Smoking prevalence among Asian Americans: Associations with education, acculturation, and gender

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ABSTRACT

There is evidence that smoking prevalence rates are related to acculturation, education, and gender among Asian Americans. However, no studies have examined how smoking rates among Asian Americans vary based on acculturation, education, and gender together. This study used National Health Interview Survey (NHIS) data (2010–2018) to examine cigarette smoking prevalence among Asian American men and women aged 18 and older (N = 14,680). Multivariate logistic regression models were used to estimate associations between educational attainment (i.e., college graduate or higher vs some college or lower), years spent in the United States (U.S.) as a proxy for acculturation (i.e., less than 10 years (less acculturated) vs 10 years or more (more acculturated) vs U.S.-born), and cigarette smoking prevalence across gender controlling for age, marital status, poverty (at/above vs below poverty threshold), country of origin (Chinese vs Filipino vs Asian Indian vs Other Asian), and the survey year. Current smoking prevalence was 9.0 % among all Asian Americans 5.0 % among women and 13.5 % among men. Among respective gender-specific subgroups, U.S.-born Asian women without a college degree and more acculturated Asian immigrant men without a college degree had the highest odds of smoking (OR: 4.096 [95 % CI: 2.638, 6.360] and 1.462 [95 % CI: 1.197, 1.774], respectively). Findings indicated that less educated U.S.-born Asian women and less educated Asian immigrant men are at greatest risk for smoking. Smoking prevalence among Asian Americans is highly related to acculturation, education, and gender. Findings may inform development of policies and programs that are targeted toward smoking cessation among Asian Americans.

1. Introduction

1.1. Background

Cigarette smoking is the leading preventable cause of morbidity and mortality in the United States (U.S.) (Gfroerer et al., 2013; Prochaska et al., 2017; US Department of Health and Human Services, 2014). In 2019, 14 % of U.S. adults were current smokers, and cigarette smoking caused more than 480,000 deaths per year (Cornelius et al., 2020). Previous studies have shown that the prevalence of smoking among Asian Americans is lower than the general U.S. population (7 % vs 14 %) (Centers for Disease Control and Prevention, 2020; Cornelius et al., 2020; US Department of Health and Human Services, 2014). Thus, smoking among Asian Americans has remained relatively understudied. The prevalence of smoking has only dropped by 1.8 % from 9.2 % to 7.4 % in Asian Americans while it has decreased by 6.1 % from 21.1 % to 15.0 % in non-Hispanic White, 5.9 % from 20.5 % to 14.6 % in non-Hispanic Black, and 2.7 % from 12.5 % to 9.8 % in Hispanic in the last decade (American Lung Association, 2019).

Previous research has indicated that the prevalence of smoking in Asian Americans may be under-reported due to exclusive use of English language instruments (Chae et al., 2006; Lew & Tanjasiri, 2003; Rao et al., 2022; Glenn et al., 2009). Smoking prevalence in Asian countries is generally much higher than in the U.S. For instance, the World Health Organization reported that smoking rates in Japan, South Korea, and China were 22 %, 22 %, and 25 % respectively in 2018 (World Health

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relationships between acculturation and smoking and the moderating
effects of education or gender (Li & Hummer, 2015; Ra et al., 2013; Cho
et al., 2004; Shelley et al., 2004; Pampel et al., 2020; An et al., 2008; Ma
et al., 2004; An et al., 2008; Mukherjea et al., 2014). Yet, no studies have
examined how smoking rates among Asian Americans vary based on
acculturation, education, and gender examined concurrently. Thus, this
study aims to examine differences in smoking prevalence attributed to
educational attainment, acculturation, and gender and identify the
highest risk subgroups for smoking among Asian Americans using na-
tionally representative data, which includes non-English speaking Asian
immigrant populations. Based on previous research, we hypothesized
that the relationship between acculturation level (i.e., U.S.-born vs
newer immigrants vs older immigrants) and smoking rates would be
modified by educational attainment, and the highest risk groups for
smoking accounting for educational attainment and the level of accul-
tration will be different across gender within Asian subgroups.

2. Methods
2.1. Data
This study used the Integrated Public Use Microdata Series National
Health Interview Survey (IPUMS NHIS) data from 2010 to 2018 (Blewett
et al., 2019). The sample for this analysis was restricted to adults aged 18
or older who reported their ethnicity as non-Hispanic and Asian yielding
a final sample size of 14,680. The analyses were weighted to account for
the complex sample design. Detailed information about the sample
design, sampling weights, and surveys are available at the NHIS IPUMS
Health Surveys website. The study procedure was reviewed by the
Institutional Review Board at the University of Oklahoma Health Sci-
ences Center (IRB#:14371).

2.2. Measures
The main predictors of current smoking prevalence were accultur-
tion and educational attainment in multivariate logistic regression
models for the overall Asian American sample as well as women and
men, separately. For acculturation, we included not only the length of
residence in the U.S. but also the nativity. Thus, this sample included
both foreign-born and U.S.-born Asians, years spent in the U.S. They
were categorized into three groups and used as a proxy of acculturation
based on previous research (Abraído-Lanza et al., 2006; Li & Hummer,
2015; Ra et al., 2013; Cho et al., 2004; Shelley et al., 2004; Pampel et al.,
2020; An et al., 2008; Ma et al., 2004). The three levels of acculturation
were: 1) less than 10 years (less acculturated immigrants), 2) 10 years or
more (more acculturated immigrants), and 3) U.S.-born Asians. Educa-
tional attainment was dichotomized into “some college or less” (less
educated) vs “college graduate or more” (highly educated) since Asian
Americans overall have the highest percentage of adults with college
degree or higher among all races (Ryan & Bauman, 2016). Smoking
prevalence was assessed using a binary categorical variable (i.e., current
smoker vs not current smoker). Current smokers were those who re-
ported having smoked at least 100 cigarettes during their lifetimes and
smoked every day or some days in the last month at the time of
interview.

Covariates included age, marital status, poverty status, the interview
language (i.e., English “vs Other”), country of origin, and survey year.
Marital status was dichotomized as “married or living with a partner” vs
“separated, divorced, widowed, or never married.” Poverty status was
coded as “at/above poverty threshold” vs “below poverty threshold”
where poverty was defined as “the ratio of family income to the U.S.
Census Bureau’s poverty thresholds for the year in question” by the
NHIS.

2.3. Analyses
Three multivariate logistic regressions for 1) all Asian Americans, 2)
women only, and 3) men only were conducted to estimate the odds of being a current smoker depending on educational attainment and years spent in the U.S. adjusted for age, marital status, poverty status, interview language, and the survey year. All analyses were performed using R Studio (1.4.1717). We took into account the NHIS complex sampling design to obtain proper variance estimates by using provided weights in the dataset (Blewett et al., 2019; IPUMS Health Surveys).

3. Results

3.1. Descriptive analyses

Table 1 displays weighted distributions of the predictor variables across all Asian Americans as well as women and men separately. Overall, the average age was 44.5 years old (SD = 17.7). Most participants (i.e., 59.1%) reported being married or living with a partner, 15.2% were living below the poverty threshold, and 93.4% had English proficiency sufficient to respond the interview in English. Among all Asian American respondents, 76.9% were foreign born and immigrated to the U.S. (23.2% lived in the U.S. for less than 10 years, 53.7% lived in the U.S. for 10 years or longer) and 23.1% were born in the U.S. Educational attainment was slightly higher among men than women, 59.4% of men vs 54.0% of women reported having graduated college or more. Men were 21.6% Chinese, 17.0% Filipino, 28.3% Asian Indian, and 33.0% other Asian; whereas women were 22.8% Chinese, 22.1% Filipino, 20.6% Asian Indian, and 34.5% other Asian. Among Asian Americans 5.0% of women and 13.5% of men were current smokers.

Table 2 presents crude frequencies and weighted distributions of current smoking prevalence, stratified by educational attainment and level of acculturation for the overall sample as well as women and men separately. Prevalence of current smoking was higher among individuals with lower (i.e., some college or less) vs higher educational attainment (i.e., college graduate or more) at all levels of acculturation, and the same patterns were found in both men and women. In terms of acculturation, prevalence of current smoking increased as duration of U.S. residence increased in less educated subgroups in the overall Asian American sample (10.4% among less acculturated immigrants vs 13.1% among more acculturated immigrants vs 17.0% among U.S.-born). However, the effects of acculturation on smoking prevalence were different across genders. While there were large differences between genders in low acculturation (immigrants with less than 10 years of residence in U.S.) and low educational attainment subgroups (3.5% in females vs 18.8% in males), the subgroups of U.S.-born higher educational attainment brought gender differences in cigarette smoking prevalence closer (4.7% in females vs 6.1% in males) (See Table 2).

Table 3 presents relations between each predictor variable and current smoking. Compared to immigrants with less than a college education and less than 10 years in the U.S. (reference group), those with a college degree and 10 years or more in the U.S. had significantly lower prevalence of current smoking overall and also for women and men separately (overall OR: 0.444 [95% CI: 0.321, 0.615]; women OR: 0.368 [95% CI: 0.171, 0.791]; men OR: 0.459 [95% CI: 0.317, 0.662]). Similarly, U.S.-born respondents with a college degree had significantly lower prevalence of smoking overall and for men (overall OR: 0.417 [95% CI: 0.286, 0.607]; men OR: 0.446 [95% CI: 0.282, 0.708]) compared to the reference group. U.S.-born women with a college degree were not significantly different from the reference group.

Fig. 1 shows the marginal probabilities and odds of current smoking among Asian Americans by educational attainment and acculturation level. The subgroup of immigrants who had resided in the U.S. less than

Table 1 Descriptive Statistics of Sociodemographic Characteristics.

| Age (M/SD) | Non-Hispanic Asian Americans | Female | Male |
|------------|-----------------------------|--------|------|
| N %        | N %                         | N %    | N %  |
| 44.5 17.1  | 45.5 18.07                 | 43.4 17.2 |

Table 2 Unweighted frequencies and weighted probabilities of dependent variables.

| Years spent in US | Currently Smoking | Educational Attainment | US born |
|-------------------|-------------------|------------------------|--------|
|                    | <10Y              | 10Y                    |        |
|                    | N % (95 % CI)     | N % (95 % CI)          | N % (95 % CI) |
| Total              | 123               | 10.4 (8.4, 12.4)       | 497    | 13.1 (11.8, 14.4) |
| college or less    | 164               | 6.8 (5.6, 8.0)         | 194    | 4.7 (3.9, 5.4) |
| college graduate or more | 24         | 3.5 (1.9, 5.2)        | 140    | 6.2 (5.1, 7.3) |
| Female             | 24                | 1.8 (1.0, 2.6)        | 39     | 1.5 (1.0, 2.0) |
| some college or less | 99           | 18.8 (14.9, 22.7)     | 347    | 23.3 (20.7, 25.9) |
| college or more    | 140               | 11.8 (9.7, 14.0)      | 155    | 7.8 (6.4, 9.2) |

Source: National Health Interview Survey 2010–2018.
N: raw sample size; %: Weighted percentage.
<10Y: less than 10 years in the U.S., 10Y+: 10 years or more in the U.S.
Prevalence estimates are weighted to reflect survey design and differential non-response.
Hispanic Asian Americans.

Logistic regression results predicting odds of current smoking among Non-Hispanic Asian Americans.

| Predictors                              | Adjusted OR (95 % CI) | Adjusted OR (95 % CI) | Adjusted OR (95 % CI) |
|------------------------------------------|------------------------|------------------------|------------------------|
| (Intercept)                              | 0.096 (0.064,0.143)    | 0.018 (0.007,0.049)    | 0.512 (0.323,0.810)    |
| Sex                                      |                        |                        |                        |
| Female                                   | 1                      |                        |                        |
| Male                                     | 3.286 (2.849,3.789)    |                        |                        |
| Age                                      | 0.989 (0.983,0.993)    | 0.989 (0.983,0.995)    | 0.988 (0.983,0.994)    |
| Marital Status                           |                        |                        |                        |
| Never Married/Divorced/Widowed/Separated | 1                      | 1                      | 1                      |
| Married/Living with a partner             | 0.886 (0.769,1.020)    | 0.814 (0.650,1.020)    | 0.898 (0.740,1.091)    |
| Poverty                                  |                        |                        |                        |
| At/Above poverty threshold               | 1                      | 1                      | 1                      |
| Below poverty threshold                  | 0.959 (0.797,1.153)    | 1.055 (0.768,1.449)    | 0.911 (0.733,1.133)    |
| Interview Language                       |                        |                        |                        |
| Other                                    | 1                      | 1                      | 1                      |
| English                                  | 0.774 (0.593,1.009)    | 2.519 (1.146,5.337)    | 0.561 (0.409,0.769)    |
| Country of Origin                        |                        |                        |                        |
| Chinese                                  | 1                      | 1                      | 1                      |
| Filipino                                 | 1.891 (1.527,2.342)    | 2.946 (1.950,4.450)    | 1.481 (1.136,1.932)    |
| Asian Indian                             | 0.868 (0.682,1.104)    | 0.604 (0.334,1.091)    | 0.894 (0.681,1.174)    |
| Other Asian                              | 1.885 (1.578,2.253)    | 2.127 (1.424,1.875)    | 1.780 (1.505,2.335)    |
| Year                                     | 0.973 (0.947,1.000)    | 0.964 (0.919,1.012)    | 0.980 (0.948,1.013)    |
| Predictors                               |                        |                        |                        |
| Years Spent in U.S.                      |                        |                        |                        |
| Less than 10 years                       | 1                      | 1                      | 1                      |
| 10 years or more                         | 1.542 (1.195,1.989)    | 2.115 (1.241,3.605)    | 1.456 (1.066,1.987)    |
| U.S. born                                | 1.508 (1.149,1.979)    | 4.099 (2.399,7.005)    | 0.890 (0.635,1.248)    |
| Educational Attainment                   |                        |                        |                        |
| Some college or less                     | 1                      | 1                      | 1                      |
| College graduate or more                 | 0.741 (0.561,0.979)    | 0.649 (0.321,1.314)    | 0.741 (0.538,1.021)    |
| Years Spent in U.S.; Educational Attainment |                        |                        |                        |
| Less than 10 years                       | 1                      | 1                      | 1                      |
| Some college or less                     | 0.444 (0.321,0.615)    | 0.368 (0.171,0.791)    | 0.459 (0.317,0.662)    |
| College graduate or more                 | 0.417 (0.286,0.607)    | 0.462 (0.206,1.037)    | 0.446 (0.282,0.708)    |

Source: National Health Interview Survey 2010–2018. CI: confidence interval; OR: odds ratio.

4. Discussion

The primary purpose of this study was to examine the intersectionality of acculturation, education, and gender as it influences smoking prevalence in the Asian American population and to identify the highest risk subgroups for smoking among the Asian American population. Overall, higher level of education was associated with lower smoking prevalence in both Asian men and women. The effects of acculturation on smoking prevalence were not consistent across gender and were modified by educational attainment. Among Asian immigrants, highly educated men and women were less likely to be current smokers the longer they resided in the U.S.; however, less educated immigrant men and women were more likely to smoke as they lived longer in the U.S. U.S.-born Asian women tended to be more likely to smoke than Asian immigrant women while U.S.-born Asian men tended to be less likely to smoke than Asian immigrant men regardless of their educational attainment. Overall, findings indicate that U.S.-born Asian women without a college degree and Asian immigrant men without a college degree who resided in the U.S. for 10 years or more had the highest odds of smoking (OR: 1.462 [95 % CI: 1.197, 1.774]).

Our findings are consistent with previous research studies that have indicated that Asians with a college degree are less likely to smoke regardless of gender and level of acculturation. The negative relationship between higher education and smoking is well documented (US Department of Health and Human Services, 2014; Leas et al., 2020; Nguyen-Grozavu et al., 2020; Pierce et al., 1989). The “socio-ecological effect” indicates that more highly educated individuals have fewer friends who smoke, are exposed to fewer smoking advertisements, and perceive stronger anti-smoking norms (de Walque, 2007; Nguyen-Grozavu et al., 2020; Leas et al., 2020). This could be a primary driver of lower smoking prevalence among Asian Americans.

The observed differences in smoking prevalence based on educational attainment support the idea of segmented assimilation (Abraido-Lanza et al., 2006; Li & Hummer, 2015; Ra et al., 2013), as mentioned earlier, smoking rates differ greatly across levels of education—highly educated Asian immigrants were less likely to smoke than less educated
Asian immigrants. Moreover, smoking rates among highly educated Asian immigrants were lower among those with longer residence in the U.S. Conversely, less educated immigrants tended to have greater prevalence of smoking with greater length of U.S. residence. Highly educated immigrants may settle into higher income neighborhoods and interact with others with higher levels of education and thus be more likely to adopt anti-tobacco sentiments (Li & Hummer, 2015; Ra et al., 2013). In contrast, individuals with less education and fewer financial resources tend to start at the bottom of the occupational hierarchy (Li & Hummer, 2015; Ra et al., 2013). They likely have more direct daily contact with lower income adults and other immigrants that have higher smoking prevalence rather than higher income adults and college graduates that are less likely to smoke (Li & Hummer, 2015; Ra et al., 2013). However, this was not applied to U.S.-born Asian American men and women who were considered most acculturated to the U.S. culture.

Smoking behaviors are influenced by cultural norms (An et al., 2008; Tsai et al., 2008). Regardless of level of education, Asian female immigrants were less likely to smoke than U.S.-born women while Asian male immigrants were more likely to smoke than U.S.-born Asian men. In most Asian countries, smoking among men is much higher than women, although there has been a rapid increase in the rate of smoking among women in Asian countries (J. J. Yang et al., 2019). Due to traditional values and normative gender expectations, female smoking is socially less acceptable in Asian countries than in the U.S. (An et al., 2008; Tsai et al., 2008). Even though the smoking rate among women in the U.S. has declined steadily, it still remains higher than that of women in Asian countries (J. J. Yang et al., 2019; M. Zhang et al., 2019). U.S.-born Asian women who are more acculturated to the U.S. culture where gender equality is more valued and female smoking is viewed more favorably, tend to be more likely to smoke than Asian immigrants (An et al., 2008). Conversely, U.S.-born Asian men smoke less than Asian male immigrants since smoking is generally less tolerated in the U.S. than in Asian countries (An et al., 2008; Ma et al., 2004).

This study has several limitations. First, we used cross-sectional data...
to examine smoking prevalence among Asian Americans. Thus, it was not possible to disentangle the temporal order of educational attainment and period of residence in the U.S. among Asian immigrants. Educational attainment may have occurred either prior to immigration to the U.S. or afterwards. Second, we used years of living in the U.S. as a proxy measure for acculturation (Abraído-Lanza et al., 2006; Li & Hummer, 2015; Ra et al., 2013) and included survey language (English vs other) as a covariate in the analyses. Although duration of residence is one of the most important dimensions of acculturation (Li & Hummer, 2015), other studies have used various scales to measure acculturation in greater detail, which include a series of questions on cultural lifestyle and indigenous beliefs that are associated with smoking behaviors (Schwartz et al., 2010; Wallace et al., 2010). Incorporating an acculturation scale in the NHIS survey or other surveys could help improve understanding of the interactions between education and acculturation and the trajectories of smoking prevalence among Asian Americans. In addition, we could not disaggregate the Asian subgroups based on their ethnicity due to the complexity of the analysis and lack of the sample size. Asian Americans are culturally heterogeneous, thus the findings of this study may not be generalized to a certain Asian ethnicity. Future study with sufficient sample size should examine the same relationships and how the findings differ based on their ethnicity.

5. Conclusions

This study addresses an important gap in the literature on smoking in Asian Americans. This is the first study to examine the intersectionality of acculturation, education, and gender as it influences smoking prevalence in the Asian American population. Findings indicated that smoking prevalence among Asian Americans is highly dependent upon interactions among these variables. Specifically, U.S.-born Asian women without a college degree and Asian immigrant men without a college degree were identified as the subgroups with the greatest risk for smoking. Findings from the current study may inform development of the just-in-time smoking cessation interventions could be developed to address the specific needs of U.S.-born Asian women without a college degree and Asian immigrant men without a college degree. Identifying smoking related risk behaviors (e.g., smoking urges, stress, alcohol use) and providing tailored intervention content in real-time may help reduce smoking cigarettes across Asian American populations (see Hébert et al., 2020).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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References

Abraído-Lanza, A.F., Armbrister, A.N., Plöreze, K.R., Aguirre, A.N., 2006. Toward a theory-driven model of acculturation in public health research. American Journal of Public Health 96 (8), 1342-1346.
Agatston, D.T., Ondani, S., Okuyemi, K.S., Armour, B., 2020. Disparities in current cigarette smoking among US adults, 2002–2016. Tobacco control 29, 269–276.
American Lung Association, (2015). National Tobacco Trends.
An, N., Cochran, S., Mays, V., McCarthy, W., 2008. Influence of American acculturation on cigarette smoking behaviors among Asian American subpopulations in California. Nicotine & Tobacco Research 10 (4), 579-587.
Berrett, L.A., Drew, J.A.R., King, M.L., Williams, K.C.W., 2019. IPUMS Health Surveys: National Health Interview Survey, Version 6.4. IPUMS, Minneapolis, MN.
Castrillo, R., Retelny, L.R., Businelle, M.S., Kendzor, D.E., Mazas, C.A., Li, Y., et al. (2009). Acculturation differentially predicts smoking cessation among Latino men and women. Cancer Epidemiology and Prevention Biomarkers, 18, 3468-3475.
Centers for Disease Control and Prevention. 2011. Quitting smoking among adults—United States, 2001–2010. MMWR. Morbidity and mortality weekly report 60; 15.
Centers for Disease Control and Prevention. (2020). State Tobacco Activities Tracking & Evaluation (STATE) system. Map of current cigarette use among adults (Behavior Risk Factor Surveillance System); 2017.
Chae, D.H., Gavin, A.R., Taleschi, D.T., 2006. Smoking prevalence among asian americans: findings from the National Latino and Asian American Study (NLAAAS). Public health reports 121 (6), 755-763.
Cho, Y., Frishbe, W.P., Hummer, R.A., Rogers, R.G., 2004. Nativity, duration of residence, and the health of Hispanic adults in the United States. International Migration Review 38 (1), 184-211.
Cornelius, M.E., Wang, T.W., Jamal, A., Loretan, C.G., Neff, L.J., 2020. Tobacco product use among adults—United States, 2019. Morbidity and Mortality Weekly Report 69 (46), 1736-1742.
de Walque, D., 2007. Does education affect smoking behaviors?: Evidence using the Vietnam draft as an instrument for college education. Journal of Health Economics 26 (5), 877-895.
Drouhot, L.G., Garip, F., 2021. What’s Behind a Racial Category? Uncovering Heterogeneity Among Asian Americans Through a Data-Driven Typology. RSF: The Russell Sage Foundation Journal. Journal of the Social Sciences 7, 22–45.
Fujisawa, T., Kawachi, I., 2009. Is education causally related to better health? A twin fixed-effect study in the USA. International Journal of Epidemiology 38 (5), 1310–1322.
Gage, S.H., Bowden, J., Davey Smith, G., Munafò, M.R., 2018. Investigating causality in associations between education and smoking: a two-sample Mendelian randomization study. International Journal of Epidemiology 47, 1131–1140.
Giroirer, J., Dube, S.R., King, B.A., Garrett, B.E., Babb, S., McAfee, T., 2013. Vital signs: current cigarette smoking among adults aged≥ 18 years with mental illness—United States, 2009–2011. MMWR. Morbidity and mortality weekly report 62, 81.
Gillen, B.A., Surani, Z., Chawla, N., Bastani, R., 2009. Tobacco use among South Asians: results of a community-university collaborative study. Ethn Health 14 (2), 131–145.
Gotay, C.C., Reid, M.S., Dawson, M.Y., Wang, S., 2015. Acculturation and smoking in North Americans of Chinese ancestry: A systematic review. Canadian Journal of Public Health 106 (5), e333 e340.
Hébert, E.T., Ra, C.K., Alexander, A.C., Helt, A., Moisuc, R., Kendzor, D.E., Vidrine, D.J., Funk-Lawler, R.K., Businelle, M.S., 2020. A Mobile Just-In-Time Adaptive Intervention for Smoking Cessation: Pilot Randomized Controlled Trial. Journal of medical Internet research 22 (3), e16907.
Heckman, J.J., Humphries, J.E., Veramendi, G., 2016. Returns to education: The causal effects of education on earnings. Health and Smoking.
Kotkapan, A., 2016. Healthy migrant effect on smoking behavior among Asian immigrants in the United States. Journal of Immigrant and Minority Health 18 (1), 94–101.
E.C. Lean D.R. Trinidad J.P. Pierce T. Benmarhnia The effect of college attendance on young adult cigarette, e-cigarette, cigarillo, hookah and smokeless tobacco use and its potential for addressing tobacco-related health disparities Preventive Medicine 132 2020 105954 105954.
Lee, L.K., Sobal, J., Frongillo, E.A., 2000. Acculturation and health in Korean Americans. Social science & medicine 51 (2), 159–173.
Lew, R., Tanjani, S.P., 2003. Slowing the epidemic of tobacco use among Asian Americans and Pacific Islanders. American Journal of Public Health 93 (5), 764–768.
Li, J., Hummer, R.A., 2015. The relationship between duration of US residence, educational attainment, and adult health among Asian immigrants. Population Research and policy review 34 (1), 49–76.
Ma, G.X., Tan, Y., Toubeib, J.J., Lu, X., Shive, S.E., Lan, Y., 2004. Acculturation and smoking behavior in Asian-American populations. Health Education Research 19, 615-625.
Martin, D.C., Gorman, K.S. Miller, R.J., Murphy, L., Sor, S., Martins, J.C., Vecchierelli, M.L., 2015. Assessment of food intake, obesity, and health risk among the homeless in Rhode Island. Public Health Nursing 32 (5), 453–461.
Maxwell, A.E., Bernards, C.A., McCarthy, W.J., 2005. Smoking prevalence and correlates among Chinese- and Filipino-American adults: findings from the 2001 California Health Interview Survey. Preventive Medicine 41 (2), 693–699.
McCarthy, W., Divan, H., Shah, D., Maxwell, A., Freed, B., Bastani, R., et al., 2005. California Asian Indian tobacco use survey: 2004. California Department of Health Services, Sacramento (CA).
Moeschberger, M.L., Anderson, J., Kuo, Y.-F., Chen, M.S., Wewers, M.E., Guthrie, R., 1997. Multivariate profile of smoking in Southeast Asian men: a biochemically verified analysis. Preventive Medicine 26 (1), 53–58.
Morrow, M., Barrclough, S., 2010. Gender equity and tobacco control: bringing masculinity into focus. Global health promotion 17 (1 suppl), 21–28.

Mukherjea, A., Wakkowski, O.A., Lee, Y.O., Delnoye, C.D., 2014. Asian american, native hawaiian and pacific islander tobacco use patterns. American journal of health behavior 38 (3), 362–369.

Nguyen-Gruzavu, F.T., Pierce, J.P., Sakumana, K.-L., Lea, E.C., McMenamin, S.B., Kealey, S., Bennarhina, T., Emery, S.L., White, M.M., Fogan, P., Trinidad, D.R., 2020. Widening disparities in cigarette smoking by race/ethnicity across education level in the United States. Preventive Medicine 139, 106220.

Pampel, F., Khlat, M., Bricard, D., Legleye, S., 2020. Smoking among immigrant groups in the United States: prevalence, education gradients, and male-to-female ratios. Nicotine and Tobacco Research 22 (4), 532–538.

Patel, M., Mistry, R., Maxwell, A.E., Divan, H.A., McCarthy, W.J., 2018. Contextual factors related to conventional and traditional tobacco use among California Asian Indian immigrants. Journal of community health 43 (2), 280–290.

Pierce, J.P., Fiore, M.C., Novotny, T.E., Hatziandreu, E.J., Davis, R.M., 1989. Trends in cigarette smoking in the United States: projections to the year 2000. Jama 261, 61–65.

Prochaska, J.J., Das, S., Young-Wolff, K.C., 2017. Smoking, mental illness, and public health. Annual review of public health 38 (1), 165–185.

Ra, C.K., Cho, Y., Hummer, R.A., 2013. Is acculturation always adverse to Korean Pampel, F., Khlat, M., Bricard, D., Legleye, S., 2020. Smoking among immigrant groups in the United States: prevalence, education gradients, and male-to-female ratios. Nicotine and Tobacco Research 22 (4), 532–538.

Mukherjea, A., Wackowski, O.A., Lee, Y.O., Delnoye, C.D., 2014. Asian american, native hawaiian and pacific islander tobacco use patterns. American journal of health behavior 38 (3), 362–369.

Nguyen-Gruzavu, F.T., Pierce, J.P., Sakumana, K.-L., Lea, E.C., McMenamin, S.B., Kealey, S., Bennarhina, T., Emery, S.L., White, M.M., Fogan, P., Trinidad, D.R., 2020. Widening disparities in cigarette smoking by race/ethnicity across education level in the United States. Preventive Medicine 139, 106220.

Pampel, F., Khlat, M., Bricard, D., Legleye, S., 2020. Smoking among immigrant groups in the United States: prevalence, education gradients, and male-to-female ratios. Nicotine and Tobacco Research 22 (4), 532–538.

Patel, M., Mistry, R., Maxwell, A.E., Divan, H.A., McCarthy, W.J., 2018. Contextual factors related to conventional and traditional tobacco use among California Asian Indian immigrants. Journal of community health 43 (2), 280–290.

Pierce, J.P., Fiore, M.C., Novotny, T.E., Hatziandreu, E.J., Davis, R.M., 1989. Trends in cigarette smoking in the United States: projections to the year 2000. Jama 261, 61–65.

Prochaska, J.J., Das, S., Young-Wolff, K.C., 2017. Smoking, mental illness, and public health. Annual review of public health 38 (1), 165–185.

Ra, C.K., Cho, Y., Hummer, R.A., 2013. Is acculturation always adverse to Korean immigrant health in the United States? Journal of Immigrant and Minority Health 15 (3), 510–516.

Rao, M., Bar, L., Yu, Y., Srinivasan, M., Mukherjea, A., Li, J., Chung, S., Venkatraman, S., Dan, S., Palaniappan, L., 2022. Disaggregating Asian American cigarette and alternative tobacco product use: results from the National Health Interview Survey (NHIS) 2006–2018. Journal of racial and ethnic health disparities 9 (3), 856–864.

Reiss, K., Lehnhardt, J., Razum, O., 2015. Factors associated with smoking in immigrants from non-western to western countries—what role does acculturation play? A systematic review. Tobacco induced diseases 15, 1–23.

Rodríguez, E.I., Fernández, A., Livaudais-Toman, J.C., Perez-Stable, E.J., 2019. How does acculturation influence smoking behavior among Latinos? The role of education and national background. Ethnicity & disease 29 (2), 227–238.

Ryan, C.L., & Bauman, K. (2016). Educational Attainment in the United States: 2015. In U.S.D.o. Commerce (Ed.).

Sam, D.L., Berry, J.W. (Eds.), 2006. The Cambridge Handbook of Acculturation Psychology. Cambridge University Press.

Sandberg, N.C., 1974. Ethnic Identity and Assimilation: The Polish-American Community. Case Study of Metropolitan Los Angeles.

Schwartz, S.J., Unger, J.B., Zamboanga, B.L., Szapocznik, J., 2010. Rethinking the concept of acculturation: implications for theory and research. Am Psychol 65, 237–251.

Shelley, D., Fahn, M., Scheimann, R., Swain, S., Qu, J., Burton, D., 2004. Acculturation and tobacco use among Chinese Americans. American journal of public health 94 (2), 300–307.

Tsai, Y.-W., Tsai, T.-L., Yang, C.-L., Kuo, K.N., 2008. Gender differences in smoking behaviors in an Asian population. Journal of Women’s Health 17 (6), 971–978.

US Department of Health and Human Services, 2014. Surgeon general’s report: the health consequences of smoking—50 years of progress. Public Health Service, Office of the Surgeon General, Rockville.

Wallace, P.M., Pomeroy, E.A., Latimer, A.E., Martinez, J.L., Salovey, P., 2010. A review of acculturation measures and their utility in studies promoting Latino health. Hispanic journal of behavioral sciences 32 (1), 57–54.

World Health Organization, 2019. WHO global report on trends in prevalence of tobacco smoking 2000–2025. World Health. Organization.

Yang, R., Charles, M., 2021. Traditional Asians? Race, Ethnicity, and Gender Policy Attitudes in the United States. RSF: The Russell Sage Foundation. Journal of the Social Sciences 7, 130–153.

Yang, J.J., Yu, D., Wen, W., Shu, X.-O., Saito, E., Rahman, S., Gupta, P.C., He, J., Tsugane, S., Xiang, Y.-B., Gao, Y.-T., Koh, W.-P., Tamakoshi, A., Irie, F., Sadakane, A., Tsuji, I., Kanemura, S., Matsumo, K., Nagata, C., Chen, C.-J., Yuan, J.-M., Shin, M.-H., Park, S.K., Pan, W.-H., Qiao, Y.-L., Pednekar, M.S., Su, D., Sawada, N., Li, H.-L., Gao, J., Cai, H., Grant, E., Tomata, Y., Sugawara, Y., Ito, H., Wada, K., Shen, C.-Y., Wang, R., Ahn, Y.-O., You, S.-L., Yoo, K.-Y., Ashan, H., Chia, K.S., Boffetta, P., Inoue, M., Kang, D., Potter, J.D., Zheng, W., 2019. Tobacco Smoking and Mortality in Asia: A Pooled Meta-analysis. JAMA Netw Open 2 (3), e191474.

Zhang, M., Liu, S., Yang, J.J., Yu, D., Wen, W., Shu, X.-O., Saito, E., Rahman, S., Gupta, P.C., He, J., Tsugane, S., Xiang, Y.-B., Gao, Y.-T., Koh, W.-P., Tamakoshi, A., Irie, F., Sadakane, A., Tsuji, I., Kanemura, S., Matsumo, K., Nagata, C., Chen, C.-J., Yuan, J.-M., Shin, M.-H., Park, S.K., Pan, W.-H., Qiao, Y.-L., Pednekar, M.S., Su, D., Sawada, N., Li, H.-L., Gao, J., Cai, H., Grant, E., Tomata, Y., Sugawara, Y., Ito, H., Wada, K., Shen, C.-Y., Wang, R., Ahn, Y.-O., You, S.-L., Yoo, K.-Y., Ashan, H., Chia, K.S., Boffetta, P., Inoue, M., Kang, D., Potter, J.D., Zheng, W., 2019. Tobacco Smoking and Mortality in Asia: A Pooled Meta-analysis. JAMA Netw Open 2 (3), e191474.

Zhang, M., Liu, S., Yang, J.J., Yu, D., Wen, W., Shu, X.-O., Saito, E., Rahman, S., Gupta, P.C., He, J., Tsugane, S., Xiang, Y.-B., Gao, Y.-T., Koh, W.-P., Tamakoshi, A., Irie, F., Sadakane, A., Tsuji, I., Kanemura, S., Matsumo, K., Nagata, C., Chen, C.-J., Yuan, J.-M., Shin, M.-H., Park, S.K., Pan, W.-H., Qiao, Y.-L., Pednekar, M.S., Su, D., Sawada, N., Li, H.-L., Gao, J., Cai, H., Grant, E., Tomata, Y., Sugawara, Y., Ito, H., Wada, K., Shen, C.-Y., Wang, R., Ahn, Y.-O., You, S.-L., Yoo, K.-Y., Ashan, H., Chia, K.S., Boffetta, P., Inoue, M., Kang, D., Potter, J.D., Zheng, W., 2019. Tobacco Smoking and Mortality in Asia: A Pooled Meta-analysis. JAMA Netw Open 2 (3), e191474.

Further reading

The World Bank. (2020). Prevalence of current tobacco use (% of adults).