Cardiovascular Risk Factors among Asian Americans Living in Northern California

Arthur L. Klatsky, MD, and Mary Anne Armstrong, MA

ABSTRACT

Background. Recent substantial immigration has created large population subsets of Asian Americans in the United States. Available data about cardiovascular risk factors in these persons are sparse.

Methods. This study examined data among 13 031 persons self-classified as 5951 Chinese, 4211 Filipinos, 1703 Japanese, and 1166 other Asians. Covariates in regression analyses were age, smoking, alcohol, education, and marital status.

Results. Chinese men and women had the lowest adjusted mean body mass index. Filipino men and women had the highest prevalence of hypertension. There were no major differences in blood glucose levels. Total cholesterol levels were highest in Japanese men and women. Comparisons of US-born persons and those born in respective countries of origin showed no major cholesterol or glucose differences; more hypertension only in Chinese and other Asian men; higher body mass index in men, but not in women of most ethnicities; and a lower smoking prevalence in men, but a substantially higher one in women.

Conclusions. These data show important ethnic differences in risk factors among Asian Americans and indicate groups that should be targeted for public health efforts concerned with obesity (Asian-American men), hypertension (Filipino-American men and women), hypercholesteremia (all Asian Americans), and smoking cessation (Asian-American women). (*Am J Public Health.* 1991;81:1423–1428)

Introduction

Despite a marked acceleration of US immigration from Asia since the 1960s,[1,2] there are few reports concerning cardiovascular risk factors and disease incidence in Asian Americans. The available data[3–7] suggest more coronary artery disease among US-resident Japanese Americans (vs those resident in Japan), related to life-style changes. A study of elderly Chinese Americans[8] suggests risk factor profiles similar to those in China, with low risk of coronary artery disease and high risk of cerebrovascular episodes.[9,10] Two reports concerning blood pressure among Asian Americans in California[11,12] suggest that Filipinos are at greater risk; the authors of one[11] suggest that sociocultural factors are involved, but the authors of the other[12] raise the possibility of genetic influences. We have been given an opportunity to study cardiovascular risk factors among a substantial number of free-living Asian Americans and here present data concerning several of these traits.

Methods

Data were supplied by 13 031 Asian Americans who voluntarily took health examinations offered by a northern California prepaid health care program from the years 1978 through 1985. Sociodemographic and medical history data were obtained from a self-administered questionnaire that included the queries "What is your race?" and "Where were you born?" Previous descriptions have been published.[12,13] Sex and ethnic distributions are included in Table 1.

Examinees were asked to take no food or nutritious drink for at least 4 hours before their appointment time. Supine blood pressure was determined by a Roche Arteriosonde Blood Pressure Monitor, Model 1216. Blood chemistry tests were performed with a Technicon SMA 12-6 Multichannel Analyzer from January through May 1978; thereafter, an American Monitor ICDA Automated Chemistry Analyzer was used.

Adjusted means for body mass index, systolic blood pressure, diastolic blood pressure, total cholesterol, and glucose were determined by multiple regression analysis with the following covariables: age, body mass index (except when the dependent variable was body mass index), marital status, education, and alcohol use. Using the largest subgroup (Chinese) as the reference and with the same covariables in logistic regression models, odds ratios (ORs) were determined for high body mass index ($\geq$ 24.4 kg/m^2 or 3.5 lb/in^2), hypertension ($\geq$ 140/90 mm Hg or on treatment), high cholesterol ($\geq$ 6.21 mmol/L or 240 mg/dL), high glucose ($\geq$ 6.11 mmol/L or 110 mgm/dL), current cigarette smoking, and current cigarette smoking of one pack per day or more. Similarly, but with birthplace as an additional covariable, the relations of various traits to each of these

Arthur L. Klatsky is with the Division of Cardiology of the Department of Medicine, Kaiser Permanente Medical Center, and Mary Anne Armstrong is with the Division of Research, Kaiser Permanente Medical Care Program, Oakland, Calif.

Requests for reprints should be sent to Arthur L. Klatsky, MD, Division of Cardiology, Kaiser Permanente Medical Center, 280 W MacArthur Boulevard, Oakland, CA 94611.

This paper was submitted to the journal November 27, 1990, and accepted with revisions April 2, 1991.

Editor's Note. See related editorial by Yu on page 1391 of this issue.

TABLE 1—Traits of Persons in Asian-American Ethnic Groups by Sex

Trait	Chinese	Filipino	Japanese	Other Asian
No. (% of total)				
M	2754 (48.2)	1729 (30.3)	688 (12.0)	543 (9.5)
F	3197 (43.7)	2482 (33.9)	1015 (13.9)	623 (8.5)
Age (mean ± SD)				
M	40.2 ± 14.2	39.2 ± 13.4	42.1 ± 14.1	35.9 ± 10.4
F	38.0 ± 13.6	36.8 ± 11.6	40.9 ± 13.4	34.1 ± 10.5
Born in continental United States (%)				
M	39.9	8.3	74.6	8.4
F	41.8	8.7	67.4	12.1
Current smoker (%)				
M	16.2	32.9	22.7	30.9
F	7.3	11.4	18.6	12.6
Smoke ≥ 1 pack/day (%)				
M	4.1	7.1	8.2	6.7
F	1.3	1.7	4.6	1.6
Drank any alcohol in past year (%)				
M	72.9	81.7	87.4	80.6
F	56.1	47.4	77.0	53.0
College graduate (%)				
M	53.1	49.6	59.3	58.4
F	43.7	53.7	46.8	38.8
Married (%)				
M	68.7	78.9	68.4	73.4
F	62.3	68.9	61.9	73.7
Cholesterol ≥ 6.21 mmol/L (%)				
M	26.6	29.8	36.3	20.4
F	20.2	20.6	30.3	13.5
Glucose ≥ 6.11 mmol/L (%)				
M	15.9	16.1	20.8	11.6
F	10.2	10.8	13.2	9.6
Body mass index ≥ 24.4 kg/m^2				
M	26.9	41.8	38.0	28.9
F	12.8	25.5	18.0	14.6
Blood pressure ≥ 140/90 mm Hg[a] (%)				
M	10.5	12.2	12.9	6.2
F	7.8	9.6	8.8	5.4

[a]Or receiving treatment for hypertension.

end points were studied within each Asian-American ethnic subset using country of ethnic origin as the reference group. Thus, for Chinese Americans, those born in Hong Kong (n = 607), Taiwan (n = 245), Hawaii (n = 121), the continental United States (n = 2431), and other places (n = 438) were compared with those born in mainland China (n = 2109). For Japanese Americans, those born in Hawaii (n = 167) and the continental United States (n = 1174) were compared with those born in Japan (n = 331). For Filipino Americans, those born in the United States (n = 352) were compared with those born in the Philippines (n = 3815). The largest subsets of other Asian Americans were 295 persons born in Korea, 178 persons born in Vietnam, 252 persons born in India, 55 persons born in Thailand, and 58 persons born in Pakistan; we compared all 102 born in the United States with those born in all "other Asian" countries combined.

Results

Adiposity

Adjusted mean body mass index was lowest in Chinese men and women and highest in Filipino men and women (Tables 2 and 3); these means translated into higher prevalence (Table 1) and adjusted ORs (Table 4) of obesity for the Japanese, Filipino, and other Asian subsets vs the Chinese reference group. Birthplace in the continental United States was associated with increased ORs of obesity in men of all ethnic subsets (Table 5); this was also true for Chinese men born in Hawaii (OR vs birthplace in China = 2.4; 95% confidence interval [CI] = 1.3, 4.5) and for Japanese men born in Hawaii (OR vs birthplace in Japan = 3.2; 95% CI = 1.5, 6.6). Among women, only other Asians of US birthplace had similar increases in ORs of obesity (Table 5). Hawaiian-born Japanese women had an increased OR of obesity (OR vs those born in Japan = 2.4; 95% CI = 1.3, 4.4), but this was less true for Chinese women born in Hawaii (OR vs birthplace in China = 1.5, 95% CI = 0.8, 2.9). Chinese men and women born in Hong Kong or Taiwan had no substantially different ORs of obesity when compared with their counterparts born in China (data not shown).

Among men and women, age and currently married status were positively related to obesity. Educational status and alcohol consumption were not related to this trait among men but showed inverse relations to obesity in women.

Hypertension

The increased hypertension risk of Filipino Americans has been described.[12] Only in Chinese men was continental US birthplace associated with more hypertension (Table 5). Chinese and Japanese men and women born in Hawaii did not have increased risk of hypertension compared with their counterparts born in China, nor did Chinese men born in Hong Kong or Taiwan, or Chinese women born in Hong Kong. Chinese women born in Hong Kong had *less* risk of hypertension (OR vs China-born = 0.3; 95% CI = 0.1, 0.8).

Cholesterol

In each sex, the adjusted means were lowest in other Asians and higher in Japanese men and women than in other ethnic groups (except for small differences between Japanese and Filipino men) (Tables 2 and 3). Compared with the Chinese reference group, only Japanese men and women had increased ORs for high cholesterol (Table 4). Birthplace in the continental United States (Table 5) or in Hawaii (data not shown) vs birthplace in country of origin carried no substantially different ORs for high cholesterol. The only birthplace subset with such a difference was the Chinese women born in Hong Kong (OR vs birthplace in China = 1.5, 95% CI = 1.1, 2.3).

For comparison, unadjusted mean total serum cholesterol was 5.49 mmol/L (212.4 mg/dL) among Black persons (n = 32 890), 5.57 mmol/L (215.4 mg/dL) among White persons (n = 73 920), and

TABLE 2—Adjusted Mean Risk Factors among Asian-American Men

Risk Factor	Ethnicity (Adjusted mean ± SE)				Pairs for Which $P < .01$
	Chinese	Filipino	Japanese	Other Asian	
Body mass index (kg/m^2) (Quetelet's)	22.9 ± 0.1	23.9 ± 0.1	23.7 ± 0.1	23.6 ± 0.1	C vs all
Systolic blood pressure (mm Hg)	122.2 ± 0.3	124.4 ± 0.4	121.3 ± 0.6	120.3 ± 0.7	F vs all
Diastolic blood pressure (mm Hg)	75.5 ± 0.2	75.5 ± 0.2	73.9 ± 0.4	74.0 ± 0.4	F vs J, O
Total cholesterol (mmol/L)	5.59 ± 0.02	5.67 ± 0.03	5.72 ± 0.04	5.52 ± 0.05	F vs O
Glucose (mmol/L)	5.45 ± 0.03	5.54 ± 0.03	5.54 ± 0.05	5.54 ± 0.06	0

Note. Each risk factor was considered separately as a dependent variable in a linear regression analysis that produced means for each ethnic group, adjusted for age, marital status, education, alcohol intake, and body mass index (except when body mass index was the dependent variable). C = Chinese; F = Filipino; J = Japanese; O = other Asian.

TABLE 3—Adjusted Mean Risk Factors among Asian-American Women

Risk Factor	Ethnicity (adjusted mean ± SE)				Pairs for Which $P < .01$
	Chinese	Filipino	Japanese	Other Asian	
Body mass index (kg/m^2) (Quetelet's)	21.2 ± 0.1	22.6 ± 0.1	21.6 ± 0.1	22.2 ± 0.1	C vs all
Systolic blood pressure (mm Hg)	116.3 ± 0.3	119.2 ± 0.3	115.7 ± 0.5	115.9 ± 0.6	F vs all
Diastolic blood pressure (mm Hg)	71.7 ± 0.2	72.9 ± 0.2	70.3 ± 0.3	70.8 ± 0.4	F vs all
Total cholesterol (mmol/L)	5.33 ± 0.02	5.35 ± 0.02	5.52 ± 0.03	5.26 ± 0.04	J vs all
Glucose (mmol/L)	5.22 ± 0.02	5.24 ± 0.02	5.26 ± 0.04	5.28 ± 0.05	0

Note. Each risk factor was considered separately as a dependent variable in a linear regression analysis that produced means for each ethnic group, adjusted for age, marital status, education, alcohol intake, and body mass index (except when body mass index was the dependent variable). C = Chinese; F = Filipino; J = Japanese; O = other Asian.

5.47 mmol/L (211.6 mg/dL) among all Asian-American persons combined.

Glucose

Study of adjusted mean blood glucose levels showed no major differences in any of the comparisons.

Smoking

Chinese men and women were least likely to smoke any amount or to smoke heavily (Tables 1 and 4). Among women, the Japanese were most likely to be smokers; among men (other than Chinese), the differences in smoking were smaller. Generally, men born in the United States were less likely to smoke than their counterparts born in Asia, although there was little difference with respect to heavier smoking (Table 5). Chinese men born in Hawaii, Hong Kong, or Taiwan were slightly less likely to smoke at all or to smoke heavily compared with Chinese men born in China (data not shown); Japanese men born in Hawaii were slightly less likely to smoke at all and substantially less likely to smoke one pack or more per day (OR = 0.3, 95% CI = 0.1, 0.9) than their counterparts born in Japan.

With the exception of Japanese women, women born in the United States were more likely to smoke and had substantially increased adjusted ORs for heavier smoking (Table 5). Chinese women born in Hawaii (but not those born in Hong Kong or Taiwan) were also more likely to smoke (OR vs Chinese birthplace = 3.6, 95% CI = 1.7, 5.5), or to smoke one pack or more per day (OR = 9.8, 95% CI = 2.1, 46.0). Hawaiian-born Japanese women, like those born in the continental United States, were, compared with their Japan-born counterparts, less likely to smoke any amount (OR = 0.5, 95% CI = 0.2, 0.98) or to smoke one pack or more per day (OR = 0.5, 95% CI = 0.1, 2.3).

Among both sexes, alcohol drinking was strongly related and college graduation inversely related to smoking. Other traits related to smoking among men were age (weak negative), body mass index (weak negative), and married status (strong positive); among women, age (weak negative) and marital status (weak negative) were related to smoking.

Discussion

There is a consensus that coronary artery disease is related substantially to all of the risk factors discussed in this article and that cerebrovascular disease is related to several. Cigarette smoking is presumably not primarily determined genetically, whereas the other risk factors studied are determined by both genetic and life-style factors. The presumption that US-born persons of each Asian-American ethnic

TABLE 4—Odds Ratios for Risk Factors among Asian-American Ethnic Groups

Risk Factor	Ethnicity: Chinese[a] OR	Filipino OR (95% CI)	Japanese OR (95% CI)	Other Asian OR (95% CI)
Body mass index ≥ 24.4 kg/m²				
M	1.0	1.9 (1.7, 2.3)	1.6 (1.3, 1.9)	1.8 (1.5, 2.2)
F	1.0	2.7 (2.3, 3.2)	1.4 (1.2, 1.8)	2.0 (1.6, 2.6)
Hypertension[b]				
M	1.0	1.3 (1.0, 1.6)	1.1 (0.8, 1.4)	0.9 (0.6, 1.3)
F	1.0	1.5 (1.2, 1.9)	0.9 (0.7, 1.3)	1.0 (0.6, 1.5)
Cholesterol ≥ 6.21 mmol/L				
M	1.0	1.1 (1.0, 1.3)	1.3 (1.1, 1.6)	0.9 (0.7, 1.2)
F	1.0	1.1 (1.0, 1.3)	1.5 (1.2, 1.8)	1.0 (0.7, 1.2)
Glucose ≥ 6.11 mmol/L				
M	1.0	1.1 (0.9, 1.3)	1.3 (1.0, 1.6)	1.1 (0.8, 1.4)
F	1.0	1.1 (0.9, 1.3)	1.2 (0.9, 1.5)	1.4 (1.1, 1.9)
Smoke any amount (current)				
M	1.0	2.3 (2.0, 2.7)	1.4 (1.1, 1.8)	2.0 (1.6, 2.6)
F	1.0	1.9 (1.6, 2.3)	2.3 (1.9, 2.9)	2.0 (1.5, 2.7)
Smoke ≥ 1 pack/day				
M	1.0	1.6 (1.2, 2.1)	1.8 (1.3, 2.6)	1.7 (1.1, 2.5)
F	1.0	1.5 (0.9, 2.3)	2.8 (1.8, 4.4)	1.5 (0.8, 2.9)

Note. OR = odds ratio; CI = confidence interval. ORs were computed from coefficients estimated by logistic regression for each risk factor and each gender separately, controlled for age, marital status, education, alcohol intake, and body mass index (except when body mass index ≥ 24.4 kg/m² was the dependent variable).
[a]Chinese are reference category.
[b]≥ 140/90 mm Hg or on treatment for hypertension.

TABLE 5—Adjusted Odds Ratios for Risk Factors among Asian-American Ethnic Groups: United States Birthplace vs Birthplace in China, Japan, the Philippines, and Other Asian Countries

Risk Factor	Ethnicity: Chinese OR M	Chinese OR F	Japanese OR M	Japanese OR F	Filipino OR M	Filipino OR F	Other Asian OR M	Other Asian OR F
Body mass index ≥ 24.4 kg/m²	1.6***	1.2	3.0*	1.3	2.0***	1.2	2.4*	2.5*
Hypertension[a]	1.4*	0.9	1.0	0.7	0.9	0.6	3.4*	1.5
Cholesterol ≥ 6.21 mmol/L	1.1	1.0	1.3	0.9	0.8	0.8	1.0	0.4
Glucose ≥ 6.11 mmol/L	1.0	0.9	1.0	1.3	0.9	0.7	1.2	1.3
Smoke any amount (current)	0.6***	2.4*	0.5**	0.7	0.7	1.8**	0.6	1.5
Smoke ≥ 1 pack/day	1.1	4.9**	0.3	1.0	1.0	3.1**	1.9	7.4*

Note. OR = odds ratio. Hawaii was not included in the US birthplace category; see text for discussion of persons born in Hawaii, Hong Kong, Taiwan, and elsewhere. All ORs were computed from coefficients estimated by logistic regression for each ethnicity and gender separately, controlled for age, marital status, education, alcohol intake, and body mass index (except when body mass index ≥ 24.4 kg/m² was the dependent variable).
[a]≥ 140/90 mm Hg or on treatment for hypertension.
*$P < .05$.
**$P < .01$.
***$P < .001$.

group are more likely to practice US lifestyle habits will be the basis for further discussion.

If the observed smoking differences represent cultural influences, ethnic group differences in smoking behavior probably reflect differences in the respective countries of origin. Asian-American men born in the United States are apparently subject to the same antismoking influences that have resulted in a substantial reduction in smoking among US men of other ethnicities.[14] In a study of ethnic Japanese men,[4,15] a much larger proportions of men in Japan than in Hawaii or California were light smokers, but the proportions of heavier smokers were similar in Japan and California (higher in Hawaii). We found both lighter and heavier smoking to be less prevalent in Japanese men born in the continental United States and Hawaii. Although the two studies used different methodologies, the data suggest that acculturation has resulted in less smoking among Japanese-American men over the 10 to 15 years between the dates of collection of data. We know of no comparable data about smoking that compare US-born and Asia-born persons of other ethnicities.

Why, then, do US-born Asian-American women (except the Japanese) exhibit so much more smoking than their Asia-born counterparts? Some of this can probably be explained by the fact that, among the Asia-born people, the women were much less likely to smoke than the men (Japanese women again excepted). This reflects the situation in the countries of origin.[16,17] It is plausible to hypothesize that the more liberal attitude of American society toward behavior or women tends to equalize this gender disparity in smoking, especially in persons of high educational attainment. Asian-American women born in the United States, under less intense specific social pressures against women not to smoke, apparently take up the habit. In this respect, Asian Americans become similar to other US ethnic groups; among young US White and Black persons, smoking is now almost equally prevalent in the sexes.[14] The Japanese Americans in our study were older and were the only ethnic group with a preponderance of US-born persons; these factors probably account for the smaller gender difference in smoking behavior. Whatever the explanation, these data about smoking suggest an area of major public health concern. The attributable risk of smoking to coronary heart disease is high in young women.[18] By its nature, smoking is the coronary disease risk factor most amenable to complete control. Thus, smoking cessation programs should be targeted toward Asian-American women.

The finding of greater risk of adiposity among US-born and Hawaii-born persons (vs counterparts born in Asian countries) was expected, both on the basis of prior data in Japanese men[4,15] and presumed dietary habits. We did not, how-

ever, expect greater adiposity in US-born persons to be limited to men. College education and use of alcoholic beverages were inversely related to adiposity in women but not men in this study. These relations support the argument that acculturation operates in the direction of more emphasis on slimness and fitness in the United States among women but not among men. We have no other data to support this speculation. We do not know whether the interethnic differences we found in the United States reflect similar differences in Asian populations, but suspect they do. Our findings confirm the need to control for body mass index in studies comparing cardiovascular risk factors among ethnic groups.

The only two relevant studies known to us[11,12] agree that Filipino Americans are at greater risk of hypertension than other Asian-American groups. Whatever the explanation, the data have potential implications for research about the pathogenesis of hypertension,[12] as well as pointing to an area for public health efforts.

There are almost no previously reported data concerning cholesterol levels in Asian-American groups. Mean total cholesterol and low-density lipoprotein (LDL) cholesterol levels are lower in Asian countries[19-26] than in Western societies. Higher mean cholesterol levels among ethnic Japanese men living in Hawaii and California (vs those living in Japan) are believed to be due to the higher proportion of fat in the Western diet.[27] We did not find that, independent of body mass index differences, US-born persons of each ethnicity had higher cholesterol levels than their counterparts born in the countries of origin, suggesting either that immigrants from Asia rapidly adopt a high-fat diet or that their progeny maintain similar dietary habits. In support of the former explanation are the similarities of mean total cholesterol levels in US Blacks, Whites, and Asians and scattered reports of rapidly rising fat intake and cholesterol levels in several Asian countries.[22-29]

In this young study population with a majority of women, it will be several more years before the study will have the power to discern possible differences in major cardiovascular disease outcomes. On the basis of the risk factor data herein described. Chinese Americans should fare the best and Filipino Americans and Japanese Americans should fare the worst. For the present, these data can be of use to workers in preventive cardiology. Special efforts should be focused on weight control in Asian-American men, on cigarette smoking among Asian-American women, on diagnosis and treatment of hypertension among Filipino-American men and women, and on control of hypercholesteremia in all Asian Americans. □

Acknowledgments

This research was presented in part on November 14, 1988, at the American Heart Association 42nd Annual Scientific Session, Washington, DC; on October 1, 1990, at the 118th Annual Meeting of the American Public Health Association in New York, NY; and on November 12, 1990, at the 44th Annual Scientific Session of the American Heart Association in Dallas, TX. Data concerning blood pressure in Asian Americans have been published.

The authors thank Harald Kipp for computer programming, Cynthia Landy and Rita Coston for data collection, and Lyn Wender for assistance in preparation of the manuscript.

This research was supported by the Alcoholic Beverage Medical Research Foundation Inc, Baltimore, Maryland. The study protocol was approved by the Kaiser Permanente Medical Care Program, Northern California Region, Institutional Review Board.

References

1. Lin-Fu JS. Population characteristics and health care needs of Asian Pacific Americans. *Public Health Rep.* 1988;103:18–28.
2. Gardner RW, Robey B, Smith PC. Asian Americans: growth, changes, and diversity. *Population Bull.* 1985; 40(4). Washington, DC: Population Reference Bureau.
3. Robertson TL, Kato H, Rhoads GG, et al. Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii and California. Incidence of myocardial infarction and death from coronary heart disease. *Am J Cardiol.* 1977;39:239–253.
4. Robertson TK, Kato H, Gordon, T, et al. Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii and California. Coronary heart disease risk factors in Japan and Hawaii. *Am J Cardiol.* 1977;39:244–249.
5. Gordon T. Mortality experience among the Japanese in the United States, Hawaii, and Japan. *Public Health Rep.* 1957;72:543–553.
6. Winklestein W, Kagan A, Kato H, Sacks S. Epidemiologic studies of coronary disease and stroke in Japanese men living in Japan, Hawaii, and California: blood pressure distributions. *Am J Epidemiol.* 1975;102:502–513.
7. Yano K, MacLean CJ, Reed DM, et al. A comparison of the 12-year mortality and predictive factors of coronary heart disease among Japanese men in Japan and Hawaii. *Am J Epidemiol.* 1988;127:476–487.
8. Choi ESK, McGandy RB, Dallal GE, et al. The prevalence of cardiovascular risk factors among elderly Chinese Americans. *Arch Intern Med.* 1990;150:413–418.
9. Wu YK. Epidemiology and community control of hypertension, stroke, and coronary heart disease in China. *Chin Med J.* 1979;92:665–670.
10. World Health Organization. *World Health Statistics Annual 1979.* Geneva, Switzerland: World Health Organization; 1979.
11. Stavig GR, Igra A, Leonard AR. Hypertension among Asians and Pacific Islanders in California. *Am J Epidemiol.* 1984;119:677–691.
12. Angel A, Armstrong MA, Klatsky AL. Blood pressure among Asian-Americans living in northern California. *Am J Cardiol.* 1989;64:237–240.
13. Klatsky AL, Siegelaub AB, Landy C, et al. Racial patterns of alcoholic beverage use. *Alcoholism: Clinical and Experimental Research.* 1983;7:373–377.
14. US Department of Health and Human Services. *Epidemiology: Seventh Special Report to the US Congress on Alcohol and Health from the Secretary of Health and Human Services.* Rockville, MD: US Dept of Health and Human Services, January 1990:13–14; DHHS publication No. (ADM) 90-1656.
15. Kagan A, Harris BR, Winkelstein W Jr, et al. Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California: demographic, physical, dietary and biochemical characteristics. *J Chronic Dis.* 1974;27:345–364.
16. Principal Investigators of the MONICA Project (WHO MONICA Project). Geographical variation in the major risk factors of coronary heart disease in men and women aged 35–64 years. *World Health Stat Q.* 1988;41:115–140.
17. Koong SL, Malison MD, Nakashima AK. A prevalence survey of behavioral risk factors in Taipei City, Taiwan. *Int J Epidemiol.* 1990;19:154–159.
18. Rosenberg L, Miller DR, Kaufman DW, et al. Myocardial infarction in women under 50 years of age. *JAMA.* 1983;250:2801–2806.
19. Simons LA. Interrelations of lipids and lipoproteins with coronary artery disease mortality in 19 countries. *Am J Cardiol.* 1986;57:5G–10G.
20. Szatrowski TP, Peterson AV Jr, Shimizu Y, et al. Serum cholesterol, other risk factors, and cardiovascular disease in a Japanese cohort, *J Chronic Dis.* 1984;37:569–584.
21. Kesteloot H, Huang DX, Yang XS, et al. Serum lipids in the People's Republic of China: comparison of western and eastern populations. *Arteriosclerosis.* 1985;5:427–433.
22. Tung C-L, Chen W-C, Liang S-P, Pan S-R, Xue W. A reappraisal of the changing proportion of the various types of heart diseases in Shanghai and its relationship to serum cholesterol levels. *Chin Med J.* 1984;97:171–174.
23. Yao C-H, Wu Z-S, Hong Z-G, et al. Risk factors of cardiovascular diseases in Beijing. *Chin Med J.* 1988;101:901–905.
24. Nitiyanant W, Ploybutr S, Harntong S, Wasuwat S, Tandhanand S. Lipid and lipoprotein contents in normal Thai subjects. *J Med Assoc Thai.* 1987;70:20–23.
25. Bates SR, Hill L, Barrett-Connor E. Car-

diovascular disease risk factors in an Indochinese population. *Am J Prev Med.* 1989;1:15–20.
26. Shieh S-M, Shen M, Fuh MM-T, Chen Y-DI, Reaven GM. Plasma lipid and lipoprotein concentrations in Chinese males with coronary artery disease, with and without hypertension. *Atherosclerosis.* 1987;67:49–55.
27. Nichaman MZ, Hamilton HB, Kagan A, et al. Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii and California: distribution of biochemical risk factors. *Am J Epidemiol.* 1975;102:491–501.
28. Hughes K, Yeo PPB, Lun KC, et al. Ischaemic heart disease and its risk factors in Singapore in comparison with other countries. *Ann Acad Med Singapore.* 1989;18:245–249.
29. Chew WLS, Mah PK, Tan YT, Cheong CK. A comparison of the levels of total serum cholesterol (1974–1984) and its relations to ischaemic heart disease in Singapore and the United States of America. *Singapore Med J.* 1988;29:6–10.

Physician Program Cut Infant Death Rate by 45%

Physicians serving poor Miami neighborhoods under a controversial national program cut the infant death rate by 45%, according to a School of Medicine study published in the September issue of *Obstetrics and Gynecology*.

The University of Miami research study is the first documentation of the effectiveness of the National Health Service Corps, a federal program that provides financial assistance to medical students in exchange for a commitment to practice for 1 to 4 years in medically needy communities. The Corps was virtually dismantled by the Reagan administration but has since been partially restored by President Bush in response to pressure from the poor and from physicians.

According to the study, the Corps program saved the lives of at least 320 infants in Miami from 1987 to 1989. Three University of Miami physicians, Hoa Nguyen, Mary Jo O'Sullivan, and Arthur Fournier, examined the impact of placing eight Corps pediatricians and seven obstetricians with four public health clinics: Borinquen Health Care Center in Little Havana, Family Health Center in Liberty City, Community Health of South Dade, and Stanley Myers Community Health Center in Miami Beach.

Before the arrival of Corps physicians, perinatal mortality rates among the poor in Miami varied from 29 to 36 per 1000 live births—about twice the national average of 15.6%. Poor maternal nutrition, financial problems, lack of transportation to clinics, substance abuse and unawareness of pregnancy were cited as contributing factors to the high infant death rate.

Within a year, the mortality rate in the neighborhoods with Corps physicians had fallen to 16 deaths per 1000 live births. In 1988 the rate remained 16 per 1000 and in 1989 it dropped to 13 per 1000, which is better than the national average. There was no significant change in death rates for three other Miami community health centers without Corps obstetricians and pediatricians.

"The Corps physicians were able to follow patients more closely, checking on nutrition and pregnancy complications like diabetes or hypertension. Corps obstetricians were able to supervise deliveries, and pediatricians monitored high-risk babies," said Dr. Arthur Fournier, associate dean for Community Health Affairs at the University of Miami School of Medicine, who served as a Corps physician in rural Onley, Va in 1976 to 1977.

Since the study was conducted, the 15 Corps physicians completed their obligations and left the Miami centers.

"Reagan felt the program was a failure because it didn't keep physicians in the underserved communities after their commitments expired," said Fournier. "But our study demonstrated that for the time they were there, they made a significant impact."

The National Health Service Corps began recruiting volunteers in 1972 to serve in medically needy communities. Scholarship awards peaked during the Carter presidency. But because students did not serve until after they completed their residency training programs, the number of active Corps physicians did not hit its highest point until 1986, when 1400 served. Awards dwindled to a low of 50 in 1988 before rebounding last year. As of May 1991 there are 131 scholarship holders, according to Lynn Trible, public affairs specialist for the Health Resources and Services Administration in Washington, DC. Altogether, 13 804 medical students have gone through the Corps program.