The Association between Fast-Flushing Response and Alcohol Use among Japanese Americans*

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ABSTRACT. This study investigated the association between the flushing response and alcohol use among Japanese Americans in the greater Los Angeles area. Epidemiological data collected through a telephone survey and a mail survey were utilized to test the flushing–alcohol use relationship in the Japanese population, and to explore the effects of socioenvironmental variables. Results showed that, as predicted, those Japanese Americans who exhibited the fast flushing response tended to drink less than those who did not flush, in the general community sample, but the relationship was weaker in the college student sample. Logistic regression analysis identified several covariates that predicted alcohol use among the general community residents: being a male, being single and being of the third/fourth generation. A separate logistic regression analysis with the college students only revealed a moderately significant interaction effect of flushing response and "Greek" affiliation (membership in a campus fraternity or sorority) on alcohol use (i.e., 6 drinks or more in a 24-hour period), indicating that the social context appeared to have a moderating effect on the relationship between the flushing response and alcohol use among Japanese Americans. Eighty out of 300 individuals completely abstained from alcohol consumption and therefore did not know if they possessed the fast-flushing response. Results were discussed with respect to further investigation of the role played by ALDH-I deficiency in varying social situations in the Japanese population. (*J. Stud. Alcohol* **54:** 48-53, 1993)

THE FLUSHING RESPONSE, or a set of facial and cardiovascular reactions evoked with alcohol ingestion, has been noted as a possible "immunizer" for alcohol abuse (Wolff, 1972, 1973). Much empirical research appears to indicate that individuals of Asian ancestry are particularly more alcohol sensitive and more likely to respond with a marked facial flushing than those individuals of European ethnicity, thereby resulting in less alcohol consumption by those who flush (e.g., Chan, 1986; Ewing et al., 1979; Johnson, 1989; Johnson et al., 1990; Wolff, 1972, 1973; Zeiner et al., 1979). Moreover, it has been demonstrated that facial flushing and other related cardiovascular symptoms due to the acetaldehyde dehydrogenase type I (ALDH-I) deficiency in persons of Mongoloid ancestry are often negatively associated with the amount of alcohol consumed by Asians (Agarwal et al., 1981; Chan, 1986).

The interpretation of these findings may be tempered with at least two methodological issues. First, in most research investigating the relationship between flushing and alcohol use, all Asian subgroups are usually lumped together under one single category, "Asians," thus making difficult the generalization of findings to all groups because there are some subgroup differences (e.g., Johnson & Nagoshi, 1990; Kitano et al., 1988). Second, because much empirical evidence for the flushing–alcohol use association is based on clinical laboratory contexts, it is not known to what extent a physio-genetic factor such as facial flushing inhibits alcohol consumption among Asians in varying sociocultural contexts (Akutsu et al., 1989; Sue et al., 1984; Yamamoto et al., 1988). In a reciprocity model of drinking behavior among Asian Americans, Sue et al. (1984) proposed that physiological reactivity, sociocultural variables and alcohol consumption have mutual influences on each other. Also, significant secular trends for increased level of alcohol use in Asian countries have been observed (Yamamoto et al., 1988).

Therefore, although flushing is often associated with or used as an explanation for Asians drinking less, it is premature to assume a relationship between flushing and reduced alcohol use without further tests of relevant variables that moderate the relationship. In a study testing the flushing–alcohol use relationship in different ethnic groups in Hawaii (Schwitters et al., 1982), it was reported that although no significant ethnic differences in drinking were found, it was only among the Japanese "fast" flushers—flushing evoked with one drink or less—whose flushing

Received: November 13, 1990. Revision: June 29, 1991.

*This study was supported in part by the Medical Student Summer Research Program Fellowship awarded to Tomoko V. Nakawatase from the Department of Molecular Genetics and Biochemistry at the University of Pittsburgh School of Medicine, and in part by National Institute of Mental Health grant R01 MH44331 awarded to Stanley Sue, principal investigator, National Research Center on Asian American Mental Health, Department of Psychology, University of California, Los Angeles.

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response inhibited drinking behavior. Therefore, Schwitters et al. (1982) argued that the flushing response is not a universal "immunizer" against alcohol use, except for fast flushing individuals of Japanese ancestry. Suwaki et al. (1985) investigated the drinking patterns and alcohol-related problems in Japanese men, and found that more nonflushers drank at least four times a week than flushers.

Nonflushers tended to drink *sake* (Japanese rice wine containing approximately 16% alcohol) and flushers tended to drink beer (containing approximately 4% alcohol). Although the study did not differentiate "fast" flushers from "slow" flushers, flushers on the whole appeared to drink a smaller amount of alcohol than nonflushers. The results of the study are consistent with the hypothesis that alcohol-induced flushing acts to a significant degree as one of the inhibitory factors against alcohol consumption. An explanatory emphasis on the physiological factor per se appears too limited in accounting for Asian drinking behavior. It is necessary to examine the flushing–alcohol intake relationship with varying social contexts.

Through telephone and mail surveys, two randomly selected samples of Japanese Americans (general community residents and college students) in the greater Los Angeles area participated in the study. It was predicted that those individuals of Japanese ancestry with fast flush tend to drink less than those who do not flush. Additionally, the effects of sociocultural factors including generational status, gender, marital status and affiliation with a fraternity or sorority (within the college sample) were assessed.

Method

Sampling procedures

Two different methods of data collection were used: (1) a telephone survey, targeting the general Japanese-American population in the greater Los Angeles area; and (2) a mail survey, targeting the Japanese-American college population. The phone survey was chosen for its cost efficiency and data quality control (Frey, 1983; Groves et al., 1990; Sasao, 1991). By making use of two survey methods, it was assumed that a sampling error variance would be minimized. All of the data collection occurred in the summer of 1989.

Sample 1: Japanese-American General Community Residents. A Los Angeles Japanese telephone directory (Japan Publicity, Inc., 1989), listing approximately 9,500 phone numbers of Japanese surnames in Southern California, was used to obtain adult Japanese-American respondents in the greater Los Angeles area. Two criteria were used for selecting potential subjects: (1) the chosen number was limited only to the 213 and 818 area codes, and (2) only subjects with non-Japanese first names were chosen, to minimize the possibility of reaching subjects who were strictly Japanese-speaking. The two above-mentioned area codes were chosen to limit our sample to the Japanese Americans who reside in the greater Los Angeles area. Individuals who spoke only Japanese were not included in the study in order to reduce the possibility of involving subjects who are native Japanese, and thus the homogeneity of our sample was maintained. Respondents were screened by dialing every 20th number and if the 20th number satisfied the above, an individual was asked to participate in the survey. Upon a verbal consent, the telephone survey was conducted with any available member of the household who was 21 years of age or older and whose parents were both of Japanese descent.[1] A total of 455 calls was needed in order to obtain the specified 200 completed interviews. The interview completion rate (56%), defined as the percent of interviews completed with eligible respondents, was calculated by dividing the total number of completed interviews (200) by the total number of calls made minus the number of disconnected or ineligible numbers (455 − 98 = 357), multiplied by 100. Only 18 of those eligibles refused to participate, thus increasing confidence in our sampling scheme.

Sample 2: Japanese-American College Students. The mail survey was chosen for several reasons: (1) the student directory often lists disconnected or outdated phone numbers; (2) many students listed their permanent phone numbers rather than their school phone numbers; and (3) college students are not readily available at home. All of the interviews were conducted by one of the authors (TVN) to keep the data collection procedure consistent. Out of 200 questionnaires sent out, 100 completed questionnaires were returned.

Instrument

The telephone survey questionnaire consisted of two questions: (1) Does the individual exhibit the flushing response after drinking one drink of alcohol (one drink is defined as consuming either a 1 oz glass of distilled spirits, 6 oz glass of wine or 12 oz can of beer) or less? (no = 1; yes = 0); and (2) Has the individual ever drunk six drinks or more of alcohol within a 24-hour period? (yes = 1; no = 0). If the answer to the second question was "yes," the Short Michigan Alcoholism Screening Test (SMAST; Selzer et al., 1975) was used to assess the possibility of alcoholism in the individual. The SMAST consists of 13 binary (yes/no) questions regarding alcohol-related behavior, such as: "Have you ever been arrested for drunken driving, driving while intoxicated, or driving under the influence of alcoholic beverages?" Respondents were classified into nonalcoholics, possibly alcoholics and alcoholics. Demographic information, including gender, age, marital status, highest education level attained and Japanese generational status (first, second, third, fourth), was also collected.

The same survey form was used in the mail survey to collect data from college students of Japanese descent, 21 years of age and older. This sample was obtained using a college student directory of a large west coast U. S. university (UCLA) and membership rosters from Asian sororities and fraternities. An additional demographic question, "Whether the individual was currently affiliated with a sorority or fraternity," was included in the mail survey questionnaire.

Results

Characteristics of the respondents

The characteristics of the respondents are shown in Table 1, and both samples were proportionately comparable to reported statistics for Los Angeles County (United Way, 1988) and for the California Asian student population.

Sample 1: General Community Residents. Approximately 56% were males and 44% were females. The majority of the respondents were either second or later generation Japanese (92%), indicating that our sampling strategy approximated the current Japanese-American population pattern in Los Angeles County. Over 90% of the sample were high school graduates or graduates of college or graduate schools. Approximately 71.5% were married and others were either single (22.5%), separated/divorced (6.0%) or widowed (3.3%). The age of the general community sample revealed a widely distributed pattern consistent with the current population estimates, with the majority falling into 30s, 40s and 50s.

Sample 2: College Students. Again, the profiles of the student sample typify the current statistics of the Japanese-American student population in California. The numbers of males and females were roughly equal: 55.0% and 45.0%, respectively. Over 80% of the sample were third or fourth generation (combined). Almost all of the students were in their 20s. None were married. Fifty-eight percent of the college sample were current members of the "Greek" system (either a fraternity or a sorority) while 42% did not belong to the system.

Although many of the nonabstainer respondents had six drinks or more within a 24-hour period, only a few (n = 12: general community and college samples combined) showed signs of possible alcoholism as assessed by the SMAST questionnaire. The results indicated that the rate of alcoholism in the Los Angeles Japanese-American community is rather low for the number of individuals who consume a considerable amount of alcohol. In comparing the gender differences of the SMAST results, there was no significant difference between males and females within the "possibly alcoholic" (score = 2) category. However, it is impossible to make any definitive statement about gender differences because the sample size included in the current study was too small (n = 12).

TABLE 1. Characteristics of survey respondents, in percent

Variable	Sample 1: Community Residents (n = 200)	Sample 2: College Students (n = 100)
Gender		
Male	56.0	55.0
Female	44.0	45.0
Generation		
1st	8.0	3.1
2nd	45.5	16.5
3rd	41.0	51.5
4th	5.5	28.9
Education		
Less than high school	2.5	0.0
High school grad.	24.5	0.0
Trade business school	5.0	0.0
Some college	22.0	34.7
College grad.	33.5	57.4
Professional/Postgrad.	12.5	6.9
Age group		
20s	18.7	98.0
30s	22.3	2.0
40s	34.5	0.0
50s	20.9	0.0
60s +	3.6	0.0
Marital status		
Single	22.5	100.0
Married	71.5	0.0
Separated/divorced	1.0	0.0
Widowed	5.0	0.0
"Greek" affiliation		
Yes	–	58.0
No	–	42.0

The relationship between fast flushing and alcohol use

The hypothesized relationship between flushing response and alcohol use (having six drinks or more within a 24-hour period) was evaluated after total abstainers were deleted from the sample (n = 76 in the general community resident sample and n = 4 in the college student sample). A contingency table analysis (Table 2) indicated that among the Japanese-American general community residents, a significant positive association was observed between fast-flush response and alcohol use, indicating

TABLE 2. The relationship between flushing and alcohol use among Japanese Americans (six drinks or more in a 24-hour period)

Flushing	GENERAL COMMUNITY RESIDENTS Yes	No	Total
Yes	6.45% (8)	37.90% (47)	44.35% (55)
No	28.23% (35)	27.42% (34)	55.65% (69)
Total	34.68% (43)	65.32% (81)	100.00% (124)
	χ^2 = 17.69, 1 df, p < .001		
	COLLEGE STUDENTS		
Yes	22.92% (22)	19.78% (19)	42.70% (41)
No	41.67% (40)	15.63% (15)	57.30% (55)
Total	64.59% (62)	35.41% (34)	100.00% (96)
	χ^2 = 3.73, 1 df, p < .05		

that nonflushers tend to drink six drinks or more within a 24-hour period, substantially more than flushers (χ^2 = 17.69, 1 df, $p < .001$). However, a chi-square test of the same relationship in the student sample indicated a somewhat weaker effect (χ^2 = 3.73, 1 df, $p < .05$).

Explanatory models of flushing–alcohol use relationship

In order to develop models for the flushing–alcohol use relationship, logistic regression analysis (Hosmer and Lemeshow, 1989; Schlesselman, 1982) was used to model alcohol use behavior ("having six or more drinks in a 24-hour period") with the covariates gender (1 = male, 0 = female); marital status (1 = single, 0 = either married, divorced/separated or widowed); generational status (coded as two dummy variables—the first generation as compared to the second generation, and the third/fourth generation as compared to the second generation); and "Greek" affiliation (1 = affiliated with one of Asian fraternities or sororities, 0 = not affiliated with any of the fraternities or sororities).

Sample 1: General Community Residents. The results of a final logistic regression model are shown in Table 3, with the log-likelihood ratio (χ^2 = 232.92, 1 df, $p <$ .001) indicating that the model fit was satisfactory. As seen in Table 3, the effect of flushing response when all other variables were held constant was significant (effect = 3.62, $p < .0001$), indicating that nonflushers are 3.62 times more likely to use alcohol when compared to flushers. Also, the effects of other sociodemographic variables were significant. "Being a male" with other variables held constant significantly contributed to more alcohol use compared to "being a female" (effect = 2.18, $p < .001$). Similarly, singleness led to more alcohol use (effect = 5.97, $p < .0001$). Two dummy variables using the second generation as a reference group revealed a significant difference between the third/fourth generation and the second generation, indicating that the third/fourth generation is more likely to use alcohol (effect = 2.36, $p < .05$) than the second generation. None of the interaction effects was statistically significant ($p > .10$).

Sample 2: College Students. It was assumed that college students who are members of the "Greek" system (i.e., fraternity and sorority affiliations) would have more social occasions for drinking than those who are not members of any fraternity or sorority, thus leading to more alcohol use. In order to assess the effect of such membership on drinking behavior, a separate logistic regression analysis was run with the following covariates: fast flush, gender and "Greek" affiliation. Marital status and generational status were not included in the model because the majority of the student sample were single and of the third/fourth generation. The resultant model included a significant interaction term between flushing response and "Greek" affiliation (log-likelihood ratio: χ^2 = 108.19, 1 df, $p <$ .001). None of the main effects was significant ($p > .10$). The adjusted interaction effects are shown in Table 4. Using the respondents with fast flushing and no "Greek" affiliation as a reference group (row 1 in Table 4), those who do not exhibit flushing but are members of a fraternity or sorority (row 4) were 10.65 times more likely to use alcohol. However, among those who do not flush and are not members of the "Greek" system (row 3), the effect of "Greek" affiliation was substantial (effects: 1.22 and 10.65, z = 3.24, $p < .001$). Moreover, a significant difference between flushers and nonflushers within the "Greek" system (row 2 vs row 4) indicates a substantial difference in alcohol drinking behavior due to fast flush. Thus, the effect of flushing appears to be robust regardless of "Greek" affiliation.

Discussion

Although results appear to support the hypothesis that those Japanese-American individuals who exhibit the fast-flushing response drink less than those who do not, the role of fast-flush response was not consistent across two samples used in the study. Among the general community residents, there was strong empirical support for the negative relationship between fast-flush response and alcohol intake whereas among the college students there was only

TABLE 3. Results of a logistic regression model relating drinking behavior to flushing response, gender, generational status and student status in the Japanese-American general community sample

Variable	Coeff.	SE	Effect[a]
Flushing response	1.29	0.33	3.62[‡]
Gender	0.78	0.33	2.18[†]
Marital status	1.79	0.35	5.97[‡]
Generation[b]			
1st vs 2nd	0.36	0.72	1.44
3rd vs 2nd	0.86	0.38	2.36*

*$p < .05$. [†]$p < .001$. [‡]$p < .0001$.
[a]Effects were computed as e^{β}.
[b]The second generation was used as a reference group in dummy coding.
Notes: Log-likelihood ratio χ^2 = 232.92. Each variable is coded as follows: flushing response (1 = no flush; 0 = flush), gender (1 = male; 0 = female) and marital status (1 = single, 0 = other).

TABLE 4. Adjusted interaction effects estimated from a logistic regression model relating drinking behavior to flushing response, "Greek" affiliation and gender among college students

Flush. Resp.	"Greek" Affil.	Effect
Yes	No	1.00[a]
Yes	Yes	1.51
No	No	1.22
No	Yes	10.65*

*$p < .05$.
[a]Respondents with flushing response and no "Greek" affiliation was used as a reference group in estimating effects.
Note: Log-likelihood ratio χ^2 = 108.19.

weak support. In the latter sample, although the main effect of fast flush was not statistically significant, examination of moderately significant interaction effects indicated that the effect of fast-flush response was still substantial even after the effects of all other sociocultural variables were held constant. This supports the theory that the ALDH-I deficiency found in the Japanese population may play a "protective" role against alcohol abuse. The aversive effects associated with the flushing response—headache, nausea, tachycardia, dyspnea, anxiety—seem to discourage drinking in those individuals with the flushing response. In the college population, however, the flushing response does not appear to be as much of a "protective" mechanism against heavy alcohol use: this study shows that over 50% of the fast-flushing group of college students have had six drinks or more within a 24-hour period. It is possible that some fast-flushing individuals may develop tolerance to the flushing response with chronic alcohol intake. Therefore, social and environmental influences, such as peer pressure to drink, the availability of alcoholic beverages at social functions, and being away from parents and other "supervisors" may override any protection of an ALDH-I deficiency against alcohol abuse. Nonetheless, from Table 4, it was shown that the effect of fast flushing among the "Greek"-affiliated students was substantial. This means that even in an apparently "unprotected environment" such as the "Greek" system, the effect of flushing on alcohol use is still tangible, and flushers are less likely to engage in drinking behavior. Although there is some evidence that heavy drinkers tend to join fraternities and sororities (Canterbury et al., 1991), the present study indicates that drinking behavior is partially dependent on the existence of fast-flush reactivity among the Japanese-American students. It can be speculated that unlike the non-Asian fraternities and sororities, the Asian "Greek" system is usually not residential, thus indicating differential motives for seeking a "Greek" membership for Asian students (e.g., avoiding being social outcasts in the Asian communities). Also, members of the Asian "Greek" system, not being residential on campus, lack opportunities for drinking when compared to other non-Asian "Greek" organizations.

To better understand the effects of the ALDH-I deficiency as a protective element against alcoholism in the Japanese-American population, the drinking behavior and pattern of this group must be discussed. First of all, a significant percentage (37.5%) of respondents did not know whether they had the fast-flushing response at all because these individuals completely abstained from alcohol consumption. The greater number of drinkers in the third and fourth generations may indicate that the later generations have assimilated into American society and may share a drinking behavior more similar to that of whites. The gender difference in drinking behavior, with more men having had six drinks or more within a 24-hour period than women, may indicate that gender roles practiced in Japan, where men are "supposed" to drink and that women are not, play an influential role in the Japanese-American community as well (Kitano et al., 1985). Interestingly, the drinking behavior of Japanese-American college students appears to be influenced by the environment and social affiliations rather than by gender roles or by genetic factors. Among the college population, the flushing response does not strongly discourage individuals from drinking heavily and approximately the same number of males and females have drunk heavily. Furthermore, the greater number of drinkers among the "Greek" students as compared to the non-"Greek" students suggest that environmental influences such as the availability of alcoholic beverages at sorority/fraternity functions and the "acceptance" of alcohol use among many individuals in this group may encourage drinking.

Finally, the number of alcoholics in this study, as assessed by the SMAST, is zero and only 12 individuals scored in the "possibly alcoholic" category. This supports a previous study by Kitano et al. (1988) that the Japanese-American style of drinking, even among those individuals who drank heavily, was not related to problem behavior and that very few Japanese-Americans become alcoholics. The results of this study suggest that variables such as generation status, gender role, age and social affiliation influence the drinking behavior among Japanese Americans, but, overall, the genetic predisposition of Japanese Americans to have the ALDH-I deficiency may somehow "protect" these individuals from becoming alcohol abusers. To understand further the lower rate of alcohol dependency in the Japanese-American population, as compared to the white and other non-Asian populations, careful studies correlating the biochemical aspects of the ALDH-I deficiency to the drinking behavior of these individuals in varying social situations must be conducted.

Acknowledgment

The assistance of Sadie Hifumi in the production of this article is gratefully acknowledged.

Note

1. Individuals of mixed ancestry (e.g., Japanese mother and white father) were excluded from the present study.

References

AGARWAL, D.P., HARADA, S. AND GOEDDE, H.W. Racial differences in biological sensitivity to ethanol: The role of alcohol dehydrogenase and aldehyde dehydrogenase isozymes. Alcsm clin. exp. Res. 5: 12-16, 1981.

AKUTSU, P.D., SUE, S., ZANE, N.W.S. AND NAKAMURA, C. Y. Ethnic differences in alcohol consumption among Asians and Caucasians in the United States: An investigation of cultural and physiological factors. J. Stud. Alcohol **50**(3), 261-267.

CANTERBURY, R.J., GRESSARD, C.F., VIEWEG, W.V.R., GROSSMAN, S.J., WESTERMAN, P.S. AND MCKELWAY, R.B. Alcohol and cocaine use among first-year college students. S. med. J. **84:** 13-17, 21, 1991.

CHAN, A.W.K. Racial differences in alcohol sensitivity. Alcohol Alcsm **21:** 93-104, 1986.

EWING, J.A., ROUSE, B.A. AND ADEHOLD, R.M. Studies of the mechanism of oriental hypersensitivity to alcohol. In: GALANTER, M. (Ed.) Currents in Alcoholism, Vol. 5, New York: Grune & Stratton, 1979, pp. 45-52.

FREY, J.H. Survey Research by Telephone, Newbury Park, Calif.: Sage Pubns. Inc., 1983.

GROVES, R.M., BIEMER, P.P., LYBERG, L.E., MASSEY, J.T., NICHOLLS, W.L., II AND WAKSBERG, J. Telephone Survey Methodology, New York: John Wiley & Sons, Inc., 1990.

JAPAN PUBLICITY, INC. Los Angeles Japanese Telephone Guide, Los Angeles: Japan Publicity, Inc., 1988.

JOHNSON, R.C. The flushing response and alcohol use. In: NATIONAL INSTITUTE ON ALCOHOL ABUSE AND ALCOHOLISM. Alcohol Use among U.S. Ethnic Minorities. Research Monograph No. 18, DHHS Publication no. (ADM) 89-1435, Washington: Government Printing Office, 1989, pp. 383-396.

JOHNSON, R.C. AND NAGOSHI, C.T. Asians, Asian-Americans and alcohol. J. psychoactive Drugs **22:** 45-52, 1990.

KITANO, H.H.L., HATANAKA, H., YEUNG, W.-T. AND SUE, S. Japanese-American drinking patterns. In: BENNETT, L. AND AMES, G.M. (Eds.) The American Experience with Alcohol: Contrasting Cultural Perspectives, New York: Plenum Press, 1985, pp. 335-357.

KITANO, H.H.L., LUBBEN, J.E., AND CHI, I. Predicting Japanese American drinking behavior. Int. J. Addict. **23:** 417-428, 1988.

SASAO, T. Practical Issues in Using Telephone Survey Methodology in Asian Pacific Communities, unpublished manuscript (University of California, Los Angeles), 1991.

SCHLESSELMAN, J.J. Case-Control Studies: Design, Conduct, Analysis, New York: Oxford Univ. Press, 1982.

SCHWITTERS, S.Y., JOHNSON, R.C., JOHNSON, S.B. AND AHERN, F.M. Familial resemblances in flushing following alcohol use. Behav. Genet. **12:** 349-352, 1982.

SELZER, M.L., VINOKUR, A. AND VAN ROOIJEN, L. A self-administered Short Michigan Alcoholism Screening Test (SMAST). J. Stud. Alcohol **36:** 117-126, 1975.

SUE, S. AND NAKAMURA, C.Y. An integrative model of physiological and social psychological factors in alcohol consumption among Chinese and Japanese Americans. J. Drug Issues **14:** 349-364, 1984.

SUWAKI, H. AND OHARA, H. Alcohol-induced facial flushing and drinking behavior in Japanese men. J. Stud. Alcohol **46:** 196-198, 1985.

UNITED WAY, INC. Asian Pacific Needs Assessment: A Human Service Needs Study, Los Angeles: United Way, Inc., 1988.

WOLFF, P.H. Ethnic differences in alcohol sensitivity. Science **15:** 449-450, 1972.

WOLFF, P.H. Vasomoter sensitivity to alcohol in diverse Mongoloid populations. Amer. J. human Genet. **25:** 193-199, 1973.

YAMAMOTO, J., YEH, E.-K., LEE, C.-K. AND LIN, K.-M. Alcohol abuse among Koreans and Taiwanese. In: TOWLE, L.H. AND HARFORD, T.C. (Eds.) Cultural Influences and Drinking Patterns: A Focus on Hispanic and Japanese Populations. NIAAA Research Monograph No. 19, DHHS Publication No. (ADM) 88-1563, Washington: Government Printing Office, 1988, pp. 135-175.

ZEINER, A.R., PAREDES, A. AND CHRISTIANSEN, H.D. The role of acetaldehyde in mediating reactivity to an acute dose of ethanol among different racial groups. Alcsm clin. exp. Res. **3:** 11-18, 1979.