

Cessation Among Smokers of “Light” Cigarettes: Results From the 2000 National Health Interview Survey

Hilary A. Tindle, MD, MPH, Nancy A. Rigotti, MD, Roger B. Davis, ScD, Elizabeth M. Barbeau, ScD, MPH, Ichiro Kawachi, MD, PhD, and Saul Shiffman, PhD

Cigarette smoking is the leading preventable cause of death in the United States.¹ Many smokers who do not quit turn instead to tobacco products that tobacco companies advertise as having lower tar and nicotine levels, implying reduced health risk. Low-tar and low-nicotine cigarettes, also known as “light cigarettes” or “lights,” are the most prevalent example of so-called “potential exposure-reduction products,”² a heterogeneous group of products that also includes filtered cigarettes, smokeless tobacco, and products made from tobacco that is cured to reduce carcinogens.³

Lights were introduced to the US market in the late 1960s and now account for almost 85% of the cigarettes sold in the United States.⁴ Although marketed as delivering less tar and nicotine to a smoker than other cigarettes, light cigarettes do not actually contain less of these compounds than other cigarettes. Instead, they are designed to deliver less tar and nicotine when smoked in the test situation used by the US Federal Trade Commission (FTC).⁵ However, numerous studies have demonstrated that light cigarettes deliver comparable amounts of tar and nicotine when smoked by humans,^{6–8} leading to the expectation that individuals who smoked light cigarettes would have no reduction in risk of tobacco-related disease compared with smokers of regular cigarettes.⁹ A large observational study with adequate follow-up time was published in 2004, and no reduction in risk was demonstrated.¹⁰ This was particularly true when comparing lowest tar (<6 mg) to medium tar categories (6–15 mg), which is the only relevant comparison in the United States market today.^{4,11} The totality of evidence supports the conclusion that light cigarettes are not a safe alternative to quitting.¹²

Nonetheless, as demonstrated by tobacco industry documents, light cigarettes were intended and marketed as a way of providing

Objectives. A large proportion of smokers erroneously believe that low-nicotine/low-tar cigarettes, also called “light cigarettes” or “lights,” reduce health risks and are a rational alternative to smoking cessation. However, the availability of light cigarettes may deter smoking cessation.

Methods. We analyzed the 32374 responses to the US 2000 National Health Interview Survey. Current and former smokers (“ever-smokers”) were asked if they had ever used a lower tar and nicotine cigarette to reduce health risks. Multivariable logistic regression identified determinants of lights use and smoking cessation. Results were weighted to reflect the national population.

Results. Of 12285 ever-smokers, 37% (N=4414) reported having used light cigarettes to reduce health risks. Current abstinence was less often reported by ever-smokers who had previously used light cigarettes than by ever-smokers who had never used lights (37% vs 53%, $P<.01$). Adjusted odds of cessation among ever-smokers who had used light cigarettes relative to those who had never used lights were reduced by 54% (adjusted odds ratio=0.46, 95% confidence interval=0.41, 0.51).

Conclusions. Use of light cigarettes was common and was associated with lower odds of current smoking cessation, validating the concern that smokers may use lights as an alternative to cessation. (*Am J Public Health.* 2006;96:1498–1504. doi:10.2105/AJPH.2005.072785)

health-concerned smokers with false reassurance that they could continue to smoke rather than quitting smoking.^{13,14} After decades of advertisements suggesting that light cigarettes deliver less nicotine and tar on the basis of FTC measurements,¹⁵ a large proportion of smokers erroneously believe that smoking lights reduces health risks.^{11,16,17} Furthermore, the evidence suggests that highly educated smokers, those who better understand the health consequences of smoking, and those who express more interest in quitting are more likely to switch to light cigarettes with the intention of reducing health risks.¹⁸ The use of light cigarettes with such an intention could feasibly hinder cessation efforts by decreasing smokers’ motivation to quit. These facts have fueled an ongoing debate about the ethical dilemmas of harm reduction products in general^{19–22} and have led to public health concerns that many smokers may use or switch to lower tar and nicotine brands as a health-protective measure instead of quitting.

The impact that using light cigarettes has on subsequent cessation is unclear. The most recent longitudinal study to examine whether using low-tar cigarettes predicts smoking cessation found that switching from a “higher” to a “lower” yield product was not associated with the likelihood of future cessation.²³ However, this study included only approximately 1000 subjects. A larger, but older, longitudinal study surveyed US Air Force recruits about switching to light cigarettes to reduce health risks in the 12 months before basic military training and at 1 year follow-up. The survey found no association between brand switching to reduce health risks and subsequent cessation after adjusting for demographic factors.²⁴ A large cross-sectional study, the 1986 Adult Use of Tobacco Survey, demonstrated a reduced prevalence of cessation among smokers who had switched brands to reduce health risk.²⁵ In this context, we used data from a large, nationally representative, and more contemporary sample with the capability to adjust for a wide range

of sociodemographic factors, health behaviors, and health conditions. We determined the prevalence and characteristics of smokers who used light cigarettes with the intention of reducing health risks and assessed the association between using lights to reduce health risks and subsequent cessation.

METHODS

Data Source

We used data collected from the Sample Adult Module of the 2000 National Health Interview Survey (NHIS), a continuing, cross-sectional, in-person household survey of the civilian, noninstitutionalized US population conducted by the US Census Bureau for the National Center for Health Statistics.²⁶ The core survey elicited information on sociodemographic factors (including age, gender, race/ethnicity, highest level of education achieved, region of the United States, marital status, birthplace, health status, insurance status, and annual household income), health conditions (including ever-diagnosis of cardiovascular disease, hypertension, asthma, peptic ulcer disease, cancer, family history of cancer, and diabetes), self-reported health status, and health behaviors (level of physical activity, alcohol intake, and smoking status). In 2000, 1 randomly selected adult per household 18 years or older completed the Sample Adult Module (N=32 374). The response rate was 72.1%.

Study Sample

A Cancer Control Supplement that contained additional questions related to smoking was administered to all participants in the NHIS Sample Adult Module in 2000. Our analyses focused on 14 416 respondents who were ever-smokers, defined as those who answered “yes” to the question, “Have you smoked at least 100 cigarettes in your lifetime?” This population included both current and former smokers. Former smokers were defined as those who answered “not at all” to the question, “Do you currently smoke cigarettes every day, some days, or not at all?” Thus, current smokers included both those who smoked every day and those who smoked less frequently. We further narrowed our sample to 12 285 respondents who

provided information on all covariates, including sociodemographic factors, health conditions, and health behaviors (n=6561 current smokers, n=5724 former smokers). An exception was made for the income variable, for which 1842 respondents did not provide data, to preserve sample size.

Use of Low-Yield Cigarettes

Ever-smokers were asked, “Did you ever use or switch to a lower tar and nicotine cigarette to reduce your health risk?” The NHIS did not include a separate question that asked about general use of light cigarettes or switching to lights (outside the context of attempting to reduce health risk) and also did not specify the type of risk (e.g., risk of lung cancer or heart disease). We use the phrase “use of lights” to refer to both use of and switching to lower tar and nicotine cigarettes for the stated purpose of reducing health risk. The NHIS did not specifically ask about cigarette brands or tar content (e.g., regular=>15 mg tar, light cigarettes=7–15 mg tar, ultra lights=1–6 mg tar). Thus, each respondent interpreted “lower tar and nicotine” as it pertained to himself or herself. Kozlowski has shown that smokers’ self-classification is generally accurate.²⁷

Additional Covariates

Covariates studied included sociodemographic characteristics: age (≥ 30 , 30–39, 40–49, 50–64, ≥ 65), gender, race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other), highest education level achieved (less than high school, completed high-school or equivalent, any higher education), region of the United States (northeast, midwest, south, west), marital status (married or living with partner, other), annual household income (<\$20 000, \$20 000–\$54 999, \$55 000–\$74 999, \geq \$75 000), insurance status (insured, uninsured), and citizenship (US citizen, other).

Chronic health conditions included respondent-reported ever diagnosis of hypertension, cardiovascular disease (including coronary heart disease, angina, myocardial infarction, peripheral vascular disease, and stroke), pulmonary disease (including asthma and emphysema), peptic ulcer disease, diabetes, chronic renal insufficiency, liver disease,

perceived health status (dichotomized as excellent/very good/good vs fair/poor), and history of cancer. Family history of cancer was also included (at least 1 first-degree relative with cancer vs no first-degree relatives with cancer). Body weight was grouped into 3 categories according to the Metropolitan Life Insurance Company Standards of Desirable Body Weight (at or below desirable body weight vs less than 20% above desirable body weight vs heavier than 20% above desirable body weight). Health behaviors included level of physical activity (physically active [vigorous physical activity at least 3 times per week for at least 10 min each time] vs less physically active), and use of alcohol. Alcohol use was classified into 2 groups: current nondrinker (including lifetime abstainers and former drinkers who had not consumed alcohol in the past year) versus current drinkers. Finally, we created a variable representing years of smoking by subtracting the age at which a respondent started to smoke from his or her current age (for current smokers) or from the age at which he or she stopped smoking (for former smokers). Respondents 85 years and older were excluded, because their exact age could not be determined according to the NHIS policy for identity protection. Missing data were excluded for all variables except income, where a “missing” category (containing 1842 respondents) was defined in addition to the 4 categories noted earlier.

Statistical Analysis

To screen for factors potentially associated with the use of light cigarettes to reduce health risk, we used χ^2 analyses (results not reported) to examine the unadjusted percentages between ever-smokers who had used light cigarettes (“users”) and those who had never used light cigarettes (“nonusers”) across all variables. We then fit a logistic regression model for each variable and report unadjusted odds ratios and 95% confidence intervals of using light cigarettes from these models. Finally, we fit a multivariable logistic regression model to determine factors independently correlated with previous use of light cigarettes to reduce health risk. For this analysis, the dependent variable was use of light cigarettes, whereas the independent variables included

all theoretically relevant sociodemographic factors, health conditions, and health behaviors that were asked about in the 2000 NHIS. To minimize the possibility of collinearity, backward elimination was used with a threshold of $P < .05$ for retention in the model. We evaluated for potential confounding by adding any excluded factors back into the final model one-by-one and examining changes in the estimated B coefficients for each of the other factors in the model (threshold for reinclusion in the model set at $\geq 10\%$ change). We evaluated for potential collinearity by examining changes in the standard error of the estimated B coefficients between the single variable model and the full model.

To determine whether use of light cigarettes to reduce health risks was independently associated with cessation after adjustment for all other factors, we followed the same process described earlier. We first used χ^2 analyses (results not reported) to examine the unadjusted percentages between ever-smokers on the basis of smoking status (yes=current smoker, no=former smoker/quit) across all variables. The dependent variable was smoking status; the independent variable was ever-use of light cigarettes to reduce health risk. Covariates included all sociodemographic factors, health conditions, and health behaviors, as noted earlier. To evaluate for potential confounding and collinearity, we used the process described in the first model, but we focused on changes in the B coefficient and the standard error of the B coefficient, respectively, of the lights variable. Because of collinearity, years of smoking and age could not be included in the same model. Therefore we fit separate models with each of these covariates and found similar results. We present the model with age in its entirety and summarize the model with years of smoking in the text of the results section. Finally, to assess the interaction of age and use of light cigarettes to reduce health risk, we fit a model with an interaction term and found this to be statistically significant. To make interpretation easier, we then stratified the final model by age group (<40, 40–49, 50–64, ≥ 65).

All analyses used SAS-callable SUDAAN software (Version 8.0, Research Triangle Institute, Research Triangle Park, NC) to obtain Taylor series linearization variance estimates

that accounted for the complex sampling design.^{28,29} All results were weighted so that estimates reflect the national population.

RESULTS

Table 1 displays the characteristics of the 12 285 ever-smokers by status of use of light cigarettes to reduce health risks (columns 1–4) and demonstrates the association between use of lights to reduce health risks and subsequent cessation (columns 5–8). Columns 1 and 2 demonstrate the unadjusted percentages of users versus nonusers for each variable, whereas columns 3 and 4 provide the unadjusted and adjusted odds ratios for use of light cigarettes, respectively.

Correlates of Using Lights to Reduce Risk

More than one third of respondents (4414) indicated they had used light cigarettes to reduce health risks. Smokers who were female, White, more educated, and US citizens were more likely (net of other factors) to say they had adopted light cigarettes to reduce health risks. The odds of using light cigarettes to reduce health risks were also greater among smokers with a history of cardiovascular or pulmonary disease and among those who reported greater physical activity and abstinence from alcohol use. In a separate analysis, we removed the age variable and added years of smoking as a continuous variable. The adjusted odds ratio was 1.05 (95% confidence interval [CI] 1.04, 1.05), demonstrating a 5% increase in odds of use of light cigarettes for each additional year of smoking. Other factors in the model did not change appreciably.

Correlates of Cessation

The odds of quitting increased in a stepwise fashion with increasing age. Blacks and non-Black Hispanics were less likely to quit than Whites. Women were slightly more likely to quit than men, although the confidence interval approached 1.0 both before and after adjustment. More education, higher income, higher perceived health status, being married or living with a partner, and having health insurance also were associated with increased odds of cessation. Living in the Midwest and the South was associated with lower odds of cessation compared with living in the

West. For health conditions, having a history of hypertension, cardiovascular disease, cancer, diabetes, and a higher body weight were associated with higher odds of cessation. Both current abstinence from alcohol and increased physical activity were associated with increased smoking cessation.

Use of Lights to Reduce Health Risks and Subsequent Cessation

Columns 5–8 of Table 1 focus on the relation between use of lights to reduce health risks and smoking cessation among ever-smokers. We compared former to current smokers across all variables (columns 5 and 6) and displayed both the unadjusted and adjusted odds ratios for all factors and smoking cessation (columns 7 and 8, respectively). Adoption of lights to reduce health risks was associated with lower probability of subsequent quitting. In the unadjusted analyses, odds of quitting were reduced by 48% among smokers who adopted lights to reduce risk compared with those who had not. Adjusting for all factors did not change this: use of lights remained significantly associated with decreased odds of quitting. In a separate model in which years of smoking replaced age, the adjusted odds ratio for use of lights was 0.49 (95% CI=0.44, 0.54), indicating a 51% reduction in the odds of quitting among respondents who had previously used lights to reduce health risks.

Table 2 assesses the effect of age on the relation between use of lights intending to reduce health risks and smoking cessation. Use of lights was associated with reduced odds of cessation for all age groups, but this effect increased with progressing age, peaking in adults age 65 and older, for whom the adjusted odds of cessation were reduced by 76% (AOR=0.24; 95% CI=0.19, 0.31). The interaction of age and adoption of lights to reduce health risks was significant in the model, predicting subsequent cessation (P Wald $F < .001$).

DISCUSSION

In this large national sample of US adults who have ever smoked cigarettes, smokers who adopted light cigarettes with the intention of reducing health risks were markedly

TABLE 1—Characteristics of Ever-Smokers Who Used “Light” Cigarettes to Reduce Health Risks Compared With Those Who Did Not

	Used Lights to Reduce Health Risks ^a (n = 4414) %	Did Not Use Lights to Reduce Health Risks ^a (n = 7871) %	Unadjusted Odds Ratio of Use of Lights to Reduce Health Risks (95% CI)	Adjusted Odds Ratio of Use of Lights to Reduce Health Risks (95% CI)	Quit Smoking (Former Smokers) (n = 5724) %	Did Not Quit Smoking (Current Smokers) (n = 6561) %	Unadjusted Odds Ratio of Smoking Cessation (95% CI)	Adjusted Odds Ratio of Smoking Cessation (95% CI)
Use of lights to reduce health risk	...	...	...	...	29.4	44.3	0.52 (0.48, 0.57)	0.46 (0.41, 0.51)
Sociodemographic factors								
Age								
<30	17.8	17.0	1.76 (1.51, 2.05)*	1.76 (1.50, 2.07)*	8.31	25.2	0.08 (0.07, 0.09)*	0.10 (0.08, 0.13)*
30–39	18.1	18.5	1.64 (1.42, 1.90)*	1.65 (1.40, 1.93)*	12.7	23.3	0.13 (0.11, 0.15)*	0.13 (0.10, 0.15)*
40–49	26.0	20.9	2.08 (1.81, 2.39)*	2.10 (1.81, 2.45)*	20.4	24.9	0.20 (0.17, 0.23)*	0.18 (0.15, 0.21)*
50–64	26.5	24.3	1.83 (1.61, 2.08)*	1.82 (1.59, 2.08)*	31.0	20.0	0.37 (0.32, 0.42)*	0.32 (0.28, 0.37)*
≥65	11.5	19.3	1.00	1.00	27.5	6.58	1.00	1.00
Race/ethnicity								
White	87.1	76.2	1.00	1.00	83.5	77.4	1.00	1.00
Non-Hispanic Black	6.2	11.0	0.49 (0.42, 0.57)*	0.51 (0.43, 0.60)*	7.03	11.1	0.59 (0.52, 0.66)*	0.72 (0.62, 0.88)*
Hispanic	4.0	9.6	0.37 (0.31, 0.43)*	0.45 (0.38, 0.53)*	6.81	8.1	0.78 (0.67, 0.90)*	1.03 (0.84, 1.25)
Other	2.7	3.2	0.73 (0.55, 0.97)*	0.81 (0.60, 1.10)	2.64	3.2	0.74 (0.56, 0.97)*	0.70 (0.52, 0.94)*
Gender: Male	47.8	58.2	1.52 (1.38, 1.67)*	1.53 (1.39, 1.69)*	44.0	47.1	0.88 (0.81, 0.96)*	1.12 (1.02, 1.23)*
Income, \$								
<20 000	17.5	22.6	1.00	1.00	20.6	28.4	1.00	1.00
20 000–54 999	35.1	34.2	1.32 (1.18, 1.48)*	1.16 (1.02, 1.31)*	38.8	43.6	1.23 (1.10, 1.37)*	1.29 (1.12, 1.47)*
55 000–74 999	14.0	10.2	1.77 (1.51, 2.08)*	1.35 (1.14, 1.61)*	14.6	13.4	1.51 (1.29, 1.76)*	1.59 (1.32, 1.92)*
≥75 000	18.6	15.4	1.56 (1.36, 1.79)*	1.10 (0.95, 1.28)	26.0	14.6	2.45 (2.10, 2.87)*	2.11 (1.74, 2.55)*
Region								
Northeast	19.0	19.9	0.96 (0.84, 1.11)	0.88 (0.77, 1.01)	21.4	17.8	0.99 (0.84, 1.18)	0.98 (0.80, 1.19)
Midwest	27.8	25.3	1.11 (0.97, 1.27)	0.98 (0.85, 1.13)	24.3	27.9	0.73 (0.63, 0.84)*	0.71 (0.60, 0.84)*
South	35.9	37.2	0.98 (0.86, 1.10)	0.97 (0.86, 1.11)	35.2	38.1	0.77 (0.67, 0.89)*	0.77 (0.60, 0.84)*
West	17.3	17.6	1.00	1.00	19.2	16.0	1.00	1.00
Insured	85.3	83.2	1.17 (1.04, 1.32)*	1.03 (0.90, 1.17)	92.5	76.5	3.78 (3.31, 4.30)*	1.71 (1.47, 2.00)*
Married or living with partner	58.0	59.3	0.95 (0.87, 1.03)	0.89 (0.81, 0.98)*	69.4	49.5	2.32 (2.14, 2.51)*	1.67 (1.51, 1.84)*
US Citizen	97.7	94.2	2.66 (2.04, 3.36)*	1.76 (1.34, 2.32)*	96.3	94.8	1.42 (1.14, 1.78)*	0.91 (0.69, 1.21)
Health conditions								
Hypertension	24.4	25.9	0.93 (0.84, 1.02)	1.09 (0.97, 1.22)	32.6	18.9	2.07 (1.90, 2.26)*	1.16 (1.04, 1.29)*
Cardiovascular disease	9.2	9.6	0.96 (0.84, 1.10)	1.36 (1.17, 1.58)*	7.44	2.62	2.53 (2.18, 2.94)*	1.23 (1.02, 1.49)*
Lung disease	13.3	11.7	1.16 (1.02, 1.33)*	1.16 (1.01, 1.33)*	12.7	12.0	1.07 (0.95, 1.21)	1.07 (0.93, 1.24)
Peptic ulcer disease	10.8	9.6	1.13 (0.99, 1.29)	1.14 (0.99, 1.31)	9.92	10.2	0.97 (0.84, 1.12)	0.78 (0.67, 0.92)*
Cancer	7.5	8.0	0.93 (0.79, 1.08)	0.96 (0.81, 1.14)	10.8	5.22	2.20 (1.88, 2.57)*	1.22 (1.01, 1.46)*
Family history of cancer	42.5	38.7	1.17 (1.07, 1.27)*	1.09 (0.99, 1.19)	46.6	36.3	1.50 (1.38, 1.62)*	1.02 (0.93, 1.12)
Diabetes	6.2	7.9	0.77 (0.65, 0.91)*	0.98 (0.81, 1.18)	10.3	4.56	2.40 (2.04, 2.82)*	1.40 (1.16, 1.70)*
Perceived health status								
Excellent/very good/good	86.9	84.5	1.22 (1.08, 1.37)*	1.02 (0.88, 1.17)	84.6	86.1	0.89 (0.79, 0.99)*	1.26 (1.08, 1.46)*
Fair/poor	13.1	15.5	1.00	1.00	15.4	13.9	1.00	1.00
Proximity to desirable body weight								
At or below	34.4	30.7	1.0	1.0	4.78	11.5	1.00	1.00
<20% above	27.5	29.6	0.83 (0.74, 0.92)*	0.90 (0.81, 1.02)	31.2	37.2	1.64 (1.47, 1.82)*	1.39 (1.23, 1.57)*
≥20% above	38.1	39.7	0.85 (0.77, 0.95)*	0.91 (0.82, 1.02)	64.0	51.2	1.99 (1.79, 2.21)*	1.85 (1.65, 2.08)*

Continued

TABLE 1—Continued

Health behaviors								
Smoking status								
Former smoker	36.9	52.7	0.68 (0.62, 0.75)*	0.75 (0.68, 0.84)*	...	...	...	...
Current smoker	63.2	47.3	1.00	1.00	...	...	...	...
Years smoked ⁵								
<10	19.1	24.3	...	...	24.5	20.4	...	...
10–19	22.0	26.7	...	...	28.1	22.2	...	...
20–29	25.6	22.3	...	...	20.8	25.9	...	...
≥30	33.4	26.7	...	...	26.6	31.4	...	...
Alcohol intake								
Abstinent/former drinker	23.7	31.3	0.68 (0.62, 0.75)*	0.75 (0.68, 0.84)*	67.1	24.6	1.51 (1.38, 1.65)*	1.32 (1.18, 1.48)*
Current drinker	76.3	68.7	1.00	1.00	32.9	75.4	1.00	1.00
Physical activity								
Active	25.9	22.7	1.18 (1.07, 1.30)*	1.08 (0.97, 1.19)*	25.5	22.5	1.18 (1.07, 1.30)*	1.51 (1.35, 1.70)*
Inactive	74.1	77.3	1.00	1.00	75.0	77.5	1.00	1.00

Note. All factors shown here. Years of smoking could not be included in the same model as age (see text for details).

⁵Percentages may not add to 100% due to rounding.

**P* < .05.

TABLE 2—Adjusted Odds Ratio of Smoking Cessation Stratified by Age Group, by Status of Use of “Light” Cigarettes to Reduce Health Risk

Age Group, y (N = 12 285)	Adjusted Odds Ratio of Smoking Cessation (95% CI)
< 40 (n = 4189)	0.76 (0.64, 0.91)*
40–49 (n = 2673)	0.43 (0.35, 0.53)*
50–64 (n = 3118)	0.36 (0.30, 0.43)*
≥ 65 (n = 2305)	0.24 (0.19, 0.31)*

Note. Adjusted for age, race/ethnicity, gender, education, income, region, insurance, marital, and citizenship status, history of hypertension, cardiovascular disease, lung disease, peptic ulcer disease, cancer, diabetes, family history of cancer, perceived health status, proximity to ideal body weight, alcohol status, and level of physical activity.

**P* < .05.

less likely to subsequently quit smoking. This relation persisted after adjustment for a number of factors that influence cessation rates and could potentially have confounded the relation between use of light cigarettes and smoking cessation. In addition, we found that adoption of light cigarettes to reduce health risks was common, being reported by more than one third of US adults who had ever smoked. This figure represents more than 30 million US adult smokers.

Our results confirm and update Giovino’s unadjusted analysis of the 1987 NHIS.¹⁸ We extend that work by contributing adjusted analyses of use of light cigarettes that control for potential confounding and by demonstrating that the relation persists in a larger, more contemporary sample of smokers. Therefore, we provide the most comprehensive evidence to date to validate the concern that use of light cigarettes in an attempt to reduce health risks may hinder smoking cessation.

Although not our major focus, we found that adoption of light cigarettes to reduce health risks was more common among smokers of higher socioeconomic status as well as those with a history of cardiovascular disease and pulmonary disease. This is concerning in that several of these same factors, including education and a history of cardiovascular disease, were associated with increased odds of smoking cessation, suggesting that the “profile” of smokers who use light cigarettes to reduce health risks overlaps with that of smokers who would otherwise quit smoking.

Our study is limited by several factors. First, the cross-sectional design of the NHIS prevents a definitive conclusion of a causal relation between use of light cigarettes to reduce health risks and reduced smoking cessation. To definitively determine whether using

light cigarettes to reduce health risks helps, hinders, or has no bearing on future cessation rates would require a large randomized trial that is unlikely to be done. However, this question could be incorporated into a large population-based study similar to the work of Hyland et al.²³ but with a larger sample size, by gathering prospective information from all participants on use of light cigarettes and subsequent cessation.

The NHIS question about adoption of light cigarettes that was the basis of our analysis was a compound question, asking whether respondents had adopted light cigarettes to reduce health risks. The question did not offer respondents the option of reporting if they used light cigarettes for any other reasons (i.e., simple preference or another reason unrelated to health concerns). Therefore, our results do not apply to use of light cigarettes in general but only to their adoption for health reasons. Theoretically, adoption of light cigarettes for health protection should be associated with having the most impact on quitting, because adoption of light cigarettes may be seen as making quitting unnecessary. Our analysis does not assess whether smokers who adopt light cigarettes for other reasons also are deterred from quitting. If they are, our analyses will underestimate the adverse effect of light

cigarettes, because these lights smokers would have been included in our contrast group. Another limitation of our analysis is that NHIS did not have any measures of interest in quitting; thus, we could not assess how this may have confounded or mediated the effects we observed. It may be that a greater proportion of smokers who were not interested in quitting instead used light cigarettes, intending to reduce health risks, whereas those who were interested in quitting smoking did so. We do know from the 1987 NHIS data that 38% of those who used light cigarettes to reduce health risks said they did so as a means to quit smoking (although there is no published information on subsequent cessation rates).¹⁸

Finally, ever-smokers who quit sooner may have had less opportunity to use light cigarettes, especially if cessation occurred before light cigarettes became common. By including former and current smokers across the lifespan, we examined a time period that exceeds the period of the widespread availability of light cigarettes, for which serious market growth began in the 1970s. Older smokers who quit before light cigarettes became common would be classified as not having used light cigarettes, but their behavior would be explained more by factors related to market conditions rather than by any relation between use of light cigarettes and smoking cessation. We addressed this scenario by examining the interaction between respondent age and use of light cigarettes with the intention of reducing health risks and found that the adjusted odds of cessation steadily decrease with advancing age; older smokers who used light cigarettes to reduce health risks were even less likely than their younger counterparts to quit smoking. The explanation for this finding is not clear, but it may reflect a differential effect by age of use of light cigarettes to reduce health risks on the motivation to quit smoking (in which older smokers who used light cigarettes to reduce health risks experienced a greater decrease in motivation to quit) and suggests that the adverse effect of adopting light cigarettes on quitting may be long lived.

The combination of the dangerous health consequences of light cigarettes, the widespread misconception held by many smokers

that light cigarettes are healthier, and the evidence supporting an association between use of light cigarettes to reduce health risks and reduced smoking cessation all pose an important question: how should public and clinical health care providers address patients' use or intended use of light cigarettes?

Shiffman et al. recently proposed "one potential strategy for countering tobacco industry marketing tactics and promoting smoking cessation is to provide smokers with accurate information about the risks of smoking Light and Ultra Light cigarettes."^{30(p. 133)} Such a strategy could reach smokers by several avenues involving both public health and clinical settings. For example, counteradvertising via brief public health radio messages or by phone may change misconceptions about light cigarettes and even increase interest in quitting.^{31,32}

Perhaps the message about light cigarettes could be further strengthened if it were delivered by physicians and other clinicians during routine smoking cessation counseling, because smokers themselves have indicated that they would be more likely to quit smoking light cigarettes if they knew that lights did not reduce health risks.¹¹ Finally, disclosures on cigarette packaging labels and warnings in advertisements could be used whenever "lights" or a similarly misleading term were used.³³ Wherever possible, smokers should be provided with accurate information on the potentially detrimental effects of the use of light cigarettes to reduce health risks on subsequent smoking cessation. ■

About the Authors

Hilary Tindle is with the University of Pittsburgh and the Department of Society, Human Development, and Health at the Harvard School of Public Health, Boston, Mass. At the time the research was conducted, H. Tindle was also with the Division for Research and Education in Complementary and Integrative Medical Therapies (Osher Institute) at Harvard Medical School and the Division of General Medicine and Primary Care at the Beth Israel Deaconess Medical Center, Boston. Nancy Rigotti is with Harvard Medical School and the Department of Society, Human Development, and Health at the Harvard School of Public Health. She also is with the Tobacco Research and Treatment Center in the Division of General Medicine at the Massachusetts General Hospital, Boston. Roger Davis is with the Division for Research and Education in Complementary and Integrative Medical Therapies (Osher Institute) at Harvard Medical School, the Division of General Medicine and Primary Care at the Beth Israel Deaconess Medical Center, and the Harvard School of Public Health, Boston, Mass.

Elizabeth Barbeau is with the Department of Society, Human Development, and Health at the Harvard School of Public Health. Ichiro Kawachi is with the Department of Society, Human Development, and Health at the Harvard School of Public Health. Saul Shiffman is with the University of Pittsburgh, Pa.

Requests for reprints should be sent to Hilary A. Tindle, MD, MPH, University of Pittsburgh, Parkvale Building, 200 Meyran Avenue, Suite 200, Pittsburgh, PA, 15213 (e-mail: tindleha@upmc.edu).

This article was accepted October 21, 2005.

Contributors

H. Tindle originated the study and supervised all aspects of its implementation. N. Rigotti and S. Shiffman made multiple key enhancements to the study design and the writing of all segments. E. Barbeau and I. Kawachi helped H. Tindle formulate the study in its initial stages and assisted in writing and revising all drafts of the article. R. Davis assisted in study design and oversaw the analyses in addition to writing and revising all drafts of the article.

Human Participant Protection

The Harvard Medical School deemed this study exempt from the need for protocol approval.

Acknowledgments

The authors are grateful to the contributions of James Bost for his assistance with the analyses.

References

1. Mokdad A, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. *JAMA*. 2004;291:1238–1245.
2. Shields PG. Tobacco smoking, harm reduction, and biomarkers. *J Natl Cancer Inst*. 2002;94:1435–1444.
3. Stratton K, Shetty P, Wallace R, Bondurant S. Clearing the smoke: the science base for tobacco harm reduction—executive summary. *Tob Control*. 2001;10:189–195.
4. Domestic market share of cigarettes by tar yield. *Federal Trade Commission Cigarette Report for 2000*. Washington, DC: US Federal Trade Commission; 2002; Table 4.
5. The FTC cigarette test method for determining tar, nicotine, and carbon monoxide yields of US cigarettes. *National Cancer Institute, Smoking and Tobacco Control Monograph No.*; 1996. NIH Publication No. 96-4028.
6. Benowitz NL, Hall SM, Herning RI, Jacob P, 3rd, Jones RT, Osman AL. Smokers of low-yield cigarettes do not consume less nicotine. *N Engl J Med*. 1983;309:139–142.
7. Djordjevic MV, Stellman SD, Zang E. Doses of nicotine and lung carcinogens delivered to cigarette smokers. *J Natl Cancer Inst*. 2000;92:106–111.
8. Jarvis MJ, Boreham R, Primatesta P, Feyerabend C, Bryant A. Nicotine yield from machine-smoked cigarettes and nicotine intakes in smokers: evidence from a representative population survey. *J Natl Cancer Inst*. 2001;93:134–138.
9. Thun MJ, Burns DM. Health impact of "reduced

yield" cigarettes: a critical assessment of the epidemiological evidence. *Tob Control*. 2001;10 (suppl 1):i4-11.

10. Harris JE, Thun MJ, Mondul AM, Calle EE. Cigarette tar yields in relation to mortality from lung cancer in the cancer prevention study II prospective cohort, 1982-8. *BMJ*. 2004;328:72.

11. Kozlowski LT, Goldberg ME, Yost BA, White EL, Sweeney CT, Pillitteri JL. Smokers' misperceptions of light and ultra-light cigarettes may keep them smoking. *Am J Prev Med*. 1998;15:9-16.

12. Augustine A, Harris RE, Wynder EL. Compensation as a risk factor for lung cancer in smokers who switch from nonfilter to filter cigarettes. *Am J Public Health*. 1989;79:188-191.

13. Kozlowski LT, Dreschel NA, Stelman SD, Wilkenfeld J, Weiss EB, Goldberg ME. An extremely compensatable cigarette by design: documentary evidence on industry awareness and reactions to the Barclay filter design cheating the tar testing system. *Tob Control*. 2005;14:64-70.

14. Pollay RW, Dewhirst T. The dark side of marketing seemingly "light" cigarettes: successful images and failed fact. *Tob Control*. 2002;11 (suppl 1):118-31.

15. Hurt RD, Robertson CR. Prying open the door to the tobacco industry's secrets about nicotine: the Minnesota Tobacco Trial. *JAMA*. 1998;280:1173-1181.

16. Shiffman S, Pillitteri JL, Burton SL, Di Marino ME. Smoker and ex-smoker reactions to cigarettes claiming reduced risk. *Tob Control*. 2004;13:78-84.

17. Shiffman S, Pillitteri JL, Burton SL, Rohay JM, Gitchell JG. Smokers' beliefs about "Light" and "Ultra Light" cigarettes. *Tob Control*. 2001;10 (suppl 1):i17-23.

18. Giovino G. Attitudes, knowledge, and beliefs about low-yield cigarettes among adolescents and adults. *The FTC Cigarette Test Method for Determining Tar, Nicotine, and Carbon Monoxide Yields of US Cigarettes*. 1996; Monograph No. 7:39-57.

19. Fox BJ, Cohen JE. Tobacco harm reduction: a call to address the ethical dilemmas. *Nicotine Tob Res*. 2002;4 (suppl 2):S81-S87.

20. Gilpin EA, Emery S, White MM, Pierce JP. Does tobacco industry marketing of "light" cigarettes give smokers a rationale for postponing quitting? *Nicotine Tob Res*. 2002;4 (suppl 2):S147-155.

21. Hatsukami DK, Slade J, Benowitz NL, et al. Reducing tobacco harm: research challenges and issues. *Nicotine Tob Res*. 2002;4 (suppl 2):S89-101.

22. Warner KE. Tobacco harm reduction: promise and perils. *Nicotine Tob Res*. 2002;4 (suppl 2):S61-71.

23. Hyland A, Hughes JR, Farrelly M, Cummings KM. Switching to lower tar cigarettes does not increase or decrease the likelihood of future quit attempts or cessation. *Nicotine Tob Res*. 2003;5:665-671.

24. Haddock CK, Talcott GW, Klesges RC, Lando H. An examination of cigarette brand switching to reduce health risks. *Ann Behav Med*. 1999;21:128-134.

25. Siegel M, Nelson DE, Peddicord JP, Merritt RK, Giovino GA, Eriksen MP. The extent of cigarette brand and company switching: results from the Adult Use-of-Tobacco Survey. *Am J Prev Med*. 1996;12:14-16.

26. *National Health Interview Survey*. Available at:

http://ftp.cdc.gov/pub/Health_Statistics/NCHS/Survey_Questionnaires/NHIS/2000/. Accessed April 11, 2005.

27. Kozlowski LT, Goldberg ME, Yost BA, Ahern FM, Aronson KR, Sweeney CT. Smokers are unaware of the filter vents now on most cigarettes: results of a national survey. *Tob Control*. 1996;5:265-270.

28. LaVange LM, Stearns SC, Lafata JE, Koch GG, Shah BV. Innovative strategies using SUDAAN for analysis of health surveys with complex samples. *Stat Methods Med Res*. 1996;5:311-329.

29. National Center for Health Statistics. *National Health Interview Survey SD. Appendix III*. 2000. Available at: <http://www.cdc.gov/nchs/nhis.htm>. Accessed May 1, 2006.

30. Shiffman S, Burton SL, Pillitteri JL, et al. Test of "light" cigarette counter-advertising using a standard test of advertising effectiveness. *Tob Control*. 2001;10 (suppl 1):i33-40.

31. Kozlowski LT, Goldberg ME, Sweeney CT, et al. Smoker reactions to a "radio message" that light cigarettes are as dangerous as regular cigarettes. *Nicotine Tob Res*. 1999;1:67-76.

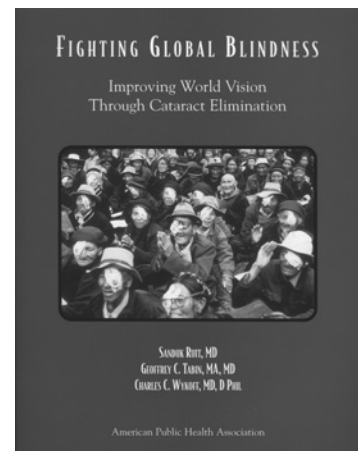
32. Shiffman S, Pillitteri JL, Burton SL, Rohay JM, Gitchell JG. Effect of health messages about "light" and "ultra light" cigarettes on beliefs and quitting intent. *Tob Control*. 2001;10 (suppl 1):i24-32.

33. Etter JF, Kozlowski LT, Perneger TV. What smokers believe about light and ultralight cigarettes. *Prev Med*. 2003;36:92-98.



American
Public Health
Association

Fighting Global Blindness:



This wonderfully written volume shares the experiences of a team of surgeons who have demonstrated how the surgical procedures can be simplified and made more efficient, accessible, and far less expensive. It is a step-by-step manual to solving the problem where adequate surgeons can be trained to follow suit.

www.aphabookstore.org

1-866-320-2742 toll free

1-866-361-2742 fax



Member:
\$ 31.50

Non-Member:
\$ 45.00