen H, Feinn R, Finan PH: Racial discrimination and metabolic control in women with type 2 diabetes. Ethn Dis 2013;23:421–427.
14. Moody-Ayers SY, Stewart AL, Covinsky KE, Inouye SK: Prevalence and correlates of perceived societal racism in older African-American adults with type 2 diabetes mellitus. J Am Geriatr Soc 2005;53:2202–2208.
15. 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 2014 January 28 [Epub ahead of print]. doi: 10.1007/s10903-013-9948-8.

16. Wagner JA, Osborn CY, Mendenhall EA, Budris LM, Belay S, Tennen HA: Beliefs about racism and health among African American women with diabetes: a qualitative study. J Natl Med Assoc 2011;103:224–232.

17. Williams DR, Mohammed SA: Discrimination and racial disparities in health: evidence and needed research. J Behav Med 2009;32:20–47.

18. Lebron AMW, Valerio MA, Kieffer E, Sinco B, Rosland AM, Hawkins J, Espita N, Palmasano G, Spencer M: Everyday discrimination, diabetes-related distress, and depressive symptoms among African Americans and Latinos with diabetes. J Immigr Minor Health 2013;16:1208–1216.

19. Rees CA, Karter AJ, Young BA, Spigner C, Grembowski D, Schillinger D, Adler NE: Correlates of patient-reported racial/ethnic health care discrimination in the Diabetes Study of Northern California (DISTANCE). J Health Care Poor Underserved 2011;22:211–225.

20. Brown AF, Ettner SL, Piette J, Weinberger M, Gregg E, Shapiro MF, Karter AJ, Safford M, Waitzfelder B, Prata PA, Beckles GL: Socioeconomic position and health among persons with diabetes mellitus: a conceptual framework and review of the literature. Epidemiol Rev 2004;26:63–77.

21. National Center for Health Statistics: National Center for Health Statistics Survey Questionnaire, National Health Interview Survey. 2002. www.cdc.gov/nchs/nhis/quest_data_related_1997_forward.htm (accessed December 9, 2014).

22. Ware J, Kosinski M, Keller S: 12-item short-form health survey: construction of scales and preliminary tests of reliability and validity. Med Care 1996;34:220–233.

23. Idler E, Benyamini Y: Self-rated health and mortality: a review of 28 studies. J Health Soc Behav 1997;38:21–37.

24. Moffet HM, Adler N, Schillinger D, Ahmed AT, Laraia B, Selby JV, Neugebauer R, Liu JY, Parker MM, Warton M, Karter AJ: Cohort profile: Diabetes Study of North California (DISTANCE)—objectives and design of a survey follow-up study of social health disparities in a managed care population. Int J Epidemiol 2009;38:38–47.

25. Halanych JH, Safford MM, Shikany JM, Person SD, Scarinci IC, Kiefe CI, Allison JJ: The association between income, education, and experiences of discrimination in older African American and European American patients. Ethn Dis 2011;21:223–229.

26. Chun H, Kang M, Cho S, Jung-Choi K, Jang S, Khang Y: Does the experience of discrimination affect health? A cross-sectional study of Korean elders. Asia Pac J Public Health 2013 October 30 [Epub ahead of print]. doi: 10.1177/1010539513506602.

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