

# An Exploration of Ethnic, Immigration and Acculturation Differences on Tobacco Smoking Among Public High School Girls in Hawai'i

Ann Pobutsky PhD; Tonya Lowery St. John MPH; Chelsi N. Urabe MPH; Fenfang Li PhD; and Lila Johnson MPH

## Abstract

*This cross-sectional study explores the differences in ethnicity, sex, immigration (place of birth of student and parents), and acculturation (based on language spoken at home) on current cigarette smoking among public high school students in Hawai'i, and especially examine if this affected smoking among girls. Previous behavior risk surveys of youth in Hawai'i showed higher smoking rates among girls, although these were not found to be statistically significant differences. Multiple years of data were compiled from the Hawai'i Youth Tobacco Survey (YTS) for years 2005, 2007, 2009, and 2011, for a total sample size of N=5,527. Multivariate logistic regression analysis was conducted to evaluate the likelihood of current cigarette smoking (in the past 30 days) in relation to a variety of factors. The analysis revealed that Hawai'i-specific ethnicity, grade, and sex were all significant predictors of smoking. Girls whose mothers were born in Hawai'i or in another United States state were more likely to smoke than those whose mothers were born in a foreign country. The model showed girls were more likely to smoke than boys. Eleventh and twelfth graders were more likely to smoke than ninth graders. Whites, Filipinos, Native Hawaiians, Pacific Islanders, and Other ethnic groups were more likely to smoke than those who identified themselves as Japanese.*

## Keywords

*ethnicity, sex, immigration, acculturation, high school smoking, Hawai'i*

## Introduction

An estimated 12% of all deaths worldwide are caused by tobacco use.<sup>1</sup> In 2012, approximately 19.6% of the total adult population in the United States self-reported current smoking,<sup>2</sup> whereas in Hawai'i this percentage was lower at 14.6%.<sup>2,3</sup> Smoking increases the risk of lung cancer in men and women by 90% and 80% respectively. Smoking has also been linked with heart disease and is associated with numerous cancers and other negative health effects.<sup>4</sup> The increased risk of morbidity and mortality secondary to smoking is dependent on multiple factors; one factor in particular is the total number of years spent smoking. Furthermore, since it is known that lifelong smokers generally initiate smoking at a young age,<sup>5</sup> adolescents who begin smoking are at greater risk of becoming lifelong smokers. In 2011, 20% of adolescents in the United States and 8.7% adolescents in Hawai'i reported current cigarette smoking, which is smoking at least one cigarette in the past 30 days.<sup>6</sup> There are multiple factors that influence an adolescent to initiate and continue to smoke including tobacco marketing, peer group pressure, and access to cigarettes.<sup>7,8</sup>

## Ethnicity and Sex

All data on smoking in Hawai'i and the nation show downward trends over the past 10-20 years, yet smoking related ethnic and socio-economic disparities persist. Trends in current smoking

in Hawai'i show persistently high smoking rates among those with the lowest household incomes, lowest educational levels, and the unemployed.<sup>9</sup> Smoking rates in Hawai'i also vary greatly by ethnicity. Among adults in 2011, current self-reported smoking was highest among Native Hawaiians at 27.5% and lowest among Chinese at 7.6%.<sup>10</sup> Sex differences are also apparent, with Filipino male adults reporting significantly higher smoking rates than females (18.1% and 7.9% respectively). Smoking rates are also higher among men than women among Native Hawaiians (30.6% compared to 24.6%) and Japanese (13.2% compared to 10.5%) but the differences are not statistically significant.<sup>10</sup> A study conducted on the island of Hawai'i revealed that the highest smoking rates among adult females were among Native Hawaiians, while among men, Filipinos had the highest smoking rates, followed closely by Native Hawaiians, European-Americans, and Japanese men.<sup>11</sup> Among middle school students, Native Hawaiians had the highest numbers of current smokers compared to other groups.<sup>12</sup> In California, a study which assessed smoking behavior among Asian American youth in grades 7-12, found that, in general, Asian Americans (Chinese, Filipino, Japanese and Korean) smoked less than non-Asians, but among Asians, Filipinos smoked the most.<sup>13</sup>

## Immigration and Acculturation

Not only do ethnicity and sex factor into smoking prevalence, but also place of birth (immigration) and acculturation (as evidenced by such indicators as language spoken at home). Many studies have provided evidence that immigrants to the US report lower tobacco use than their US-born counterparts and this pattern was also apparent among second-generation immigrants.<sup>14</sup> The US Tobacco Use Supplement of the Current Population Survey, found that US-born individuals born to US-born parents had the higher odds for smoking than US-born individuals born to first-generation immigrants; foreign-born individuals had the lowest.<sup>15</sup> However, among Asians, sex complicates such smoking patterns. For Asian/Pacific Islander women, those born in foreign countries were less likely to smoke than women born in the United States.<sup>16</sup> Traditional cultural norms discourage smoking among women in most Asian countries. Meanwhile Japanese men in Japan are more likely to smoke than their Japanese American counterparts.<sup>16</sup> Immigration and place of birth may be very important factors to consider with smoking prevalence since 12% of the nation's population is born outside of the country. In Hawai'i this percentage is larger at 17.3%.<sup>17</sup> Furthermore, Hawai'i has a diverse multicultural population

with 24.4% reporting speaking a language other than English at home, compared with 19.6% in the United States overall.<sup>18</sup>

Acculturation is used to describe a foreign-born immigrant's adjustment to their new country of residence through the adoption of new customs, norms, values, and behaviors.<sup>15</sup> This topic has generated increasing interest as a possible factor leading to higher smoking rates among immigrants and their children in the United States. Acculturation effects are seen among Latino immigrants in the United States; Latinos who spend more time in the United States and adopt US values, customs, norms, attitudes and behaviors are 1.5 times as likely to smoke and twice as likely to have high alcohol consumption than those with less time in the United States.<sup>14,19</sup> A study by Choi, et al, also looked at acculturation among Asian-Americans, using language spoken at home and English proficiency as measurable variables. They concluded that the more acculturated an Asian-American person was, the more likely they were to smoke.<sup>15</sup> However, studies have been inconsistent as sex-specific analysis revealed that the more acculturated an Asian American male was, the less likely he was to smoke.<sup>13</sup>

Among US Asian adolescents who participated in the National Survey on Drug Use and Health (NSDUH) from 1999-2001 cited in the study by Carballo, et al, Japanese had the lowest rates of smoking and Koreans had the highest; however, both were lower than Native Hawaiians or Other Pacific Islanders.<sup>5</sup> Almost all ethnic groups in the NSDUH study had females reporting a higher lifetime smoking prevalence than males, although only European-American and Filipino girls had higher current smoking rates.<sup>5</sup>

As ethnicity, acculturation and place of birth (immigration) have been shown to be important factors in smoking prevalence in the continental US, it is likely that Hawai'i is also affected by these factors with its ethnically diverse population. Very little has been done to study the effect of immigration status, immigrant generation, acculturation, and smoking in Hawai'i. Although not asked in the 2010 US Census, in 2000, almost one-half of the foreign born population in Hawai'i (48%) came from the Philippines, where the World Health Organization estimates that 60% of men smoke.<sup>16</sup> In addition, about 25% of Hawai'i households speak a language other than English at home.<sup>18</sup> Among those households, more than one-third (34%) speak Filipino languages (Ilocano, Tagalog or Visayan), 16.7% speak Japanese, 9.5% Chinese, 8.4% Spanish, 6.1% Hawaiian, 18% other Pacific Islander or Asian languages and 7% Other languages.<sup>18</sup>

This study used several years of Youth Tobacco Survey (YTS) data from Hawai'i public high school students to (1) create an adequate sample size to characterize current smoking behavior among the students and (2) explore the relationships between smoking and sex, ethnicity and acculturation, and examine possible associations among these and other variables.

## Methods

The Youth Tobacco Survey (YTS) was designed by the Centers for Disease Control and Prevention (CDC) in collaboration

with participating states.<sup>20</sup> YTS surveys are conducted at the national, state, and city level. Beginning in 2003, the Hawai'i Department of Health's Tobacco Prevention and Education Program added questions about student and parent birthplace as well as language spoken at home to the state YTS. These questions yielded consistent sex and ethnic differences in smoking observed in the separate years of 2005, 2007, 2009 and 2011 with girls reporting more smoking than boys (although not statistically significant in each separate year), suggesting that this warranted a more in-depth analysis than could be done with separate years. The Hawai'i YTS is administered biennially in public schools across the state. The survey employs a two-stage cluster design to produce a representative sample of students in grades 9-12 and roughly 1,500 students participate in the self-administered survey each year. For all years, the first-stage sampling frame consisted of all public schools containing any grades 9-12. Schools were selected with probability proportional to school enrollment size. The second sampling stage consisted of systematic equal probability sampling of classes from each school that participated in the survey. All students in the selected classes were eligible to participate in the survey. All participants provided signed parental consent forms prior to participating in the survey. No student incentives were offered. Hawai'i achieved or exceeded the minimum combined school and student response rate of 60% or greater required by the CDC in order for the data to be weighted to be representative of the state. Student responses were weighted to reflect their likelihood of being sampled and non-response within the selected classrooms, and adjusted to reflect the grade, sex, and race/ethnicity distribution of Hawai'i public school students.

Hawai'i-specific ethnicity was assessed with the following question: "Which one of these groups BEST describes you? (Choose only one answer)." Response choices included: Black or African-American, Caucasian/White, Chinese, Filipino, Japanese, Native Hawaiian/part-Hawaiian, other Pacific Islander and Other. These Hawai'i specific ethnic categories were included to provide a level of detail needed to adequately describe Hawai'i's diverse population. Hispanic or Latino ethnicity was assessed in a separate question which assesses race/ethnicity according to federal guidelines. Students were asked to pick which group best described them (choose only one) from the following choices: American Indian or Alaska Native, Asian, Black or African-American, Hispanic or Latino, Native Hawaiian or Other Pacific Islander or White. Current smoking was defined as smoking cigarettes on one or more of the past 30 days. Level of acculturation was assessed by the question: "What language do you speak mainly at home? (Choose only one answer)," with the choices: Chinese (any dialect), English, Filipino (Ilokano/Tagalog), Hawaiian, Japanese, Spanish, and other. Place of birth of the student, mother and father was determined using the question: "Which describes best the place where you (your mother, your father) were (was) born?" with possible response choices including: Hawai'i, United States (not including Hawai'i), born in another country, and don't know. A three-level composite variable using the birth ques-

tions was created to indicate the generation of immigration of the students with students born in a foreign country being first generation, students born in the United States with at least one foreign-born parent being second generation, and students born in the United States to US-born parents being third generation or higher. Current cigarette smoking was defined as smoking cigarettes on one or more of the past thirty days.

The data were analyzed using SPSS Statistics 20.0 to generate a descriptive analysis of the prevalence of current smoking by sex, grade, ethnicity, Hispanic origin, language spoken at home, and place of birth of the student, mother and father, and students generation in the United States. Unadjusted odds ratios (OR) were calculated for each variable. Then all variables were included in a multivariate logistic regression analysis model to calculate the adjusted odds of current smoking among high school students by different variables. To explore the different influences of acculturation on boys and girls, separate logistic regression models were run for each sex using variables that were significant in the all students model. For the logistic regression analysis, language spoken at home was dichotomized in to English or other, and Japanese was set at the reference for smoking by ethnicity, since Japanese are the group with the lowest current smoking rate in the state. For all analyses, “don’t know” responses were coded as missing and excluded from the analysis.

## Results

Table 1 summarizes the sample sizes and response rates for the YTS data used in this study. In the four survey years, 2005, 2007, 2009, and 2011, 5,527 students were surveyed, with the number of students surveyed by year ranging from 1,211 to 1,551. During this time period smoking prevalence ranged from 12.6% in 2005 to 8.7% in 2011.

Examination of the population prevalence of smoking and 95% confidence intervals by risk factors using data from 2005, 2007, 2009, and 2011 combined (Table 2) revealed that among all students, smoking varied significantly by grade, ethnicity, Hispanic origin, home language, birth place of student, mother and father, and generation in the United States. Overall, 10.8% of high school students smoked cigarettes with 11.7% of girls and 9.9% of boys smoking in the past 30 days. Smoking increased from 8.1% in 9th grade to 14.5% by 12th grade ( $P < .001$ ).

Among the predominant ethnicities in Hawai‘i (regardless of Hispanic origin), Pacific Islanders (14.2%), Others (14.0%), Native Hawaiians (13.0%) and Whites (12.4%) were most likely to smoke. Prevalence of current smoking did not vary by sex except among Blacks (18.9% of boys vs. 4.4% of girls), and Native Hawaiians (9.2% and 16.9%, respectively). Language spoken at home was significantly related to smoking prevalence ( $P = .021$ ) with those speaking Japanese (5.9%) or Chinese (7.3%) at home being less likely to smoke than those speaking Hawaiian (23.0%) or Spanish (16.9%). Students who self-identified as being of Hispanic or Latino origin had higher smoking prevalence (16.1%) and were significantly more likely to smoke than non-Hispanics ( $P = .004$ ).

By place of birth, students who themselves or whose parents were born outside the United States were the least likely to smoke, followed by those born in Hawai‘i, with those born elsewhere in the United States (not Hawai‘i) having the highest smoking prevalence ( $P = .003$ ,  $P < .001$ , and  $P = .006$  for the association of current smoking status with student’s, mother’s and father’s place of birth respectively). Overall there was roughly a two-fold increase in smoking prevalence when comparing students, mothers, and fathers born in a foreign country compared to those born elsewhere in the United States (not Hawai‘i). By generation in the United States, smoking was most prevalent among students who were at least third-generation Americans (ie, they and both their parents were born in the United States; 11.8%) ( $P = .008$ ). However, the association of place of birth and smoking status was more pronounced in girls than boys; 14.7% of girls who were at least third generation Americans smoked compared to 7.2% of girls who were first generation immigrants. Among boys, the figures were 8.9% for third generation and 8.0% for first generation immigrants (Table 2).

The multivariate logistic regression analysis (Table 3) shows that even after adjusting for sex, grade, ethnicity, Hispanic origin, home language, place of birth of student, mother and father, and generation in the United States, Hawai‘i-specific ethnicity ( $P = .001$ ), grade ( $P < .001$ ), and sex ( $P = .029$ ) were all significant predictors of smoking. The model showed girls were more likely to smoke than boys (OR=1.35, 95% CI 1.06–1.72). Eleventh and twelfth graders were more likely to smoke than ninth graders (OR=1.55, 95% CI 1.18–2.04 and OR=2.00, 95% CI 1.45–2.75). Whites (OR=2.00, 95% CI

Table 1. Sample Size, Response Rate and Smoking Status of Hawai‘i High School Students by Year

Survey Year	Sample size	Response Rate	Current Smoker			
			Yes		No	
			Percent	Weight n*	Percent	Weighted n*
2005	1,551	60.0%	12.6%	9,900	87.4%	69,000
2007	1,211	62.6%	9.7%	5,600	90.3%	51,800
2009	1,467	66.5%	11.3%	5,500	88.7%	43,100
2011	1,298	67.4%	8.7%	3,800	91.3%	39,600
Total	5,527	Na	10.8%	24,800	89.2%	203,500

\*Weighted n is rounded to the nearest hundred. Data source: Hawai‘i Youth Tobacco Survey Years: 2005, 2007, 2009 and 2011

Table 2. Hawai'i High School Students Reporting Current Smoking by Sex, Grade, Ethnicity, Hispanic Origin, Language Spoken at Home, Place of Birth, and Generation (Hawai'i YTS 2005-2011).

	Girls		Boys		Total		
	Weighted %	95% CI	Weighted %	95% CI	Weighted%	95% CI	P-value+
<b>Total</b>	11.7	10.2 - 13.5	9.9	8.6 - 11.4	10.8	9.8 - 11.9	.091
<b>Grade</b>							
9th	8.0	5.9 - 10.7	8.1	6.1 - 10.8	8.1	6.3 - 10.1	<.001
10th	11.3	8.3 - 15.1	8.1	6.0 - 10.8	9.6	7.7 - 12.1	
11th	13.7	10.6 - 17.6	10.0	7.8 - 12.9	11.9	10.0 - 14.1	
12th	14.9	11.7 - 18.6	13.9	10.5 - 18.1	14.5	11.8 - 17.4	
<b>Race/Ethnicity</b>							
White	14.4	9.6 - 20.9	10.5	7.0 - 15.5	12.4	8.8 - 17.1	.001
Black	4.4	2.0 - 9.3	18.9	9.4 - 34.4	11.9	8.3 - 20.3	
Chinese	4.7	1.8 - 12.2	10.6	5.7 - 18.9	8.0	4.5 - 14.1	
Filipino	9.5	7.4 - 12.1	9.3	7.3 - 11.7	9.4	7.8 - 11.2	
Native Hawaiian	16.9	13.5 - 21.0	9.2	6.3 - 13.3	13.0	10.4 - 16.2	
Japanese	5.0	3.1 - 8.0	6.6	4.2 - 10.3	5.9	4.2 - 8.0	
Pacific Islander	15.2	10.4 - 21.6	12.9	8.1 - 19.9	14.2	10.1 - 19.3	
Other	14.5	10.1 - 20.4	13.8	9.2 - 20.1	14.0	11.2 - 17.7	
<b>Hispanic*</b>							
Yes	17.0	12.0 - 23.6	14.8	8.5 - 22.4	16.1	12.1 - 21.2	.004
No	11.4	9.8 - 13.2	9.8	8.5 - 11.3	10.5	9.5 - 11.7	
<b>Home Language</b>							
English	12.0	10.4 - 13.9	9.1	7.8 - 10.5	10.5	9.4 - 11.8	.021
Chinese	3.4	1.1 - 10.2	10.3	4.9 - 20.2	7.3	3.5 - 14.7	
Japanese	2.7	0.4 - 17.2	10.4	2.5 - 34.1	5.9	2.0 - 16.6	
Hawaiian	30.6	16.3 - 50.0	14.1	4.1 - 38.8	23.0	11.7 - 36.5	
Filipino	8.9	4.9 - 15.7	10.1	5.9 - 16.9	9.8	5.9 - 15.2	
Spanish	7.9	2.1 - 25.6	28.6	16.4 - 45.0	16.9	9.6 - 27.9	
Other	12.6	7.6 - 20.1	18.9	11.0 - 30.5	15.9	10.9 - 22.8	
<b>Place of Birth – Respondent</b>							
US (not HI)	16.3	12.2 - 21.3	11.9	8.8 - 16.0	13.9	11.9 - 17.1	.003
Hawai'i	11.7	9.9 - 13.9	9.2	7.9 - 10.7	10.4	9.2 - 11.8	
Foreign country	7.2	4.9 - 10.4	8.0	5.4 - 11.6	7.5	5.7 - 10.0	
<b>Place of Birth – Mother</b>							
US (not HI)	17.9	13.7 - 23.1	11.5	8.7 - 15.0	14.6	11.9 - 17.8	<.001
Hawai'i	13.6	11.6 - 15.8	9.1	7.1 - 11.6	11.4	9.8 - 13.1	
Foreign country	6.6	5.1 - 8.4	9.5	7.6 - 11.8	8.1	6.9 - 9.5	
<b>Place of Birth – Father</b>							
US (not HI)	15.6	12.1 - 20.0	9.9	7.3 - 13.4	12.8	10.3 - 15.7	.006
Hawai'i	13.1	11.0 - 15.7	9.1	7.2 - 11.3	11.1	9.6 - 12.8	
Foreign country	7.7	6.1 - 9.6	9.1	7.3 - 11.4	8.4	7.0 - 10.0	
<b>Generation in US</b>							
First	7.2	4.9 - 10.4	8.0	5.4 - 11.6	7.6	5.7 - 10.0	.008
Second	8.2	6.0 - 11.0	10.6	8.3 - 13.4	9.4	7.7 - 11.4	
Third or higher	14.7	12.5 - 17.3	8.9	7.3 - 10.8	11.8	10.4 - 13.4	

+P-Value represents the probability of differences in smoking by demographic characteristic.

\*Hispanic origin is determined by a separate question from the Hawai'i-specific ethnicity question. As such, it is not mutually exclusive and is presented for all respondents.

Table 3. Estimated Unadjusted and Adjusted Effect (odds ratios) and 95% Confidence Intervals (CIs) of Sex, Grade, Ethnicity, Hispanic origin, Home language, Place of Birth, and Generation.

			All Students		Girls only		Boys only	
	Unadjusted OR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
<b>Sex</b>								
Male	1.00		1.00					
Female	1.21	0.97 – 1.51	1.35	1.06 - 1.72				
<b>Grade</b>								
9th	1.00		1.00		1.00		1.00	
10th	1.21	0.80 - 1.81	1.31	0.87 - 1.97	1.71	1.08 - 2.72	0.91	0.55 - 1.49
11th	1.53	1.15 – 2.04	1.55	1.18 - 2.04	1.98	1.33 - 2.95	1.20	0.83 - 1.74
12th	1.92	1.37 - 2.70	2.00	1.46 - 2.75	2.32	1.62 - 3.31	1.75	1.11 - 2.75
<b>Ethnicity</b>								
Japanese	1.00		1.00		1.00		1.00	
Black	2.18	1.03 – 4.59	1.96	0.75 - 5.14	0.83	0.32 - 2.15	2.72	0.88 - 8.40
Chinese	1.41	0.71 – 2.79	1.75	0.84 - 3.61	0.99	0.35 - 2.78	1.71	0.68 - 4.27
Filipino	1.66	1.14 – 2.44	2.48	1.59 - 3.86	3.23	1.74 - 5.97	1.51	0.78 - 2.91
Native Hawaiian	2.39	1.58 – 3.63	2.54	1.57 - 4.10	3.48	2.08 - 5.84	1.46	0.76 - 2.79
White	2.28	1.36 - 3.82	2.00	1.05 - 3.75	2.40	1.31 - 4.40	1.58	0.73 – 3.43
Pacific Islander	2.65	1.61 – 4.37	2.93	1.62 - 5.27	4.38	2.03 - 9.42	1.99	1.03 - 3.86
Other	2.62	1.77 – 3.88	3.06	1.86 - 5.01	4.08	2.34 - 7.10	2.32	1.11 - 4.86
<b>Hispanic Origin+</b>								
No	1.00		1.00					
Yes	1.68	1.18 – 2.38	1.10	0.74 - 1.64				
<b>Home Language English</b>								
No	1.00		1.00					
Yes	0.86	0.66 - 1.11	0.69	0.48 - 1.01				
<b>Place of Birth – Respondent</b>								
Outside US	1.00		1.00					
Hawai'i	1.43	1.01 – 2.05	0.95	0.50 - 1.80				
US (not Hawai'i)	1.98	1.35 – 2.90	1.07	0.57 - 1.99				
<b>Place of Birth – Mother</b>								
Outside US	1.00		1.00		1.00		1.00	
Hawai'i	1.46	1.18 – 1.81	1.73	1.03 - 2.92	2.42	1.67 - 3.53	1.10	0.73 - 1.67
US (not Hawai'i)	1.94	1.46 – 2.58	1.95	1.14 - 3.36	3.50	2.37 - 5.19	1.15	0.66- 2.024
<b>Place of Birth – Father</b>								
Outside US	1.00		1.00					
Hawai'i	1.35	1.04 – 1.76	1.45	0.80 - 2.63				
US (not Hawai'i)	1.60	1.20 - 2.12	1.61	0.96 - 2.72				
<b>Generation in US</b>								
First	1.00		1.00					
Second	1.28	0.84 – 1.94	1.48	0.77 - 2.82				
Third or higher	1.64	1.16 – 2.31	1.00	1.00 - 1.00				

+Hispanic origin is reported regardless of other ethnicity specified

1.05–3.75), Filipinos (OR=2.48, 95% CI 1.59–3.86), Native Hawaiians (OR=2.54, 95% CI 1.57–4.10), Pacific Islanders (OR=2.93, 95% CI 1.62–5.27), and Others (OR=3.06, 95% CI 1.86–5.01) were more likely to smoke than those who identified themselves as Japanese. Students whose mothers were born in Hawai‘i (OR=1.73, 95% CI 1.03–2.92) or in another US state (OR=1.95, 95% CI 1.14–3.36) were more likely to smoke than those whose mothers were born in a foreign country. To refine the model, and better examine interactions between sex and acculturation, a second sex-specific model was created (Table 3) using significant variables from the all students model and mother’s place of birth. The model for girls showed that grade, Hawai‘i-specific ethnicity and mother’s place of birth were all highly significant ( $P < .001$ ) predictors of smoking among girls, but only grade in school ( $P = .03$ ) was predictive of smoking among boys. Girls whose mothers were born in the United States (not Hawai‘i) were 3.5 times more likely to smoke than girls whose mothers were born outside the United States.

## Discussion

This study examined data from public high school students in Hawai‘i to assess if there were any associations between ethnicity, sex, immigration (based on place of birth of student and parents), and acculturation (language spoken at home and time spent in the United States) and the likelihood of current smoking. These possible factors may help explain differences in smoking behavior among adolescent smokers in Hawai‘i and help to identify at risk groups to target for preventing initiation and promoting smoking cessation. The analysis revealed that Hawai‘i-specific ethnicity, grade, sex and mother’s place of birth were all significant predictors of smoking. The model showed girls were more likely to smoke than boys. Eleventh and twelfth graders were more likely to smoke than ninth graders. Whites, Filipinos, Native Hawaiians, Pacific Islanders, and Other ethnic groups were more likely to smoke than those who identified themselves as Japanese.

One key finding from this study is that girls were 35% more likely to smoke than their male counterparts. This consistent finding across all of the YTS survey years and in this combined year analysis suggests a need to target teen girls in Hawai‘i for preventing initiation of smoking and encouraging cessation. Another state where girls smoke more than boys is Alaska. In 2007, 35.8% of Native Alaskan high school girls smoked compared with 27.4% of their male counterparts.<sup>21,22</sup> Where recent estimates are available on the Youth Tobacco Survey (and not all states participate), Alaska and Hawai‘i are the only states where girls smoke more than boys.<sup>23</sup>

This study also revealed varying rates of smoking among different ethnic groups, with Native Hawaiian girls having the highest prevalence of current smoking. However, when grade and ethnicity are adjusted for, having a mother born outside the United States is protective for girls but not boys. Girls whose mothers were born in Hawai‘i (AOR 2.42, 95% CI 1.67– 3.53) or another US state (AOR 3.50, (95% CI 2.37– 5.19) were

more likely to smoke than girls with mothers born in another country. This was not true for boys where only grade in school was predictive of smoking. Since Hawai‘i’s diversity creates a social environment with no ethnic majority, ethnicity, place of birth, and immigration may not have the same effects on acculturation as it does for immigrants living in other areas of the United States. Native Hawaiians are indigenous inhabitants of Hawai‘i; they may have unique issues related to US colonization and annexation,<sup>24</sup> as well as their relationship with the United States, whereby their smoking parallels the US pattern. As such, their experience may not be comparable to recent immigrants from other Pacific islands and Asian countries. For Asian populations in Hawai‘i, the acculturation concept may be more relevant; having a foreign born mother or speaking a language other than English at home was linked to lower rates of current smoking.

## Limitations

This study has numerous limitations. The state added questions to the Hawai‘i YTS, did not include language spoken at home by the parent, or other questions that would assist in measuring “acculturation”. In addition, “place of birth” of self or parent was only one way to determine immigration status, and in the YTS, there were many students who reported they did not know where they (0.7%) or their parents (2.9% mothers and 5.2% fathers) were born (8.8% in all). Since this study was exploratory, it is likely that any correlations between ethnicity, immigration, and language still need to be evaluated among both youth and adults regarding smoking. Moreover, with the increasing proportion of people in Hawai‘i with multi-ethnic backgrounds, ethnicity may not be the best way to assess risk for smoking as it is challenging, if not inaccurate, to identify a single true ethnic background for a student who has 5 or 6 ethnicities, as is common in Hawai‘i.

In conclusion, given these data, (1) there should be more exploration of the possible effects of ethnicity/immigration and/or acculturation on both youth and adult smoking in Hawai‘i, especially with regards to the differential impact by sex, and (2) smoking cessation interventions should specifically be targeted to Native Hawaiian, Filipina, and Other ethnic group girls. The Hawai‘i State Department of Health’s Tobacco Prevention and Education Program is working with community partners, and efforts to address smoking among local girls in Hawai‘i are in development.

## Conflict of Interest

None of the authors identify a conflict of interest.

## Acknowledgements

This study was made possible by funding from the Hawai‘i State Asthma Control Program in 2009 (Grant # 1U59EH000495-01) and the Tobacco Prevention and Control Program in both 2009 (Grant #U58/DP922810) and 2010 (Grant #158DP001962-01).

#### Authors' Affiliations:

- Hawaii State Department of Health, Office of Program Improvement and Excellence; Honolulu, HI (AP)
- Hawaii State Department of Health, Science and Research Group (TLSt.J)
- University of Hawaii at Manoa, Department of Public Health Sciences (CNU)
- University of Hawaii at Manoa, Myron B. Thompson School of Social Work (FL)
- Hawaii State Department of Health, Tobacco Prevention and Control Program (LJ)

#### Corresponding Author:

Ann Pobutsky PhD; Research Statistician/Social Epidemiologist, Office of Program Improvement and Excellence (OPIE), Hawai'i State Department of Health, 1250 Punchbowl St., Room 218, Honolulu, HI 96813;  
Ph: (808) 586-4132; Email: ann.pobutsky@doh.hawaii.gov

#### References

1. World Health Organization (WHO) (2004). Global Report: Mortality Attributed to Tobacco. Available at: [www.who.int/tobacco/publications/surveillance/fact\\_sheet\\_mortality\\_report.pdf](http://www.who.int/tobacco/publications/surveillance/fact_sheet_mortality_report.pdf). Accessed August 3, 2013
2. Centers for Disease Control and Prevention (2012). Prevalence and Trends Data--Tobacco Use, Behavioral Risk Factor Surveillance System. Available at: <http://apps.nccd.cdc.gov/brfss/>. Accessed October 8, 2013.
3. Hawaii State Department of Health. (2012) Hawaii Behavioral Risk Factor Surveillance System-BRFSS. Available at: [http://hawaii.gov/health/statistics/brfss/reports/BRFSS\\_2012results.pdf](http://hawaii.gov/health/statistics/brfss/reports/BRFSS_2012results.pdf). Accessed October 8, 2013.
4. Centers for Disease Control and Prevention (2013). Health effects of cigarette smoking. Available at: [http://www.cdc.gov/tobacco/data\\_statistics/fact\\_sheets/health\\_effects/effects\\_cig\\_smoking/](http://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/effects_cig_smoking/). Accessed October 8, 2013.
5. Caraballo RS., Yee, SL, Gfroerer, JC, Pechacek TF, and R Henson. (2006). Tobacco use among racial and ethnic population subgroups of adolescents in the United States. *Preventing Chronic Disease*. 3(2), A39.
6. Hawaii State Department of Health and Hawaii State Department of Education. (2011) Youth Tobacco Survey-YTS. Available at: [http://www.cdc.gov/tobacco/data\\_statistics/surveys/yts/index.htm](http://www.cdc.gov/tobacco/data_statistics/surveys/yts/index.htm) Accessed October 8, 2013.
7. U.S. Department of Health and Human Services. (1994) Preventing Tobacco Use Among Young People: A Report of the Surgeon General. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Office on Smoking and Health. Available at: [http://www.cdc.gov/tobacco/data\\_statistics/sgr/1994/index.htm](http://www.cdc.gov/tobacco/data_statistics/sgr/1994/index.htm). Access October 8, 2013.
8. U.S. Department of Health and Human Services. (2012). Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Office on Smoking and Health. Available at: [http://www.cdc.gov/tobacco/data\\_statistics/sgr/2012/index.htm](http://www.cdc.gov/tobacco/data_statistics/sgr/2012/index.htm). Accessed October 8, 2013.
9. Pobutsky A and T Lowery St. John. (2010) Smoking and tobacco use in Hawaii: Facts, figures and trends, Hawaii State Department of Health (DOH), Honolulu HI. Available at: <http://hawaii.gov/health/healthy-lifestyles/tobacco/resources/general/trends.pdf>. Accessed October 8, 2013.
10. Hawaii State Department of Health, Behavioral Risk Factor Surveillance System-BRFSS. (2013). Tobacco Use – Current Smokers, for the State of Hawaii, for State and Selected Ethnicities, for the Year 2011. Special tabulation from the Hawaii Health Data Warehouse.
11. Kaholokula JK., Braun KL, Kana'iaupuni S, Grandinetti A, and HK Chang. (2006) Ethnic-by-gender differences in cigarette smoking among Asian and Pacific Islanders. *Nicotine Tobacco Research.*; 8(2):275-86.
12. Glanz K, Mau M, Steffen A, Maskarinec G, and KJ Arriola. (2007) Tobacco use among Native Hawaiian middle school students: Its prevalence, correlates and implications. *Ethnicity & Health*; 12(3):227-44.
13. Chen X., Unger JB, Cruz TB and CA Johnson. (1999). Smoking patterns of Asian-Americans youth in California and their relationship with acculturation. *Journal of Adolescent Health*; 24(5):321-8.
14. Acevedo-Garcia D, Pan J, Jun H, Osypuk TL, and KM Emmons K. (2005). The effect of immigrant generation on smoking. *Social Science & Medicine*; 61(6):1223-42.
15. Choi S, Rankin S, Stewart A and R Oka. (2008). Effects of acculturation on smoking behavior in Asian Americans: A meta-analysis. *Journal of Cardiovascular Nursing*; 23(1):67-73.16.
16. Mackey J and M Eriksen (2012). The Tobacco Atlas, 4th Edition. Available at: The Global [http://tobaccoatlas.org/uploads/Images/PDFs/TobaccoAtlas\\_2ndPrint.pdf](http://tobaccoatlas.org/uploads/Images/PDFs/TobaccoAtlas_2ndPrint.pdf). Accessed October 8, 2013.
17. U.S. Department of Commerce, Bureau of the Census. (2010). Nation's foreign-born population nears 37 million. Available at: [http://www.census.gov/newsroom/releases/archives/foreign-born\\_population/cb10-159.html](http://www.census.gov/newsroom/releases/archives/foreign-born_population/cb10-159.html). Accessed January 17, 2013.
18. Hawaii Department of Business, Economic Development and Tourism. (2011). The non-English speaking population in Hawaii. Available at: <http://files.hawaii.gov/dbedt/census/acs/Report/Data-Report-Non-English-Speaking-Profile-Hawaii.pdf>. Accessed October 8, 2013.
19. Abraido-Lanza AF, Chao MT and KR Florez. (2005) Do health behaviors decline with greater acculturation? Implications for the Latino mortality paradox. *Social Science & Medicine*; 61(6): 1243-55.
20. Centers for Disease Control and Prevention. (2011). National Youth Tobacco Survey. Available at: [http://www.cdc.gov/tobacco/data\\_statistics/surveys/nyts/](http://www.cdc.gov/tobacco/data_statistics/surveys/nyts/). Accessed October 8, 2013.
21. Alaska Department of Health (2013). Alaska Tobacco Facts. Available at: [http://dhss.alaska.gov/dphi/Chronic/Documents/Tobacco/PDF/2013\\_alaska\\_tobacco\\_facts.pdf](http://dhss.alaska.gov/dphi/Chronic/Documents/Tobacco/PDF/2013_alaska_tobacco_facts.pdf). Accessed October 8, 2013.
22. Wolsko C, Mohatt GV, Lardon C and R Burket. (2009). Smoking, chewing, and cultural identity: prevalence and correlates of tobacco use among the Yup'ik-The Center for Alaska Native Health Research (CANHR) study. *Cultur Divers Ethnic Minor Psychol.*;15(2): 165-72.
23. Centers for Disease Control and Prevention (2013). Youth Tobacco Survey, Detailed Tables. Available at: [http://www.cdc.gov/tobacco/data\\_statistics/surveys/nyts/](http://www.cdc.gov/tobacco/data_statistics/surveys/nyts/). Accessed October 8, 2013.
24. Kanahele GS (1996). The new Hawaiians in ethnic sources in Hawaii. *Social Process in Hawaii*; 29:13-21.