JVIN Journal of Vascular and Interventional Neurology
OFFICIAL JOURNAL OF THE ZEENAT QURESHI STROKE RESEARCH CENTER

Paradoxical increase in stroke mortality among Asian Indians in the United States

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Abstract

Objective—To better characterize the stroke mortality and risk factors among Asian Indians by using U.S. multiple-cause-of-death and National Health and Interview Survey data.

Methods—Age-adjusted fatal stroke incidence, stroke rate ratio with 95% confidence interval, and average annual percentage change (APC) over 10 years were calculated.

Results—The annual incidence of stroke mortality in 2000 was lowest among Asian Indians (88 per 100,000) followed by American Indians and Alaska Natives (112 per 100,000), whites (301 per 100,000) and African Americans (312 per 100,000). Significantly lower rates of hypertension and cigarette smoking in Asian Indians in 2000–2001 (compared with whites) explained the lower rates of stroke mortality. The APC increase over subsequent 10 years was 13.5%, 0.9%, −2.5%, and −2.9% for Asian Indians, American Indians and Alaska Natives, whites, and African Americans, respectively.

Conclusions—There is a paradoxical increase in stroke mortality among Asian Indians over the last 10 years in contrast to other population subsets.

Keywords

Stroke; National Health and Interview Survey (NHIS); Asian Indians; Mortality; Incidence

Introduction

Asian Indians are one of the largest Asian populations in the United States after Chinese and Filipinos. The U.S. Census Bureau in May 2009 estimated that there are 2.77 million Americans of Asian Indian descent [1]. Asian Indians have unique attributes that can increase or decrease the occurrence of stroke. Vegetarian diet was used by 20.4% of Asian-Indians but only 1.4% of whites according to California Men's Health Study (CMHS) [2]. Another analysis also found that Asian Indians were more likely have never smoked and abstain from alcohol use compared with whites [3]. However, Asian Indians were less likely to report moderate or vigorous physical activity ≥3.5 h/week. High rates of undiagnosed diabetes mellitus in Asian Indians is also noteworthy [4]. The rate of deep venous thrombosis also appears higher among Asian Indians compared with whites and African Americans suggesting a predilection to thrombo-embolic events [5].

With these considerations, we performed this study to characterize the stroke mortality and risk factors among Asian Indians in the United States.

Methods

Stroke-related mortalities in the United States were identified through Multiple-Cause Mortality Files for 2000–2009. The Multiple-Cause Mortality Files are compiled by the National Center for Health Statistics annually and includes data from all death certificates filed in the United States. These data contain the *International Classification of Diseases* codes for the underlying cause of death and up to 20 conditions listed on the death certificate. The causes of death are further processed by the automated classification of medical entities algorithm. The cause-specific death categories are categorized into one of the 358 cause-of-death groups [6]. We included all deaths categorized as ICD-10 235-238 to represent stroke-related deaths. The stroke mortality rates were analyzed according to age and racial/ethnicity including whites, African Americans, American Indian and Alaska Natives, and Asian Indians. The denominator was provided by 1,899,599 people reported only Asian Indian and or reported Asian Indian in combination with one or more other races or Asian groups from the 2000 Census [1]. The population residing for each racial and ethnic

Published May, 2014.

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Table 1. The age adjusted incidence, rate ratio, and annual percentage change of stroke mortality in Asian Indians and other race/ethnic groups

	Incidence (per 100,000) in 2000	Rate ratio (95% CI) in 2000	Incidence (per 100,000) in 2009	Rate ratio (95% CI) 2009	APC
Whites	301.67	Reference	238.96	Reference	-2.53
African Americans	312.21	1.03 (0.9–1.1)	238.63	1.0 (0.9–1.1)	-2.91
American Indian and Alaska Native	112.71	0.37 (0.3–0.4)	114.06	0.47 (0.4–0.6)	0.91
Asian Indians	88.43	0.29 (0.2–0.4)	220.12	0.92 (0.8–1.0)	13.51

APC. annual percentage change; CI, confidence interval.

Table 2. The incidence of stroke mortality in Asian Indians and other race/ethnic groups according to age strata (years) for 2000 and 2009

Age strata (years)	<24	25–44	45–64	65–84	≥85
Incidence (per 100,000) in 2000					
Whites	0.31	3.03	20.05	216.33	1268.63
African Americans	0.52	8.56	57.09	296.91	1197.96
American Indian and Alaska Natives	0.22	1.87	14.96	95.64	450.86
Asian Indians	0.14	0.93	11.45	75.87	353.75
Incidence (per 100,000) in 2009					
Whites	0.30	2.32	20.42	148.55	1023.20
African Americans	0.50	5.84	60.20	226.21	900.42
American Indian and Alaska Natives	0.16	1.22	17.65	92.24	459.05
Asian Indians	0.42	1.33	11.74	158.51	928.59

group in the United States was divided into age strata as follows: <24, 25–44, 45–64, 65–84, and ≥85 years. To remain consistent, we used similar methodology for determining the population of other race/ethnic groups. Average annual age-adjusted stroke mortality for whites, African Americans, American Indian and Alaska Natives, and Asian Indians were estimated. The age adjusted incidence and incidences within age groups were estimated for 2000 and 2009, The stroke rate ratio with 95% confidence interval (CI) and average annual percentage change were also calculated for 2000 and 2009.

We used the National Health Interview Survey 2000–2001 and 2009–2010 to determine the differences in demographic and clinical characteristics between whites and Asian Indians. The survey is based on a cross-sectional household interview with sampling and interviews throughout each year. A core set of questions regarding presence or absence of health conditions are inquired from participants during the interview. We performed "within" race/ethnicity group comparison for the two time periods for whites and Asian Indians separately. We also performed "between" race/ethnicity group comparisons for 2000–2001 and 2009–2010 separately. Means and frequencies were compared using analysis of variance and chi-square tests, respectively, using SAS 9.1 software (SAS Institute, Cary, NC).

Results

The incidences of stroke mortality in various racial/ethnic groups in 2000 and 2009 are presented in Table 1. The annual incidence of stroke mortality in 2000 was lowest among Asian Indians (88 per 100,000) followed by American Indians and Alaska Natives (112 per 100,000), whites (301 per 100,000), and African Americans (312 per 100,000). The incidence of stroke mortality decreased in all race/ethnic categories in 2009 (compared with 2000) except in Asian Indians (average APC of 13.5%) and remained relatively unchanged in American Indians and Alaska Natives (APC 0.91%). The rate ratio (compared with whites) was 0.3 (95% CI 0.2–0.4) and 0.9 (95% CI 0.8–1.0) in 2000 and 2009, respectively. The largest reduction in stroke mortality occurred in persons aged 65–84 years and ≥85 years for whites and African Americans in 2009. The rate of stroke mortality prominently increased in Asian Indians persons aged 65–84 years and ≥85 years in 2009.

A comparison of demographic and clinical characteristics of whites and Asian Indians is provided in Table 3. Asian Indians had significantly lower rates of hyperten-

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Table 3. Differences in demographic and clinical characteristics between whites and Asian Indians: National Health Interview Survey 2000–2001 and 2009–2010

	2000–2001		2009–2010	
	Whites	**Asian Indians**	**Whites**	**Asian Indians**
Total	151,516	1220	133,238	2280
Age(mean±SD)	37.76 (±22.3)	29.46 (±17.8)††	36.38 (±22.5)	32.45 (±19.6)††
Gender				
Men	73918 (48.8)	623 (51.1)	65431 (49.1)	1211 (53.1)
Women	77598 (51.2)	597 (48.9)	67807 (50.9)	1069 (46.9)††
BMI (mean±SD)	29.7 (±15.8)	26.6 (±14.7)††	30.18 (±14.7)	26.11 (±11.2)††
Overweight	17361 (33.9)	97 (29.4)	14258 (34.6)	195 (32.3)
Obesity	12562 (24.5)	30 (9.1)††	12356 (30.0)	69 (11.4)††
Hypertension	12303 (24.1)	32 (9.7)††	12616 (30.6)	108 (17.9)††
Diabetes mellitus	3148 (3.7)	12 (2.4)	38.66 (6.7)	51 (5.5)
Cigarette smoking				
Current	11896 (23.4)	37 (11.3)††	8147 (19.9)	47 (7.8)††
Former	12014 (23.7)	20 (6.1)††	9707 (23.7)	51 (8.5)††
Cancer	4054 (7.9)	2 (0.6)††	3984 (9.7)	9 (1.5)††
Coronary artery disease	2129 (4.2)	1 (0.3)††	2153 (5.2)	15 (2.5)††
Myocardial infarction	1877 (3.7)	0 (0)††	1542 (3.7)	6 (1.0)††
Stroke	1261 (2.5)	0 (0)††	1197 (2.9)	6 (1.0)††
Alcohol use	31958 (21.1)	138 (11.3)	26610 (20.0)	265 (11.6)††
Education				
Less than grade 12	46958 (34.5)	285 (26.6)††	40043 (32.9)	464 (22.8)††
High school graduate	35796 (26.3)	137 (12.8)††	29630 (24.3)	221 (10.9)††
Any college	45276 (33.2)	387 (36.1)	43908 (36.1)	748 (36.8)
More than 5 years of college	8205 (6.0)	262 (24.5)††	8196 (6.7)	599 (29.5)††
Medical insurance				
Present	126566 (84.3)	1035 (85.7)	108906 (81.7)	1995 (87.5)††

†$p < 0.01$ compared with whites.

Note: SD, standard deviation; BMI, body mass index.

sion, obesity, and current cigarette smoking in 2000–2001 and 2009–2010 compared with whites. A significantly higher proportion of Asian Indians had completed >5 years of college as compared with whites. A lower proportion of persons reporting a history of stroke or myocardial infarction among Asian Indians further supporting the results of fatal stroke rate analysis. The only significant increase between 2000–2001 and 2009–2010 was in proportion of persons with hypertension from 9.7% to 17.9% among Asian Indians.

Discussion

We found lower stroke mortality among Asian Indians in 2000 is probably due to lower rates of hypertension, obesity, and cigarette smoking as reported in the analysis of the National Health Interview Survey. The higher rate of educational attainment among Asian Indians may also contribute to the lower rate of stroke mortality. In a previous analysis, the risk for all fatal strokes was increased in persons who reported less than 12 years of education [7]. The increased risk was more prominent in persons aged 50 years or less. However, the reason for increase in stroke mortality among Asian Indians, in the time frame when a reduction in such rates is seen in other race/ethnicity groups, remains unclear. There appeared to be an increase in the proportion of Asian Indians with hypertension but the small magnitude of increase does not seem to account for the increase in stroke mortality.

The interpretation of these findings requires an understanding of the limitations posed by the methodology. Ascertainment of fatal strokes by death certificates may lead to diagnostic inaccuracies. A comparison of cause of death as stroke by death certificates and clinician

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adjudicators in one study demonstrated a specificity of 99% and agreement of 94% [8]. However, the sensitivity was 52% which suggests that death certificate based ascertainment underestimates the incidence of stroke mortality. However, the ascertainment bias is probably not different according to race/ethnicity groups. The analysis was performed in five age strata (due to availability) rather 8–10 strata as used in previous analysis [9]. Such stratification is relatively insensitive to smaller changes particular in the elderly given the large spectrum of age ranges ≥85 years. We were also unable to study incidences according to gender due to lack of detailed data on Asian Indians in the Census.

Our findings identify a gap in prevention strategies such as pharmacological treatment of risk factors, appropriate public policy, and lifestyle interventions to reduce cigarette smoking, limiting salt consumption, encouraging physical exercise, and dietary modifications, all of which can prevent events [10]. Such efforts have resulted in a decline of stroke mortality rates from 1999 and 2007, both in African American and in whites, and men and women [9]. However, the implementation or effect of primary prevention efforts in the United States appears to be lacking in Asian Indians. Further studies need to identify whether more effective implementation or detection of novel risk factors is required to address the increasing rate of fatal strokes in Asian Indians.

Conflicts of Interest and Source of Funding

This study was performed independently of any financial support. None of the authors have any conflict of interest to disclose and there are no financial conflicts to disclose.

Dr. Qureshi has received funding from the National Institutes of Health RO1-NS44976-01A2 (medication provided by ESP Parma), American Heart Association Established Investigator Award 0840053N, National Institute of Health U01-NS062091-01A2, and the Minnesota Medical Foundation, Minneapolis, MN.

All authors have read and approved submission of the manuscript.

The material in the manuscript has not been published and is not being considered for publication elsewhere in whole or in part in any language except as an abstract.

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