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Racial and Ethnic Differences in Diabetes Mellitus among People with and without Psychiatric Disorders: Results from the National Epidemiologic Survey on Alcohol and Related Conditions

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Abstract

Objective—This study examined racial/ethnic differences in the prevalence of diabetes mellitus in a nationally representative sample of adults with and without common psychiatric disorders.

Method—Data were drawn from Wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (N= 34,653). Logistic regression models adjusting for sociodemographic variables and diabetes risk factors were used to examine racial/ethnic differences in 12-month prevalence rates of diabetes by psychiatric status.

Results—Among people without psychiatric disorders, African Americans, Hispanics, and American Indians/Alaska Natives, but not Asians/Pacific Islanders, had significantly higher rates of diabetes than non-Hispanic whites even after adjusting for socio-demographic variables and diabetes risk factors. In the presence of psychiatric disorders, these health disparities persisted for African Americans and Hispanics, but not for American Indians/Alaska Natives. No significant interactions between race/ethnicity and psychiatric disorders in the odds of diabetes were found across any group.

Conclusion—Policies and services that support culturally appropriate prevention and treatment strategies are needed to reduce racial/ethnic disparities in diabetes among people with and without psychiatric disabilities.

Keywords

diabetes mellitus; psychiatric disorders; health disparities; NESARC

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1. Introduction

Diabetes mellitus is a common and disabling condition among racial/ethnic minorities in the United States and people with psychiatric disorders. Presently, it afflicts 7.8% of the general population and is the sixth leading cause of death nationwide [1]. U.S. racial and ethnic minority groups, particularly African Americans, Hispanics, and American Indians/Alaskan Natives, are disproportionately impacted by diabetes and suffer higher levels of morbidity and mortality due to this chronic illness [2,3]. The age-adjusted prevalence of diabetes is higher among American Indians (16.5%), African Americans (11.8%), and Hispanics (10.4%) than among Asian Americans (7.5%) and non-Hispanics whites (6.6%) [4].

People with psychiatric disorders, such as major depression, bipolar disorder, and substance use disorders, are at increased risk for diabetes and other chronic medical conditions compared to the general population [5]. The comorbidity of diabetes and psychiatric disorders is common and associated with reduced functioning and quality of life and elevated mortality rates [6,7]. For instance, depressive disorders are present in approximately 10% to 30% of patients with diabetes and increase the risk for diabetes-related complications, such as blindness, myocardial infarctions, and stroke [8,9]. Diabetes is also prevalent among people with anxiety disorders [10] and among those with heavy alcohol use (more than three drinks a day) [11]. Compared to people without psychiatric conditions, people with psychotic disorders (e.g., schizophrenia) are about twice as likely to have diabetes [12]. Less is known about the prevalence of diabetes among people with substance use disorders and personality disorders. Substance use disorders, including alcohol abuse and dependence, seem to increase the risk for diabetic complications [13] and to be more frequently associated with diabetes when comorbid with psychotic disorders [7]. Personality disorders might be less prevalent among people with diabetes than in the general population [14] with the exception of antisocial [15] and borderline personality disorders [16].

There are good reasons to expect that the combination of racial/ethnic minority status and the presence of a psychiatric disorder may increase the risk of diabetes. Racial/ethnic minorities face numerous risk factors, such as higher rates of obesity, insulin resistance, and physical inactivity, as well as poor access to health care, that place them at elevated risk for diabetes [17-21]. The presence of a psychiatric disorder may exacerbate these risks for racial/ethnic minorities in several ways. First, the higher rates of obesity and insulin resistance in racial and ethnic groups, particularly African Americans and Hispanics, may place them at greater risk for negative metabolic alterations associated with psychotropic medications (e.g., second-generation antipsychotics) that increase the risk of diabetes. Evidence for this greater susceptibility to antipsychotic-induced glucoregulatory complications among African Americans and Hispanics with schizophrenia was found in a 6-month, randomized, double blind study of risperidone and olanzapine [22]. Second, the social and cognitive deficits associated with psychiatric disabilities may amplify the existing difficulties racial and ethnic minorities face in communicating with their medical providers [3], thus compromising their access and involvement in appropriate medical care. Third, mistrust of the medical establishment due to past experiences of racism - a known obstacle to medical care for racial/ethnic minorities [3] - may be compounded by the stigma associated with the presence of a psychiatric condition.

Recent studies indicate that racial and ethnic minorities, particularly African Americans and Hispanics, with common psychiatric disorders (e.g., major depression) report higher rates of diabetes than non-Hispanic whites with similar psychiatric conditions [12,17,23,24]. For instance, African American race, obesity, and a diagnosis of depression each independently increased the risk of diabetes in a large primary care sample (n=8,179), and these risk factors

significantly interacted to create a multiplicative burden of developing diabetes among African Americans compared to non-Hispanic whites [25]. These studies, however, are mostly based on clinical samples and focused on one mental disorder. Few studies have used standardized psychiatric diagnostic instruments and examined racial/ethnic differences in a sufficiently large community sample to study the interaction of race/ethnicity with other risk factors while including racial/ethnic groups other than non-Hispanic whites, African Americans, and Hispanics.

The current study builds upon this literature and addresses many of the methodological limitations listed above by using a large multi-ethnic nationally representative community sample and structured diagnostic interviews to examine racial/ethnic differences in diabetes among people with a variety of psychiatric conditions including mood, anxiety, substance use, and personality disorders. Given the combination of two known diabetes risk factors, we hypothesized that: a) the rates of diabetes will be higher for African Americans, Hispanics, American Indians/Alaska Natives (AI/AN), and Asians/Pacific Islanders (A/PI) with and without psychiatric disorders than for non-Hispanic Whites with similar psychiatric status even after adjusting for sociodemographic variables and other diabetes risk factors (e.g., body mass index [BMI], other medical conditions, and lifetime use of psychotropic medications); and b) race/ethnicity and the presence of psychiatric disorders will have an interactive effect on risk, resulting in higher vulnerability of diabetes among racial/ethnic minority groups compared to non-Hispanic whites.

2. Methods

2.1. Sample

The 2004-2005 Wave 2 sample of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) was used in the present study. A detailed description of the NESARC Wave 1 and 2 methodology is reported elsewhere [26,27]. The NESARC is based on a nationally representative sample of the U.S. non-institutionalized population 18 years of age or older who reside in households and group quarters (e.g., college dormitories, group homes, boarding homes) throughout the 50 states and the District of Columbia. African Americans, Hispanics, and adults ages 18-24 were oversampled, with data adjusted for oversampling, household- and person-level non-response. All procedures, including informed consent, received full ethical review and approval from the U.S. Census Bureau and U.S. Office of Management and Budget.

The Wave 1 NESARC surveyed 43,093 respondents, yielding a response rate of 81% [19]. Respondents from Wave 1 who were deceased (n=1,403), deported, mentally or physically impaired (n=781) or on active military duty (n=950) were ineligible to be re-interviewed in Wave 2 [28]. The total sample for the present study included the 34,653 respondents who were re-interviewed in Wave 2, yielding a response rate of 86.7%. Sample weights are described elsewhere [27] and were developed to adjust for Wave 2 non-response, sociodemographic factors and the presence of any psychiatric diagnoses in Wave 1. Weighted data were adjusted to be representative of the U.S. civilian population based on estimates from the 2000 census.

2.2. Measures

2.2.1. Psychiatric Diagnostic Assessment—Diagnostic assessments of past-year mood, anxiety, and substance use disorders, and lifetime personality disorders were derived from the National Institute on Alcohol Abuse and Alcoholism (NIAAA) Alcohol Use Disorder and Associated Disabilities Interview Schedule – DSM-IV version (AUDADIS-IV), Wave 2 version [26]. The AUDADIS-IV is a structured diagnostic interview designed

for use by lay interviewers in large-scale surveys [26,29]. Previous studies indicate that the AUDADIS-IV measures for mood, anxiety and substance abuse disorders show adequate reliability (e.g., test-retest) and validity (e.g., convergent, construct) among general population samples and racial and ethnic minority groups [30,31-34]

In the present study, we used aggregate variables for any mood disorders, any anxiety disorders, and any substance use disorders in the past 12 months, and any lifetime personality disorders. Any mood disorders included major depressive disorder, dysthymia, bipolar I and bipolar II. Any anxiety disorders included generalized anxiety disorder, panic disorder (with or without agoraphobia), social anxiety disorder, specific phobia, and posttraumatic stress disorder. Mood and anxiety disorders that were substance-induced or caused by a general medical condition or bereavement were excluded. Any substance use disorders included abuse and/or dependence for alcohol and/or 11 classes of drugs: sedatives, tranquilizers, nicotine, opiates (other than heroin or methadone), stimulants, hallucinogens, cannabis, cocaine (including crack cocaine), inhalants/solvents, heroin and other drugs. Any lifetime personality disorders included antisocial, avoidant, dependent, obsessive-compulsive, paranoid, schizoid, schizotypal, narcissistic, borderline, and histrionic. A global indicator of any psychiatric disorder was developed that included the presence of any of the disorders presented above.

2.2.2. Diabetes and other medical conditions—The AUDADIS-IV section assessing medical conditions was used to develop indicators for diabetes mellitus and other medical conditions, including cardiovascular disease (CVD; defined as hardening of the arteries or arteriosclerosis; chest pain or angina pectoris; rapid heartbeat or tachycardia; heart attack or myocardial infarction; stroke and/or any other form of heart disease), high cholesterol, high blood pressure or hypertension, liver disease, gastritis or stomach ulcer, HIV/AIDS, sexually transmitted disease or venereal disease, and arthritis. The presence of these health conditions was determined by two questions. Participants were first asked whether they had a particular medical condition (e.g., diabetes) in the last 12 months. If they answered “yes”, then they were asked whether this diagnosis was confirmed by a doctor or other health professional. Those responding “yes” to both questions were categorized as having the medical condition in question (0 = absent, 1 = present). To account for the presence of other medical conditions in our multivariate models that did not include diabetes, a continuous variable representing the total number of medical conditions endorsed by each participant was created for the present study.

Self-reported height and weight were used to compute participants’ body mass index (BMI) by dividing weight in kilograms by the square of height in meters. To describe the sample’s BMI, participants were classified into one of four groups: underweight (BMI < 18.5), normal weight (BMI 18.5-24.9), overweight (BMI 25-29.9), and obese (BMI ≥ 30). Given that the use of some psychotropic medications is linked to diabetes, we included a global indicator of lifetime use of psychotropic medications in our multivariable models. Participants were asked if a doctor had ever prescribed medications for symptoms of each mood and anxiety disorder assessed, but specific medications were not coded. A dichotomous variable (No = 0, Yes = 1) was created to capture participants’ lifetime use of these medications.

2.2.3. Sociodemographics—Sociodemographic variables included gender, age, marital status, education, and annual family income. Race and ethnicity were determined by self-identification. Five groups were included: non-Hispanic whites (n = 20,161), African Americans (n = 6,587), Hispanics (n = 6,359), AI/AN (n = 578), and A/PI (n = 968).

2.3. Statistical Analysis

Weighted percentages and means were computed to describe the sociodemographic, physical and mental health characteristics of the sample stratified by race/ethnicity. Chi-squares and Wald F-tests were used to determine the significance of differences between percentages and means, respectively. Odds ratios (ORs), derived from a series of logistic regression analyses, evaluated racial/ethnic differences in past-year diabetes rates among people with psychiatric diagnoses. Non-Hispanics whites were the reference group for these analyses. To examine whether the diabetes prevalence rates across racial/ethnic groups was moderated by the presence of psychiatric disorders, we used logistic regression models with diabetes as the outcome and race, presence of psychiatric disorder, and their interaction as predictors. A model was run for each psychiatric disorder. All models adjusted for sociodemographic variables (gender, age, marital status, education and family income) and diabetes risk factors (BMI, other medical conditions, and lifetime use of psychotropic medications), and all predictors (including interactions) were considered significant at α=0.05 level, two-tailed. Approximately, less than 3% of the sample reported missing data in the independent and dependent variables included in our models. All models were re-examined excluding cases with missing data and no changes in the direction and significance of the findings were found, thus results presented in this paper include models with missing data. Standard errors and 95% confidence intervals for all analyses were estimated using SUDAAN [35], a software package that uses Taylor series linearization to adjust for the design effects of complex sample surveys like the NESARC.

3. Results

3.1. Sample Characteristics

The sample was composed of 58% non-Hispanic whites, 19% African Americans, 18% Hispanics, 2% AI/AN and 3% A/PI (See Table 1). Considerable differences were found across racial/ethnic groups. African Americans had the largest percentage of females, whereas Hispanics had the highest percentage of males. Non-Hispanic whites on average were the oldest group and Hispanics were the youngest. A/PI had the largest proportion of participants who were married or living with someone, whereas African Americans had the highest proportion of widowed, separated, or divorced participants. Hispanics had the highest proportion of participants with less than a high school education, whereas non-Hispanic whites and A/PI had the highest proportion of participants with some college or higher. African Americans, Hispanics, and AI/AN reported the highest percentages of families making less than $20,000 per year.

In regards to the physical health and mental health characteristics of the sample, African Americans and Hispanics had the highest proportion of participants who were overweight or obese (BMI ≥25). The 12-month prevalence of diabetes was highest among AI/AN (12.3%) followed by African Americans (11.5%), and Hispanics (8.5%). The lowest rates of diabetes were found for non-Hispanic whites (7.6%) and A/PI (5.9%). AI/AN reported the highest rates of 12-month cardiovascular disease, liver, gastritis/stomach ulcers, sexually transmitted disease, and arthritis. High cholesterol was more prevalent among non-Hispanic whites and AI/AN. African Americans reported the highest rates of hypertension and HIV/AIDS. AI/AN reported the highest prevalence of all psychiatric disorders. Lifetime use of psychotropic medication was highest among AI/AN and lowest among A/PI.

3.2. Racial and Ethnic Differences in Diabetes by Psychiatric Status

Table 2 shows the unadjusted prevalence rates of diabetes by psychiatric disorders stratified by racial/ethnic groups. Significant racial/ethnic differences in diabetes rates were found by psychiatric status. In the absence of psychiatric diagnoses, AI/AN reported the highest

prevalence rates of diabetes followed by African Americans and Hispanics. A/PI and non-Hispanic whites had the lowest rates of diabetes among people without psychiatric diagnoses. The presence of psychiatric disorder had a differential impact on diabetes rates across racial/ethnic groups. For non-Hispanic Whites, AI/AN, and A/PI, diabetes rates decreased in the presence of any-psychiatric, substance abuse, and mood disorders in the past year. However, diabetes rates increased for all three racial/ethnic groups with past-year anxiety disorders and marginally increased for non-Hispanic Whites and AI/AN with lifetime personality disorders. For African Americans and Hispanics, diabetes rates increased in the presence of any-psychiatric, mood, and anxiety disorders in the past year and in lifetime personality disorders. Yet, diabetes rates decreased for both groups in the presence of past-year substance abuse disorders. For any-psychiatric, substance use, mood, and anxiety disorders in the past year, African Americans reported the highest rates of diabetes followed by Hispanics and AI/AN. For lifetime personality disorders, AI/AN reported the highest levels of diabetes followed by African Americans and Hispanics.

Table 3 shows results from logistic regression models comparing the prevalence of diabetes between non-Hispanic whites and each of the racial/ethnic groups stratified by psychiatric disorders and adjusting for sociodemographic variables and diabetes risk factors. African Americans and Hispanics reported significantly higher rates of diabetes than non-Hispanic whites with and without psychiatric disorders. Moreover, the odds of having diabetes for African Americans and Hispanics were higher in the presence of psychiatric disorders than in the absence of any psychiatric disabilities. Among people without psychiatric disorders, AI/AN reported significantly higher rates of diabetes than non-Hispanics whites. In contrast, there were no significant differences in diabetes rates between AI/AN and non-Hispanic whites with any of the psychiatric disorders examined. Similarly, no significant differences in diabetes rates between A/PI and non-Hispanic whites were found. Tests of the interactions between each racial/ethnic group and every psychiatric disorder in the odds of diabetes found no significant differences (data available upon request).

4. Discussion

Our study is one of the few to date to examine racial/ethnic differences in diabetes rates across common psychiatric disorders using a large multi-ethnic nationally representative sample in the United States. Since racial/ethnic minority status and psychiatric disabilities are two known diabetes risk factors, we hypothesized that the prevalence of diabetes will be higher for racial/ethnic minorities with and without psychiatric disorders compared to non-Hispanic Whites and that race/ethnicity and psychiatric disorders will interact resulting in a higher vulnerability of diabetes among racial/ethnic minority groups. We found partial support for our hypotheses.

Among people without psychiatric disorders, African Americans, Hispanics, and American Indians/Alaska Natives (AI/AN), but not Asians/Pacific Islanders (A/PI), had significantly higher prevalence rates of diabetes than non-Hispanic whites even after adjusting for demographic and diabetes risk factors. In the presence of psychiatric disorders, these health disparities clearly persisted for African Americans and Hispanics, but were found to be statistically non-significant for AI/AN. These findings replicate previous results from clinical studies reporting disparities in diabetes prevalence for African Americans and Hispanics with schizophrenia [12,23] and major depression [25], and extend these racial/ethnic disparities to African Americans and Hispanics with past-year anxiety and substance use disorders, and lifetime personality disorders. Contrary to our hypothesis, our findings also revealed no significant interactions between race/ethnicity and psychiatric disorders in the odds of diabetes prevalence, suggesting that each of these is an independent diabetes risk

factor. Taken together, these findings indicate that risk of diabetes among people with and without psychiatric disorders is not uniform and varies across racial/ethnic groups.

No significant differences in diabetes rates were observed between non-Hispanics whites and A/PI regardless of psychiatric status, sociodemographic variables, and other diabetes risk factors. Considerable genetic, ethnic, socioeconomic, linguistic, and cultural diversity exists in the A/PI U.S. population. This variability may have masked important differences in diabetes rates within these heterogeneous groups. For example, diabetes and heart disease rates are higher among Asian Indians and Filipinos and lower among Koreans, Vietnamese, and Chinese in the U.S. (36,37). Moreover, Pacific Islanders (e.g., Native Hawaiians, Samoans) have higher rates of diabetes than other Asian American groups and non-Hispanic whites (38). More research is warranted to better clarify how various risk factors vary among the growing A/PI population and impact their health risk and health status, including diverse lifestyles related to culture, diet, family structure, perceptions of body image, physical activity, and acculturation to Western diets and culture (36).

Consistent with previous studies, AI/AN without psychiatric disorders had significantly higher rates of diabetes compared to non-Hispanics whites even after adjusting for sociodemographic variables and other diabetes risk factor [3]. These differences, however, were no longer significant in the presence of common psychiatric disorders. A closer examination of our logistic models showed that BMI and the total number of other medical conditions accounted for the differences in diabetes rates between non-Hispanics whites and AI/AN (data available upon request). These findings should be interpreted with caution as the small sample size of AI/AN in our study may have contributed to the loss of power to detect significant differences when compared to non-Hispanics whites once all covariates were included in our models. Future studies are needed to confirm these findings with a larger community sample of AI/AN. Nonetheless, our results suggest that policies that target obesity and improve the treatment of comorbid medical conditions among AI/AN may help reduce risk of diabetes in this vulnerable population.

Compared to non-Hispanic whites with and without psychiatric disorders, African Americans and Hispanics were disproportionately impacted by diabetes even after adjusting for socio-demographic variables and common diabetes risk factors. The presence of a psychiatric disorder significantly increased the odds of diabetes prevalence for African Americans and Hispanics, but did not seem to create an additive effect beyond the burden already present by their racial/ethnic minority status. These findings suggest that for African Americans and Hispanics common psychiatric conditions and racial/ethnic minority status are each independent risk factors for diabetes. African Americans and Hispanics in the U.S. face an accumulation of genetic, environmental, and lifestyle factors that magnify their vulnerability to develop diabetes [17-20], and these in turn are exacerbated by poor access to high-quality medical care [3]. Our findings indicate that psychiatric conditions significantly contribute to this vulnerability. Given that this is a largely understudied area, more research is needed to clarify the impact of psychiatric conditions and mental health care on the onset and course of diabetes among African Americans and Hispanics. A fertile area for future research is to examine how exposure to psychotropic medications with known cardiometabolic side effects increases diabetes vulnerability among African Americans and Hispanics, given their predispositions to this costly and disabling condition. Moreover, studying the links between onset and course of diabetes, biological predispositions, and social determinants (such as stigma, racism, and differential access to medical and mental health care) can also help clarify the mechanisms that create these health inequalities among African Americans and Hispanics.

The higher prevalence of diabetes among African Americans, Hispanics, and AI/AN with and without psychiatric disorders indicates that systematic efforts to screen and monitor the physical health of these groups in both mental health and primary care settings are needed. Expert consensus guidelines for the physical health monitoring of people with mental disorders [39,40] provide the basis for these efforts and if implemented across settings of care could set the stage for improved detection and management of diabetes in these at-risk populations. Models of integrated physical and mental health care (e.g., co-located and collaborative care [41-43], lifestyle interventions [44,45], and care management programs [46]) are another viable strategy recommended by the Institute of Medicine to improve the prevention and treatment of diabetes and other chronic medical illnesses among people with psychiatric conditions [5]. Given the multiple determinants of diabetes and psychiatric comorbidities, a one-size-fits-all approach is not appropriate for this complex health problem. Prevention and treatment strategies must be multi-level and take into consideration patients' needs, preferences, lifestyle choices, socioeconomic status, and cultural resources and strengths; providers' skills, training and supports; organizational structures and policies for supporting culturally appropriate diabetes prevention and care; and community resources and infrastructures for enhancing and sustaining health promotion and general wellness.

Several study limitations warrant consideration. Ascertainment of diabetes, BMI, other health conditions, and the lifetime use of psychotropic medications was based on self-report measures and did not distinguish between Type 1 and Type 2 diabetes. Self-report measures tend to underestimate rates of physical health conditions. For example, compared to medical or laboratory records, self-reported diabetes measures tend to underestimate the prevalence of diabetes [47], thus the prevalence of diabetes in this study are most likely under-reported. The cross-sectional nature of our analyses prevented us from determining causation. Our analyses did not include people with a diagnosis of schizophrenia as it was not assessed in the AUDADIS-IV. Moreover, psychosis was also excluded from our analyses because it was assessed with one self-report question of unknown diagnostic reliability and validity and few people endorsed this item, restricting the power for meaningful statistical comparisons. Our analyses may mask important within-group differences in the comorbidity of diabetes and psychiatric conditions. Great diversity in risk factors and prevalence rates exists within racial/ethnic groups. For example, in the diverse Hispanic population, prevalence rates of diabetes and psychiatric conditions vary by country of origin, language preference, and acculturation levels [48,49]. Future studies that unpack within-group differences in racial/ethnic minority populations are needed to better identify and understand health disparities and develop targeted services and policies to help eliminate inequalities in disease burden and quality of care.

This study presents racial and ethnic differences in diabetes prevalence in a nationally representative community sample of people with a variety of psychiatric disabilities. These racial and ethnic inequalities mirror the diabetes disparities observed in the general U.S. population and indicate that racial/ethnic minority status, particularly for African Americans and Hispanics, and psychiatric disorders are both independent risk factors for this costly and disabling condition. Culturally and linguistically appropriate prevention and treatment strategies are needed to reduce the negative impact of diabetes and its complications among racial/ethnic minority communities and help eliminate the unnecessary suffering caused by these health disparities.

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Table 1

Sample Characteristics

	Non-Hispanic Whites (N = 20161)		African Americans (N = 6587)		Hispanics (N = 6359)		American Indians/Alaska Natives (N = 578)		Asians/Pacific Islanders (N = 968)		Chi-square (df), p
	%	SE	%	SE	%	SE	%	SE	%	SE	
Sex											8.49 (4) <0.0001
Male	48.13	0.43	43.70	0.79	50.86	0.83	45.17	2.31	48.76	2.10	
Female	51.87	0.43	56.30	0.79	49.14	0.83	54.83	2.31	51.24	2.10	
Age, y (Mean, SD)	49.90	0.19	45.42	0.28	41.38	0.43	48.47	0.72	44.53	0.93	121.63 (65) <0.0001*
Marital status											12.79 (8) <0.0001
Married/living with someone	66.51	0.42	42.84	0.84	65.20	1.31	61.94	2.20	69.98	1.90	
Widowed, separated or divorced	18.96	0.33	25.43	0.72	14.40	0.81	23.65	1.88	9.98	1.09	
Never Married	14.54	0.38	31.73	0.88	20.41	0.92	14.41	1.67	20.04	1.77	
Education											14.81 (8) <0.0001
Less than high school	10.06	0.32	17.61	0.73	34.75	1.55	19.52	2.20	11.45	2.07	
High school	24.51	0.51	26.44	0.84	20.26	0.75	22.52	2.21	15.78	1.52	
Some college or higher	65.43	0.67	55.95	1.15	44.99	1.41	57.96	2.75	72.77	2.89	
Family income, $											8.57 (12) <0.0001
1-19,999	16.75	0.45	31.97	1.06	25.19	1.21	27.31	2.72	15.89	1.23	
20,000-34,999	17.46	0.40	22.77	0.65	24.75	0.77	22.34	1.75	14.91	1.58	
35,000-69,999	32.84	0.46	28.16	0.76	32.44	1.00	29.61	2.47	32.66	1.94	
70,000 +	32.95	0.89	17.09	0.94	17.62	0.92	20.74	2.09	36.54	2.05	
BMI (Mean, SD)	27.34	0.05	29.29	0.11	28.30	0.14	28.63	0.31	24.64	0.21	160.87 (65) <0.0001*
BMI											8.60 (12) <0.0001
Underweight	2.31	0.14	1.94	0.25	1.73	0.28	2.95	0.72	3.22	0.57	
Normal	35.43	0.43	25.22	0.75	27.40	0.94	29.12	2.31	55.87	2.12	
Overweight	35.90	0.40	33.27	0.81	39.86	0.91	30.33	2.12	31.00	1.73	
Obese	26.36	0.40	39.57	0.96	31.01	1.08	37.60	2.37	9.92	1.28	
Physician confirmed medical conditions											

	Non-Hispanic Whites (N = 20161)		African Americans (N = 6587)		Hispanics (N = 6359)		American Indians/Alaska Natives (N = 578)		Asians/Pacific Islanders (N = 968)		Chi-square (df), p
	%	SE	%	SE	%	SE	%	SE	%	SE	
Diabetes	7.61	0.20	11.52	0.45	8.54	0.54	12.33	1.58	5.86	1.20	12.30 (4) <0.0001
Cardiovascular disease (CVD)	10.72	0.27	9.00	0.45	6.72	0.49	13.22	1.66	5.30	1.02	10.83 (4) <0.0001
High Cholesterol	22.33	0.35	16.56	0.58	14.31	0.72	22.30	1.90	18.16	1.64	15.01 (4) <0.0001
Hypertension	25.60	0.42	32.04	0.86	15.95	0.79	26.56	2.57	18.81	1.85	16.92 (4) <0.0001
Liver disease	0.90	0.08	0.92	0.15	0.70	0.13	1.36	0.51	0.54	0.22	1.06 (4) 0.3832
Gastritis or stomach ulcer	6.35	0.21	6.13	0.38	7.26	0.42	9.92	1.69	4.32	0.74	3.66 (4) 0.0094
HIV/AIDS	0.16	0.03	0.73	0.10	0.30	0.11	0.30	0.22	0.00	0.00	9.32 (4) <0.0001
Sexually transmitted disease	0.57	0.07	0.49	0.10	0.49	0.15	0.91	0.38	0.23	0.14	1.16 (4) 0.3367
Arthritis	23.90	0.39	21.18	0.80	11.83	0.66	26.63	2.26	11.44	1.33	13.72 (4) <0.0001
Past year psychiatric disorders											
Any disorder	43.61	0.51	45.96	0.97	40.66	1.32	56.30	2.67	28.33	1.81	12.58 (4) <0.0001
Any substance use disorder	22.63	0.42	19.39	0.89	15.51	0.85	34.15	2.42	10.43	1.21	15.87 (4) <0.0001
Any mood disorder	9.54	0.27	10.05	0.50	9.74	0.57	14.86	1.69	6.88	1.13	3.57 (4) 0.0108
Any anxiety disorder	16.66	0.34	16.98	0.66	14.82	0.81	19.92	1.75	10.07	1.21	5.06 (4) 0.0013
Any lifetime personality disorder	20.41	0.42	27.98	0.90	22.39	0.96	32.62	2.39	15.21	1.56	11.61 (4) <0.0001
Lifetime use of psychotropic medications	19.57	0.35	12.05	0.60	12.18	0.81	24.70	1.89	7.55	0.92	19.45 (4) <0.0001

*Wald F-test

Table 2

Unadjusted Rates of Diabetes by Psychiatric Disorders Stratified by Racial/Ethnic Groups

	Non-Hispanic Whites (N = 20161)		African Americans (N = 6587)		Hispanics (N = 6359)		American Indians/ Alaska Natives (N = 578)		Asians/Pacific Islanders (N = 968)		Chi-Square (df), p
	%	SE	%	SE	%	SE	%	SE	%	SE	
Any psychiatric disorders											
No	8.27	0.26	11.42	0.69	8.07	0.57	16.67	2.90	5.89	1.30	7.14 (4) 0.0001
Yes	6.75	0.32	11.64	0.65	9.25	0.81	8.94	1.75	5.76	1.79	8.39 (4) <0.0001
Any substance use disorder											
No	8.41	0.25	11.85	0.48	8.71	0.58	14.83	2.18	5.97	1.36	10.70 (4) <0.0001
Yes	4.87	0.36	10.14	0.93	7.62	1.22	7.53	2.23	4.88	2.48	5.32 (4) 0.0009
Any mood disorders											
No	7.62	0.21	11.29	0.49	8.15	0.56	12.52	1.72	5.86	1.27	11.01 (4) <0.0001
Yes	7.47	0.67	13.60	1.64	12.14	1.73	11.26	4.28	5.79	3.16	3.79 (4) 0.0078
Any anxiety disorders											
No	7.52	0.21	11.01	0.52	7.95	0.55	12.04	1.85	5.59	1.02	9.60 (4) <0.0001
Yes	8.12	0.58	14.26	1.29	12.27	1.46	13.62	3.28	8.41	4.68	5.08 (4) 0.0013
Any personality disorders [a]											
No	7.61	0.22	11.31	0.54	8.27	0.54	12.28	1.91	6.27	1.42	8.94 (4) <0.0001
Yes	7.60	0.49	12.07	0.90	9.46	1.19	12.44	2.67	3.57	1.86	5.53 (4) 0.0007

[a] Any lifetime personality disorders

Table 3

Racial/ethnic Differences in Diabetes Mellitus by Psychiatric Disorders Adjusting for Socio-demographic and Diabetes Risk Factors

	NHW vs. AA		NHW vs. H		NHW vs. AI/AN		NHW vs. A/PI	
	OR	(95% Cl)	OR	(95% Cl)	OR	(95% Cl)	OR	(95% Cl)
No psychiatric disorders	1.49	(1.22,1.83)	1.48	(1.18,1.84)	1.99	(1.16,3.43)	1.53	(0.97,2.41)
Any psychiatric disorders	1.79	(1.45,2.20)	2.05	(1.61,2.61)	1.20	(0.67,2.17)	1.64	(0.90,3.01)
Any substance use disorders	1.89	(1.36,2.61)	2.54	(1.67,3.86)	1.27	(0.56,2.89)	1.91	(0.58,6.24)
Any mood disorders	1.89	(1.19,2.99)	1.96	(1.27,3.01)	1.78	(0.57,5.55)	1.14	(0.31,4.22)
Any anxiety disorders	1.58	(1.13,2.20)	1.76	(1.24,2.51)	1.60	(0.70,3.65)	1.57	(0.42,5.87)
Any personality disorders [a]	1.71	(1.28,2.27)	2.05	(1.44,2.92)	1.87	(0.96,3.66)	1.07	(0.28,4.05)

Note: NHW: Non-Hispanic Whites; AA: African Americans; H: Hispanics; AI/AN: American Indians/Alaska Natives; A/PI: Asians/Pacific Islanders; Reference group for all models is non-Hispanic Whites with the corresponding psychiatric status. All models adjusted for socio-demographics (i.e., gender, age, marital status, education, and family income) and diabetes risk factors (i.e., continuous BMI, total number of physician confirmed medical conditions and lifetime use of psychotropic medications).