



## Psychological trauma symptoms and Type 2 diabetes prevalence, glucose control, and treatment modality among American Indians in the Strong Heart Family Study ☆☆☆★

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### ABSTRACT

**Aims:** The aims of this paper are to examine the relationship between psychological trauma symptoms and Type 2 diabetes prevalence, glucose control, and treatment modality among 3776 American Indians in Phase V of the Strong Heart Family Study.

**Methods:** This cross-sectional analysis measured psychological trauma symptoms using the National Anxiety Disorder Screening Day instrument, diabetes by American Diabetes Association criteria, and treatment modality by four categories: no medication, oral medication only, insulin only, or both oral medication and insulin. We used binary logistic regression to evaluate the association between psychological trauma symptoms and diabetes prevalence. We used ordinary least squares regression to evaluate the association between psychological trauma symptoms and glucose control. We used binary logistic regression to model the association of psychological trauma symptoms with treatment modality.

**Results:** Neither diabetes prevalence (22%–31%;  $p = 0.19$ ) nor control (8.0–8.6;  $p = 0.25$ ) varied significantly by psychological trauma symptoms categories. However, diabetes treatment modality was associated with psychological trauma symptoms categories, as people with greater burden used either no medication, or both oral and insulin medications (odds ratio = 3.1,  $p < 0.001$ ).

**Conclusions:** The positive relationship between treatment modality and psychological trauma symptoms suggests future research investigate patient and provider treatment decision making.

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### 1. Introduction

American Indians have disproportionately high rates of diabetes compared to other populations in the United States (Calhoun et al., 2009; Jiang, Beals, Whitesell, Roubideaux, & Manson, 2007; O'Connell, Yi, Wilson, Manson, & Acton, 2010; Wang, Shara, Calhoun, Umans, Lee, & Howard, 2010). American Indians also experience high levels of

stress, and there is a growing concern regarding the relationship between stress burden and diabetes among American Indians (Jiang, Beals, Whitesell, Roubideaux, & Manson, 2008). Understanding the causes and consequences of diabetes among American Indians is important because of the heavy burden that this disease has among that population. For example, mortality from diabetes is approximately three times higher for American Indians and Alaska Natives than for others in the United States (Centers for Disease Control and Prevention, 2007; Roubideaux, 2010). People with diabetes who maintain good glucose control, however, lower their risk for mortality and long-term complications.

Recent studies have examined the possible link between psychiatric conditions and diabetes (Anderson, Freedland, Clouse, & Lustman, 2001; Calhoun et al., 2009). As is common in the general literature, most of the studies among American Indians have focused on depression, generally

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demonstrating a higher prevalence of depressive symptoms among individuals with diabetes (Jiang et al., 2007). These studies also suggest that individuals with depressive symptoms have poorer glucose control (Calhoun et al., 2009). The causes for these associations are still poorly understood, though implicated factors include insulin resistance (Lustman & Clouse, 2002; Lustman & Clouse, 2007); central adiposity (Everson-Rose et al., 2004) and diabetes-specific stressors such as negative emotions towards diabetes, adherence to recommended diabetes treatment, dietary concerns, and lower levels of social support (van Bastelaar et al., 2010).

Relatively little is known about the relationship between diabetes and other psychiatric conditions. Prevalent diabetes has been linked to elevated rates of mood and anxiety disorders (Lin et al., 2008) and schizophrenia (Lin & Shuldiner, 2010), but links with specific psychiatric conditions, such as Posttraumatic Stress Disorder (PTSD), are still being investigated. One prospective cohort study of military service members found that PTSD symptoms were significantly associated with future risk of diabetes (Boyko et al., 2010) and researchers have postulated a link between trauma and resulting stress disorders with diabetes prevalence and glucose control (Boyko et al., 2010; Dedert, Calhoun, Watkins, Sherwood, & Beckham, 2010; Goodwin & Davidson, 2005; Jiang et al., 2007).

Research is generally lacking in the association of PTSD symptoms with prevalent diabetes, glucose control, and diabetes treatment modality. No study examines patterns of care among people with diabetes suffering with psychological trauma. Examining treatment modality is important because of its association with severity of diabetes, differences in cost effectiveness, and patient education (Clar, Barnard, Cummins, Royle, & Waugh, 2010; Delahanty et al., 2007). These questions are especially relevant for American Indian populations because they are disproportionately affected by PTSD, with prevalence estimates as high as 15% in some portions of the population (Beals, Manson, Whitesell, Spicer, Novins, & Mitchell, 2005; Centers for Disease Control and Prevention, 2007).

We used data from the Phase V of the Strong Heart Family Study (SHS) to examine the association of psychological trauma symptoms with diabetes prevalence, glucose control, and treatment modality. The SHS is a large longitudinal effort to assess cardiovascular disease in three distinct American Indian populations, and Phase V of the SHS included a brief instrument to assess PTSD symptoms, but did not yield a clinical diagnosis, so we refer to psychological trauma symptoms, rather than PTSD here. Our specific aims were to determine whether: 1) psychological trauma symptoms correlated with higher prevalence of diagnosed diabetes; 2) psychological trauma symptoms correlated with poorer glucose control among those with diabetes; and 3) diabetes treatment modalities differed according to psychological trauma burden among those with diabetes.

## 2. Subjects

The SHS is the largest epidemiologic study of cardiovascular disease and its risk factors ever undertaken among American Indian men and women. A detailed discussion of study methods is published elsewhere (Lee et al., 1990; Welty et al., 1995). The SHS includes 13 American Indian tribes and communities in three geographic regions: Northern Plains—North and South Dakota (Oglala Sioux, Cheyenne River Sioux, and Spirit Lake Communities), Oklahoma (Apache, Caddo, Comanche, Delaware, Fort Sill Apache, Kiowa, and Wichita), and the Southwest—Arizona (Gila River and Salt River Pima/Maricopa, and Akchin Pima/Papago), and has collected a wealth of information on cardiovascular risk factors. All participants in SHS provided written informed consent and clinical assessment that included laboratory testing for cardiovascular disease. Phase V examined cardiovascular disease risk factors, diabetes-associated risk factors among 3776 American Indian family members who were examined in 2006–2007.

## 3. Materials and methods

### 3.1. Assessment of psychological trauma symptoms

Psychological trauma symptoms were measured using the National Anxiety Disorder Screening Day instrument (Marshall, Olfson, Hellman, Blanco, Guardino, & Struening, 2001), which was originally developed to identify potential cases of anxiety disorder; it has been validated among American Indians in a cross-cultural study (Ritsher, Struening, Hellman, & Guardino, 2002). This brief instrument, administered by interview, asks participants whether they have ever experienced any of a list of significant traumas (Have you ever had an extremely frightening, traumatic, or horrible experience like being the victim of a violent crime, seriously injured in an accident, sexually assaulted, seeing someone seriously injured or killed, or been the victim of a natural disaster?). Endorsement of a traumatic experience triggers additional questions about four symptom clusters (re-experiencing, withdrawal/loss of interest, insomnia, and avoidance) experienced in the past month. Symptom questions are based on the criteria specified in the Diagnostic and Statistical Manual of Mental Disorders IV-TR: re-experiencing the traumatic event (Did you relive the experience through recurrent dreams, preoccupations, or flashbacks?), withdrawal/loss of interest as a result of the traumatic event (Did you seem less interested in important things, not “with it,” or unable to experience or express emotions?), insomnia as a result of the traumatic event (Did you have problems sleeping, concentrating, or have a short temper?), and avoidance of things related to the traumatic event (Did you avoid any place or anything that reminded you of the original horrible event?). Finally, participants who report experiencing psychological trauma and symptoms are asked whether any symptoms had persisted for longer than one month.

Following Marshall et al. (2001), we created a 4-level summary variable reflecting the burden of self-reported psychological trauma symptoms: 1) No endorsed trauma, 2) Endorsed trauma but none of the four psychological trauma symptoms, 3) Endorsed trauma and 1–3 psychological trauma symptoms, or 4) Endorsed trauma and all 4 psychological trauma symptoms but none lasting >1 month, and 4) Endorsed trauma and all 4 psychological trauma symptoms that have lasted >1 month. The latter category was considered to indicate presumptive PTSD because individuals meet the full screening criteria for PTSD (Marshall et al., 2001).

### 3.2. Assessment of diabetes

We used the SHS-derived indicator of prevalent diabetes (Calhoun et al., 2009) to classify each participant as diabetic or not diabetic at the Phase V clinical exam. The indicator was based on the American Diabetes Association criteria and primarily reflected fasting blood glucose  $\geq 126$  mg/dL, taking insulin or oral hypoglycemic medication, and/or previously diagnosed diabetes.

For diabetic participants with fasting blood glucose  $\geq 100$  mg/dL at the clinical exam, glucose control was measured as the total percent glycosylated hemoglobin (HbA1c). HbA1c reflects a weighted average of recent blood glucose levels, with higher levels reflecting higher average glucose values. For diabetic participants, elevated HbA1c is indicative of poor glucose control, and the high-normal HbA1c threshold for non-diabetic people is approximately 6%.

For each participant with diabetes, treatment modality was divided into four categories: no medication, oral medication only, injected insulin only, or both oral medication and injected insulin.

### 3.3. Covariates

Demographic covariates included SHS region (Northern Plains, Oklahoma, Southwest), age in years, sex, and education level (total years). We controlled for health behavior covariates known to effect

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