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Christiana E. Reene Date

Psychosocial Factors Among U.S. South Asians at Risk for Diabetes: A Cross-Sectional Analysis of the South Asian Health and Prevention Education (SHAPE) Trial

By

Christiana E. Reene, RDN
Master of Public Health

Hubert Department of Global Health

Mary Beth Weber, PhD, MPH
Associate Professor of Global Health and Epidemiology
Rollins School of Public Health
Committee Chair

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Thesis Committee Chair: Mary Beth Weber, PhD, MPH
Associate Professor of Global Health and Epidemiology
Rollins School of Public Health

An abstract of
a thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

Psychosocial Factors Among U.S. South Asians at Risk for Diabetes: A Cross-Sectional Analysis of the South Asian Health and Prevention Education (SHAPE) Trial

By Christiana E. Reene, RDN

Purpose: Research clearly indicates there is an increased risk of diabetes in South Asians, yet there is a lack of knowledge on what psychosocial factors are important to consider for tailored prevention efforts in South Asian communities. This study is intended to address this gap by describing patterns and exploring what, if any, differences exist among a cohort of South Asian Americans at risk of type 2 diabetes regarding: (1) weight loss self-efficacy, (2) perceived stress, (3) risk perception, and (4) social support.

Methods: This cross-sectional study analyzed baseline survey data from the South Asian Health and Prevention Education (SHAPE) trial screenings. The sample included 55 primarily male, middle-aged, well-educated South Asians. Student *t* tests and analysis of variance were used to compare continuous psychosocial variable means by sex, education level, annual household income, and BMI group.

Results: Weight loss self-efficacy scores were moderately high across all participant subgroups, (overall mean 120.08 ± 39.61, scale of 0-180) with significantly increased self-efficacy in higher BMI groups (p=0.0001). Perceived stress levels were low across the cohort (mean 0.36 ± 0.15, scale of 0-1). Participants reported a high perceived control over preventing diabetes (mean 3.21 ± 0.53, scale of 1-4), while a slight optimistic bias was observed (mean 2.35 ± 0.71, scale of 1-4), reflecting a lower perceived risk of developing diabetes. Socially supportive behaviors for weight management were experienced infrequently among participants (mean overall frequency score 1.97 ± 0.58, scale of 1-5). Those with four-year degrees or less experienced informational social support more frequently than those with higher levels of education (p=0.002); however, low levels of social support were consistently observed across the cohort.

Conclusion: This study suggests that South Asian Americans have higher weight loss self-efficacy and perceived control over developing diabetes and a lower perceived risk of developing diabetes. Poor social support for weight management is also of concern. These psychosocial factors should be prioritized in the design and delivery of future diabetes prevention efforts for South Asian Americans.

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Introduction

South Asians are one of the fastest growing immigrant group in the United States, accounting for over 5 million people in 2017 (South Asian Americans Leading Together, 2019). The population of South Asian Americans, comprised of individuals who have their roots in India, Pakistan, Bangladesh, Nepal, and Sri Lanka and who currently live in the United States, grew by about 40 percent from 2010 to 2017 (U.S. Census Bureau, 2017). South Asians are projected to be the largest immigrant population in the United States by 2065 (Pew Research Center, 2017).

Compared to other racial-ethnic groups in the United States, South Asian Americans have an increased risk of developing chronic diseases, including metabolic syndrome, coronary heart disease, insulin resistance, and type 2 diabetes mellitus (A. Misra & Khurana, 2011). Diabetes in particular often develops among South Asians at younger ages and in lower BMI groups, suggesting potential phenotypic differences which place individuals of South Asian descent at a lower diabetes risk threshold (S. A. Patel et al., 2016). Although common risk factors for chronic disease such as poor diet and physical inactivity likely contribute to the prevalence of diabetes among South Asian Americans, phenotypic differences creating biological susceptibility also appear to play a major role.

Despite strong epidemiological evidence of a different risk profile among South Asians globally, research on diabetes among South Asians in the United Sates is limited. Only in 2019 did the Centers for Disease Control and Prevention first release diabetes prevalence data specific to US South Asians (Cheng et al., 2019). Furthermore, South Asians are often lumped with other Asian subgroups into one “Asian” category during research studies, making it difficult to find meaningful diabetes evidence specific to those of South Asian descent. Diabetes prevention efforts targeting South Asian Americans have also been limited.

Because South Asians are an understudied community, little is known about psychosocial factors among South Asians that may play an influential role on health behaviors and therefore act as key contributors to the prevention of diabetes within South Asian communities in the United States. Both internal and external factors can be psychosocial contributors. For example, an individual's internal perceived self-efficacy to prevent diabetes can impact their likelihood to engage in healthful lifestyle behaviors and weight management practices such as fruit and vegetable intake and physical activity (Weber et al., 2015). External social support from people important to that individual may affect the extent to which that person engages in and sustains healthful behaviors (Kim, McEwen, Kieffer, Herman, & Piette, 2008). Other psychosocial factors that might affect how a person engages in diabetes prevention activities are stress and perceived risk of diabetes (Macaden & Clarke, 2006; Mukerji et al., 2016; Weber, Hennink, & Narayan, 2020). This study seeks to explore the presence of potential psychosocial factors (weight loss self-efficacy, perceived stress, risk perception, and social support) relevant to diabetes prevention among a South Asian American cohort living in Atlanta and assess how these factors may differ among various cohort subgroups (sex, education level, income level, BMI status).

Literature Review

Diabetes Prevalence Among South Asians

Prior literature reveals inconsistencies regarding diabetes prevalence estimates among South Asians living in the United States. For some studies involving self-report surveys, prevalence estimates have ranged from 4 to 11 percent (Ivey, Mehta, Fyr, & Kanaya, 2006). The Diabetes among Indian Americans study which included a large, nationwide cohort sampled via telephone interviews found a diabetes prevalence of 17.4 percent among Asian Indians compared to 7.8 percent among non-Hispanic whites, 13 percent among non-Hispanic blacks, and 10.2 percent among Hispanic-Latinos (R. Misra et al., 2010). A cross-sectional study of 150 South Asian Indians in California found a diabetes prevalence of 29 percent and a prediabetes prevalence of 37 percent. These estimates were higher than those in other racial-ethnic groups (Kanaya et al., 2010). A recent study estimated diabetes prevalence among Hispanic and Asian subgroups using a sample of 7,575 adults from NHANE's. This was the first time a nationally representative sample of South Asians was included in a study cohort in the United States. This study defined individuals as having diabetes through either self-reported diabetes diagnoses or through lab values indicative of diabetes, meaning that undiagnosed diabetes was considered and included. South Asian Americans had a total diabetes prevalence of 23.3 percent (Cheng et al., 2019).

Racial-ethnic differences in diabetes prevalence appear within Asian populations, with several studies reporting a higher risk of diabetes specifically in South Asian subgroups. A recent study with a cohort that included health record data from 274,910 Asian Americans found large differences between diabetes prevalence in Asian subgroups. While Chinese, Korean, and Japanese American subgroups had age-standardized diabetes prevalence's of 15.6 percent, 18.0

percent, and 18.1 percent respectively, South Asians had a prevalence of 29.1 percent (Gordon, Lin, Rau, & Lo, 2019).

Diabetes Risk Factors Among South Asians

Common "universal" diabetes risk factors, including lifestyle behaviors such as poor diet and physical inactivity, are likely contributors to diabetes prevalence among South Asian Americans, particularly because of acculturation toward a western lifestyle among individuals in this group (Gujral, Pradeepa, Weber, Narayan, & Mohan, 2013). For example, one study found an increase in consumption of fruit juice, chips, margarine, cola, and alcoholic beverages among Asian Indians who had immigrated to the United States, with an increase in length of US residency correlated with an increase in intake of these foods (Raj, Ganganna, & Bowering, 1999). Other studies have noted a decrease in fruit, vegetable, and fiber intake among South Asians who immigrate to western countries (Garduno-Diaz & Khokhar, 2012; Wandel, Raberg, Kumar, & Holmboe-Ottesen, 2008). A literature review of studies conducted in the United Kingdom suggested lower levels of physical activity among South Asian immigrants, as much as 50-75 percent lower than other racial-ethnic groups (Fischbacher, Hunt, & Alexander, 2004).

BMI, another common risk factor for diabetes, has been previously reported in studies of South Asians, with varying BMI averages found among cohorts. A 2013 systematic review noted an average BMI among cohorts of South Asian Americans ranging from 22.4 to 26.1 (Staimez, Weber, Narayan, & Oza-Frank, 2013). The previously mentioned nationally representative study using NHANE's data reported an average BMI of 25.9 among South Asian Americans. This value was higher than those of other Asian subgroups, with average BMI among East Asians at 23.4 and Southeast Asians at 23.9. South Asians also had a larger proportion of people in higher BMI groups compared to East Asians and Southeast Asians, with 37.8 percent of the cohort falling in the 25-29.9 BMI group, 13.2 percent falling in the 30-34.9 BMI group, and 4.1 percent falling in the ≥ 35 BMI group (Cheng et al., 2019).

Although BMI is an indicated risk factor for diabetes among South Asians as with any group, several studies have found an increased risk of diabetes in South Asians compared to other racial-ethnic groups even after accounting for differences in BMI. A study using data from Asian Indians included in the National Health Interview Survey found that after adjusting for BMI, individuals of Asian Indian ethnicity had a significantly increased risk for diabetes compared to non-Hispanic whites (OR 3.1) (Oza-Frank, Ali, Vaccarino, & Narayan, 2009). Another study reported twice the risk of diabetes among non-obese South Asian Americans compared to other racial-ethnic groups (Chan, De Souza, Kobayashi, & Fuller-Thomson, 2019) . One study reported a 4.98 times greater odds of diabetes among South Asian men of normal weight and a 9.09 times greater odds of diabetes among South Asian women of normal weight compared to US whites of normal weight (S. A. Patel et al., 2016).

The increased prevalence of diabetes among South Asian Americans compared to other racial-ethnic groups, especially among lower BMI groups, suggests the potential for a different risk profile among those of South Asian descent. Several mechanisms for how this difference in risk may occur have been proposed. Biological susceptibility is a prominent theme emerging from prior literature.

The "South Asian Phenotype" is a term that has been used for decades to describe the observed biological susceptibility of South Asians which manifests as increased indicators of cardiometabolic risk (S. A. Patel et al., 2016). These indicators include the increased presentation of dysglycemia and dyslipidemia across all BMI groups in South Asians, with the most pronounced differences often occurring at normal weight. Increased insulin resistance among

South Asians has been noted as a potential contributor to the South Asian Phenotype (Gujral et al., 2013; Raji, Seely, Arky, & Simonson, 2001). Beta cell differences, including an observed early decline in beta cell function as well as intrauterine undernutrition leading to abnormal pancreatic development in some individuals have also been explored as plausible mechanisms (Chan et al., 2019; Motala & Omar, 1994; Petersen et al., 2006; Pilgaard et al., 2010). Additionally, increased abdominal adiposity, visceral fat accumulation, excess body fat per unit of BMI, and truncal subcutaneous fat have been noted as distinguishing features of the South Asian phenotype in prior literature (Indulekha, Anjana, Surendar, & Mohan, 2011; S. A. Patel et al., 2016; Raji et al., 2001; Sandeep, Gokulakrishnan, Velmurugan, Deepa, & Mohan, 2010).

The observed biological susceptibility to chronic diseases including diabetes among South Asians has prompted experts to reevaluate BMI risk level cut points for those of South Asian descent. The World Health Organization first suggested different BMI risk cut points for South Asians in 2000, with BMIs of 23-24.9 defined as overweight and BMIs $\geq$ 25 as obese (World Health Organization, 2000). In the United States, the American Diabetes Association and other diabetes stakeholders have adopted these lower thresholds in recent years (A. Misra, 2015). Most experts agree that the South Asian phenotype, combined with environmental factors such as lifestyle behaviors, increases the risk of diabetes among South Asian Americans.

Prevention Efforts Targeting South Asians to Date

Despite evidence of increased risk of diabetes among South Asians, prevention efforts specifically targeting this group have been limited. Most lifestyle change interventions in the United States have targeted majority white communities and these interventions have showed differential effectiveness among racial-ethnic groups, with worse outcomes in minority groups including South Asians (Artinian et al., 2010; Muilwijk et al., 2018). However, in recent years some researchers have sought to adapt these programs for South Asian populations with promising outcomes. DCLIP, a National Diabetes Prevention Program lifestyle change adaptation and randomized clinical trial conducted in Chennai, India showed a relative risk reduction of 32 percent for developing diabetes among South Asian intervention participants, though most participants required metformin in addition to lifestyle change (Weber et al., 2016). Another culturally-tailored lifestyle change randomized clinical trial conducted among South Asians in the United States found reductions in weight, waist circumference, and HgA1c among intervention arm participants (R. M. Patel, Misra, Raj, & Balasubramanyam, 2017). A pilot study conducted in an Asian Indian community in New York showed significant improvements in clinical characteristics as well as knowledge and behavior indicators among study participants, suggesting that lifestyle changes targeting South Asians can be acceptable, feasible, and efficacious (Islam et al., 2014). Other lifestyle change interventions, such as those focusing on cardiovascular health, have showed differential effectiveness among South Asians compared to other targeted racial-ethnic groups. Mixed evidence in prior studies suggests a need for improved culturally-tailored interventions that consider social determinants of health and psychosocial factors specifically for this group (Muilwijk et al., 2018).

Psychosocial Factors Relevant to Lifestyle Change among South Asians

While the current understanding of psychosocial factors which may influence health behaviors and diabetes risk among South Asian Americans is quite limited, some lifestyle change interventions have shed light on potential psychosocial considerations with this group.

Self-efficacy for positive health behaviors among South Asian individuals at risk of diabetes has also been explored as a potential psychosocial factor of relevance to diabetes prevention. Exercise self-efficacy among South Asians participating in lifestyle change interventions has been linked with improved weight, waist circumference, and exercise outcomes, though the effect on diabetes risk is unclear (Cioffi et al., 2018). Exercise and weight loss self-efficacy has been linked with improved average minutes per week exercising and increased fruit and vegetable intake (Weber et al., 2015).

Research has also highlighted the importance of considering stress with health interventions among South Asians due to beliefs and attitudes of stress as a primary contributor to poor health. One study highlighted a common belief among South Asian participants of stress as the cause of diabetes (Tirodkar, Baker, Makoul, et al., 2011). Further research suggested similar perspectives, with stress viewed by South Asians as a primary driver of cardiovascular disease and other health outcomes (Tirodkar, Baker, Khurana, et al., 2011).

Risk perception for developing diabetes is a critical factor to consider in diabetes prevention. Beliefs about the cause, severity, and perceived control over developing diabetes have been highlighted as key influencers for risk perception among South Asians (Macaden & Clarke, 2006). Despite an increased susceptibility for developing diabetes among South Asians, risk perceptions do not always reflect this. One study that assessed risk perception for developing type 2 diabetes among women with gestational diabetes found that those of South Asian ethnicity and other high-risk ethnicities reported a lower perceived risk compared to Caucasians despite being in a high-risk group (Mukerji et al., 2016).

Social support is a theme that has emerged in various studies of South Asian Americans. Research indicates that kinship and family are of central importance to U.S. South Asians, with collectivism and group identity as a core component of culture. Increased density and depth of social networks have been associated with increased discussions related to health among US South Asians. Increased levels of emotional closeness with others have been associated with increased self-rated health among this population (Kandula et al., 2018). Yet, studies have found that social support is often lacking in South Asian communities which can negatively impact engagement in diabetes prevention efforts (Kandula et al., 2013; Terragni et al., 2018).

Further research is needed to understand psychosocial factors in South Asians in relation to diabetes prevention. While weight management self-efficacy, stress, risk perception, and social support have been highlighted as potential factors of interest in prior literature, a deeper understanding of these factors is required to develop meaningful prevention efforts that are both culturally appropriate and effective.

Study Purpose and Research Question

While the body of research on diabetes clearly indicates an increased risk for diabetes in those of South Asian descent, research is less clear on what psychosocial factors should be considered when tailoring prevention efforts in South Asian communities. This study is intended to contribute to the understanding of psychosocial factors relevant to diabetes prevention among South Asian Americans. By using baseline psychosocial survey data from a cohort of South Asians at risk of diabetes living in Atlanta enrolled in the SHAPE trial, this cross-sectional study aims to explore the following question:

> *What patterns exist among a cohort of South Asians for: (1) self-efficacy to implement lifestyle changes, (2) perceived stress, (3) risk perception for developing diabetes, and (4) perceived social support for weight management? Are there differences in these factors by participant sex, income, education, or BMI category?*

Methods

Introduction

The South Asian Health and Prevention Education pilot study (SHAPE, clinicaltrials.gov #NCT01084928) sought to test the feasibility of a lifestyle change program culturally adapted for overweight or obese adult South Asians living in Atlanta with prediabetes. Baseline survey data collected as part of the SHAPE trial included psychosocial measures of weight loss self-efficacy, social support, perceived stress, and risk perception for developing diabetes. This cross-sectional analysis seeks to assess differences of these measures by sex, income, education, and BMI category to improve the understanding of psychosocial factors that may be relevant to diabetes prevention among South Asian Americans.

Design and Sample

Information about the design and outcomes of the SHAPE trial are described elsewhere (Weber et al., 2020). This analysis uses baseline survey data that was collected at the beginning of the SHAPE trial. Participant recruitment for the SHAPE trial involved outreach through community organization listservs, advertisements in South Asian magazines, as well as in-person outreach at health fairs, screenings, diabetes events, and South Asian stores. Screening was conducted either in-person or via phone using the Finnish Diabetes Risk Score (FINDRISC) tool, which assesses an individual's risk of type 2 diabetes using age, sex, BMI, use of blood pressure medication, physical activity levels, consumption of fruits and vegetables, history of high glucose, and family history of diabetes. South Asian adults who scored an 11 or greater on the FINDRISC tool were invited for a clinic screening. In-person health assessments and anthropometric measures were also performed to determine eligibility for a clinic screening.

Next, as part of the SHAPE trial's clinic-based screening for eligibility, baseline survey data was collected using a health questionnaire, which included sociodemographic, economic, behavioral, psychosocial, anthropometric, and clinical measures. Fasting blood samples were taken to assess metabolic and biochemical indicators, a 75g oral glucose tolerance test was performed, and blood pressure and resting heart rate were measured. These screenings were conducted at the Emory University Hospital Clinical Research Site, Georgia Clinical and Translational Science Alliance (https://georgiactsa.org). The following analysis includes psychosocial data from 55 baseline surveys administered during these clinic-based screenings.

Measures

Demographic Characteristics

We dichotomized demographic variables as follows: sex as male or female; household income as <$100,000 or ≥ 100,000; and education level as four-year college degree or less and master's degree or higher. Income and education levels were dichotomized so that approximately one half of the participants were in each group.

Body Mass Index

Body Mass Index (BMI) was calculated as the weight in kilograms divided by the height in squared meters. Asian-specific recommendations were used to categorize participants as underweight (BMI <18.5), normal weight (BMI 18.5-22.9), overweight (23-27.5), or obese (BMI ≥27.5) (World Health Organization, 2000). Height was measured without shoes using a stadiometer and weight was measured on a digital scale with the participant in light clothing.

Weight Loss Self-Efficacy

Weight loss self-efficacy was assessed in the SHAPE baseline survey using the Weight Efficacy Lifestyle Questionnaire, which uses self-efficacy theory to quantify a person's judgement of his or her ability to effectively cope in a given situation (Clark, Abrams, Niaura, Eaton, & Rossi, 1991). This tool, first developed in 1991 and validated across multiple populations, assesses an individual's ability to resist overeating in various situations by asking respondents to score his/her confidence for avoiding overeating in a given situation on a 10-point scale. A total score as well as five sub-scores are assessed: the negative emotions scale, the availability scale, the social pressure scale, the physical discomfort scale, and the positive activities scale.

Perceived Stress

The Perceived Stress Questionnaire is a widely used and validated tool that was developed for clinical psychosomatic research in 1993 to assess stress levels in individuals with chronic disease (Levenstein et al., 1993). The Perceived Stress Questionnaire was later reevaluated in larger adult populations and was revised and streamlined, retaining high reliability and validity (Fliege et al., 2005). Twenty-one statements are included on the revised questionnaire, including both negative and positive stress aspects. Respondents are asked to report the frequency of these aspects over the last year or two: (1) almost never, (2) sometimes, (3) often, and (4) usually. An overall score is calculated from the 21 items and then transformed to values from 0 to 1. Some questions are positively coded and inversed. A higher PSQ score indicates higher levels of perceived stress. The perceived stress questionnaire was included in the baseline survey to estimate stress levels in recruited participants during the SHAPE trial.

Risk Perception for Developing Diabetes

The Risk Perception Survey for Developing Diabetes assesses multiple dimensions of perceived risk for developing diabetes, including comparative disease risk, environmental risk, personal control, and optimistic bias. The 43 item survey was originally developed and piloted among a group of 74 overweight, middle-aged community members without diabetes; further assessment included a group of 535 physicians without diabetes (Walker, Mertz, Kalten, & Flynn, 2003). Participants are asked to score their level of agreement with provided statements about diabetes risk, on a scale of (1) strongly agree, (2) agree, (3) disagree, and (4) strongly disagree. For the purposes of the SHAPE trial, the perceived control subscale comprised of four questions and the optimistic bias control subscale comprised of two questions was selected from the larger survey.

Perceived Social Support

Social support data from the baseline survey was collected using the Weight Management Support Inventory, a tool developed specifically to assess social support for weight management through the identification of supportive behaviors and four types of social support: emotional, instrumental, informational, and appraisal (Rieder & Ruderman, 2007). The survey consists of 25 questions that list potential things people in participants' lives may do or say to help with dieting or attempting weight loss. Social support from friends, family members, and any other important people is included, and participants are asked to consider how often these positive supportive behaviors have been exemplified by any of these social groups over the past four weeks. The scale includes five responses: (1) never, (2) 1 or 2 times per month, (3) 1 time per week, (4) several times a week, and (5) daily. Participants are also asked to rank the helpfulness of each social support behavior on a scale of 1-5, (1) not at all helpful, (3) somewhat helpful, and (5) extremely helpful. The responses for overall frequency and overall helpfulness are scored by calculating the mean for all correlated questions. Emotional frequency, emotional helpfulness, instrumental frequency, instrumental helpfulness, informational frequency, informational helpfulness, appraisal frequency, and appraisal helpfulness can be scored as subscales. This tool has been tested for validity and reliability and was determined to be a useful and appropriate psychosocial survey for the purposes of the SHAPE trial.

Analytic Strategy

All analyses were conducted in SAS, Version 9.4 (Cary, NC). Each variable was determined to be normally distributed. Overall population characteristics, including demographic, socio-economic, and anthropometrics are presented in Table 1. Categorical data are described in proportions while continuous data are reported using mean and standard deviation. Student *t* tests and analysis of variance were utilized to compare continuous variable means (perceived social support score, perceived stress score, risk perception for developing diabetes score, and weight loss self-efficacy score) between men and women, between BMI category groups, between education level groups, and between annual household income groups.

Ethical Considerations

The Emory Institutional Review Board approved both the formative research and intervention components of the SHAPE trial (#IRB00019630, #IRB00035893). Individuals provided written informed consent before clinic screenings where baseline data was collected.

Results

Demographic, Socioeconomic, and Anthropometric Characteristics

Demographic, socioeconomic, and anthropometric participant characteristics are reported in Table 1. Overall, the sample included 55 participants with an average age of 44.5 ($\pm$ 10.6 years). The majority of the sample was male (65%). Using Asian-specific BMI cutoff points, 6 participants were of normal weight, 24 participants were overweight, and 25 participants were obese. Half the sample had a 4-year degree or less while half the sample had a graduate degree or more. All participants had completed high school and at least some college, reflecting a well-educated group overall. Of those who chose to report annual household income, 26 reported an income of less than $100,000 while 18 reported an income of $100,000 or more. The majority of the sample was married (83.6%) and employed full-time (72.7%).

Weight Loss Self-Efficacy

Table 2 reports overall results from the Weight Efficacy Lifestyle Questionnaire. On a scale of 0-180 with increasing values representing higher weight management self-efficacy, the mean total score among participants was 120.08. Women had a lower mean WEL than men, with 115.06 and 122.75 respectively; this difference was not significant. There were no significant differences by sex among the WEL subscales including the negative emotions scale, the availability scale, the social pressure scale, the physical discomfort scale, and the positive activities scale. WEL scores by income level were not significantly different, with similar WEL total scores of 118.77 and 119.47 among those earning less than $100,000 and $100,000 or more respectively. There were also no significant differences in WEL score by education level, with those earning a bachelor’s degree or less having a mean WEL total score of 122.33 while those with a master’s degree or higher having a mean WEL total score of 117.92.

Table 1. Demographic, socio-economic, and anthropometric characteristics among adults in South Asian Health and Prevention Education Study (SHAPE) (n=55)

Characteristics (n %)	**Overall** (n = 55)	**Men** (n = 36)	**Women** (n = 19)	Missing Observations
Age, years	44.5 ± 10.6	44.1 ± 10.5	45.3 ± 10.9	-
BMI Category				-
Underweight (BMI <18.5)	-	-	-	
Normal (BMI 18.5-22.9)	6 (10.9)	4 (11.1)	2 (10.5)	
Overweight (BMI 23-27.5)	24 (43.6)	15 (41.7)	9 (47.4)	
Obese (BMI ≥27.5)	25 (45.5)	17 (47.2)	8 (42.1)	
Annual Income, $				11 (20.0)*
≤ 100,000	26 (47.3)	18 (50.0)	8 (42.1)	
≥ 100,000	18 (32.7)	10 (27.8)	8 (42.1)	
Education				1 (1.8)
≤4-year college	27 (49.1)	16 (44.4)	11 (57.9)	
Graduate degree	27 (49.1)	20 (55.6)	7 (36.8)	
Marital Status				
Married	46 (83.6)	33 (91.7)	13 (68.4)	1 (1.8)
Occupation				
Employed full time	40 (72.7)	29 (80.6)	11 (57.9)	1 (1.8)

**Or preferred not to answer*

Among BMI category groups, WEL scores varied between normal, overweight, and obese individuals. Individuals of normal weight had an average WEL total score of 70.20, while individuals who were overweight and obese had average scores of 109.24 and 140.83 respectively; these differences were significant (p=0.0001). Significant differences between BMI groups were also observed in all WEL subscales, with increasing scores observed in increasing BMI categories.

Perceived Stress

The mean perceived stress index score on a scale of 0-1 among participants was 0.36, with higher scores indicating higher perceived levels of stress. Table 2 describes these results in detail. Men had a mean index score of 0.35 while women had a mean score of 0.39; this difference was not significant. Those with annual income below $100,000 had a mean stress score of 0.38 while participants with annual income $100,000 or more had a mean stress score of 0.36. Individuals with a 4-year college degree or less had a mean perceived stress index score of 0.36 while those with a master’s degree or higher had a mean score of 0.37. Differences in stress by income or education were not significant. In BMI categories, individuals of normal weight had a mean stress score of 0.42; individuals of overweight and obese status had mean scores of 0.41 and 0.32 respectively. These differences were not significant.

Risk Perception for Developing Diabetes

As part of the Risk Perception for Developing Diabetes survey, the mean perceived control score among participants was 3.21 on a scale from 1-4, as listed in Table 2. Higher perceived control scores indicate higher perceived control over developing diabetes. Men had a mean score of 3.18 while women had a mean score of 3.27. Those with income less than $100,000 had a mean score of 3.21 while those of higher income had a mean score of 3.32.

Participants with 4-year degrees or less had a mean score of 3.19 and those with a master's degree or more had a mean perceived control score of 3.22. Mean perceived control scores among BMI categories were 3.13 in normal weight individuals, 3.06 in overweight individuals, and 3.35 in obese individuals. No significant differences in perceived control score among participants by sex, income, education, or BMI category were observed.

Optimistic bias scores were also collected as part of the Risk Perception for Developing Diabetes survey on a scale of 1-4, with higher scores indicating a higher perceived risk of developing diabetes. The mean score among all participants was 2.35, reflecting a moderately low perceived risk among participants. Men had a mean optimistic bias score of 2.47 while women had a mean of 2.09. Those with annual income less than $100,000 had a mean score of 2.44 while those with higher income averaged 2.28. Participants with a 4-year degree or less had a mean optimistic bias score of 2.38 while those with more education had a mean score of 2.31. Among BMI categories, mean scores were 2.17, 2.20, and 2.52 among normal, overweight, and obese categories respectively. None of these differences were significant.

Social Support

As part of the Weight Management Support Inventory (WMSI), overall frequency of socially supportive behaviors and overall helpfulness of socially supportive behaviors were individually assessed, as reported in Table 2. Frequency and helpfulness were also assessed as sub-scores in the four types of socially supportive behaviors: emotional, instrumental, informational, and appraisal, as described respectively in Table 3 and Table 4. All WMSI measures are reported on a scale of 1-5, with higher scores reflecting higher frequency or helpfulness or socially supportive behaviors.

The mean overall frequency score was 1.97. Men had a mean score of 2.02 while women had a mean score of 1.88. Those with income below $100,000 had a mean WMSI frequency score of 2.06; those with income $100,000 or above had a mean score of 1.79. Individuals with four-year degrees or less had a mean frequency score of 2.14 while those with a master's degree or more had a mean score of 1.83. Those of normal weight had a mean WMSI frequency score of 1.97, those with overweight and obese had mean scores of 1.92 and 2.02 respectively. None of the differences observed among frequency scores were significant.

When participants were asked about the helpfulness of supportive behaviors on the WMSI, the mean score was 2.57. Among men, the mean score was 2.57 while women had a mean score of 2.58. Those of income less than $100,000 had a mean helpfulness score of 2.66 while those of higher income had a score of 2.50. Individuals with a four-year degree or less had a mean WMSI helpfulness score of 2.66 while those with further education had a score of 2.49. Among BMI categories, mean helpfulness scores were 2.63, 2.35, and 2.79 respectively. There were no significant differences in overall helpfulness scores.

Among emotional, instrumental, informational, and appraisal frequency subscale scores, a significant difference by education level was observed in the informational frequency comparison ($p=0.002$). Those with a four-year degree or less had a mean informational frequency score of 2.29 while those with a master's degree or more had a mean score of 1.70. There were no other significant differences among frequency or helpfulness subscale scores.

Table 2. Psychosocial score means among adults in South Asian Health and Prevention Education Study (SHAPE) (n=55)

	Weight Loss Self-Efficacy (WEL)	**Perceived Stress** (PSQ)	**Risk Perception Perceived Control (**RPSDD)	**Risk Perception Optimistic Bias** (RPSDD)	**Social Support Frequency** (WMSI)	**Social Support Helpfulness** (WMSI)
Overall	120.08 ± 39.61	0.36 ± 0.15	3.21 ± 0.53	2.35 ± 0.71	1.97 ± 0.58	2.57 ± 0.85
Sex						
Male	122.75 ± 43.42	0.35 ± 0.14	3.18 ± 0.53	2.47 ± 0.77	2.02 ± 0.59	2.58 ± 0.86
Female	115.06 ± 31.83	0.39 ± 0.15	3.27 ± 0.54	2.09 ± 0.48	1.88 ± 0.58	2.57 ± 0.85
Annual Income, $						
≤ 100,000	118.77 ± 39.45	0.38 ± 0.14	3.21 ± 0.52	2.44 ± 0.82	2.06 ± 0.66	2.66 ± 1.06
≥ 100,000	119.47 ± 39.47	0.36 ± 0.13	3.33 ± 0.53	2.28 ± 0.69	1.79 ± 0.40	2.50 ± 0.54
Education						
≤4-year college	122.33 ± 35.15	0.36 ± 0.14	3.19 ± 0.51	2.38 ± 0.79	2.14 ± 0.71	2.66 ± 0.92
Graduate degree	117.92 ± 44.09	0.37 ± 0.15	3.22 ± 0.55	2.31 ± 0.64	1.83 ± 0.39	2.49 ± 0.79
BMI Category						
Normal (BMI 18.5-22.9)	70.20 ± 56.80*	0.42 ± 0.14	3.13 ± 0.67	2.17 ± 0.75	1.97 ± 0.50	2.63 ± 0.23
Overweight (BMI 23-27.5)	109.24 ± 28.74*	0.41 ± 0.17	3.06 ± 0.43	2.20 ± 0.72	1.92 ± 0.58	2.35 ± 0.76
Obese (BMI ≥27.5)	140.83 ± 30.95*	0.32 ± 0.11	3.35 ± 0.55	2.52 ± 0.68	2.02 ± 0.62	2.79 ± 0.96

*p<0.05

Table 3. Weight Management Support Inventory (WMSI) frequency subscale means among adults in South Asian Health and Prevention Education Study (SHAPE) (n=55)

	Overall Frequency	Emotional Frequency	Instrumental Frequency	Informational Frequency	Appraisal Frequency
Overall	1.97 ± 0.58	2.04 ± 0.75	2.16 ± 0.68	1.99 ± 0.71	1.83 ± 0.75
Sex					
Male	2.02 ± 0.59	2.12 ± 0.80	2.20 ± 0.65	2.02 ± 0.75	1.87 ± 0.76
Female	1.88 ± 0.58	1.90 ± 0.63	2.07 ± 0.74	1.90 ± 0.63	1.75 ± 0.74
Annual Income					
≤ $100,000	2.06 ± 0.66	2.06 ± 0.83	2.15 ± 0.71	2.02 ± 0.65	1.95 ± 0.79
≥ $100,000	1.79 ± 0.40	1.96 ± 0.65	2.03 ± 0.56	1.79 ± 0.57	1.61 ± 0.71
Education					
≤4-year college	2.14 ± 0.71	2.19 ± 0.90	2.27 ± 0.75	2.29 ± 0.81*	2.04 ± 0.90
Graduate degree	1.83 ± 0.39	1.92 ± 0.58	2.06 ± 0.59	1.70 ± 0.47*	1.64 ± 0.53
BMI Category					
Normal	1.97 ± 0.50	2.06 ± 0.62	1.98 ± 0.42	1.90 ± 0.60	1.94 ± 0.85
Overweight	1.92 ± 0.58	2.08 ± 0.69	2.10 ± 0.62	1.88 ± 0.60	1.63 ± 0.68
Obese	2.02 ± 0.62	2.01 ± 0.86	2.26 ± 0.78	2.10 ± 0.83	1.99 ± 0.78

*p<0.05

Table 4. Weight Management Support Inventory (WMSI) helpfulness subscale means among adults in South Asian Health and Prevention Education Study (SHAPE) (n=55)

	Overall Helpfulness	Emotional Helpfulness	Instrumental Helpfulness	Informational Helpfulness	Appraisal Helpfulness
Overall	2.57 ± 0.85	2.58 ± 0.87	2.76 ± 0.89	2.61 ± 0.96	2.51 ± 1.07
Sex					
Male	2.58 ± 0.86	2.66 ± 0.93	2.82 ± 0.88	2.57 ± 0.95	2.50 ± 1.05
Female	2.57 ± 0.85	2.42 ± 0.77	2.63 ± 0.93	2.69 ± 1.00	2.53 ± 1.16
Annual Income					
≤ $100,000	2.66 ± 1.06	2.48 ± 1.10	2.76 ± 1.02	2.76 ± 1.09	2.65 ± 1.21
≥ $100,000	2.50 ± 0.54	2.63 ± 0.57	2.64 ± 0.74	2.45 ± 0.70	2.32 ± 0.80
Education					
≤4-year college	2.66 ± 0.92	2.61 ± 0.97	2.81 ± 0.89	2.84 ± 0.99	2.71 ± 1.24
Graduate degree	2.49 ± 0.79	2.55 ± 0.79	2.70 ± 0.92	2.38 ± 0.89	2.33 ± 0.89
BMI Category					
Normal	2.63 ± 0.23	2.61 ± 0.10	2.76 ± 0.50	2.89 ± 0.47	2.42 ± 0.78
Overweight	2.35 ± 0.76	2.42 ± 0.79	2.52 ± 0.81	2.41 ± 0.92	2.18 ± 0.94
Obese	2.79 ± 0.96	2.72 ± 1.00	2.98 ± 0.98	2.73 ± 1.05	2.89 ± 1.18

*p<0.05

Discussion

Our study found that weight loss self-efficacy among a cohort of South Asians living in Atlanta was moderately high across all participant subgroups, with significantly increased self-efficacy among those in higher BMI groups. Perceived stress levels were generally low across the cohort. Participants reported a high perceived control over preventing diabetes, while a slight optimistic bias was observed, suggesting that participants perceived a lower risk of developing diabetes. Finally, socially supportive behaviors for weight management were experienced infrequently among participants. Those with four-year degrees or less experienced informational social support more frequently than those with higher levels of education; however, low levels of social support were consistently observed across the cohort.

Weight Loss Self-Efficacy

An overall mean weight loss self-efficacy (WEL) score of 120.08 on a scale of 0-180 indicates a moderate to high level of weight loss self-efficacy among participants, meaning individuals felt a moderate to high ability to cope when faced with situations where overeating was a temptation. WEL scores in another study of South Asians were similar, with a mean WEL score of 117.8 reported (Weber et al., 2015). The original Diabetes Prevention Program study reported a mean WEL score of 139.6 (Delahanty et al., 2002).

Although WEL scores were similar between men and women and across income and education groups, WEL scores were significantly different between normal, overweight, and obese individuals, with increasing scores in higher BMI groups. This suggests that individuals with higher BMIs reported a stronger ability to effectively cope when confronted with situations that might encourage the respondent to overeat. This was true across overall scores and across all subscale scores. Several potential considerations may offer some insight into this difference.

When considering weight management strategies, it is plausible that those with former or current experiences of excess weight or weight loss attempts might have had increased awareness of their food intake and eating patterns compared to those in normal BMI groups. This increased awareness and experience may had led a respondent of a higher BMI to have an increased recognition of situations that may cue overeating and an increased ability to manage these situations. For example, it is common for South Asians to offer large portions of food as an act of affection and generosity, which can make turning down food difficult even when it means overeating (Weber et al., 2020). Individuals with former experiences of weight management might report a stronger ability to manage situations like these, reflecting higher self-efficacy. Other studies have found positive associations between weight loss self-efficacy and a history of weight loss (Delahanty et al., 2002; Linde, Rothman, Baldwin, & Jeffery, 2006; Strychar et al., 2009).

As decades of research has indicated, weight management is a complex and multi-faceted issue where no single contributor explains weight status. Genetics, family history, metabolic indicators, stress, health behaviors, environment, social determinants, and a multitude of other factors have been correlated with weight status. Even if an individual reported a stronger ability to resist overeating in a given situation, one cannot assume that that individual is of a certain weight status or has a more or less effective weight management approach. In short, while those of higher BMI status reported a stronger likelihood of being able to resist overeating and therefore scored higher on the weight loss self-efficacy scale, the issue of weight management is far too complex for us to draw definitive conclusions.

Perceived Stress

The overall mean perceived stress index score of 0.36 on a scale of 0-1 indicates a low to moderate average stress level among participants. The original DPP study reported a perceived stress index score of 0.3 among participants (Delahanty et al., 2002). The lack of significant differences by sex, education, income, and BMI suggests that stress may not be a psychosocial factor of primary concern in our population. This population primarily consisted of well-educated and moderate to high-income participants. Experiences of stress may have been lower in this cohort compared to less-educated and lower-income populations who may face more magnified stressors related to socioeconomic factors. It is also possible that this instrument was not the most effective tool for measuring stress within this population. However, literature suggests that stress is viewed as a psychosocial contributor to the development of diabetes and a barrier to a healthy lifestyle among South Asians (Tirodkar, Baker, Makoul, et al., 2011; Weber et al., 2020). Further research in this area is warranted.

Risk Perception for Developing Diabetes

For our population, a risk perception perceived control sub-score of 3.21 on a scale of 1-4 indicates a high perceived personal control over developing diabetes. All subgroups, including subgroups by sex, income, education, and BMI had a mean risk perception score above 3.0, reflecting a high perceived personal control over developing diabetes among all participants. This is inconsistent with prior qualitative literature, which points to a perceived lack of control among South Asians in developing diabetes. For example, a recent meta-synthesis of qualitative studies found that those with a family history of diabetes report its onset as inevitable, and divine will is seen as responsible for the development of diabetes and outside of one's own control (Fleming & Gillibrand, 2009).

In the optimistic bias subscale, a mean score of 2.35 on a scale of 1-4 was observed in our population. A higher optimistic bias score reflects more perceived risk for developing diabetes, indicating lower optimistic bias and higher realism or pessimism about developing diabetes (Walker et al., 2003). A score of 2.35 is therefore a moderate to low score, reflective of a slight inclination toward a lower perceived risk for developing diabetes, or a higher level of optimistic bias among our population. This is consistent with prior literature which suggests South Asians have a lower risk perception of developing diabetes compared to other racial-ethnic groups (Mukerji et al., 2016).

No significant differences by perceived control or optimistic bias were observed between subgroups, suggesting that risk perceptions for developing diabetes were similar across our population. Further research is warranted to understand risk perception specifically among South Asians at risk of developing diabetes.

Social Support

In our population, the mean score of 1.97 for social support frequency on a scale of 1-5 suggests that participants did not frequently experience socially supportive behaviors from people important to them. For reference, a response of 2 on a given question indicates that the behavior is experienced only 1 or 2 times per month according to the participant. This is consistent with prior literature, which has noted low social support among South Asian cohorts. Formative research conducted prior to the South Asian Heart Lifestyle Intervention (SAHELI) randomized control trial in Chicago found that socio-cultural constraints and poor social support were prominent factors preventing participants from engaging in a healthy lifestyle (Kandula et al., 2013). A qualitative study which sought to explore lessons learned among researchers engaged in lifestyle change prevention efforts for South Asians noted challenges of poor social support among South Asian migrant groups who lacked establishment and did not have wide social networks (Terragni et al., 2018). Some evidence points to a higher level of concern among South Asian social supporters compared to other racial-ethnic groups, reflecting an increased perception of risk that their family member/friend will develop diabetes (van Esch, Cornel, Geelhoed-Duijvestijn, & Snoek, 2012). However, concern and risk perception among supporters may not always translate into socially supportive behaviors.

Participants had a mean helpfulness score of 2.57 on a scale of 1-5, with 1 being “not at all helpful”, 3 being “somewhat helpful”, and 5 being “extremely helpful”. This suggests that the socially supportive behaviors listed in the questionnaire were not perceived as either strongly helpful or unhelpful overall.

Among the results reported from the Weight Management Support Inventory across subgroups, only the informational frequency subscale showed a significant difference. Those with a four-year degree or less reported receiving informational support from those important to them at a higher frequency compared to those with a master’s degree or more. The informational subscale assesses the provision of helpful information that could aid in weight management. For example, a supportive individual may tell their friend about the calorie content of a specific food (Rieder & Ruderman, 2007).

While we did not capture the education level of individuals other than the participant, it is likely that when individuals with a certain level of education were asked about the behaviors of people important to them, these people were of similar education levels. This is plausible when we consider that social networks tend to consist of individuals with similar education levels (McPherson, Smith-Lovin, & Cook, 2001). Higher education has been associated with improved knowledge regarding weight management practices (Johansson, Wikman, Ahren, Hallmans, &

Johansson, 2001). If we assume that the most social supporters are of a similar education status to the participant, it is plausible that individuals with a higher level of education might provide more social support in the form of informational support to the participant.

However, this pattern was not reflected in our population. Several factors may help to explain the observed pattern. First, just because an individual has a higher level of education, it does not mean that they have increased knowledge or information specific to weight management. The type of degree, subject of degree, difficultly of degree, etc. will influence how relevant a person's education is to their knowledge of weight management. Furthermore, formal education is only one way to obtain knowledge or information; it is likely that individuals obtain information or knowledge about weight management in other, informal ways. Additionally, even if an individual holds helpful information about weight management, it does not mean that they will share it with someone else. If they do choose to share helpful information, the way in that information is received can vary. For example, while one person may find it helpful for their partner to tell them about the calorie content of food, another individual might take offense or be frustrated by this practice which will reduce the likelihood of that partner sharing weight management information in the future.

These nuances reveal the complicated nature of social support which cannot be completely and thoroughly measured through a survey. In our population, the sharing of helpful weight management information by participants' supporters was reported less frequently in those with the highest levels of education. The factors discussed above may help explain why this pattern was observed. Overall, a low frequency of socially supportive behaviors was reported by participants across the cohort, reflecting poor social support for weight management in our population.

Strengths and Limitations

The primary strength of this study is its contribution of knowledge to an existing gap in the literature of an understudied community, improving the understanding of psychosocial factors in South Asian Americans who are disproportionately affected by diabetes. There are also limitations to our analysis. First, our sample size was small. Additionally, our population was somewhat homogenous, primarily consisted of male, middle-aged, well-educated participants. This study was cross-sectional, limiting any causal implications.

Conclusion and Implications

The findings in this study suggest that South Asian Americans may have higher levels of weight loss self-efficacy, especially in higher BMI groups. This reflects positively on the potential for South Asian Americans at risk of diabetes to effectively engage in interventions involving lifestyle or behavior change. This study also suggests a strong perceived control over developing diabetes in South Asian Americans, further supporting the potential for successful engagement in lifestyle change interventions.

However, findings from this study also indicate that a lower perceived risk of developing diabetes may exist among members of South Asian American communities. This is a critical psychosocial factor that should be adequately addressed in the design of future interventions. The delivery of tailored education on diabetes risk specific to South Asians may be warranted as part of these interventions.

While our study did not determine stress to be a primary psychosocial factor of importance among our population, further research is needed in other samples of South Asian Americans to fully understand how stress may a role in diabetes prevention efforts.

Low levels of social support for weight management reported among our participants is of paramount importance. Considering that South Asian cultures tend to place high priority on social relationships and kinship as previously discussed, further research should continue to explore the area of social support in diabetes prevention among South Asians. Researchers should ensure that components of social support are included throughout the design of future interventions, and that these components are delivered in an appropriate and culturally tailored manner specific to the needs of South Asians.

In summary, we believe that the analysis in this study effectively described key patterns emerging from psychosocial data that may be relevant to diabetes prevention among South Asian Americans, an understudied community disproportionately affected by diabetes. Weight loss self-efficacy, risk perception, and social support were identified as psychosocial factors of primary importance in our population. We anticipate that experts in the field of diabetes prevention will be able to use these findings to inform research and practice in the future.

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