Diabetes and Cardiovascular Disease Among Asian Indians in the United States

Sarita A. Mohanty, MD, MPH,¹ Steffie Woolhandler, MD, MPH,² David U. Himmelstein,² MD, David H. Bor, MD²

¹Department of Medicine, Division of Geriatric and General Internal Medicine, University of Southern California, Los Angeles, CA, USA;

²Department of Medicine, Cambridge Health Alliance/Harvard Medical School, Cambridge, MA, USA.

CONTEXT: Studies, mostly from outside the United States, have found high prevalence of diabetes, coronary heart disease (CHD), and hypertension among Asian Indians, despite low rates of associated risk factors.

OBJECTIVE: To analyze the prevalence of obesity, diabetes, CHD, hypertension, and other associated risk factors among Asian Indians in the United States compared to non-Hispanic whites.

DESIGN, SETTING, AND SUBJECTS: Cross-sectional study using data from the National Health Interview Survey (NHIS) for 1997, 1998, 1999, and 2000. We analyzed 87,846 non-Hispanic whites and 555 Asian Indians.

MAIN OUTCOME MEASURES: Whether a subject reported having diabetes, CHD, or hypertension.

RESULTS: Asian Indians had lower average body mass indices (BMIs) than non-Hispanic whites and lower rates of tobacco use, but were less physically active. In multivariate analysis controlling for age and BMI, Asian Indians had significantly higher odds of borderline or overt diabetes (adjusted OR [AOR], 2.70; 95% confidence interval [CI], 1.72 to 4.23). Multivariate analysis also showed that Asian Indians had non-significantly lower odds ratios for CHD (AOR, 0.58; 95% CI, 0.25 to 1.35) and significantly lower odds of reporting hypertension (AOR, 0.58; 95% CI, 0.42 to 0.82) compared to non-Hispanic whites.

CONCLUSION: Asian Indians in the United States have higher odds of being diabetic despite lower rates of obesity. Unlike studies on Asian Indians in India and the United Kingdom, we found no evidence of an elevated risk of CHD or hypertension. We need more reliable national data on Asian Indians to understand their particular health behaviors and cardiovascular risks. Research and preventive efforts should focus on reducing diabetes among Asian Indians.

KEY WORDS: Asian Indian; diabetes; coronary heart disease; hypertension; obesity.

DOI: 10.1111/j.1525-1497.2005.40294.x

J GEN INTERN MED 2005; 20:474-478.

Accepted for publication October 11, 2004

We the authors certify that we have no affiliations with or financial involvement (e.g., employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, royalties) with any organization or entity with a financial interest in or in financial competition with the subject matter or materials discussed in the manuscript. In addition, all financial and material support for this research and work are clearly identified in the manuscript. Dr. Mohanty had full access to all the data in the study and had final responsibility for the decision to submit for publication.

An abstract of this manuscript was presented as a poster at the Society of General Internal Medicine meeting, Vancouver, BC, Canada, May 1, 2003.

Address correspondence and requests for reprints to Dr. Mohanty: Department of Medicine, Division of Geriatric and General Internal Medicine, University of Southern California, 2020 Zonal Avenue, IRD 627, Los Angeles, CA 90033 (e-mail: samohant@usc.edu). See editorials Chin, p. 448; and Vinicor, p. 483.

Many studies have reported high rates of diabetes, coronary heart disease (CHD), and hypertension among South Asians worldwide (South Asian includes Asian Indians, Pakistanis, Bangladeshis, and Sri Lankans). Studies in the United Kingdom have found that South Asians' risk of CHD death is as much as 40% above whites', and that they have a 2- to 3-fold higher incidence of hypertension and diabetes.¹⁻³ Other studies, however, have found high rates of CHD but not hypertension among Asian Indians.^{4,5} Studies of South Asians in the United Kingdom⁶ and other countries^{7,8} have shown a high prevalence of diabetes and a few studies of South Asians in the United Kingdom found lower body mass indices (BMI) despite high rates of diabetes.⁹ Recently, the South Asian Association for Regional Cooperation (SAARC) reported that cardiovascular disease mortality and morbidity, as well as non-insulin-dependent diabetes, among expatriate South Asian populations are higher than in any other expatriate ethnic group worldwide.¹⁰

There have been few analyses of cardiovascular disease risk among Asian Indians in the United States. The largest U.S. study to date was a 1996 survey of 1,688 Asian Indian male physicians and their family members who had immigrated to the United States ($n=1,131$ men and 557 women). Compared to the U.S. white population, this affluent and select group had a high prevalence of CHD and non-insulin-dependent diabetes mellitus, and low HDL levels and hypertriglyceridemia; however, they also had low rates of obesity and tobacco use.⁴ A recent study of 227 Asian Indians living in the United States found significant elevations in plasma homocysteine concentrations.¹¹ However, this study could not conclude that the elevated homocysteine levels are a risk for CHD in the U.S. Asian Indian population.

The U.S. South Asian population has more than doubled in the past decade to 2 million.¹² Asian Indians, a subgroup population of South Asians, are one of the three largest Asian-American subgroups, comprising 16.4% of the total Asian population.¹³ Yet, no population-based studies have examined in detail the prevalence of diabetes, heart disease, hypertension, obesity, or other CHD risk factors in this group. One study analyzed National Health Interview Survey (NHIS) data from 1992 to 1995 on Asian and Pacific Islanders. This heterogeneous group of immigrants (including Asian Indians) was in better health than U.S.-born Asian or Pacific Islanders; their health advantages decreased with duration of residence in the United States.¹⁴ Another study, also based on NHIS data, examined the heterogeneity of Asian Americans and found that Asian Indians more frequently reported themselves in "excellent health" than other Asian groups.¹⁵ Neither study examined specific health outcomes such as diabetes, heart disease, or risk factors for CHD such as hypertension or obesity in Asian Indians.

We used population-based data from the NHIS to analyze the prevalence of obesity, diabetes, CHD, hypertension, and

other associated risk factors among Asian Indians compared to non-Hispanic whites in the United States.

METHODS

We analyzed data from the National Health Interview Survey (NHIS). The NHIS is a household interview survey of the civilian noninstitutionalized population conducted by the National Center for Health Statistics, Centers for Disease Control and Prevention. The NHIS administers face-to-face interviews to a nationally representative sample of households. The survey is conducted yearly using computer-assisted personal interviewing (CAPI), with a new sample of respondents interviewed each year. The data collected in the NHIS are obtained through a complex sample design involving stratification, clustering, and multistage sampling. Blacks and Hispanics are oversampled to allow for more precise estimation of health in these populations. Because the number of Asian Indians surveyed in each year is low, we pooled data from the 1997–2000 NHIS in order to collect a sufficient sample of Asian Indians. We first merged the sample adult file with the person-level file and then concatenated years 1997, 1998, 1999, and 2000. Response rates for each year of data were: 80.4% in 1997; 73.9% in 1998; 69.6% in 1999; and 72.1% in 2000. The comparison group was the non-Hispanic white population of the same time period.

Study Variables

We identified adult subjects who were either Asian Indian or non-Hispanic white among adults in the 4 years of data. The NHIS collected information on 131,731 adults, ages 18 years and older over the 4 years, of whom 87,846 were non-Hispanic white and 555 were Asian Indian. We only compared non-Hispanic whites and Asian Indians, excluding other racial/ethnic groups from the analysis.

We focused on the 3 following health outcomes: 1) diabetes, 2) CHD, and 3) hypertension, ascertained by the responses to 3 separate questions: “Have you ever been told by a doctor or health professional that you have . . .” either “diabetes or sugar diabetes,” “coronary heart disease,” or “hypertension, also called high blood pressure?”

We compared age, gender, income, health insurance coverage, and place of birth (U.S.-born vs foreign-born) among Asian Indians and non-Hispanic whites. We categorized annual family income as greater than or equal to \$20,000, or less than \$20,000. Many respondents did not know or refused to give precise dollar amounts in response to the question regarding income. In these cases, interviewers asked the subjects if their income fell below or was equal to or greater than \$20,000. We elected to use this dichotomous income variable in order to minimize the number of missing values. We also compared the proportion of each group who reported any usual source of care and the proportion who had a general doctor defined as “a doctor in general practice, family medicine, or internal medicine.”

In addition, the NHIS provides calculations of BMI, which we analyzed as both a continuous variable and in categories (normal or low weight [BMI < 25], overweight [BMI 25–30], and obese [BMI > 30]). BMI is calculated by the NHIS from the formula $\text{weight}/(\text{height})^2$, where weight and height are in kilograms and meters, respectively. Height and weight are self-

reported; no physical measurements, laboratory measurements, or physical examinations are performed. We looked at levels of physical activity dichotomously by exploring whether the subject had any vigorous activity “that cause heavy sweating or large increases in breathing or heart rate” (10–20 minutes) at least once per week.

Statistical Analysis

Baseline characteristics for Asian Indian and non-Hispanic whites were compared using χ^2 tests to examine categorical variables and t tests to compare continuous variables. Two-tailed P values of .05 or less were considered significant for both tests.

We examined the association between being Asian Indian and the likelihood of having diabetes, CHD, and hypertension using logistic regression analysis. We first identified potential confounders of the association of Asian Indian ethnicity and the likelihood of reporting disease by examining the univariate association (using χ^2 tests) between ethnicity (being Asian Indian or non-Hispanic white) and sociodemographic and health characteristics. Sociodemographic characteristics included age, gender, insurance status, income status, education, acculturation measured by whether subject lived in the United States for 10 years or less versus greater than 10 years, and immigrant status. Health characteristics included smoking status, vigorous activity level, BMI, and usual source of health care. We also tested the univariate correlation between these potential confounders and the 3 disease outcomes: self-reported diabetes, CHD, and hypertension. Confounders that were correlated with both the primary exposure of interest and the disease outcome of interest were included in the 3 multivariate models. In order to prevent overfitting of the model, we used a cutoff of $P < .025$ for the χ^2 tests. For the multivariate model for self-reported diabetes, we included the following confounders: age (continuous variable) and BMI (continuous variable). For self-reported CHD, age was the only identified confounder. Adding other covariates (e.g., gender) did not improve the model fit. For self-reported hypertension, the final identified confounders were the following: age (continuous), gender, smoking status, has a regular general doctor, and whether subject performed some vigorous activity/exercise weekly. There was no univariate association between education and Asian Indian versus non-Hispanic white ethnicity. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) were computed by using the regression coefficients. We were unable to study the impact of years lived in the United States on these health outcomes in Asian Indians because there were too few subjects available for such subgroup analyses.

We extrapolated our sample to the U.S. civilian noninstitutionalized population using weights provided by the National Center for Health Statistics (NCHS). All analyses were performed using SAS-callable Survey Data Analysis (SUDAAN 9.0, Research Triangle Institute, Research Triangle Park, NC) software to produce standard errors and confidence intervals appropriate to the complex survey design. Such software is recommended for analyzing the NHIS data set by the NCHS.¹⁶ SUDAAN is designed for analysis of complex sample surveys (those that are multistage, stratified, unequally weighted, or clustered) and computes standard errors of means, regression coefficients, ratio estimations, and other statistics.

The statistical power to detect a 2-fold higher odds ratio in Asian Indians versus non-Hispanic whites for diabetes was calculated to be almost 100%, based on a prevalence of diabetes of 7.8% for non-Hispanic whites over the age of 20.¹⁷ For CHD, the statistical power was 95% (based on CHD prevalence among non-Hispanic whites age 20 and older of 6.9% for men and 5.4% for women [age-adjusted]). For hypertension, the statistical power was close to 100% (based on prevalence among non-Hispanic whites age 20 and older of 25.2% for men and 20.5% for women [age-adjusted]).¹⁸

RESULTS

Table 1 presents demographic and health-related characteristics of Asian Indians and non-Hispanic whites. Asian Indians comprised 0.6% of the total sampled population, and non-Hispanic whites 74.6%. These figures are consistent with 2000 U.S. Census data, which also showed that 0.6% of the total U.S. population of 281.4 million identified itself as Asian Indian.¹⁹ Asian Indians were younger than non-Hispanic whites (37.6 years vs 46.2 years), with many more between the ages of 17 and 44 years (69.9% vs 51.5%; $P < .0001$). A higher propor-

tion of Asian Indians were male (55.2% vs 48.1%; $P = .004$) and uninsured (19.3% vs 10.5%; $P = .003$), though Asian Indians had slightly higher incomes (85.9% $\geq$ \$20,000 vs 81.6% of non-Hispanic whites; $P = .003$). Most Asian Indians were foreign-born (93.8% vs 4.6%; $P < .0001$).

Asian Indians were much less likely to be current or former smokers (15.9% vs 49.9% of non-Hispanic whites; $P < .0001$), consistent with an earlier report based on NHIS data²⁰ as well as figures from the National Survey on Drug Use and Health (NSDUH),²¹ 1999–2001. Asian Indians also had lower mean BMIs than non-Hispanic whites (24.0 vs 26.2; $P < .0001$), with a majority of Asian Indians having a normal or low body weight (67.1% vs 45.7%; $P < .0001$). Only 6.2% of Asian Indians were obese compared to 19.2% of non-Hispanic whites, despite lower numbers of Asian Indians reporting vigorous activity (33.0% vs 40.7%; $P = .004$).

Asian Indians had similar unadjusted rates of reported borderline or overt diabetes compared to non-Hispanic whites (6.7% vs 5.9%; $P = .6$), and lower unadjusted rates of self-reported CHD (1.0% vs 3.8%; $P < .0001$) and hypertension (9.9% vs 23.0%; $P < .0001$).

The results of the univariate and multivariate logistic regression analyses are shown in Table 2 (diabetes as outcome), Table 3 (CHD as outcome), and Table 4 (hypertension as outcome). Multivariate logistic regression analysis adjusting for age (as a continuous variable) and BMI (continuous variable) showed that Asian Indians had higher adjusted odds of reporting diabetes than non-Hispanic whites (AOR, 2.70; 95% CI, 1.72 to 4.13). CHD was not statistically different among Asian Indians (AOR, 0.58; 95% CI, 0.25 to 1.35), after controlling for age. The odds of self-reported hypertension, even after controlling for age, gender, smoking status, having a regular doctor, and level of vigorous activity, were lower for Asian Indians compared to non-Hispanic whites (AOR, 0.58; 95% CI, 0.42 to 0.82).

DISCUSSION

Unlike previous studies in India and the United Kingdom, our population-based data from the United States do not show an elevated risk of CHD or hypertension among Asian Indians. These findings could be attributable to underdiagnosis of CHD and hypertension among Asian Indians, who are less likely than non-Hispanic whites to have a general physician or a usual source of care, and less likely to have health insurance. Due to cultural barriers (e.g., language or lack of understanding of disease), Asian Indians may also underreport their

Table 1. Descriptive Characteristics: Asian Indians Versus Non-Hispanic Whites

	Non-Hispanic White	Asian Indian	P value
Sample size	87,846	555	
Percentage of total weighted population	74.6	0.6	
Mean age, y	46.2	37.6	<.0001
17–44 years old, %	51.1	69.9	
45+, %	48.9	30.1	
Gender, %			
Male	48.1	55.2	.004
Insurance status, %			
Uninsured	10.5	19.3	.002
Income status, %			
Greater $\geq$ \$20,000	81.6	85.9	.008
Born in the U.S., %			
Yes	95.4	6.2	<.0001
If not born in U.S., %			<.0001
Lived in U.S. 0–4 years	14.3	28.8	
Lived in U.S. 5–10 years	10.7	18.2	
Lived in U.S. > 10 years	75.0	53.0	
Smoking status, %			
Current or former smoker	49.9	15.9	<.0001
Activity level (vigorous activity), %			
Never active or active less than once a week	59.3	67.0	.004
Mean BMI	26.2	24.0	<.0001
Normal or low body weight, %	45.7	67.1	<.0001
Overweight, %	35.1	26.7	
Obese, %	19.2	6.2	
Has a usual source of health care, %	86.9	78.6	.0001
Has a general doctor, %	67.7	54.7	<.0001
Told by a doctor or health professional that has either borderline or overt diabetes, %	5.9	6.7	.6
Told by a doctor or health professional that has coronary heart disease, %	3.8	1.0	<.0001
Told by a doctor or health professional that has hypertension, %	23.0	9.9	<.0001

BMI, body mass index

Table 2. The Association (Odds Ratio) Between Being Asian Indian and the Likelihood of Reporting Diabetes, Unadjusted and Adjusted

	OR	95% CI
Unadjusted Model		
Asian Indian*	1.14	0.73 to 1.77
Adjusted Model		
Asian Indian*	2.70	1.72 to 4.23
Age†	1.051	1.049 to 1.053
BMI‡	1.12	1.11 to 1.12

*Non-Hispanic white as the referent group.

†Age as a continuous variable.

‡BMI as a continuous variable.

OR, odds ratio; CI, confidence interval; BMI, body mass index.

Table 3. The Association (Odds Ratio) Between Being Asian Indian and the Likelihood of Reporting Coronary Heart Disease, Unadjusted and Adjusted

	OR	95% CI
Unadjusted Model		
Asian Indian*	0.25	0.11 to 0.58
Adjusted Model		
Asian Indian*	0.58	0.25 to 1.35
Age†	1.07	1.07 to 1.08

*Non-Hispanic white as the referent group.

†Age as a continuous variable.

OR, odds ratio; CI, confidence interval.

illnesses. Alternatively, disease may actually be less prevalent in Asian Indians as a result of the “healthy immigrant” effect, as immigrants tend to be healthier than people who remain in their native land.²² However, the “healthy immigrant effect” would presumably also be operant in countries such as the United Kingdom, where studies of immigrant South Asians have actually found high rates of CHD and hypertension.

Our study confirms that Asian Indians in the United States have a higher prevalence of diabetes than non-Hispanic whites, despite lower BMI and being younger in age. However, our study uses BMI calculations that correlate with generalized obesity rather than truncal obesity. In fact, studies have shown that South Asians, compared to whites, are more likely to have truncal obesity and increased waist/hip ratios (WHR) than generalized obesity.^{23,24} Both central obesity and increased WHR have been shown to correlate with glucose intolerance.^{25–29} BMI calculations provided by the NHIS may not accurately reflect these risk factors. Some experts suggest that WHR is the most valid anthropometrical indicator of Asian Indians who are at risk for type 2 diabetes¹ and that a lower BMI cutoff point should be used to define overweight in this population, or even that all Asian Indians should be viewed as prediabetic.³⁰

Asian Indians were less likely to report regular heavy physical activity than non-Hispanic whites. Lack of physical activity is a known risk factor for diabetes, hyper-

triglyceridemia, and elevations in systolic and diastolic blood pressure. Although our study did not find a significant correlation between activity and risk of diabetes in Asian Indians, promotion of physical activity may be a target for intervention in this community.^{26,31} Although our study looked at rates of vigorous activity, limited new evidence suggests that moderate physical activity may be as effective as vigorous activity in the prevention of diabetes and cardiovascular disease.³²

Our study has limitations. First, despite pooling 4 years of NHIS data in this study, we had only 555 adult Asian Indians.³³ Given our small sample, we were not able to perform subgroup analyses by age or gender. While our NHIS-based analysis lacks precision (due to small sample size), its unique strength is its validity (i.e., representativeness) as a measure of the health of the entire U.S. Asian Indian population. The NHIS is conducted in English or Spanish but not in any Asian languages. Therefore, the Asian Indian respondents may have been more educated and fluent in English than nonrespondent Asian Indians (who did not have a family member to help translate), thereby underestimating the prevalence of disease. Furthermore, the NHIS does not check medical records to corroborate the subjects’ reporting of their diseases. One study in the United Kingdom found that at least 28% of South Asians interviewed did not understand the term “diabetes.”³⁴ In such a setting, self-reports would also underestimate disease. Sample size for Asian Indians was too small, even after combining 4 years of data, to permit specific subgroup evaluations of nativity. We are also uncertain of the crosscultural validity of the measurement of physical activity. In addition to problems with recall bias of specific vigorous physical activities, different ethnic groups may describe exercise differently. For instance, one study looking at African Americans demonstrated successes in modified physical activity questionnaires for this specific racial subgroup.³⁵ However, to our knowledge, there are no studies that explore the validity of the physical activity question in Asian Indians. Furthermore, the NHIS does not explore service use for medical illness. Finally, we had no information on lipids, specific dietary habits, or family history because these questions were not asked consistently in the four NHIS surveys. Therefore, our study was unable to analyze several potential lifestyle and genetic contributors to morbidity in Asian Indians.

Obviously, we need much more reliable national data on Asian Indians to understand their particular health behaviors and risks. Culturally sensitive national surveys of Asian Indians should explore the prevalence of diabetes and cardiovascular disease and their modifiable risk factors. Lumping all Asians, as many surveys have done previously, precludes useful analysis, given the heterogeneity of this group.^{33,36} Surveys should assess Asian Indian life styles, family histories for clues to genetic susceptibility, and possible barriers to care, including language and cultural barriers.

Although Asian Indians still comprise a small proportion of the total U.S. population, they are a fast growing group in the United States, having had an unprecedented population growth rate since 1990.³³ Immediate prevention priorities for Asian Indians should include promoting culturally appropriate exercise and dietary strategies to improve glucose tolerance. We should further explore the use of anthropometric measurements such as WHR rather than BMI in this ethnic group. Resources devoted to unraveling the web of socioeconomic, cultural, and genetic contributors to diabetes and cardiovascular risk in Asian Indians might pay great health

Table 4. The Association (Odds Ratio) Between Being Asian Indian and the Likelihood of Reporting Hypertension, Unadjusted and Adjusted

	OR	95% CI
Unadjusted Model		
Asian Indian*	0.37	0.27 to 0.50
Adjusted Model		
Asian Indian*	0.58	0.42 to 0.82
Age†	1.051	1.049 to 1.052
Gender‡	1.11	1.07 to 1.16
Smoking status§		
Current smoker	1.01	0.96 to 1.06
Former smoker	1.14	1.09 to 1.20
Has a regular doctor	0.46	0.44 to 0.48
Vigorous activity¶	1.34	1.28 to 1.40

*Non-Hispanic white as the referent group.

†Age as a continuous variable.

‡Female as the referent group.

§Never smoked as the referent group.

||Having a regular doctor as the referent group.

¶Doing some vigorous activity in a week as the referent group.

OR, odds ratio; CI, confidence interval.

dividends for this growing population in both the United States and worldwide.

Dr. Mohanty's work was supported by an Institutional Health Resources and Services Administration (HRSA) research award, U.S. Department of Health and Human Services, grant 5 D08 HP 50018. The funding source had no involvement in the study design, collection, analysis, and interpretation of data, in the writing of the report, and in the decision to submit the paper for publication.

The authors have participated sufficiently in the work to take public responsibility for the whole content. S.A. Mohanty conceived of the study, supervised all aspects of the study, completed the analyses, and led in the writing of the manuscript. Drs. S. Woolhandler and D.U. Himmelstein helped in the conception of the study, interpretation of the findings, and writing of the manuscript. Dr. D.H. Bor helped to conceptualize ideas, interpret findings, and edit the manuscript. All authors have made substantial contributions to the intellectual content of the paper, including the conception and design, acquisition of data, analysis and interpretation of data, and drafting of the manuscript.

REFERENCES

1. **McKeigue PM, Marmot MG.** Mortality from coronary heart disease in Asian communities in London. *BMJ*. 1988;297:903.
2. **Cappuccio F, Cook D, Atkinson R, Strazzullo P.** Prevalence, detection, and management of cardiovascular risk factors in different ethnic groups in south London. *Heart*. 1997;78:555-63.
3. **Cappuccio F, Oakeshott P, Strazzullo P, Kerry S.** Application of Framingham risk estimates to ethnic minorities in United Kingdom and implications for primary prevention of heart disease in general practice: cross-sectional population based study. *BMJ*. 2002;325:1271.
4. **Enas EA, Garg A, Davidson MA, Nair VM, Huet BA, Yusuf S.** Coronary heart disease and its risk factors in first-generation immigrant Asian Indians to the United States. *Indian Heart J*. 1996;48:343-53.
5. **Jha P, Enas E, Yusuf S.** Coronary artery disease in Asian Indians: prevalence and risk factors. *Asian Am Pac Isl J Health*. 1993;1:163-75.
6. **Landman J, Cruickshank JK.** A review of ethnicity, health and nutrition-related diseases in relation to migration in the United Kingdom. *Public Health Nutr*. 2001;4:647-57.
7. **Dowse GK, Gareeboo H, Zimmet PZ, et al.** High prevalence of NIDDM and impaired glucose tolerance in Indian, Creole, and Chinese Mauritians. Mauritius Noncommunicable Disease Study Group. *Diabetes*. 1990;39:390-6.
8. **Middelkoop BJ, Kesarlal-Sadhoeram SM, Ramsaransing GN, Struben HW.** Diabetes mellitus among South Asian inhabitants of The Hague: High prevalence and an age-specific socioeconomic gradient. *Int J Epidemiol*. 1999;28:1119-23.
9. **Patel S, Unwin N, Bhopal R, et al.** A comparison of proxy measures of abdominal obesity in Chinese, European, and South Asian adults. *Diabet Med*. 1999;16:853-60.
10. **Srivastava R.** South Asia's governments exhorted to focus on CVD. *Lancet*. 2002;359:858.
11. **Chandalia M, Abate N, Cabo-Chan AV Jr, Devaraj S, Jialal I, Grundy SM.** Hyperhomocysteinemia in Asian Indians living in the United States. *J Clin Endocrinol Metab*. 2003;88:1089-95.
12. **The South Asian Public Health Association.** A Brown Paper: The Health of South Asians in the United States, Executive Summary. Berkeley, CA: South Asian Public Health Association; 2002.
13. **Grieco EM, Cassidy RC.** Census 2000 Brief: Overview of Race and Hispanic Origin. Washington, DC: U.S. Census Bureau; 2001.
14. **Frisbie W, Cho Y, Hummer R.** Immigration and the health of Asian and Pacific Islander adults in the United States. *Am J Epidemiol*. 2001;153:372-80.
15. **Ryu H, Young W, Kwak H.** Differences in health insurance and health service utilization among Asian Americans: Method for using the NHIS to identify unique patterns between ethnic groups. *Int J Health Plann Manage*. 2002;17:55-68.
16. **SUDAAN User's Manual, Release 8.0.** Research Triangle Park, NC: Research Triangle Institute; 2001.
17. **National Institute of Diabetes and Digestive and Kidney Diseases.** National Diabetes Statistics Fact Sheet: General Information and National Estimates on Diabetes in the United States, 2000. Bethesda, MD: U.S. Dept. of Health and Human Services, NIH; 2000.
18. **American Heart Association.** Biostatistical Fact Sheet—Populations: Whites and Cardiovascular Disease, 1999. Available at: <http://www.americanheart.org>. Accessed October, 2002.
19. **The Asian Population: 2000; Census 2000 Brief.** U.S. Census Bureau, February 2002. Available at: <http://www.census.gov/prod/2002pubs/c2kbr01-16.pdf>. Accessed March 2003.
20. **Kuo J, Porter K.** Health status of Asian Americans: United States, 1992-94. *Adv Data*. 1998;298:1-16.
21. **Prevalence of cigarette use among 14 racial/ethnic populations—United States, 1999-2001.** *MMWR Morb Mortal Wkly Rep*. 2004;53:49-52.
22. **Marmot MG, Adelstein AM, Bulusu L.** Lessons from the study of immigrant mortality. *Lancet*. 1984;1:1455-7.
23. **Snehalatha C, Viswanathan V, Ramachandran A.** Cutoff values for normal anthropometric variables in Asian Indian adults. *Diabetes Care*. 2003;26:1380-4.
24. **Snehalatha C, Ramachandran A, Satyavani K, Vijay V, Haffner SM.** Specific insulin and proinsulin concentrations in nondiabetic South Indians. *Metabolism*. 1998;47:230-3.
25. **McKeigue PM, Shah B, Marmot MG.** Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in South Asians. *Lancet*. 1991;337:382-6.
26. **McKeigue PM, Pierpoint T, Ferrie JE, Marmot M.** Relationship of glucose intolerance and hyperinsulinaemia to body fat pattern in South Asians and Europeans. *Diabetologia*. 1992;35:785-91.
27. **Hughes K, Aw TC, Kuperan P, Choo M.** Central obesity, insulin resistance, syndrome X, lipoprotein(a), and cardiovascular risk in Indians, Malays, and Chinese in Singapore. *J Epidemiol Community Health*. 1997;51:394-9.
28. **Knight TM, Smith Z, Whittles A, et al.** Insulin resistance, diabetes, and risk markers for ischaemic heart disease in Asian men and non-Asian in Bradford. *Br Heart J*. 1992;67:343-50.
29. **Raji A, Seely EW, Arky RA, Simonson DC.** Body fat distribution and insulin resistance in healthy Asian Indians and Caucasians. *J Clin Endocrinol Metab*. 2001;86:5366-71.
30. **Bhopal R, Fischbacher C.** Many South Asian people probably need pre-diabetes care. *BMJ*. 2002;325:965.
31. **Dhawan J, Bray C.** Asian Indians, coronary heart disease and physical exercise. *Heart*. 1997;78:550-4.
32. **Bauman AE.** Updating the evidence that physical activity is good for health: an epidemiological review 2000-2003. *J Sci Med Sport*. 2004;7(suppl):6-19.
33. **Barnes J, Bennett C.** U.S. Census Bureau. The Asian Population: 2000: United States Census 2000. Washington, DC; February 2002.
34. **Rankin J, Bhopal R.** Understanding of heart disease and diabetes in a South Asian community: cross-sectional study testing the 'snowball' sample method. *Public Health*. 2001;115:253-60.
35. **Resnicow K, McCarty F, Blissett D, Wang T, Heitzler C, Lee RE.** Validity of a modified CHAMPS physical activity questionnaire among African-Americans. *Med Sci Sports Exerc*. 2003;35:1537-45.
36. **Centers for Disease Control and Prevention (CDC).** Chronic Disease in Minority Populations. Atlanta, GA: U.S. Dept. of Health and Human Services (CDC); 1994.