

Adolescents' Perceptions of Light and Intermittent Smoking in the United States

Stephen M. Amrock, SM^a, Michael Weitzman, MD^{a,b,c}

abstract

BACKGROUND: Light smoking, consuming a few cigarettes daily, and intermittent, or nondaily, smoking patterns are increasingly common but carry health risks comparable to heavier smoking patterns. Nearly all smokers begin smoking as adolescents, who are at risk for developing these smoking patterns. Previous research suggests that smokers underestimate the risks associated with smoking. The extent to which adolescents perceive light and intermittent smoking as harmful has not been previously assessed.

METHODS: Data from 24 658 US adolescents sampled by the 2012 National Youth Tobacco Survey, a national, school-based, cross-sectional survey, were examined. Cross-tabulations and multivariate ordered probit regression models were constructed to describe correlates of US adolescents' perception of light and intermittent smoking.

RESULTS: Although most adolescents (88.0%; 95% confidence interval [CI], 87.2% to 88.8%) reported beliefs that a heavier smoking pattern is very harmful, only 64.3% (95% CI; 63.2% to 65.3%) and 33.3% (95% CI; 32.0% to 34.6%) reported that light and intermittent smoking, respectively, are very harmful. Conversely, nearly one-quarter of US adolescents believed intermittent smoking causes little or no harm. Males, younger adolescents, Hispanics, and non-Hispanic blacks were more likely than their peers to view light and intermittent smoking patterns as less harmful. Those who were already light or intermittent smokers, those who used other tobacco products, and those who had a family member who used tobacco were also less likely to view their smoking patterns as harmful.

CONCLUSIONS: Misconceptions about the safety of light and intermittent smoking are widespread among US adolescents. Significant public health attention is needed to redress these misperceptions.



WHAT'S KNOWN ON THIS SUBJECT: Light and intermittent smoking are harmful, but increasingly common, smoking patterns. It is unknown how adolescents perceive these smoking patterns, and whether these views differ by sociodemographic characteristics, and exposure to and use of tobacco.

WHAT THIS STUDY ADDS: US adolescents perceive light and intermittent smoking as significantly less dangerous than heavier smoking. One in 4 adolescents believes intermittent smoking causes little to no harm. Perceptions of relative safety were common among smokers.

Departments of ^aPediatrics, and ^bEnvironmental Medicine, New York University School of Medicine, New York, New York; and ^cGlobal Institute of Public Health, New York University, New York, New York

Mr Amrock conceptualized and designed the study, carried out the statistical analyses, drafted the initial manuscript, and revised the manuscript; Dr Weitzman helped interpret the results and critically reviewed and revised the manuscript; and both authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

www.pediatrics.org/cgi/doi/10.1542/peds.2014-2502

DOI: 10.1542/peds.2014-2502

Accepted for publication Nov 13, 2014

Address correspondence to Stephen M. Amrock, SM, New York University School of Medicine, 550 First Ave, NBV-8 South 4-11, New York, NY 10016. E-mail: stephen.amrock@med.nyu.edu

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2015 by the American Academy of Pediatrics

Mounting concern exists regarding light and intermittent cigarette smoking,¹ tobacco use patterns that have become increasingly common.²⁻⁴ Nearly one-fifth of adult smokers^{5,6} and four-fifths of child smokers³ engage in intermittent or nondaily smoking. Previous research assessing children's smoking trajectories indicates substantial variability in the onset and progression of their smoking.⁷ Yet data on light and intermittent smoking in children, particularly as a potential stable pattern of use, remain limited. Of all smoking patterns in children, light and intermittent smoking appear the least stable.⁸ Yet those who smoke lightly or intermittently are more likely than not to continue to do so over the next half year.⁸ Until recently, in both children and adults light and intermittent smoking were not viewed as potentially stable patterns of tobacco use^{8,9} and, as a consequence, remain inadequately studied.¹

Existing data on light and intermittent smoking suggest a potentially alarming picture. Light and intermittent smokers may perceive their tobacco use to be less addictive,⁹⁻¹¹ although nicotine dependence symptoms appear to form rapidly in intermittent smokers¹² and the relationship between consumption and addiction does not follow a clear-cut threshold effect.¹³ Some light and intermittent smokers do not even consider their use to qualify them as "smokers," demonstrating an unduly optimistic bias in their assessment of smoking's associated risks.^{9-11,14} Also possible are potentially significant misconceptions regarding the safety of light and intermittent smoking. No level of tobacco exposure is safe.¹⁵ Health risks from light and intermittent smoking are comparable to heavier smoking patterns,¹⁶ the relationship between smoking intensity and cardiovascular disease is notably

nonlinear,^{17,18} and reducing smoking intensity without abstinence has not been found to improve survival.^{19,20}

Understanding views that may lead to these smoking patterns is critical. The perceived harm of different tobacco forms correlates with their use.²¹ Perception of tobacco influences youths' behaviors over time. Exposure to pro- and anti-tobacco media²² and perceptions of secondhand smoke,²³ for example, alter adolescents' affinities toward tobacco use. Because 9 out of 10 smokers begin smoking as adolescents,²⁴ understanding adolescents' perception of light and intermittent smoking may be particularly helpful in assessing which individuals may benefit from targeted public health and clinical interventions. Because, among adults, light and intermittent smokers appear most willing of all smokers to quit,²⁵ preventing and identifying those at high risk for developing and continuing these smoking patterns is of obvious importance.

The US Preventive Services Task Force recommends clinicians provide interventions to prevent initiation of tobacco use among school-aged children and adolescents.²⁶ Nearly a half-billion dollars is spent annually on anti-tobacco advertising.²⁷ Yet whether adolescents nationwide perceive light and intermittent smoking to be less harmful than heavier forms of smoking has not been assessed. To address this, we use a national, school-based survey of US adolescents to describe their perception of light and intermittent smoking, comparing those views with perceptions of heavier smoking patterns. We attempt to characterize this at-risk population by examining correlates of adolescents' perceptions of light and intermittent smoking, including adolescents' demographics and use of tobacco products.

METHODS

Study Population

Data used are from the 2012 National Youth Tobacco Survey (NYTS), a survey conducted by the Centers for Disease Control and Prevention and designed to provide nationally representative estimates of US middle and high school students' tobacco-related knowledge, attitudes, and behaviors. Its methodology, approved by the Centers for Disease Control and Prevention's institutional review board, has been described previously.²⁸ In brief, the NYTS uses a stratified cluster sample designed to oversample minority students; students from sixth to twelfth grade enrolled in a public, secular, or nonsecular private school were eligible to be sampled. Respondents completed a pencil-and-paper, self-administered questionnaire. Participation at the school and student level was voluntary. In 2012, the school participation rate was 80.3% and the student participation rate 91.7%.

Variables

Dependent Variables

Three survey questions assessing individuals' harm perception of light, intermittent, and heavy smoking patterns were used as ordinal dependent variables. Regarding light smoking, respondents were asked, "How much do you think people harm themselves when they smoke a few cigarettes every day?" For intermittent smoking, respondents were queried, "How much do you think people harm themselves when they smoke cigarettes some days but not every day?" and, about heavy smoking, "How much do you think people harm themselves when they smoke 10 or more cigarettes every day?" To each, respondents could select responses from a 4-point Likert scale: "no harm," "little harm," "some harm," or "a lot of harm."

Independent Variables

Independent variables included students' demographic information and use of and exposure to tobacco products, because norms and misperceptions may differ along these lines.²⁹ Demographic variables included students' gender, age, and ethnicity. Individuals' self-reported recent cigarette use was assessed from the question, "During the past 30 days, on how many days did you smoke cigarettes?" We classified individuals as nonsmokers (ie, responding "0 days"); daily smokers (ie, responding "30 days"); or, for the remainder, intermittent smokers. We subsequently categorized daily smokers as either light smokers (ie, ≤ 5 cigarettes per day) or heavier smokers (ie, > 5 cigarettes per day), based on their responses to the question, "During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?" This definition, used previously,³⁰ corresponds closely to the harm perception questions, allowing us to ascertain potential misperceptions among those engaged in the studied behaviors.

A variable indicating use of any alternative tobacco products within the past 30 days was included, characterized by any use of: cigars, cigarillos, or little cigars; chewing tobacco, snuff, or dip; pipe tobacco; waterpipe tobacco or hookah; snus (ie, moist snuff); or dissolvable tobacco products. A separate variable indicating e-cigarette use within the past 30 days was also included. Previous research indicates that e-cigarette users perceive e-cigarettes as more harmful than conventional cigarettes,³¹ although e-cigarette users' perception of smoking itself has not been previously examined. Whether other individuals in the students' home used tobacco products (ie, cigarettes; smokeless tobacco, such as chewing tobacco, snuff, dip, or snus; cigars, cigarillos,

or little cigars; or any other form of tobacco) was included as well.

Statistical Methods

Because the NYTS used a stratified, multistage sample design, all analyses were weighted to adjust for nonresponse, the probability of selection, and to match the sample's sociodemographic characteristics with those of US middle and high school students.²⁸ Standard errors, calculated by Taylor series linearization, account for clustering of responses.³² Using Stata 11.2 (Stata Corp, College Station, TX), cross-tabulations were assessed and ordered probit regression models were constructed. Average marginal effects, which estimate the average change of altering each covariate among the study sample, were reported.

RESULTS

Data from 24 658 individuals were assessed. Although 88.0% of adolescents reported they believed heavy smoking caused "a lot of harm," only 64.3% and 33.3% believed that light and intermittent smoking, respectively, were similarly harmful (Table 1). Conversely, roughly 5% of adolescents viewed heavy smoking as causing little or no harm. In contrast, $\sim 10\%$ of adolescents viewed light smoking and one-quarter of adolescents viewed intermittent smoking as similarly unharmed (data not shown).

Perception of harm differed by demographic group and individuals' tobacco use. Whereas, unadjusted, perceptions of harm did not vary by age, females were consistently more likely than males to perceive each tobacco use pattern assessed as harmful. While 69.2% and 36.2% of females perceived that light and intermittent smoking, respectively, caused a lot of harm, only 59.5% and 30.4% of males did so. Asians also were consistently more likely than

other ethnic groups to perceive tobacco as harmful.

Perception of smoking patterns varied dramatically by individuals' tobacco use habits. Though 67.3% of nonsmokers considered light smoking to cause a lot of harm, just 38.6% of intermittent smokers, 35.2% of light smokers, and 28.5% of heavier smokers did so. Intermittent smoking was perceived as even less harmful. Only 35.2% of nonsmokers believed intermittent smoking caused a lot of harm and, strikingly, only 14.0% of intermittent smokers believed their own tobacco use to be very harmful. These views differed markedly from perceptions of heavy smoking. Regarding heavy smoking, 90.3% of nonsmokers and even 45.0% of heavier smokers thought such behavior was very harmful. Alternative tobacco use and having a family member who used tobacco were also associated with perceiving various cigarette smoking patterns as less harmful.

Results from an ordered probit regression model examining correlates of increased perception of harm from intermittent smoking are shown in Table 2. Females and those of older ages were more likely to perceive intermittent smoking as harmful. Compared with whites, blacks and Hispanics perceived intermittent smoking as less harmful. Differences were noted between smokers and nonsmokers; heavier smokers were, for example, 21.8 percentage points less likely than nonsmokers to view intermittent smoking as very harmful. Use of alternative tobacco products and exposure to a family member's use of tobacco were associated with perceiving intermittent smoking as harmful, although e-cigarette use was not.

Table 3 displays a similar analysis for light smoking. Females were again more likely to perceive light smoking as harmful. Blacks and Hispanics were less likely than whites to

TABLE 1 Study Characteristics and Proportion of US Adolescents Who Perceive Light, Intermittent, and Heavy Smoking as Causing a Lot of Harm

	Sample Size	Weighted Proportion ^a	Perception That Smoking Pattern Causes a Lot of Harm, % (95% CI) ^b		
			Intermittent	Light	Heavy
Overall	24 658	100.0	33.3 (32.0–34.6)	64.3 (63.2–65.3)	88.0 (87.2–88.8)
Gender					
Male	12 369	51.1	30.4 (29.0–32.0)	59.5 (58.0–60.9)	85.4 (84.2–86.5)
Female	12 275	48.9	36.2 (34.6–37.8)	69.2 (68.0–70.4)	90.7 (90.0–91.4)
Ethnicity					
Non-Hispanic white	11 814	53.9	33.3 (31.6–34.9)	64.3 (62.9–65.7)	89.9 (89.0–90.7)
Non-Hispanic black	3114	13.9	33.1 (30.1–36.3)	64.7 (62.4–66.9)	86.1 (84.7–87.4)
Hispanic	5733	21.7	31.6 (29.7–33.5)	62.3 (60.3–64.3)	84.5 (82.4–86.4)
Non-Hispanic Asian	1106	3.7	37.3 (34.0–40.8)	71.1 (66.6–75.2)	91.5 (88.0–94.1)
Other/multiple	2105	6.9	36.2 (33.3–39.2)	66.7 (63.8–69.4)	88.2 (86.2–90.0)
Age, y					
≤12	5037	19.8	32.3 (30.3–34.3)	66.1 (64.1–68.1)	89.9 (88.7–91.0)
13	3995	14.6	33.1 (30.2–36.1)	63.9 (61.4–66.4)	88.2 (86.5–89.7)
14	3595	14.2	30.5 (28.6–32.5)	63.3 (61.4–65.2)	88.2 (86.3–89.9)
15	3185	14.7	32.7 (30.5–34.9)	63.3 (61.0–65.6)	86.7 (85.1–88.2)
16	3245	14.5	35.0 (32.7–37.3)	66.7 (64.0–69.2)	89.3 (87.5–90.8)
≥17	5498	22.3	35.4 (33.3–37.5)	62.5 (60.7–64.4)	86.5 (84.7–88.1)
Smoking pattern					
Nonsmoker	21 391	90.6	35.2 (34.0–36.5)	67.3 (66.4–68.3)	90.3 (89.5–91.0)
Intermittent smoker	1765	7.4	14.0 (12.2–16.0)	38.6 (35.7–41.5)	73.1 (70.3–75.8)
Light smoker	167	0.7	17.7 (11.8–25.7)	35.2 (26.9–44.5)	68.3 (59.1–76.2)
Heavier smoker	305	1.3	19.6 (15.2–24.9)	28.5 (23.4–34.5)	45.0 (38.1–52.0)
Alternative tobacco use					
No	18 132	73.3	36.4 (35.0–37.8)	68.6 (67.6–69.6)	90.7 (89.9–91.4)
Yes	6447	26.7	24.7 (23.4–26.0)	52.3 (50.8–53.8)	80.7 (79.2–82.2)
E-cigarette use					
No	24 158	98.0	33.7 (32.4–34.9)	64.8 (63.8–65.8)	88.5 (87.7–89.2)
Yes	500	2.0	15.5 (12.3–19.4)	39.5 (35.0–44.2)	66.5 (61.7–71.0)
Family use of tobacco					
No	13 215	57.7	37.4 (35.9–39.0)	69.2 (68.0–70.4)	91.0 (90.1–91.7)
Yes	9631	42.3	27.9 (26.6–29.2)	58.0 (56.7–59.3)	85.1 (84.0–86.2)

^a Column percentages are displayed, using survey weights to adjust for the complex survey design. The unadjusted sample size is displayed. Subcategories may not sum to 100% because of rounding.

^b Survey weighted percentages and 95% CI that account for the complex survey design are displayed, indicating the proportion of individuals perceiving each smoking pattern as causing “a lot of harm.”

perceive light smoking as harmful, although the magnitude of ethnicity’s influence was, as with intermittent smoking, relatively small; blacks and Hispanics were, respectively, 3.4 and 3.9 percentage points less likely than whites to describe light smoking as very harmful. As with intermittent smoking, perception of increased harm increased with age, with those age 16 years and older more likely to perceive light smoking as dangerous. Perception of decreased harm was more common with greater exposure to and use of tobacco products. Compared with nonsmokers, heavier smokers were, all else equal, 36.7 percentage points less likely to describe light smoking as causing a lot of harm, a greater difference

than with intermittent smoking. Intermittent and light smokers were, respectively, 21.2 and 24.5 percentage points less likely to do so. As with intermittent smoking, alternative tobacco use and having a family member who used tobacco were associated with decreased harm perception; e-cigarette use was not.

For comparison, beliefs about heavy smoking are shown in Table 4. Results from a similar model indicate similar results along gender and ethnic lines. Unlike analyses of light and intermittent smoking, though, harm perception of heavy smoking did not vary by age. Differences were again noted between nonsmokers and smokers, with the average heavier

smoker 33.8 percentage points less likely than their nonsmoking peers to perceive heavy smoking as causing a lot of harm; intermittent and light smokers were, respectively, 10.4 and 13.5 percentage points more likely to do so. Users of alternative tobacco and those with family member who used tobacco were less likely to view heavy smoking as harmful, although the magnitude of the differences noted was smaller than for light and intermittent smoking.

DISCUSSION

In this study, we report results from the first study of which we are aware to examine views of light and intermittent smoking among US adolescents. Light and intermittent

TABLE 2 Ordered Probit Model Assessing Correlates of Harm Perception of Intermittent Smoking

	OR (95% CI) ^a		Average Marginal Effects ^b			
			No Harm		A Lot of Harm	
			Prob. (%)	P value	Prob. (%)	P value
Gender						
Male	1.00	(Ref.)	—	—	—	—
Female	1.26	(1.21–1.32)	–1.5	<.001	8.2	<.001
Ethnicity						
Non-Hispanic white	1.00	(Ref.)	—	—	—	—
Non-Hispanic black	0.89	(0.83–0.97)	0.8	<.01	–3.9	<.01
Hispanic	0.90	(0.85–0.95)	0.7	<.001	–3.8	<.001
Non-Hispanic Asian	1.02	(0.93–1.11)	–0.1	.67	0.7	.68
Other/multiple	1.06	(0.99–1.13)	–0.3	.09	2.0	.10
Age, y						
≤12	1.00	(Ref.)	—	—	—	—
13	1.04	(0.95–1.14)	–0.3	.35	1.4	.35
14	1.02	(0.96–1.09)	–0.2	.53	0.7	.52
15	1.10	(1.02–1.18)	–0.7	.01	3.1	.01
16	1.20	(1.13–1.29)	–1.2	<.001	6.5	<.001
≥17	1.26	(1.18–1.34)	–1.5	<.001	8.0	<.001
Smoking pattern						
Nonsmoker	1.00	(Ref.)	—	—	—	—
Intermittent smoker	0.54	(0.50–0.59)	6.0	<.001	–18.8	<.001
Light smoker	0.56	(0.44–0.71)	5.5	<.01	–18.0	<.001
Heavier smoker	0.49	(0.40–0.62)	7.4	<.001	–21.8	<.001
Alternative tobacco use						
No	1.00	(Ref.)	—	—	—	—
Yes	0.77	(0.73–0.82)	1.9	<.001	–8.6	<.001
E-cigarette use						
No	1.00	(Ref.)	—	—	—	—
Yes	0.94	(0.83–1.06)	0.4	.35	–2.1	.32
Family use of tobacco						
No	1.00	(Ref.)	—	—	—	—
Yes	0.80	(0.77–0.83)	1.5	<.001	–8.0	<.001
Model coefficients						
Cut 1	0.14	(0.13–0.15)				
Cut 2	0.47	(0.44–0.50)				
Cut 3	1.57	(1.47–1.68)				

^a OR displayed are from the weighted multivariate ordered probit model in which all listed covariates are included, with 95% CI calculated by Taylor series linearization to account for the complex survey design.

^b Average marginal effects estimate the average change of altering each covariate (eg, being an intermittent smoker compared with being a nonsmoker) among the study population, estimating the likelihood that an individual perceived intermittent smoking as causing no harm or a lot of harm.

smoking patterns are harmful¹⁶ and increasingly common.^{2–4} Because harm perception influences the development of smoking patterns,²¹ understanding who espouses views that light and intermittent smoking are less harmful may prove helpful for public health planning. Although the vast majority of US adolescents agree a heavy smoking pattern is very harmful, far fewer believe light and intermittent smoking are similarly harmful. Although some may be reassured that many adolescents do recognize these

smoking patterns are dangerous, we find the discrepancy between these views of significant public health concern. Two out of 3 adolescents believe light smoking is very harmful and only 1 of 3 views intermittent smoking as very harmful. Conversely, roughly one-quarter of US adolescents consider intermittent smoking to cause little or no harm. Together, our findings indicate that, among adolescents nationwide, misperceptions regarding the safety of light and intermittent smoking are

widespread, a finding potentially at root of these practices' increasing prevalence.

Important, however unsurprising, is that those who engaged in light and intermittent smoking were much more likely to espouse views that their own smoking patterns were not particularly harmful. Approximately 1 in 3 light smokers perceived their smoking as causing a lot of harm; roughly 1 in 7 intermittent smokers perceived their smoking pattern as similarly dangerous. That marked differences were noted in adolescents' views of the comparative dangers of heavy, light, and intermittent smoking patterns is broadly consistent with previous research examining US adolescents' perceptions of light cigarettes. Such research found that adolescents underestimated the associated health risks and overestimated the ease of cessation associated with light cigarettes,³³ findings themselves consistent with research illustrating that smokers underestimate smoking's risks.¹⁴ Related findings have also been reported in college-aged youths, which showed widespread misperceptions of harm caused by both tobacco products and nicotine replacement therapy.³⁴

Our findings suggest that males, younger adolescents, and ethnic minorities appear particularly susceptible to beliefs that light and intermittent smoking are safer. Consistent with previous research,³⁴ females perceived each smoking pattern as more harmful compared with males. Such differing views may in part provide insight as to why smoking susceptibility differs by gender,³⁵ and that the use of potentially reduced exposure products also differs by gender.³⁶ If adolescent boys are somehow uniquely susceptible to altered views, a factor unaccounted for in our analysis may be at root; evidence would suggest

TABLE 3 Ordered Probit Model Assessing Correlates of Harm Perception of Light Smoking

	OR (95% CI) ^a		Average Marginal Effects ^b			
			No Harm		A Lot of Harm	
			Prob. (%)	P value	Prob. (%)	P value
Gender						
Male	1.00	(Ref.)	—	—	—	—
Female	1.30	(1.25–1.35)	–1.2	<.001	9.4	<.001
Ethnicity						
Non-Hispanic white	1.00	(Ref.)	—	—	—	—
Non-Hispanic black	0.91	(0.84–0.98)	0.5	.02	–3.4	.01
Hispanic	0.90	(0.84–0.95)	0.5	<.01	–3.9	<.001
Non-Hispanic Asian	1.05	(0.93–1.19)	–0.2	.38	1.8	.40
Other/multiple	1.04	(0.96–1.12)	–0.2	.30	1.4	.32
Age, y						
≤12	1.00	(Ref.)	—	—	—	—
13	0.97	(0.89–1.05)	0.2	.41	–1.2	.41
14	1.00	(0.93–1.09)	0.0	.94	0.1	.94
15	1.02	(0.94–1.11)	–0.1	.62	0.1	.62
16	1.15	(1.06–1.24)	–0.6	<.01	4.7	<.001
≥17	1.10	(1.03–1.19)	–0.5	<.01	3.5	<.01
Smoking pattern						
Nonsmoker	1.00	(Ref.)	—	—	—	—
Intermittent smoker	0.57	(0.52–0.63)	3.8	<.001	–21.2	<.001
Light smoker	0.53	(0.43–0.64)	4.7	<.001	–24.5	<.001
Heavier smoker	0.38	(0.30–0.47)	9.8	<.001	–36.7	<.001
Alternative tobacco use						
No	1.00	(Ref.)	—	—	—	—
Yes	0.79	(0.74–0.84)	1.3	<.001	–8.7	<.001
E-cigarette use						
No	1.00	(Ref.)	—	—	—	—
Yes	0.98	(0.86–1.11)	0.1	.77	–0.7	.77
Family use of tobacco						
No	1.00	(Ref.)	—	—	—	—
Yes	0.80	(0.77–0.83)	1.0	<.001	–8.0	<.001
Model coefficients						
Cut 1	0.11	(0.10–0.12)				
Cut 2	0.23	(0.21–0.25)				
Cut 3	0.65	(0.61–0.70)				

^a OR displayed are from the weighted multivariate ordered probit model in which all listed covariates are included, with 95% CI calculated by Taylor series linearization to account for the complex survey design.

^b Average marginal effects estimate the average change of altering each covariate (eg, being an intermittent smoker compared with being a nonsmoker) among the study population, estimating the likelihood that an individual perceived light smoking as causing no harm or a lot of harm.

a contextual, not biologic, explanation underlies this difference.³⁷ One potential factor, exposure to tobacco advertising, suggests no difference between the genders, however.³⁷

Ethnic differences were also noted, with blacks and Hispanics perceiving all smoking patterns as comparatively less harmful than did their white peers. Previous research suggests that blacks and Hispanics, as well as Asians, are more likely to engage in light and intermittent smoking than whites.³⁸ A recent article

examining trends among Latino smokers reported that, over a 15-year period, heavy daily smoking decreased, whereas light and intermittent smoking increased.³⁹ Although one cannot assess here how changing views over time may have influenced these patterns, it may not be unreasonable to speculate that the rise in light and intermittent smoking over time,² particularly in certain populations,³⁹ may have been brought about by differential views as to those smoking patterns' comparative safety.

Of note, older adolescents were more likely to perceive light and intermittent smoking as very harmful compared with their younger peers, but they were no more likely to perceive heavy smoking as more harmful. Such a discrepancy not only indicates that perceptions of light and intermittent smoking change with age, but suggests that a knowledge gap exists in which younger adolescents view light and intermittent smoking as distinct, safer entities than do their older peers. Consequently, younger adolescents may be at increased risk for establishing these smoking patterns or progressing to more intense tobacco use. Changing the implicit risk-benefit calculation made by would-be light and intermittent smokers may prove critical; one study of young adult social smokers found that such individuals believed that simply extending smoke-free areas would help curb their habit.⁴⁰ Future research into how and why these alternative smoking patterns are established, and the role of harm perception in that process, may be critically important to reduce the rise in light and intermittent smoking.

Use of alternative tobacco products as well as having a family member who used tobacco were also associated with perceiving light or intermittent tobacco use patterns as less harmful. Such a finding is consistent with previously described links between alternative tobacco products and cigarette smoking⁴¹ and between the use of alternative tobacco products and perception of those products' harm.³¹ The associations described here suggest the possibility that exposure to a family member's tobacco use or the use of alternative tobacco products may, in turn, lead to stable patterns of cigarette use, as others have hypothesized regarding alternative tobacco.⁴²

Some reservation is needed in interpreting our results. Data are

TABLE 4 Ordered Probit Model Assessing Correlates of Harm Perception of Heavy Smoking

	OR (95% CI) ^a		Average Marginal Effects ^b			
			No Harm		A Lot of Harm	
			Prob. (%)	P value	Prob. (%)	P value
Gender						
Male	1.00	(Ref.)	—	—	—	—
Female	1.27	(1.19–1.34)	–1.0	<.001	4.2	<.001
Ethnicity						
Non-Hispanic white	1.00	(Ref.)	—	—	—	—
Non-Hispanic black	0.76	(0.70–0.82)	1.2	<.001	–5.0	<.001
Hispanic	0.75	(0.70–0.81)	1.3	<.001	–5.2	<.001
Non-Hispanic Asian	0.96	(0.78–1.18)	0.1	.71	–0.6	.71
Other/multiple	0.93	(0.83–1.03)	0.3	.18	–1.2	.17
Age, y						
≤12	1.00	(Ref.)	—	—	—	—
13	0.95	(0.86–1.05)	0.2	.34	–0.9	.33
14	0.99	(0.89–1.09)	0.0	.83	–0.2	.83
15	0.94	(0.83–1.06)	0.3	.32	–1.1	.32
16	1.1	(0.99–1.22)	–0.4	.08	1.5	.07
≥17	1.03	(0.91–1.17)	–0.1	.62	0.5	.62
Smoking pattern						
Nonsmoker	1.00	(Ref.)	—	—	—	—
Intermittent smoker	0.62	(0.56–0.69)	2.7	<.001	–10.4	<.001
Light smoker	0.56	(0.46–0.68)	3.7	<.001	–13.5	<.001
Heavier smoker	0.31	(0.25–0.38)	12.9	<.001	–33.8	<.001
Alternative tobacco use						
No	1.00	(Ref.)	—	—	—	—
Yes	0.77	(0.70–0.84)	1.3	<.001	–5.3	<.001
E-cigarette use						
No	1.00	(Ref.)	—	—	—	—
Yes	0.95	(0.82–1.10)	0.2	.49	–1.0	.48
Family use of tobacco						
No	1.00	(Ref.)	—	—	—	—
Yes	0.82	(0.78–0.87)	0.8	<.001	–3.6	<.001
Model coefficients						
Cut 1	0.09	(0.09–0.10)				
Cut 2	0.14	(0.13–0.15)				
Cut 3	0.24	(0.22–0.26)				

^a OR displayed are from the weighted multivariate ordered probit model in which all listed covariates are included, with 95% CI calculated by Taylor series linearization to account for the complex survey design.

^b Average marginal effects estimate the average change of altering each covariate (eg, being an intermittent smoker compared with being a nonsmoker) among the study population, estimating the likelihood that an individual perceived heavy smoking as causing no harm or a lot of harm.

cross-sectional; although we are able to depict associations between perceptions of various tobacco smoking patterns' harm and use of tobacco, we cannot provide an assessment regarding to what extent these views motivate tobacco use or whether these views develop in those already using tobacco. In addition, data rely on adolescents' self-report, which could be subject to unknown biases. Various socioeconomic influences, including adolescents' family structure, family income, parental education, and geography,

were unavailable in the dataset analyzed, and might have influenced the observed associations. In addition, the survey is school-based and generalizations to US adolescents not attending school may be inappropriate.

Our analysis also has multiple strengths that merit attention. It uses a large, nationally representative sample. It uses statistical techniques, including ordinal probit regression, most appropriate to the data's natural form, and uses average

marginal effects calculated from those models to provide readers with estimates of the relative impact of those estimated associations' magnitudes. Importantly, we detail the widespread misperception that light and intermittent smoking are safer than heavier smoking patterns, beliefs that may be contributing to their rise as public health threats. In noting the marked discrepancy between adolescent views of the dangers of heavier smoking patterns, compared with light and intermittent smoking, we underscore a potentially important shortcoming of programs designed to educate and deter teenagers from smoking. Given adolescents' widespread understanding that heavier smoking patterns carry substantial risk, minor changes to programs designed to alter normative beliefs²⁹ incorporating the insights presented here may prove fruitful. We advocate that clinicians engaged in tobacco use anticipatory guidance²⁶ emphasize the risk from all tobacco use to correct potential misconceptions.

CONCLUSIONS

We examined US adolescents' perceptions of light and intermittent smoking and correlates of those views with students' sociodemographic and tobacco exposure profiles. We report that US adolescents differ markedly in their perceptions of heavy smoking compared with light and intermittent smoking. Light smoking is perceived as less dangerous; nearly 1 in 11 adolescents believes it will cause little or no harm. Intermittent smoking is viewed as even less suspect, with nearly one-quarter of all adolescents reporting nondaily smoking will cause little or no harm. These findings should prompt further investigation and public health attention to redress widespread misconceptions that light and intermittent smoking are a safer alternative.

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Supported partially by grants from the National Institutes of Health, NIH/NIEHS 5 P30 ES000260-49 and NIH/NCI 3 P30 CA016087-33S1. Funded by the National Institutes of Health (NIH).

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

REFERENCES

1. Fagan P, Rigotti NA. Light and intermittent smoking: the road less traveled. *Nicotine Tob Res.* 2009;11(2): 107–110
2. Pierce JP, White MM, Messer K. Changing age-specific patterns of cigarette consumption in the United States, 1992–2002: association with smoke-free homes and state-level tobacco control activity. *Nicotine Tob Res.* 2009;11(2): 171–177
3. US Department of Health and Human Services. *The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2014:17
4. Office of the Surgeon General, Centers for Disease Control and Prevention. *Preventing Tobacco Use Among Youth and Young Adults.* Atlanta, GA: Department of Health and Human Services, Centers for Disease Control and Prevention; 2012:12
5. Hassmiller KM, Warner KE, Mendez D, Levy DT, Romano E. Nondaily smokers: who are they? *Am J Public Health.* 2003; 93(8):1321–1327
6. Wortley PM, Husten CG, Trosclair A, Chrismon J, Pederson LL. Nondaily smokers: a descriptive analysis. *Nicotine Tob Res.* 2003;5(5):755–759
7. Schepis TS, Rao U. Epidemiology and etiology of adolescent smoking. *Curr Opin Pediatr.* 2005;17(5):607–612
8. White HR, Bray BC, Fleming CB, Catalano RF. Transitions into and out of light and intermittent smoking during emerging adulthood. *Nicotine Tob Res.* 2009;11(2): 211–219
9. Schane RE, Glantz SA, Ling PM. Nondaily and social smoking: an increasingly prevalent pattern. *Arch Intern Med.* 2009; 169(19):1742–1744
10. Schane RE, Glantz SA, Ling PM. Social smoking implications for public health, clinical practice, and intervention research. *Am J Prev Med.* 2009;37(2): 124–131
11. Levinson AH, Campo S, Gascoigne J, Jolly O, Zakharyan A, Tran ZV. Smoking, but not smokers: identity among college students who smoke cigarettes. *Nicotine Tob Res.* 2007;9(8):845–852
12. DiFranza JR, Rigotti NA, McNeill AD, et al. Initial symptoms of nicotine dependence in adolescents. *Tob Control.* 2000;9(3): 313–319
13. Husten CG. How should we define light or intermittent smoking? Does it matter? *Nicotine Tob Res.* 2009;11(2):111–121
14. Weinstein ND, Marcus SE, Moser RP. Smokers' unrealistic optimism about their risk. *Tob Control.* 2005;14(1):55–59
15. US Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2006:709
16. Schane RE, Ling PM, Glantz SA. Health effects of light and intermittent smoking: a review. *Circulation.* 2010;121(13): 1518–1522
17. Pope CA III, Burnett RT, Krewski D, et al. Cardiovascular mortality and exposure to airborne fine particulate matter and cigarette smoke: shape of the exposure-response relationship. *Circulation.* 2009; 120(11):941–948
18. Office of the Surgeon General, Centers for Disease Control and Prevention. *How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease.* Atlanta, GA: Centers for Disease Control and Prevention; 2010
19. Godtfredsen NS, Holst C, Prescott E, Vestbo J, Osler M. Smoking reduction, smoking cessation, and mortality: a 16-year follow-up of 19,732 men and women from The Copenhagen Centre for Prospective Population Studies. *Am J Epidemiol.* 2002;156(11):994–1001
20. Tverdal A, Bjartveit K. Health consequences of reduced daily cigarette consumption. *Tob Control.* 2006;15(6): 472–480
21. Bondurant S, Wallace R, Shetty P, Stratton K. *Clearing the Smoke: Assessing the Science Base for Tobacco Harm Reduction.* Washington, DC: National Academies Press; 2001
22. Weiss JW, Cen S, Schuster DV, et al. Longitudinal effects of pro-tobacco and anti-tobacco messages on adolescent smoking susceptibility. *Nicotine Tob Res.* 2006;8(3):455–465
23. Song AV, Glantz SA, Halpern-Felsher BL. Perceptions of second-hand smoke risks predict future adolescent smoking initiation. *J Adolesc Health.* 2009;45(6): 618–625
24. US Department of Health and Human Services. *Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General.* Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; 2012
25. Tong EK, Ong MK, Vittinghoff E, Pérez-Stable EJ. Nondaily smokers should be asked and advised to quit. *Am J Prev Med.* 2006;30(1):23–30
26. Moyer VA; US Preventive Services Task Force. Primary care interventions to prevent tobacco use in children and adolescents: US Preventive Services Task Force recommendation statement. *Ann Intern Med.* 2013;159(8):552–557
27. Campaign for Tobacco-Free Kids. A Decade of Broken Promises: The 1998

- State Tobacco Settlement Fifteen Years Later. Available at: www.tobaccofreekids.org/what_we_do/state_local/tobacco_settlement/. Accessed November 29, 2014
28. Centers for Disease Control and Prevention. *2012 National Youth Tobacco Survey: Methodology Report*. Atlanta, GA: Centers for Disease Control and Prevention; 2012
 29. Perkins HW. The emergence and evolution of the social norms approach to substance abuse prevention. In: *The Social Norms Approach to Preventing School and College Age Substance Abuse*. San Francisco, CA: Jossey-Bass; 2003: 3–17
 30. Gold DR, Wang X, Wypij D, Speizer FE, Ware JH, Dockery DW. Effects of cigarette smoking on lung function in adolescent boys and girls. *N Engl J Med*. 1996; 335(13):931–937
 31. Amrock SM, Zakhar J, Zhou S, Weitzman M. Perception of e-cigarettes' harm and its correlation with use among US adolescents [published online ahead of print August 14, 2014]. *Nicotine Tob Res*. PMID 25125321
 32. Wolter K. *Introduction to Variance Estimation*. New York, NY: Springer; 2007
 33. Kropp RY, Halpern-Felsher BL. Adolescents' beliefs about the risks involved in smoking "light" cigarettes. *Pediatrics*. 2004;114(4). Available at: www.pediatrics.org/cgi/content/full/114/4/e445
 34. Smith SY, Curbow B, Stillman FA. Harm perception of nicotine products in college freshmen. *Nicotine Tob Res*. 2007; 9(9):977–982
 35. Nuño VL, Zhang Q, Harris RB, Wilkinson-Lee AM, Wilhelm MS. Smoking susceptibility among students followed from grade six to eight. *Addict Behav*. 2011;36(12):1261–1266
 36. Zhu SH, Gamst A, Lee M, Cummins S, Yin L, Zoref L. The use and perception of electronic cigarettes and snus among the US population. *PLoS ONE*. 2013;8(10):e79332
 37. Steinberg L. A social neuroscience perspective on adolescent risk-taking. *Dev Rev*. 2008;28(1):78–106
 38. Trinidad DR, Pérez-Stable EJ, Emery SL, White MM, Grana RA, Messer KS. Intermittent and light daily smoking across racial/ethnic groups in the United States. *Nicotine Tob Res*. 2009;11(2): 203–210
 39. Blanco L, Garcia R, Pérez-Stable EJ, et al. National trends in smoking behaviors among Mexican, Puerto Rican, and Cuban men and women in the United States. *Am J Public Health*. 2014;104(5): 896–903
 40. Hoek J, Maubach N, Stevenson R, Gendall P, Edwards R. Social smokers' management of conflicted identities. *Tob Control*. 2013;22(4):261–265
 41. Amrock SM, Gordon T, Zelikoff JT, Weitzman M. Hookah use among adolescents in the United States: results of a national survey. *Nicotine Tob Res*. 2014;16(2):231–237
 42. Dutra LM, Glantz SA. Electronic cigarettes and conventional cigarette use among US adolescents: a cross-sectional study. *JAMA Pediatr*. 2014;168(7):684

Adolescents' Perceptions of Light and Intermittent Smoking in the United States

Stephen M. Amrock and Michael Weitzman

Pediatrics 2015;135;246

DOI: 10.1542/peds.2014-2502 originally published online January 12, 2015;

Updated Information & Services	including high resolution figures, can be found at: http://pediatrics.aappublications.org/content/135/2/246
References	This article cites 32 articles, 7 of which you can access for free at: http://pediatrics.aappublications.org/content/135/2/246#BIBL
Subspecialty Collections	This article, along with others on similar topics, appears in the following collection(s): Substance Use http://www.aappublications.org/cgi/collection/substance_abuse_sub Smoking http://www.aappublications.org/cgi/collection/smoking_sub Public Health http://www.aappublications.org/cgi/collection/public_health_sub
Permissions & Licensing	Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at: http://www.aappublications.org/site/misc/Permissions.xhtml
Reprints	Information about ordering reprints can be found online: http://www.aappublications.org/site/misc/reprints.xhtml

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Adolescents' Perceptions of Light and Intermittent Smoking in the United States

Stephen M. Amrock and Michael Weitzman

Pediatrics 2015;135;246

DOI: 10.1542/peds.2014-2502 originally published online January 12, 2015;

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/135/2/246>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2015 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

