Ethnic Differences in Trends and Determinants of Cigarette Smoking in Hawaii

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Background: The prevalence of smoking continues to be higher in some ethnic groups than in others, despite the overall decrease of smoking during the last 30 years. The goal of this project was to investigate the trends and predictors of cigarette smoking among a population of Caucasians, Japanese, Chinese, Filipino, and Native Hawaiians.

Methods: We combined data from 19 earlier studies conducted in Hawaii between 1975 and 2001. After excluding 1,885 individuals without smoking data, 158,629 subjects (40.0% Japanese, 30.3% Caucasian, 14.3% Hawaiian, 8.1% Filipino, 3.0% Chinese) were included in the analysis. The prevalence of current smoking and past smoking was estimated for 5-year periods by sex and ethnicity and age-adjusted to the state's population. We calculated odds ratios and 95% confidence intervals by using polytomous logistic regression to explore determinants of smoking, while controlling for clustering by study.

Results: Men were more likely to smoke than women throughout the study period, but they experienced a greater decline in smoking until 1994. We observed a small increase in smoking prevalence thereafter. Native Hawaiians reported the highest smoking prevalence, Japanese the lowest, and Caucasians intermediate levels. Graduate level education had the strongest inverse association with current and past smoking. Older age at interview, being married, and a higher body weight were related to lower smoking prevalence.

Conclusions: Our data suggest a modest reversal in the declining smoking prevalence during the late 1990s. The persistent ethnic differences require new approaches that reach those groups who remain at high risk for adverse health effects from smoking. (*Ethn Dis.* 2005;15:316–323)

Key Words: Ethnic Groups, Prevalence Trends, Smoking

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Introduction

Since the first Surgeon General's Report in 1964 informed the public about the adverse health effects of tobacco,[1] the prevalence of smoking has been decreasing in the United States. The Centers for Disease Control and Prevention (CDC) reported significant reductions in smoking between 1974 and 2000, close to 40% for males and 30% for females.[2] Among men, smoking prevalence varied relatively little by ethnicity: 21% in Asians, 24% in Hispanics, 26% in Caucasians and African Americans, and 29.1% in Native Americans. However, among women the difference was five-fold: 7.6% in Asians, 13.3% in Hispanics, 20.9% in African Americans, 22.4% in Caucasians, and 42.5% in Native Americans.[3] Based on the Behavioral Risk Factor Surveillance System (BRFSS) in Hawaii, smoking prevalence for men and women combined (numbers by sex and ethnicity are not available) has been approximately 15% for Japanese, close to 20% for Filipinos and Caucasians, but as high as 30% for Native Hawaiians during 1994–2000.[4] Age, education, marital status, socioeconomic status, and nicotine dependency are some of the factors that have been associated with smoking behavior.[5–8] The ethnic composition of Hawaii's population is unique. According to the 2000 census (total population: 1,211,537),[9] 239,655 persons reported Native Hawaiian ethnicity, and 503,868 individuals were of Asian ancestry only. Among this diverse population, however, we are uncertain which of these factors are important determinants of smoking habits. Exploring smoking trends over time by sex, ethnicity, and other demographic variables that influence smoking behavior in Hawaii may help us to develop strategies to reduce smoking that are tailored to our local community. For this purpose, we explored the trends and determinants of cigarette smoking in the state of Hawaii from 1975 to 2001 by using a large population-based sample. In an innovative approach, we aggregated information from 19 previous epidemiologic studies conducted by the Cancer Research Center of Hawaii.

Methods

Datasets and Variables

Data from 19 epidemiologic studies conducted at the Cancer Research Center of Hawaii (Table 1) were pooled. Most studies included were case-control studies (Table 1),[10–24] two were large prospective cohorts,[25,26] one was a cross-sectional study,[27] and one was an intervention study.[28] All studies used a population-based recruitment approach. Recruitment for the prospective cohorts was based on a large household survey[29] and on driver's license records.[26] For case-control studies, cancer patients were enrolled through the Hawaii Tumor Registry covering Oahu where two thirds of the state's residents live.[9] Matching controls were usually identified through the Hawaii Department of Health's household survey.[29] Each subject contributed data at one point in time only. After excluding 1,885 individuals without smoking data from the pooled sample of 160,514 subjects, the analysis data set had 158,629 individu-

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als. Of these, 6,232 participants were recruited as cancer cases. The Committee on Human Studies at the University of Hawaii and the Hawaii Cancer Commission approved the project. For the present analyses, the variables extracted from the pooled data set were smoking status (never, past, or current), year of data collection (categorized into five-year groups and one seven-year group: 1975–1979, 1980–1984, 1985–1989, 1990–1994, 1995–2001), age, sex, ethnicity (Caucasian, Chinese, Filipino, Hawaiian, Japanese, or Other), marital status, education (less than high school, high school graduate, some college, or college graduate), and body mass index (BMI). For the smoking and ethnicity variables, we recorded the original information and applied the same definitions to all studies. Never smokers were defined as people who had smoked fewer than 20 packs of cigarettes in their lifetime; past smokers were those who had smoked more than 20 packs of cigarettes but were not currently smoking; current smokers were those who had smoked more than 20 packs of cigarettes and were currently smoking. Persons of multiple ethnicities were classified into the ethnicity with the highest ethnic proportion categorized. When in question, the mother's ethnicity took priority over the father's ethnicity. If any Hawaiian ethnicity was present, then the classification was Native Hawaiian. The category of others included African Americans, Hispanics, and Asians and Pacific Islanders who were not Chinese, Japanese, Filipino, or Native Hawaiian.

Statistical Analysis

Logistic regression[30] was employed for the analyses because the outcome variable of interest, smoking status, was measured on a nominal scale. Given that the entire study population consisted of 19 individual studies, we could not assume independence of the observations but had to consider clustering within studies. In this case, the estimates for the standard errors are biased and are likely to show spurious statistical significance. Therefore, we performed polytomous logistic regression using the SUDAAN Multilog procedure[31] to address both the correlated data structure and a three-level outcome measure (never smoker, past smoker, and current smoker) in one combined model. Results from these analyses provided the odds ratio of the outcome level for an incremental change in each predictor variable. While never smokers were used as the reference outcome group in the model, for presentation, we computed the risk of being a current compared to a never smoker. We also show the odds of being a past smoker compared to a current smoker as a measure of smoking cessation. For all odds ratios, 95% confidence intervals were computed. Predictor variables included the year of data collection (1975–1979 as the reference group), age, BMI, marital status (unmarried as the reference group), ethnicity (Caucasian as the reference group),

Table 1. Source studies pooled for individual patient meta-analysis

Years Study Conducted	Study Type*	Reference	Cancer Type	Number of Subjects	Sex M/F	Case/Control	Median Age (Range)
1975–1980	CH	25	N/A	40,575	20,002/20,573	N/A	41 (17–98)
1975–1980	CC	10	Breast	1,050	0/1,050	350/700	58 (40–79)
1979–1982	CC	11	Lung	1,363	964/399	502/861	64 (29–94)
1979–1987	CC	12	Urinary Tract	787	589/198	263/524	68 (31–96)
1980–1986	CC	13	Thyroid	661	173/488	220/441	50 (19–83)
1981–1983	CC	14	Prostate	1,369	1,369/0	470/899	73 (50–101)
1983–1985	CC	15	Lung	1,378	993/385	410/968	67 (33–92)
1987–1991	CC	16	Colorectal	2,384	1,369/988	1,192/1,192	67 (23–87)
1988–1992	CC	17	Melanoma	627	373/254	312/315	52 (19–83)
1988–1992	CC	18	Endometrial	1,100	0/1,100	358/742	60 (28–81)
1988–1992	CC	19	Prostate	828	828/0	433/395	72 (48–89)
1992–1997	CC	20	Lung	797	505/292	341/456	67 (31–82)
1993–1996	CH	26	N/A	103,899	48,937/54,962	N/A	59 (41–78)
1993–1998	CC	21	Stomach	831	529/302	385/446	72 (26–95)
1993–1998	CC	22	Colorectal	464	252/212	218/246	52 (21–61)
1993–1998	CC	23	Ovarian	483	0/483	204/279	53 (18–88)
1993–1999	CS	27	N/A	527	0/527	N/A	44 (32–48)
1994–1999	CC	24	Colorectal	1,150	679/471	574/576	70 (26–86)
2000–2001	IV	28	N/A	241	0/241	N/A	43 (35–47)

* CH=Cohort, CC=Case-Control, CS=Cross-Sectional, IV=Intervention.

Table 2. Demographic characteristics of the study population

	Never	Male Current	Past	Never	Female Current	Past
Total number *N* (%)	26,579 (34.8)	17,674 (23.1)	32,137 (42.1)	48,960 (59.5)	14,233 (17.3)	19,046 (23.2)
Mean age at interview						
Mean ± SD	53.7 ± 15.6	51.3 ± 14.6	60.2 ± 10.8	55.2 ± 14.3	49.9 ± 14.0	57.2 ± 11.0
Med (min, max)	55 (17, 97)	52 (18, 96)	61 (18, 101)	56 (17, 98)	51 (17, 94)	57 (18, 95)
Mean BMI (kg/m^2)						
Mean ± SD	25.2 ± 4.0	24.9 ± 4.2	25.7 ± 4.1	23.9 ± 4.8	23.9 ± 5.0	25.1 ± 5.3
Med (min, max)	24.6 (13.7, 64.6)	24.3 (11.9, 66.1)	25.2 (13.7, 97.6)	23 (9.9, 77)	22.9 (11.8, 57.2)	24 (12.4, 66.7)
Mean education (yrs)						
Mean ± SD	13.6 ± 3.6	12.6 ± 3.4	13.4 ± 3.2	13.1 ± 3.3	12.9 ± 2.9	13.8 ± 2.8
Med (min, max)	14 (0, 26)	12 (0, 29)	14 (0, 25)	13 (0, 28)	12 (0, 30)	14 (0, 28)
Ethnicity						
Japanese	10,033 (33.0)	6,245 (20.5)	14,168 (46.5)	23,481 (71.0)	3,715 (11.2)	5,859 (17.7)
Hawaiian	3,610 (35.5)	2,939 (28.9)	3,624 (35.6)	5,909 (47.4)	3,443 (27.6)	3,106 (24.9)
Filipino	2,651 (39.6)	2,029 (30.3)	2,010 (30.0)	4,382 (70.4)	1,045 (16.8)	799 (12.8)
Chinese	985 (55.2)	377 (21.1)	422 (23.7)	2,227 (75.2)	302 (10.2)	433 (14.6)
Caucasian	8,233 (33.8)	5,233 (21.5)	10,909 (44.8)	10,884 (45.9)	4,856 (20.5)	7,961 (33.6)
Other	1,067 (36.5)	851 (29.1)	1,004 (34.4)	2,077 (54.1)	872 (22.7)	888 (23.1)
Marital status						
Unmarried	6,769 (37.7)	5,003 (27.9)	6,178 (34.4)	15,521 (54.9)	5,919 (20.9)	6,859 (24.2)
Married	19,810 (33.9)	12,671 (21.7)	25,959 (44.4)	33,439 (62.0)	8,314 (15.4)	12,187 (22.6)

and education (below high school as the reference group). We performed separate analyses for men and women.

RESULTS

The total study population from the 19 studies (Table 1) included 76,390 men and 82,239 women (Table 2), of which 33,972, 11,801, 2574, 95,482, and 14,800 persons contributed to the five time periods, respectively. In the combined data set, 23.1% of men and 17.3% of women reported current smoking. The overall proportion of never smokers was considerably higher among women than among men, 60% vs 35%, whereas past smoking was twice as common among men as among women. Past smokers were older and reported a higher body weight at the time of interview than did never and current smokers. The mean education level was lowest among current smokers. Filipino men were the most likely to be current smokers, closely followed by Others and Native Hawaiians, while the proportion of current smokers was much lower among Caucasian, Chinese, and Japanese men. Among women, Native Hawaiians reported the highest percentage of current smokers, Others and Caucasians had an intermediate prevalence, and only 1 out of 10 women with Japanese and Chinese ancestry reported current smoking. In fact, more than two thirds of Asian women had never smoked.

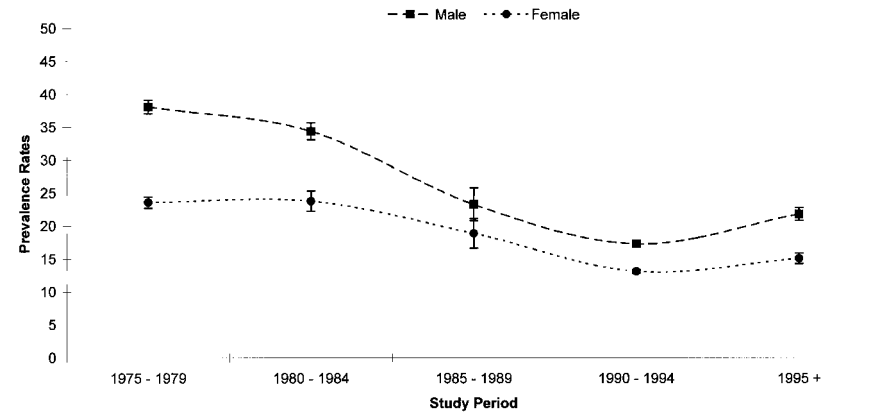

Fig 1. Trend of current smoking by sex, age-adjusted to Hawaii's population 40+ years

The gender difference in current smoking diminished from 15% to 7% over time (Figure 1). In men, the prevalence of smoking decreased continuously from 1975–1979 to 1990–1994 when it reached a low of 17%. The decrease among women was more gradual, starting at 24% in the 1970s and reaching a low of 13% during the period 1990–1994. Among men, the prevalence of current smoking began to de-

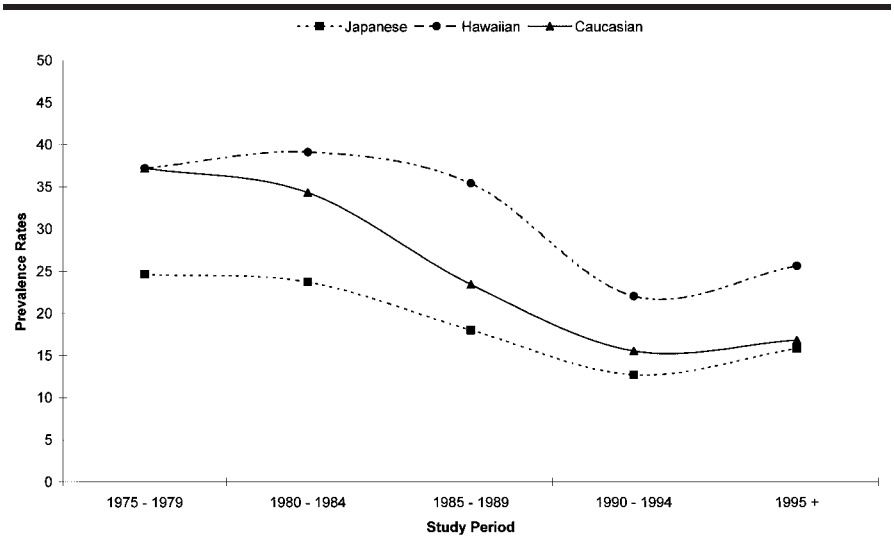

Fig 2. Trend of current smoking by ethnicity, age-adjusted to Hawaii's population 40+ years

cline in the 1970s, whereas a parallel decline among women began in the 1980s. This downward trend continued until the early 1990s and led to the smallest gender difference during 1990–1994. Interestingly, the declining trend reversed in the late 1990s when the gap between men and women widened slightly. For men, the smoking prevalence increased by 4.5% and for women by 2%. The fact that the 95% confidence intervals in each sex group do not overlap for the two last time periods indicates the statistical significance of this upward trend. In addition, the confidence intervals show that the smoking prevalence was always statistically different between men and women except in 1985–1989. Comparison of age-adjusted current smoking rates among the three largest ethnic groups (the size of the other groups did not allow for separate rates) showed that Japanese had the lowest prevalence of current smoking at all times (Figure 2), while Native Hawaiians reported the highest smoking rates. Caucasians experienced the greatest decline in smoking between 1975 and 1994 (55%) and the smallest increase during 1995–1999 compared to the other ethnic groups. Smoking rates among Japanese and Native Hawaiians declined by 36% and 31%, respectively, during the 25-year period. The ranking by ethnicity did not change after stratification by sex (data not shown). Whereas for Caucasians and Native Hawaiians, the difference in smoking prevalence between men and women was never more than 10%, the low smoking prevalence among Japanese was primarily due to the low smoking prevalence (15% or less) among women (data not shown). The smoking prevalence for Japanese men was very similar to the trend in Caucasian men, and the curve was more or less parallel to the trend in Japanese women.

The multivariate analysis (Table 3) confirmed the trends and provided additional information about predictors of smoking. During 1990–1994, the odds of being a current smoker were 50% lower for men and 33% lower for women than in 1975–1979. However, during the latest time period the odds ratios increased slightly to 0.60 and 0.70, respectively. Whereas the odds of being a current smoker compared to a never smoker changed very little over time, the odds of being a past smoker compared to a current smoker increased approximately four-fold during the study period. Some of the trends observed revealed differences between men and women. For women, older age was associated with a reduced likelihood of being a current smoker, but a greater likelihood of being a past smoker. Also for women, a higher BMI and being married were associated with lower odds of being a current smoker and higher odds of being a past smoker. For men, we observed a linear relation between educational level and current smoking: college graduates were half as likely to smoke as those with less than a high school education. However, the protective effect of education among women was limited to those with a graduate education and the effect was smaller (44%) than it was among men. The odds of being a past smoker similarly increased with education for men and women.

Smoking behavior varied significantly by ethnicity even after controlling for confounders (Table 3). Japanese and Chinese men were 13% and 19% less likely to smoke than Caucasian men. Among Japanese and Chinese women, the respective percentages were 45% and 38%. For Filipinos, only women were less likely to smoke than Caucasians. Native Hawaiian men and women had 26% and 76% higher odds, respectively, to smoke than Caucasians. Native Hawaiian men and women were also significantly less likely to be past smokers than Caucasians. Rapidly increasing proportions of past smokers by year of interview were apparent for all ethnic groups (Figure 3). Before 1980, 18% of Caucasians, 12% of Japanese, and 12% of Native Hawaiians reported that they were past smokers, whereas by 1990–1994 as many as 48% of Caucasians and 37% of the other two groups had quit smoking. Parallel to the increasing trend in smoking prevalence, the proportion of past smokers decreased slightly during the late 1990s.

DISCUSSION

Similar to findings from population surveys in Hawaii and in other parts of

Table 3. Determinants of smoking behavior*

	Risk for Current vs Never and Past Smoking Odds Ratio (95% CI)		Risk for Current vs Never Smoking Odds Ratio (95% CI)		Risk for Past vs Current Smoking Odds Ratio (95% CI)	
Smoking Status Variable	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Year of interview						
1975–1979	1	1	1	1	1	1
1980–1984	0.84 (0.61, 1.17)	0.96 (0.78, 1.17)	0.93 (0.61, 1.43)	0.98 (0.74, 1.30)	**1.54** (1.11, 2.13)	1.32 (0.92, 1.91)
1985–1989	0.73 (0.31, 1.70)	0.73 (0.50, 1.08)	1.04 (0.46, 2.33)	0.86 (0.58, 1.27)	**2.36** (1.08, 5.16)	**2.96** (1.87, 4.70)
1990–1994	**0.50** (0.30, 0.81)	0.67 (0.45, 1.00)	0.85 (0.53, 1.37)	0.91 (0.61, 1.37)	**4.08** (3.21, 5.18)	**4.48** (2.93, 6.85)
1995+	0.60 (0.36, 1.00)	0.70 (0.42, 1.17)	0.93 (0.56, 1.54)	0.94 (0.56, 1.59)	**3.15** (2.41, 4.11)	**4.17** (2.51, 6.93)
Age at interview (10 yrs)	0.81 (0.81, 1.00)	**0.81** (0.68, 0.98)	0.89 (0.76, 1.05)	**0.81** (0.67, 0.99)	**1.46** (1.29, 1.65)	**1.23** (1.05, 1.44)
Body mass index (kg/m^2)	0.97 (0.93, 1.01)	**0.97** (0.96, 0.98)	0.98 (0.96, 1.01)	**0.98** (0.97, 0.99)	**1.05** (1.02, 1.08)	**1.04** (1.03, 1.05)
Marital status						
Unmarried	1	1	1	1	1	1
Married	0.90 (0.56, 1.43)	**0.69** (0.52, 0.93)	0.97 (0.57, 1.64)	**0.67** (0.47, 0.94)	**1.27** (1.03, 1.57)	**1.35** (1.11, 1.66)
Education						
Below high school	1	1	1	1	1	1
High school	**0.81** (0.66, 0.98)	1.04 (0.94, 1.15)	0.81 (0.63, 1.04)	1.08 (0.97, 1.18)	**1.22** (1.07, 1.38)	1.07 (0.98, 1.17)
Under graduate	**0.73** (0.59, 0.89)	0.88 (0.77, 1.00)	0.74 (0.54, 1.02)	0.96 (0.84, 1.09)	**1.40** (1.29, 1.53)	**1.45** (1.22, 1.72)
Graduate and plus	**0.45** (0.28, 0.72)	**0.56** (0.42, 0.74)	**0.37** (0.17, 0.80)	**0.58** (0.43, 0.79)	**1.85** (1.36, 2.50)	**2.07** (1.76, 2.44)
Ethnicity						
Caucasian	1	1	1	1	1	1
Japanese	**0.87** (0.79, 0.97)	**0.55** (0.51, 0.59)	**0.90** (0.84, 0.96)	**0.43** (0.37, 0.51)	1.14 (1.00, 1.31)	0.95 (0.79, 1.14)
Hawaiian	**1.26** (1.21, 1.31)	**1.76** (1.64, 1.88)	**1.16** (1.10, 1.23)	**1.85** (1.75, 1.92)	**0.73** (0.70, 0.76)	**0.63** (0.59, 0.67)
Filipino	0.96 (0.88, 1.05)	**0.74** (0.68, 0.80)	**0.87** (0.78, 0.97)	**0.62** (0.57, 0.68)	0.92 (0.65, 1.30)	**0.79** (0.69, 0.90)
Chinese	**0.81** (0.70, 0.92)	**0.72** (0.62, 0.83)	**0.73** (0.65, 0.82)	**0.62** (0.56, 0.68)	1.05 (1.00, 1.09)	0.98 (0.92, 1.04)

* Odds ratios were obtained by polymotous logistic regression using the SUDAAN Multilog procedure; statistically significant ($P<.05$) are shown in **bold**.

the United States, our study showed that smoking rates in Hawaii generally declined during the last 25 years of the 20th century. Although the prevalence of smoking was consistently higher for men than for women, men experienced a larger decline in smoking during the study period. The proportion of past smokers increased over time, while that for never smokers was relatively constant, suggesting that the decline in smoking prevalence was not due to lower smoking initiation, but rather due to higher smoking cessation rates. National data show an acceleration of the quit ratio (ratio of past smoker to ever smoker) during the 1980s with a substantial slowing in the next decade.[32]

Two observations in our data are noteworthy. First, despite the decreasing smoking trends during the past 25 years, tobacco use began to increase

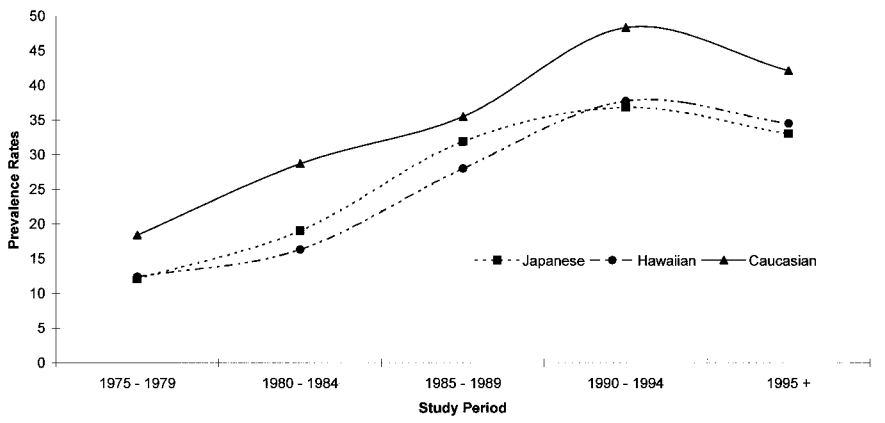

Fig 3. Trend of past smoking by ethnicity, age-adjusted to Hawaii's population 40+ years

Although the prevalence of smoking was consistently higher for men than for women, men experienced a larger decline in smoking during the study period.

slightly in the late 1990s for both men and women in Hawaii. Second, trends in tobacco use varied substantially by ethnicity. We observed a widening gap between Native Hawaiians and other ethnic groups in the prevalence of smoking during the study period. The reversal in the downward trend resulted primarily from increased smoking among Hawaiian and Japanese men (+5% and +3.7%) as well as Hawaiian and Japanese women (+1.8% and +1.9%), while the prevalence only rose by 0.7% and 0.6% in Caucasian men and women. A high smoking prevalence among Filipino men (Table 2) disappeared after adjustment for education and other confounders, adding to our concern that poorer and less-educated people are at greatest risk for tobacco-related disease. The consequences of ethnicity on smoking behavior are reflected in the corresponding lung cancer incidence rates in Hawaii.[33,34] Lung cancer rates in Filipino men have increased from 29.8 to 58.0 cases per 100,000 (age-adjusted to the World Standard Population) during the past 25 years.

At the same time, the risk of lung cancer declined among Hawaiian men from 97.3 to 66.5 cases per 100,000 and for Caucasian men from 64.6 to 50.6 per 100,000, although little change was observed in Japanese men (35.1 to 33.3 cases per 100,000). The fact that lung cancer incidence is not directly proportional to lifetime smoking habits in different ethnic groups may be related to differences in genetic susceptibility and nutrition.[35–38]

According to the results of the logistic regression (Table 3), educational achievement was the most important predictor of current and past smoking in this study, but it was more relevant for men than for women. However, this minimal measure of socioeconomic status could not account for the higher prevalence of smoking among Native Hawaiians. A more detailed assessment of socioeconomic status would be required to distinguish socioeconomic factors from other determinants of smoking. A reduced risk of smoking among married participants was greater for women than for men. Increasing age also reduced the likelihood of being a current smoker. This finding may be the result of cumulative quitting attempts or due to an increasing number of health problems, more frequent interactions with the healthcare system, and a higher receptivity to messages promoting smoking cessation with increasing age.

Our findings are consistent with previous reports that described lower smoking rates with higher education and age.[5,6,39] Similarly, low smoking rates especially in women of Asian descent have often been observed.[7,8] However, a study conducted among younger people in four US cities found no racial differences in smoking behavior after controlling for the effect of socioeconomic factors.[40] The smoking trends in our study differ slightly from the smoking information collected through the BRFSS in Hawaii.[4] Overall smoking prevalence rates in our data were 15.2% and 18.5% in 1990–1994 and 1995–2001, respectively, whereas the corresponding proportions from the BRFSS were 20.5% and 19.4%. The same standard population was used for age-adjustment apart from the truncation to older persons in our study as compared to BRFSS. Because our study includes only individuals aged 40 years and over, we expect our smoking prevalence to be somewhat lower than the BRFSS that includes adults 18 years and older. In contrast to the lack of change in overall smoking prevalence since 1990 in the BRFSS, our data suggest a decrease in smoking until 1990–1994, with a small increase thereafter.

Because of the large sample size available to this study, close to 160,000 persons over a 25-year period, equivalent to an average of 6,400 per year, our study provides more power to study smoking predictors than health surveys. The annual sample size for the BRFFS in Hawaii was approximately 2,000 persons.[41] Although the number of subjects varied by year and according to the study design, all 19 studies made an effort to recruit patients and healthy individuals from the population-at-risk. Given Hawaii's relatively small population, 964,691 persons in 1980 and 1,211,537 in 2000,[9] our study subjects represents a very large proportion of the entire population. Therefore, the fact that many subjects were recruited for case-control studies should not compromise our ability to estimate the prevalence of smoking for the entire state.

Some limitations of our approach are related to the changes in data collection methods over time, in particular, a change from interview-administered questionnaires for the case-control studies to self-administered instruments for the multiethnic cohort.[26] Also, the questions were obviously tailored toward the primary objectives of the different studies. However, questions about ethnicity and smoking behavior were integral to all studies, despite slight variations in format. The upward trend in the late 1990s may have been a result of the change in data collection method, but the more than 100,000 members of the multi-ethnic cohort may have represented a sample of the population with different smoking habits than the cases and controls in the earlier studies. Unfortunately, the small number of subjects under 40 years of age limited our ability to generalize the findings to the younger population of the state. This limitation is particularly regrettable in light of the fact that young adults 18–24 years nationwide have the highest smoking prevalence of all age grops.[42] We considered the issue of excluding the relatively small number of subjects who were recruited as cancer cases (6,232 or 3.93%, of these 1,253 had lung cancer). However, an analysis without the cases did not make an observable change in smoking prevalence as shown in the figures. Also, the odds ratios (Table 3) remained very similar and did not lead to any different conclusions.

The large impact of smoking cessation on lung cancer mortality was recently demonstrated in a British report.[43] Stopping smoking before middle age prevents more than 90% of the lung cancer risk attributable to tobacco. However, our data suggest reversal in the decline in tobacco use seen during the late 1990s. In a dynamic forecasting model[44] to explore why the national smoking prevalence rates have leveled off, an increase in smoking initiation appeared to be more important than a decline in smoking cessation. However, the smaller proportion of past smokers since 1995 suggests that a different mechanism may be applicable to our population. We observed decreasing smoking trends in Hawaii since 1975, persistent ethnic differences, a strong protective effect from education, and a modest reversal in the declining smoking prevalence during the late 1990s. New approaches to anti-smoking campaigns may be required to continue the progress in lowering smoking rates. The persistent ethnic differences in smoking may have to be addressed with novel interventions that take into account ethnic and cultural diversity.[45–47] Several agencies have started a collaboration that involves community members in addressing tobacco use issues in the Native Hawaiian population.[48] A grant funded by the National Cancer Institute, 'Imi Hale–the Native Hawaiian Cancer Awareness, Research, and Training Project,[1] has the goal to develop culturally sensitive strategies to reduce cancer risk among Native Hawaiians.[49] Providing higher education to a greater proportion of men and women of all ethnic groups may help to reduce the proportion of smokers and to increase the proportion of past smokers in all ethnic groups.

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