

**Acculturation & Coronary Artery Disease (CAD)
in the South Asian Immigrants (SAIs):
A Unique Population with Increased Risk**

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BACKGROUND & RATIONALE

- **The cultural composition of the US is diverse and rapidly changing due to rising immigration**
- **South Asian Immigrants (SAIs)** are the fastest growing and second largest Asian immigrant group in the US. Asian Indians, together with people who identify with the cultures of Bangladesh, Sri Lanka, Nepal, and Pakistan, are grouped as **SAs** and account for more than 3.2 million US residents.
- Another 1.3 M have illegal status (US census 2004)



BACKGROUND & RATIONALE

- Aggressive clinical and public health interventions have resulted in significant reduction in Coronary Artery Disease (**CAD**) mortality.
- CAD is still the leading causes of mortality and morbidity in the US, accounting for more than 40% of all deaths **(AHA 2004 report)**
- CAD and its risk factors are on the rise in immigrant populations which constitute for more than 11% of the US population.
- SAIs as a whole have the highest prevalence of CAD; 21.5% in men and 15.9% in women and a higher mortality risk from CAD as compared to other immigrant groups and Caucasians.
- CAD occurs at younger age in SAIs **(Yusuf INTERHEART Study 2004)**
- Risk factors have greater impact at same levels compared to Caucasians.

BACKGROUND & RATIONALE

- Traditional CAD risk factors may not fully explain the excess risk. There is a need to explore and understand other non-traditional risk factors.
- Greater incidence of type 2 diabetes (T2D) and metabolic syndrome than other immigrants populations and Caucasians.
- India is known as the, “diabetes capital of the world” with the highest number of diabetics. According to the International Diabetes Federation (2006), the number of people with diabetes in India is currently around 40.9 million.
- The susceptibility of diabetes amongst SAls also promotes an adverse CAD risk.

BACKGROUND & RATIONALE

- ***The process during which immigrants adopt the behavior and cultural traits of their host country is referred to as acculturation***
- Differences in CAD between SAIs and those in South Asian (SA) countries could be due to either the effect of a new environment triggering latent susceptibilities that weren't triggered in the home country, or environmental and behavioral changes due to immigration.
- Susceptibility to these effects among SAIs may not be uniform. (e.g., some immigrants may arrive in a new environment and find the lifestyle and attitudes similar to those of their previous home)
- Most SAIs arrive to the US facing a totally new environment
- SAIs frequently experience major hardships as they acclimate to the new environment

BACKGROUND & RATIONALE

- Studies on the relationship between acculturation and CAD among immigrants to North America have produced inconsistent results (depending on country of origin)
- In general, studies show that South East Asian and Hispanic immigrants with longer resident time in North America, and those with more acculturation, had increased CAD risk
- Example: early data from Japanese immigrant men showed that the most acculturated had a 3- to 5-fold increase in CAD prevalence and a worse risk factor profile
- There is insufficient data on how acculturation is related to the CAD and its associated risk factors in SAls

OBJECTIVES

The objectives of this study are to

- 1. Measure the level of acculturation and its association with CAD**
- 2. Assess acculturation association with CAD risk factors, T2D, as well as sub-clinical CAD using common carotid intima-media thickness (CCA-IMT) as a surrogate marker for atherosclerosis.**

METHODOLOGY

- **Design:** Epidemiologic Cross-sectional Study
- 205 South Asian Hindus between the ages of 35-65 years recruited from temples and other organizations from three states of the US (Georgia, Missouri and Kansas)
- Information on socio-demographic and lifestyle characteristics, CAD risk factors
- A 12- Hour fasting blood samples were for; C-reactive protein (CRP), total cholesterol, HDL, LDL, TG, Lpa, Insulin, and other tests.
- CAD diagnosed on history (using Rose questionnaire)
- Sub-Clinical CAD was assessed using CCA-IMT as a surrogate marker.

Carotid Ultrasound Doppler for CCA-IMT

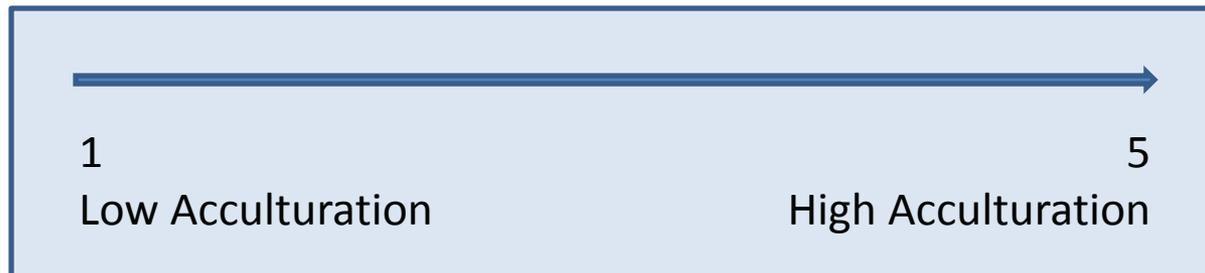
B-mode ultrasound scanning of bilateral carotid arteries performed by trained non-invasive vascular ultrasound technicians

- We used a SonoCalc™ Micromax IMT machine (SonoSite, Inc Bothell, WA) with a 10.0 MHz linear array transducer
 - CCAs were scanned with the subject in the supine position. Four images, obtained on each side, 1 cm proximal to the carotid bulb using an anterior approach
 - ECG leads were placed to obtain end-diastolic measurements
- Any focal thickening of the intima-media complex or carotid plaque was recorded but not included in the analysis
- Two participating cardiologists (blinded to patient's medical history) reported CCA-IMT findings using automated edge detection technology software (SonoCalc™IMT).
- Measurements of the far wall of the CCA were done, as they are more indicative of the true thickness of the arterial wall
- CCA-IMT cut-off of ≥ 0.80 mm was chosen and analyzed as positive IMT measurements based on the available evidence supporting the presence of sub-clinical CAD

Measurement of Acculturation

Scaled Measure: The Suinn-Lew Asian Self-Identity Acculturation scale (SL-ASIA Scale)

- A 21-item multiple-choice questionnaire covering topics such as language (4 items), identity (4 items), friendship (4 items), behaviors (5 items), generation/ geographic history/enclave residence (3 items), and attitudes (1 item). A validated Indian-language version of this scale is also available for non English speaking participants.
- A total value was obtained by summing the answers for all 21 items.
- A final acculturation score was calculated by dividing the total value by 21. Scores range from 1.00 (low acculturation) to 5.00 (high acculturation).



Methodology

- While the total score reflects the overall level of acculturation, the scale can also be evaluated by component topics such as language, identity, friendships, behaviors, geographic history, and attitudes.

(data analysis in progress)

- Reliability studies show that Cronbach's alpha for the SL-ASIA scales for South Asian Americans 0.91 and 0.88, reflecting high reliability.
- A validity study showed that the SL-ASIA scores were significantly correlated with demographic information hypothesized to reflect levels of Asian American identity.
- **Non-Scaled Measure for Acculturation:** Total duration of stay in the US

Statistical Analysis & Power Calculation

- The sample size was determined by a 2-sided test at α of 0.05, with a power ($1-\beta$) of 80% to yield a sample size of 205 subjects.
- BMI of ≥ 23 was considered overweight and ≥ 30 as obese (WHO 2007)
- Logistic regression was performed with CAD and T2D as outcome, acculturation and CAD risk factors as predictors.
- The Fisher's exact test was used to assess the relationship between the variables. Significance was taken as $p \leq 0.05$ for all tests.
- Data was entered and analyzed using SAS package (2006, SAS Institute, Cary, North Carolina).

Results

Table 1: Socio-demographic characteristics (n=173)
Interim Analysis

PARAMETER	N (%)
Male	93(53.8)
Female	80(46.2)
Age	52.7±10.8
<40 years	27(15.6)
≥ 40 years	146(84.4)
*Acculturation (SL-ASIA Scale)	
Low (score 1 to 2)	44(27.7)
High(Biculturation and Westernization) (score 2.1 to 5)	115(72.4)

Table 2: CAD risk factor profile

Hypertension (History & examination)	37(21.9)
Cholesterol (≥ 200mg/dl)	82(75.2)
T2D (History plus blood testing)	37(21.9)
History of CAD	16(9.4)
Smoking	6 (3.5)
Family history of CAD***	63(37.7)
Family history of T2D	83(49.7)
Body Mass Index¹⁷	25.6\pm3.3
Normal (BMI ≤ 23)	19(21.8)
Overweight (BMI between 24-29)	11(12.6)
Obese (BMI between 30-39)	47(54.0)
Morbidly obese (BMI =40 or more)	10(11.5)
Waist circumference	
Mean in males	91.36 \pm 7.9
Mean in females	87.07 \pm 11
≥ 90 cms in men	20(55.5)
≥ 80 cms in women	19(76)

Impaired fasting glucose levels (100-125mg/dl)	17(35.4)
Insulin levels ≥ 20 ul/ml	2(5.7)
HDL levels (≥ 40 mg/dl)	48.85 \pm 10.4 8(22.9)
LDL levels (≥ 150 mg/ dL)	122.02 \pm 40.98 \neq 12(35.3)
Tryglicerides ≥ 150 mg/ dL	150.74 \pm 87.32 \neq 13(37.1)
HsCRP (≥ 8mg/L)	8.94 \pm 22.4 \neq 2(5.7)
Apo A1 (≥ 200 mg/dL)	176.57 \pm 19.42 \neq 3(8.6)
Lp [a] (≥ 30 mg/ dL)	26.80 \pm 27.90 \neq 10(28.6)
Fibrinogen activity (<175 and > 425 mg/ dL)	4(21.1)
CCA-IMT measure ≥ 0.8	17(48.57)

Table 3: Association of CAD (including age adjustment) with Acculturation and risk factors

Variable	Without age adjustment		With age adjustment	
	Wald Chi-square	p-value	Wald Chi-square	p-value
Acculturation (Mostly Asia vs. Mostly West)	14.2871	<0.001	16.0709 (†1.50 ±0.5.164)	<0.001
Length of Stay in U.S (≥ 10 years)	10.8283	0.001	14.3890	<0.001
Age	0.0006	0.98	–	–
Cholesterol (≥200mg/dl vs.<200 mg/dl)	10.6504	0.001	9.2080	0.001
T2D**	13.7454	<0.001	9.7943	0.001
Hypertension(≥120 or ≥90)	14.3489	<0.001	16.2329	<0.001
Family History of T2D**	0.0005	0.98	0.1453	0.70
Family History of Cardiac Disease	7.289	0.006	7.1703	0.007
Waist Circumference (Male ≥90 cm;Female≥80cm)	0.0415	0.83	0.5232	0.72
BMI* (≥23.1 vs.≤ 23)	12.3044	<0.001	7.2949	0.006
Physical In-Activity	2.8826	0.08	4.1414	0.04

* Body mass index ** Type 2 Diabetes ***Coronary Artery Disease

Table 4: Association of T2D (with and without age adjustment) with Acculturation and CAD risk factors

Variable	Without age adjustment		With age adjustment	
	Wald Chi-square	p-value	Wald Chi-square	p-value
Acculturation (Mostly Asia vs. Mostly West)	15.0893	<0.001	15.8639(+1.50 ‡0.5164)	<0.001
Length of Stay in U.S (≥ 10 years)	4.4413	0.03	7.2667	0.007
Age	1.1268	0.28	-	-
Cholesterol (≥200mg/dl vs.<200 mg/dl)	7.5614	0.006	6.1417	0.01
History of CAD***	42.1219	<0.001	33.5255	<0.001
Hypertension(≥120 or ≥90)	39.3083	<0.001	34.4369	<0.001
Family History of T2D**	16.0892	<0.001	10.8620	0.001
Family History of Cardiac Disease	5.3035	0.021	4.8123	0.02
Waist Circumference (Male ≥90 cm; Female ≥80cm)	0.393	0.53	0.8678	0.35
BMI* (≥23.1 vs.≤ 23)	10.2976	0.001	10.8306	0.001
Physical Activity	8.2128	0.004	8.3328	0.003
CCA-IMT	6.3854	0.0115	3.9638	0.0465

Results Summary

- SAls in general, share a very heavy burden of CAD risk factors
- Prevalence of hypertension was 21.3%
- High cholesterol ≥ 200 mg/dl- 87%,
- HDL ≤ 40 mg/dl – 34%,
- LDL ≥ 150 mg/dl-35%,
- Obesity (BMI ≥ 23)- 54%,
78.2 % had BMI ≥ 23 , and of those 12.6% were overweight, 54% were obese and 11.5% were morbidly obese.
- Family history of CAD in 37.7%.
- History of CAD and T2D was 9.4% and 21.9%.
- The 26.7% of subjects had waist circumference ≥ 90 cms in males and ≥ 80 cms in females.
- Around 35% of study subjects had impaired glucose tolerance; low HDL (≤ 40 mg/dl) and abnormally high triglycerides and LDL

Results Summary

- 44 (27.7%) subjects were classified to have “low acculturation”, i.e. very Asian, while 115 (72.4%) were classified to have “high acculturation”, i.e. more westernized.
- High acculturation ($p < 0.0001$), ≥ 10 years stay in the US ($p = 0.0001$), cholesterol level ≥ 200 mg/dl ($p = 0.001$), hypertension ($p < 0.0001$), T2D ($p = 0.001$), BMI ≥ 23 ($p = 0.006$), physical inactivity ($p = 0.04$), and family history of CAD (0.007) were found to be independent predictors of CAD even after age adjustment.
- Similarly for T2D, high acculturation ($p < 0.0001$), ≥ 10 years stay in the US ($p = 0.007$), cholesterol level ≥ 200 mg/dl ($p = 0.013$), history of CAD (< 0.0001), hypertension ($p < 0.0001$), BMI ≥ 23 ($p = 0.001$), physical inactivity ($p = 0.003$), and family history of CAD (0.028) were found to be independent predictors of T2D after age adjustment.

Discussion/Strengths

- To our knowledge, no previous study has assessed acculturation association with CAD using SL-ASIA questionnaire
- Sample was randomly selected from Georgia, Kansas and Missouri to represent a geographically diverse yet culturally homogenous SA population.
- Pilot data re-emphasizes the need to consider acculturation as a predictor for CAD and T2D in contributing to the overall CAD risk
- More data is being collected for further association on SL-ASIA components with CAD
- Based on the available data, Framingham risk scores (FRS) for CAD prediction were calculated.
- 22% of SAs who were categorized as low risk based on FRS had CCA-IMT values of ≥ 75 th percentile for age, sex and ethnicity.
- The association of acculturation with CCA-IMT was not significant in this current study and could be attributable to small sample of CCA-IMT subjects.

Limitations

- Cross-sectional with a relatively small sample size.
- To obtain a homogenous group of South Asians, only South Asian Indians following Hindu religion were recruited.
- SAIs were recruited from health fairs in local Hindu temples and through Indian Association directories which may not be all inclusive and entirely representative of the South Asian community. However, to our knowledge, there is no database available that can provide some census data on SAIs in the US. Therefore, SAIs were most readily accessible through such community based approaches.
- Due to limited funding, blood testing was completed only on 67 patients.
- CAD Diagnosed on history and could be underestimation.

Conclusions

- SAIs in the US are at higher risk for CAD and T2D - Immigration and acculturation may play a major role in disease causation
- SAIs are known to carry a disproportionately high risk for CAD; traditional CAD risk factors may not fully explain the excess risk, there is a need to explore and understand other non-traditional risk factors.
- SAIs with high acculturation (being Westernized) appear to have higher prevalence of CAD, and its risk factors like obesity, hypertension, hyperlipidemia, and low physical inactivity
- Future studies are needed to better understand how acculturation influences health behaviors across different immigrant racial/ethnic groups
- Intervention studies that test tailored strategies to improve lifestyle behaviors across diverse racial/ethnic groups of immigrants are needed

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Conflict of Interest: None

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Questions ?