HEALTH PROBLEMS AND HOSPITALIZATIONS AMONG ASIAN-AMERICAN ETHNIC GROUPS

Arthur L. Klatsky, MD; Irene Tekawa, MA

Objectives: To study health status and hospitalization risk among Asian Americans.

Design: Cross-sectional analyses and cohort study.

Setting: Comprehensive prepaid health care program in Northern California.

Patients: Adult Asian Americans (N=13,592), self-classified at health examinations as 6050 (44.5%) Chinese, 1707 (12.6%) Japanese, 4232 (31.1%) Filipinos, 714 (5.3%) South Asians, and 889 (6.5%) Other Asians.

Interventions: None except data analysis.

Outcome Measures: With Chinese and Whites (n=72,019) as referents, comparison of symptom composites by logistic regression and hospitalization risk by Cox proportional hazards models.

Results: Compared to Chinese, Filipinos, South Asians, and other Asians more frequently reported coronary, respiratory, gastrointestinal, and emotional problems. Chinese and Japanese generally had the lowest hospitalization risk. Compared to Chinese, hospitalization risk was higher (P<.05) among Filipinos for circulatory (men or women), respiratory (men), and digestive (women) conditions (relative risks [RR] range from 1.5 to 1.7) and among South Asian men for cardiovascular conditions (RR=2.2). While Asian groups generally had similar or lower hospitalization risk than Whites, risks were higher for asthma (Filipino and South Asian men, RRs >3.0), peptic ulcer (Chinese men, Filipino men and women, other Asian women [RRs 1.9–5.6]), and coronary disease (South Asian men (RR=2.3) and Filipino women (RR=1.5).

Conclusions: Variations in risk of hospitalization and frequency of reported health problems point out differences in health problems and health needs among subgroups of Asian Americans. This diversity shows the need to study Asian ethnic groups separately. (*Ethn Dis.* 2005;15:753–760)

Key Words: Asian Americans, Chinese, Epidemiology, Ethnicity, Filipino, Hospitalization, Japanese, Risk, South Asian

From the Division of Research, Kaiser Permanente Medical Care Program, Oakland California.

INTRODUCTION

The rapidly growing Asian-American and Pacific Islander (AAPI) population in the United States includes ethnic groups with diverse cultures, languages, and countries of origin. The AAPI population of 7.3 million in 1990 in the United States increased to 12.1 million in the 2000 census.[1] In the San Francisco-Oakland Bay Area, AAPIs constituted ≈15% of the population in 1990 and >20% in 2000.[2] The AAPI ethnic groups have disparate immigration histories due, in large part, to US immigration policies.[3–5] Some groups, such as Vietnamese, consist substantially of refugees who are recent immigrants; others, such as Filipinos and South Asians (Indians, Pakistanis, Sri Lankans, and Bangladeshi) are largely foreign-born. The Chinese include substantial proportions of both recent immigrants and US-born persons. The Japanese have the highest proportion US born, with many third- and fourth-generation family members in the United States.

Until recently health status information has been generally reported for AAPIs overall or for the more established, relatively acculturated Japanese and Chinese; these data suggested a generally healthy population.[3–7] More recent survey data indicate a bimodal distribution of health, with relatively poor health status among several of the more recent immigrant groups.[5,8] Differences in socioeconomic status and

Address correspondence and reprint requests to Arthur L. Klatsky, MD; 3505 Broadway; Oakland, CA 94611; 510-752-6538; 510-752-7456 (fax); arthur.klatsky@kp.org

education, plus linguistic isolation,[5,9–12] have implications for access to medical care and could affect health status. Independent of access, healthcare utilization by some groups may also depend on traditional beliefs.

AAPIs have higher risks for certain cancers and higher prevalence of tuberculosis and hepatitis B.[4,13] Except for reports of Japanese men[14–17] and Kaiser Permanente publications about coronary disease[18,19] and venous thromboembolism,[20] little follow-up information has been reported from Asian cohorts living in the United States. In particular, hospitalization data have been limited to self-reported episodes, with limited information about reasons for the hospitalizations.

In this article we present self-reported indices of health problems and prospective data about hospitalization diagnoses among Asian-American ethnic groups in northern California.

METHODS

Subjects and Materials

The study subjects were persons who, from 1978–1985, voluntarily took a health examination offered by a north-

ern California prepaid health plan.[21] The analysis includes all Asian Americans (*n*=13,592; 10.5% of all 128,934 examinees) and Whites (*n*=72,019; 55.9% of examinees). A self-administered questionnaire provided sociodemographic data. The question "What is your race?" identified 6050 Chinese (44.5% of Asians), 1707 Japanese (12.6%), 4232 Filipinos (31.1%), and 889 (6.5%) other Asians. Among those who reported race as other Asian or other, South Asians (Asian Indians, Pakistanis, Bangladeshi, and Sri Lankans, *n*=714; 5.3% of Asians) and others were identified from review of birthplace, surname, and religion. We do not know whether Pacific Islanders are included among the Asians. Among those responding other Asian, Korea was given as birthplace for approximately one-third and Vietnam for approximately one fifth.

Responses to questions about medical history and current symptoms were used to create dichotomous (yes, no) composites as indicators for possible pre-existing coronary artery disease (CAD)[18] and respiratory, upper gastrointestinal (GI), lower GI, and emotional health problem*s*. For example, the upper GI composite was composed of responses to: "now have liver trouble, trouble swallowing, abdominal or stomach pain, or unexplained weight loss," "doctor ever said you had liver disease (cirrhosis, hepatitis), gallstones or gallbladder disease, hiatal (diaphragmatic) hernia, stomach or duodenal ulcer," and "ever had an operation on gallbladder, stomach?" Each symptom composite was based on responses to similarly selected sets of questions and considered positive if the response to any question in the set was yes.

Hospital admissions to health plan medical centers in northern California from the examination date through December 1996 were identified from computerized data sources. The primary discharge diagnosis was used to classify hospitalizations into major categories as defined in the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM). Hospitalizations for pregnancy, congenital anomalies, and certain perinatal conditions (codes 630-676, 740-759, and 760-779) were excluded. Selected diagnoses making up ≥1% of all hospitalizations among either Asian or White persons were also identified for study.

Analytic Methods

Differences between race/ethnic groups in proportions with positive symptom composites were analyzed by using logistic regression. For hospitalization analysis, subjects were followed from the examination date to the end of continuous participation (participation termination or death) or through December 31, 1996. Mean follow-up was 10.5 years for Asian men, 10.6 years for Asian women, 9.9 years for White men, and 10.1 years for White women. For analyses of specific diagnoses, follow-up ended at the date of first hospital admission with the diagnosis.

Age-specific hospitalization rates (age <45, 45–59, ≥60) were obtained by gender and race/ethnicity. Age-adjusted rates (AAR) were obtained by the direct method with the observed age distribution of all Asians over the follow-up period and are reported per 1000 person-years of follow-up. Risk for Asian groups was compared by gender to risk for Chinese, the largest Asian group, and to risk for Whites. Proportional hazards regression models yielded relative risk (RR) estimates, 95% confidence intervals, and *P* values. Results are generally given for the Asian ethnic groups separately. Some results are reported for Asians overall when comparisons with Whites show similar trends for all or most Asian ethnic groups. Analyses were reported separately by gender, and except where otherwise indicated, reported results are age adjusted only. Analyses were performed by using SAS Software (SAS Institute, Cary, NC).

RESULTS

Characteristics of Study Subjects

Mean ages at examination for the Asian ethnic groups ranged from 34 years (South Asians and Other Asians) to 41 years (Japanese) and were younger than that for Whites (43 years). The proportions <45 years of age ranged from 57% in Japanese to 86% in South Asians. Most (54%–59%) Asian examinees were women (except for South Asians with 41% women), as was also true for Whites (53% women). Differences among the Asian groups in the proportions born in the United States varied markedly, as follows: Japanese=79%, Chinese=43%, Other Asians=11%, Filipinos=8%, and South Asians – identified, in part, by birthplace – only 1%. Proportions of current smokers in men varied from 15% (Chinese) to 33% (other Asian) and in women from 2% (South Asians) to 18% (Japanese). For comparison, 23% of White men and 24% of White women were smokers. Among Asian men, proportions of lifelong alcohol abstainers ranged from 10% (Japanese) to 25% (Chinese) and among Asian women from 20% (Japanese) to 59% (South Asians). Lifelong alcohol abstinence among Whites was lower than for all Asian ethnic groups for both men (4%) and women (9%).

Baseline Health Information

Options for the question "Reason for having this examination?" were "check up" and "feel ill/want advice." Among all respondents, ≈70% reported "check up," with minor ethnic variations—approximately three fourths of White, Chinese, and Japanese examinees and approximately two thirds of Filipino, South Asian, and other Asian examinees.

Results for the symptom composites (Table 1) indicate that, among Asians, positive proportions were generally lowest among Chinese and Japanese and highest among Filipinos and other

Table 1. Baseline symptom composites: percent with positive responses, by race/ethnicity and gender

Gender/Composite Indicator	Asian American					White
	CH	**FI**	**JA**	**SA**	**OA**	**White**
Men						
CAD	30	45	38	37	32	37
Respiratory	22	31	21	20	24	22
Lower GI	20	25	21	27	28	29
Upper GI	17	21	15	20	22	24
Emotional	28	43	30	36	44	40
Women						
CAD	24	38	26	24	31	32
Respiratory	17	28	16	18	21	22
Lower GI	22	34	28	28	33	37
Upper GI	16	23	14	16	26	25
Emotional	35	53	34	32	46	48

CH=Chinese, FI=Filipino, JA=Japanese, SA=South Asians, OA=Other Asians; CAD=coronary artery disease; GI=gastrointestinal.

Asians. Controlled for age, the Filipino/Chinese differences had $P<.05$ for each composite in each sex. Compared to Chinese, South Asian and other Asian men or women also were more likely to be positive for most composites. Most Japanese/Chinese differences had $P<.05$, except that Japanese had greater proportions positive for the CAD composite in men and for the lower GI composite in women. Both Chinese and Japanese were less likely than Whites to be positive for the composites, except for the respiratory and CAD composites in men. Filipinos were more likely than Whites to be positive for the CAD, respiratory, and emotional composites. South Asians and Other Asians had similar positive proportions compared to Whites, except that South Asian women were lower for the emotional composite.

Positive proportions by place of birth were examined in Chinese, Filipinos, and Japanese, the three largest Asian ethnic groups. In each ethnic group, US-born and foreign-born persons had similar or lower positive proportions for all composites in both men and women (data not shown). Controlling for age and place of birth, the greater proportions positive for Filipino/Chinese comparisons remained, with $P<.05$, except for the upper GI composite in men.

Relationship of Composites to Hospitalization

Symptom composite positivity carried the following expected higher age-adjusted hospitalization risks in Asians and Whites combined: circulatory system diagnoses with CAD composite (RR=2.0 [95% CI=1.9–2.1] for men; RR=2.2 [2.0–2.3] for women); respiratory system diagnoses with respiratory composite (RR=2.3 [2.1–2.5] for men; RR=2.6 [2.3–2.8] for women); digestive system diagnoses with upper-GI

Table 2. Diagnosis categories with greatest numbers of Asians hospitalized, 1978–1996, by gender and race/ethnicity

Men					
Chinese Category (AAR)	**Filipino Category (AAR)**	**Japanese Category (AAR)**	**South Asian Category (AAR)**	**Other Asian Category (AAR)**	**All Asian Category (AAR)**
CV (6.1)	CV (9.9)	CV (7.5)	CV (11.4)	CV (8.0)	CV (7.7)
GI (6.2)	GI (7.1)	GI (5.8)	GI (4.5)	GI (6.5)	GI (6.3)
CA (2.5)	SS (4.1)	CA (3.0)	IP (5.5)	SS (3.8)	RE (3.0)
GU (2.5)	RE (4.1)	RE (2.6)	GU (4.1)	IP (3.1)	SS (2.8)
SS (2.5)	CA (2.5)	SS (2.5)	RE (3.7)	RE (2.2)	CA (2.4)
Women					
Chinese Category (AAR)	**Filipino Category (AAR)**	**Japanese Category (AAR)**	**South Asian Category (AAR)**	**Other Asian Category (AAR)**	**All Asian Category (AAR)**
CV (3.7)	GI (5.0)	CA (3.6)	GU (4.6)	GU (3.6)	GI (4.0)
GI (3.6)	GU (4.1)	GI (3.2)	BN (2.9)	GI (5.4)	GU (3.6)
CA (3.5)	CV (4.9)	CV (3.1)	IP (3.9)	BN (3.7)	CV (3.8)
BN (3.1)	BN (3.0)	GU (3.3)	MU (4.3)	CV (2.5)	CA (3.2)
GU (3.1)	CA (2.9)	IP (2.7)	GI (2.6)	IP (2.0)	BN (3.1)

AAR=age-adjusted rate per 1000 person-years, based on time to first hospitalization.
International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) code—CA: malignant neoplasm (140–209); BN: benign and unspecified neoplasm (210–239); CV: diseases of the circulatory system (390–459); RE: diseases of the respiratory system (460–519); GI: diseases of the digestive system (520–579); GU: diseases of the genitourinary system (580-629); MU: diseases of the musculoskeletal system and connective tissue (710–739); SS: symptoms, signs, and ill-defined conditions (780–799); IP: injury and poisonings (800–999).

Table 3. Summary of conditions with differences in relative risk of hospitalization

Category or Condition (ICD-9-CM Code)	All Asians vs White RR (95% CI)	Specific Asian vs White RR (95% CI)	Specific Asian vs Chinese RR (95% CI)
Cardiovascular System			
Coronary heart disease (410–414)		CH (M) 0.7 (0.5, 0.8) FI (W) 1.5 (1.1, 2.0) SA (M) 2.3 (1.6, 3.5)	FI (M) 1.8 (1.3, 2.3) FI (W) 2.4 (1.6, 3.6) JA (M) 1.5 (1.1, 2.2) SA (M) 3.7 (2.4, 5.8) OA (M) 2.1 (1.2, 3.7)
Venous thromboembolism (415.1, 451, 453)	M 0.3 (0.2, 0.5) W 0.3 (0.1, 0.5)	CH (M) 0.3 (0.1, 0.7) CH (W) 0.3 (0.1, 0.7) FI (M) 0.3 (0.1, 0.9) FI (W) 0.2 (0.1, 0.8)	
Dysrhythmias (427)	M 0.7 (0.5, 0.9) W 0.7 (0.5, 1.0)	CH (W) 0.5 (0.3, 0.8) JA (M) 0.4 (0.2, 0.9)	FI (W) 2.6 (1.2, 5.6)
Heart failure (428)			FI (M) 1.9 (1.0, 3.2)
Respiratory System			
Acute respiratory (460–466, 480–487)	W 0.6 (0.4, 0.7)	CH (M) 0.7 (0.5, 1.0) CH (W) 0.6 (0.4, 0.9) FI (W) 0.6 (0.3, 1.0)	FI (M) 1.8 (1.1, 2.8)
Asthma (493)	M 2.2 (1.5, 3.2)	FI (M) 3.6 (2.1, 6.2) SA (M) 6.2 (2.2, 17.0)	FI (M) 3.1 (1.4, 6.8) FI (W) 2.5 (1.1, 5.8) SA (M) 7.4 (2.2, 24.4)
Chronic lung, except asthma (490–492, 494–496)	W 0.3 (0.2, 0.7)	CH (M) 0.3 (0.1, 0.9) CH (W) 0.2 (0.1, 0.8)	FI (M) 5.0 (1.5, 16.1)
Digestive System			
Peptic ulcer (531–534)	M 1.8 (1.5, 2.3) W 1.6 (1.1, 2.2)	CH (M) 1.8 (1.3, 2.5) FI (M) 2.2 (1.5, 3.2) FI (W) 1.9 (1.1, 3.3) OA (W) 5.6 (2.4, 12.6)	OA (W) 4.0 (1.6, 10.3)
Hernia (550–553)	M 0.3 (0.3, 0.4) W 0.4 (0.2, 0.7)	CH (M) 0.3 (0.2, 0.5) CH (W) 0.2 (0.1, 0.6) FI (M) 0.3 (0.2, 0.5) JA (M) 0.2 (0.1, 0.6)	
Intestinal obstruction w/o mention of hernia (560)	M 0.5 (0.3, 0.8)		
Gallbladder (574, 575)	W 0.6 (0.5, 0.8)	CH (W) 0.4 (0.3, 0.6) JA (W) 0.5 (0.3, 1.0)	FI (W) 2.8 (1.7, 4.6)
GI hemorrhage (578)	M 1.6 (1.2, 2.2)	CH (M) 1.8 (1.3, 2.6)	
Genitourinary System			
Hyperplasia of prostate (600)	M 0.6 (0.5, 0.8)	CH (M) 0.7 (0.5, 0.9) FI (M) 0.4 (0.2, 0.7)	
Endometriosis (617)	W 1.4 (1.0, 2.0)	FI (W) 2.0 (1.2, 3.1)	
Genital prolapse (618)	W 0.6 (0.4, 0.8)	CH (W) 0.3 (0.2, 0.7)	FI (W) 3.0 (1.3, 7.2)
Pain and other symptoms, female genital organs (625)	W 0.4 (0.3, 0.6)	CH (W) 0.3 (0.1, 0.5) FI (W) 0.5 (0.3, 0.9)	
Miscellaneous and Other			
Septicemia (038)			FI (M) 2.3 (1.0, 5.2)
Osteoarthrosis (715)	M 0.2 (0.1, 0.4) W 0.2 (0.1, 0.4)	CH (M) 0.2 (0.1, 0.4) CH (W) 0.2 (0.1, 0.5) FI (M) 0.2 (0.1, 0.6) FI (W) 0.1 (0.0, 0.5) JA (M) 0.3 (0.1, 0.8)	

Table 3. Continued

Category or Condition (ICD-9-CM Code)	All Asians vs White RR (95% CI)	Specific Asian vs White RR (95% CI)	Specific Asian vs Chinese RR (95% CI)
		Genitourinary System	
Symptoms involving respiratory system, other chest		CH (M) 0.6 (0.4, 0.9)	FI (M) 2.7 (1.7, 4.2)
(786)		CH (W) 0.5 (0.4, 0.8)	FI (W) 2.2 (1.2, 3.8)
		FI (M) 1.6 (1.2, 2.1)	SA (M) 3.5 (1.7, 7.2)
		SA (M) 2.0 (1.1, 3.8)	OA (M) 2.9 (1.3, 6.5)
Fracture of neck of femur	M 0.3 (0.1, 0.6)	CH (M) 0.4 (0.2, 0.9)	
(820)	W 0.4 (0.2, 0.6)	CH (W) 0.4 (0.2, 0.8)	
		FI (W) 0.3 (0.1, 1.0)	

P<.05 in proportional hazards regression controlling for age.
RR=relative risk; CI=confidence interval; M=men; W=women; CH=Chinese; JA=Japanese; FI=Filipino; SA=South Asians; OA=Other Asians.
GI=Gastrointestinal ICD-9-CM=International Classification of Diseases, 9th Revision, Clinical Modification.

composite (RR=1.6 [1.5–1.7] for men; RR=1.7 [1.6–1.9] for women). Results were similar in analyses done separately in Asians.

Total Hospitalizations

Among Asians, 1376 men (23%) and 1576 women (21%) had at least one hospitalization (exclusive of obstetric/perinatal conditions). Among Asian men, ascending order of age-adjusted rates (per 1000 person-years) for any hospitalization were other Asian (23.0), Chinese (24.5), Japanese (26.2), Filipino (30.7), South Asian (34.7); among Asian women, Chinese (22.5), Other Asian (23.0), Japanese (23.3), Filipino (26.9), South Asian (27.6). With Chinese as referent, age-adjusted risk of hospitalization was higher for Filipino men (RR=1.2, [1.1–1.4]), Filipino women (RR=1.3 [1.1–1.4]), and South Asian men (RR=1.7 [1.4–2.2]). Among Whites, 33% of men and 32% of women had at least one hospitalization. Age-adjusted rates (per 1000 person-years) for Whites were 39.5 for men and 36.6 for women. Asian ethnic groups of each sex, except South Asian men, had lower hospitalization risk than Whites (age-adjusted RR=0.7–0.8). Hospitalization risk was similar for US- vs foreign-born persons among Chinese (RR=1.0 for men, 1.1 for women) and Filipinos (RR=1.2 for men, 1.1 for women).

Major Diagnostic Groups

The major diagnosis categories with the greatest number hospitalized for Asians overall were circulatory system diseases among men (*n*=474) and digestive system conditions among women (*n*=297). However, the categories showed variation by ethnic group in the relative frequency of individuals hospitalized and in age-adjusted rates (Table 2). Among men, circulatory and digestive system diagnoses involved the most individuals in all Asian ethnic groups and in Whites. Among Asian women, the diagnosis categories with the largest number of women hospitalized differed by ethnic group (Table 2), with digestive system diagnoses either the most or second-most frequent in all ethnic groups except for South Asians. Among White women, circulatory system diagnoses and digestive system diagnoses were the two categories involving the most women.

Compared to Chinese, no other Asian ethnic group of men or women showed a lower risk, with *P*<.05, for any category, but higher risk was seen in some categories. For example, risk of hospitalization with a circulatory system diagnosis was higher for Filipino men (RR=1.6 [1.3–1.9]) and South Asian men (RR=2.2 [1.5–3.4]). For the categories shown in Table 2, Filipino women, compared to Chinese women, were at higher risk of hospitalization for

the following diagnostic groups: circulatory, digestive, genitourinary, and general symptoms (RR=1.4–1.6). Other diagnostic groups with higher risk compared to Chinese included: 1) in Filipino men, respiratory (RR=1.7) and general symptoms (RR=2.0); 2) in South Asian men, genitourinary, respiratory, and injury/poisonings (RR=2.0–2.5).

Compared to Whites, Chinese and Japanese men and women had lower risks for many categories, with relative risks <1.0 in all but one category. Risk (vs Whites) also tended to be either lower or similar for Filipino, South Asian, and other Asian men and women. For example, compared to White men, risk of circulatory system diagnoses was lower for Chinese men (RR=0.7 [0.6–0.8]) and Japanese men (RR=0.8 [0.6,–1.0]); no differences with *P*<.05 were seen for Filipinos, South Asians, and other Asians. Compared to White women, relative risk estimates for circulatory system hospitalizations were less than one for each Asian ethnic group (RR=0.6–0.8, *P*<.05 for Chinese and Japanese) except Filipinos (RR=1.1). Compared to Whites, the relative risks for digestive system diagnoses for all Asian ethnic groups were 0.4–0.9 (*P*<.05 for Chinese men and women and Japanese and South Asian women).

The place-of-birth variable was examined in proportional hazards models run on Chinese, Filipinos, and Japanese combined and controlled for age. No RR for US-born compared to foreign-born had $P<.05$ for circulatory system, respiratory system, and digestive system hospitalizations in either men or women. The Filipino/Chinese and Japanese/Chinese comparisons were similar to those in models controlled only for age.

Specific Diagnoses Within Major Categories

Table 3 shows all sex-specific differences ($P<.05$) in risk for diagnoses making up ≥1% of hospitalizations (Asians or Whites). Although CAD risk was similar for Asians overall, of each sex vs Whites, Chinese men were at lower and South Asian men at higher risk than White men. Asian interethnic comparisons showed Filipinos of each sex and Japanese, South Asian, and other Asian men to be at increased CAD risk vs their Chinese counterparts. Asian men and women were at lower risk than Whites for venous thromboembolism, with apparent similarity for all Asian ethnic groups. A slightly lower hospitalization risk for heart rhythm disturbances was seen in Asian men or women (vs Whites), driven by lower risk of Japanese and Chinese. Filipino women had higher dysrhythmia and Filipino men had higher heart failure risks than Chinese, with no other interethnic differences for these syndromes. Stroke hospitalizations stood alone among cardiovascular conditions studied in having no Asian/White or inter-Asian ethnic risk differences.

Compared to Whites, Asian women overall, and Chinese men and women, Filipino women had lower risk for acute respiratory diagnoses, with Filipino men at higher risk than Chinese. Asian men overall, but not women, had higher risk than Whites for asthma-related hospitalization, driven by substantially higher risk of Filipino and South Asian men. Compared to Chinese and Filipino men

or women, South Asian men also had increased asthma risk, and Filipino men also had higher risk for diagnoses indicative of chronic lung disease.

Among GI diagnoses, Asian men or women overall had higher risk than Whites for peptic ulcer, fairly consistent across Asian ethnic groups. Risk for GI hemorrhage was also higher for Asian men vs Whites, most noteworthy for Chinese men. Compared to Whites, Asian women overall had lower risk of hospitalization for gallbladder disease, Filipino women being an exception with similar risk compared to Whites and higher risk compared to Chinese. Asian men and women were at substantially lower risk vs Whites of hospitalization for abdominal cavity hernias, and Asian men were also at lower risk of admissions for intestinal obstruction. The only gastrointestinal condition studied with no differences in hospitalization risk was appendicitis.

Among male genitourinary conditions, risk of benign prostatic hypertrophy was lower for Asians overall (vs Whites) but without inter-Asian differences. Among female genitourinary conditions (vs Whites), risk for endometriosis was higher among Asians, lower for genital prolapse, and lower for nonspecific pain/symptoms. Asians of both sexes were at lower risk of hospitalization for osteoarthritis or femoral neck fracture, without interethnic Asian differences. Compared to Whites, hospitalization risk for nonspecific respiratory/chest symptoms was lower among Chinese men and women but greater among Filipino and South Asian men. Compared to Chinese, risk was higher for Filipino women and for Filipino, South Asian, and other Asian men.

DISCUSSION

Our subjects were members of a prepaid health plan who voluntarily took a health examination. Thus, some selection bias in the direction of higher

socioeconomic status and "health consciousness" was probable. The membership constituted roughly 25% of the area population, with probable underrepresentation of the extremes of the socioeconomic scale.[22] Asians in this report had characteristics fairly similar to the 1980 US Census Asian population.[2] Membership in a comprehensive health plan probably minimized disparities in access to medical care. Even without economic barriers, patient attitudes, fluency in English, and individual health practitioner traits play a sometimes subtle, but important, role in health-related data.[23–25] Birthplace (United States vs elsewhere) did not seem to affect hospitalization risk in Chinese and Filipinos, but other information relevant to acculturation, such as length of US residence or linguistic ability, was unavailable.

Even hospitalization statistics may not accurately reflect the underlying health status of a population. For example, patients do not immediately seek medical care for a substantial proportion of myocardial infarctions.[26,27] Hypothetical inter-Asian ethnic disparities in ability or willingness to communicate symptoms might be factors in CAD hospitalization data.

Reports[18,19,28] of high CAD risk in South Asians and Filipinos indicate that reduction of CAD risk in South Asians and Filipinos is a public health priority. The CAD data exemplify the need to examine data separately for Asian ethnic groups, as study of all Asians vs Whites masks disparities.

Hospitalization risks in our Asian population agree with a 1992–1994 national survey[5] in showing that most Asian ethnic groups had less risk than Whites for any hospitalization and in showing relatively low percentages with at least one hospital stay among Chinese. These national survey data[5] did not differentiate by possession of health-care coverage.[5] Health Care Financing Administration data for 1997–1998 also showed lower hospitalization rates for

older Asians for several diagnoses.[29] While our hospitalization data are limited to healthcare plan facilities, admission of health plan members elsewhere is not likely systematically related to ethnicity.

The symptom composites used as possible indicators of health problems, created from questionnaire responses, were unique to this study. The questionnaire was in English, possibly creating comprehension or interpretation problems for some Asians. However, the composites were related to risk of relevant hospitalization in the expected manner and similarly among Whites and Asians. Comparison can be made to the 1992–1994 national survey[5] that showed that Chinese had the lowest percentage with reported activity limitation and that Chinese, Filipino, and Japanese had lower proportions than Whites with "fair" or "poor" health status.

The comparisons of disparities in symptom composites and hospitalization risk by Asian ethnic group seem generally more noteworthy than the total Asian vs White comparisons. While all Asian ethnic groups were either at similar or lower risk compared to Whites for major diagnosis categories, risk for more specific diagnoses showed substantial variation by ethnic group. For example, cancer was the fourth most frequent major category among women overall, but it was first among Japanese. Breast cancer risk, formerly thought low in Asians, has been increasing in Asian-American women, especially in Japanese-American women.[30,31] These temporal changes provide implicit support for environmental causes of breast cancer.

The higher relative risk in most Asian groups of hospitalization for both peptic ulcer and GI hemorrhage are probably related findings in need of further investigation. Without knowledge of weight gain, estrogen use, and other gallstone risk factors, we cannot interpret the increased relative risk of gallstones in Filipino compared to Chinese women. The lower risk of Asians for hospitalization for abdominal hernias could have genetic and environmental explanations.[32] Lower hernia risk may explain the lower risk of Asian men for intestinal obstruction, substantially related to previous abdominal surgery.[33]

An increased relative risk of asthma among Asian men has been previously described.[34] Ethnic differences in hospitalization rates for asthma may be related not only to prevalence of the condition but also to perceptions and coping mechanisms.[35–37] Two reports of disparity between hospitalization rate and prevalence of asthma involve higher hospitalization rates among South Asians in the United Kingdom.[35–37] Migration has been suggested as a provocation of asthma and other allergic diseases.[38] Since Asian men did not have increased relative risk of hospitalization for other acute or chronic respiratory problems, the specificity of the asthma relationship makes it more likely to be a true one.

We have already mentioned limitations of this study related to possible bias in selection of subjects and limited data about acculturation. We would add that, because of our multiple comparisons and use of the $P<.05$ cutpoint, several of the "differences" mentioned are likely due to chance. High sensitivity seemed appropriate in a search for possible ethnic disparities in need of further investigation. Also, some differences may be missed because of relatively small numbers of events for some of the specific diagnoses for Asian ethnic groups, in particular South Asians and other Asians. In conclusion, we emphasize the potential value of epidemiologic study of specific conditions in specific Asian-American ethnic groups.

REFERENCES

1. *Current Population Survey, March 2000.* Washington, DC: US Census Bureau; 2000.
2. Rosenbaum D, Ed. *Asian Growth in the 1990s.* San Francisco, Calif: San Francisco Chronicle Publishing Company; 1998.
3. Frisbie WP, Cho Y, Hummer RA. Immigration and the health of Asian and Pacific Islander adults in the United States. *Am J Epidemiol.* 2001;153:372–380.
4. Flack JM. Epidemiology of minority health. *Health Psychol.* 1995;14:592–600.
5. Kuo J, Porter K. *Health Status of Asian Americans: United States, 1992–94.* Bethesda, Md: US Dept of Health and Human Services; 1998. Advance Data CDC-NCHS Publication No. 298.
6. Choi BSK, McGandy RB, Dallal GE, et al. The prevalence of cardiovascular risk factors among elderly Chinese Americans. *Arch Intern Med.* 1990;150:413–419.
7. Lauderdale DS, Kestenbaum B. Mortality rates of elderly Asian-American populations based on Medicare and Social Security data. *Demography.* 2002;39:529–540.
8. US Bureau of the Census. *We, the American Asians.* Washington, DC: US Government Printing Office; 1993.
9. Yu E, Liu H, William T. US national health data on Asian-American and Pacific Islanders: a research agenda for the 1990s. *Am J Public Health.* 1992;82:1645–1652.
10. *National Asian American and Pacific Islander Cardiovascular Health Action Plan.* San Francisco, Calif: APIA Health Forum; 1999;1–29.
11. Jenkins CNH, Kagawa-Singer M. Cancer. In: Zane N, Takeuchi D, Young K, eds. *Confronting Critical Health Issues of Asian and Pacific Islander Americans.* Thousand Oaks, Calif: Sage Publications; 1994;105–147.
12. Ro M. Moving forward: addressing the health of Asian-American and Pacific Islander women. *Am J Public Health.* 2002;92:516–519.
13. Singh GK, Siahpush M. All-cause and cause-specific mortality of immigrants and native born in the United States. *Am J Public Health.* 2001;91:392–349.
14. Marmot MG, Syme SL, Kagan A, et al. Epidemiologic studies of coronary heart disease and stroke in Japanese men living in Japan, Hawaii, and California: prevalence of coronary and hypertensive heart disease and associated risk factors. *Am J Epidemiol.* 1975;102:514–525.
15. Marmot MG, Syme SL. Acculturation and heart disease in Japanese Americans. *Am J Epidemiol.* 1976;104:225–247.
16. Nichaman MZ, Hamilton HB, Kagan A, et al. Epidemiologic studies of coronary heart dis-

ease and stroke in Japanese men living in Japan, Hawaii, and California: distribution of biochemical risk factors. *Am J Epidemiol.* 1975;102:491–501.

17. Yano K, Reed DM, McGee DL. Ten-year incidence of coronary heart disease in the Honolulu Heart Program: relationship to biologic and lifestyle characteristics. *Am J Epidemiol.* 1984;119:653–666.

18. Klatsky AL, Tekawa I, Armstrong MA, Sidney S. The risk of hospitalization for ischemic heart disease among Asian Americans in northern California. *Am J Public Health.* 1994;84: 1672–1675.

19. Klatsky AL, Armstrong MA. Cardiovascular risk factors among Asian Americans living in northern California. *Am J Public Health.* 1991;81:1423–1428.

20. Klatsky AL, Armstrong MA, Poggi J. Risk of pulmonary embolism and/or deep venous thrombosis in Asian Americans. *Am J Cardiol.* 2000;85:1334–1337.

21. Collen MF, Davis LF. The multitest laboratory in health care. *J Occup Med.* 1969;11: 355–360.

22. Krieger N. Overcoming the absence of socioeconomic data in medical records: validation and application of a census-based methodology. *Am J Public Health.* 1992;82: 703–710.

23. Singh GK, Siahpush M. Ethnic-immigrant differentials in health behaviors, morbidity, and cause-specific mortality in the United States: an analysis of two national data bases. *Hum Biol.* 2002;74:83–109.

24. Kramer EJ, Kwong K, Lee E, Chung H. Cultural factors influencing the mental health of Asian Americans. *West J Med.* 2002;176: 227–231.

25. Jin XW, Slomka J, Blixen CE. Cultural and clinical issues in the care of Asian patients. *Cleve Clin J Med.* 2002;69:53–58.

26. Aronow WS, Silent MI. Prevalence and prognosis in older patients diagnosed by routine electrocardiograms. *Geriatric.* 2003;58:24–26.

27. Kannel WB. Silent myocardial ischemia and infarction: insights from the Framingham Study. *Cardiol Clin.* 1986;4:583–591.

28. Enas EA. Malignant coronary artery disease in young Indian Asians: thought on pathogenesis, prevention, and therapy. *Clin Cardiol.* 1995;18:131–135.

29. Eggers PW, Greenberg LG. Racial and ethnic differences in hospitalization rates among aged Medicare beneficiaries. *Health Care Finance Rev.* 2000;21:91–105.

30. Deapen D, Liu L, Perkins C, et al. Rapidly rising breast cancer incidence rates among Asian-American women. *Int J Cancer.* 2002;99:747–750.

31. Lee MM. Breast cancer in Asian women. *West J Med.* 2002;176:91–92.

32. Rutkow IM. Epidemiologic, economic, and sociologic aspects of hernia surgery in the United States in the 1990s. *Surg Clin North Am.* 1998;78:941–951.

33. Sufian S, Matsumoto T. Intestinal obstruction. *Am J Surg.* 1975;130:9–14.

34. Chen JT, Krieger N, Van Den Eeden SK, et al. Different slopes for different folks: socioeconomic and racial/ethnic disparities in asthma and hay fever among 173,859 US men and women. *Environ Health Perspect.* 2002; 110(suppl 2):211–216.

35. Griffiths C, Kaur G, Gantley M, et al. Influences on hospital admission for asthma in south Asian and White adults: qualitative interview study. *BMJ.* 2001;323: 962–966.

36. Hussein S, Partridge M. Perceptions of asthma in South Asians and their views on educational materials and self-management plans: a qualitative study. *Patient Educ Couns.* 2002;48: 189–194.

37. Meredith LS, Siu AL. Variation and quality of self-report health data. Asians and Pacific Islanders compared with other ethnic groups. *Med Care.* 1995;33:1120–1131.

38. Leung R. Asthma and migration. *Respirology.* 1996;1:123–126.