Original Investigation

The role of tobacco-specific media exposure, knowledge, and smoking status on selected attitudes toward tobacco control

Kelly D. Blake, K. Viswanath, Robert J. Blendon, & Donna Vallone

Abstract

Background: In August 2007, the President's Cancer Panel urged the leadership of the nation to "summon the political will to address the public health crisis caused by tobacco use" (President's Cancer Panel, N, 2007, *Promoting healthy lifestyles: Policy, program, and personal recommendations for reducing cancer risk*. <http://deainfo.nci.nih.gov/advisory/pcp/pcp07rpt/pcp07rpt.pdf>). While some research has examined predictors of public support for tobacco control measures, little research has examined modifiable factors that may influence public attitudes toward tobacco control.

Methods: We used the American Legacy Foundation's 2003 American Smoking and Health Survey 2 to examine the contribution of smoking status, knowledge of the negative effects of tobacco, and tobacco-specific media exposure (antitobacco messages, news coverage of tobacco issues, and protobacco advertising) on U.S. adults' attitudes toward tobacco control. In addition, we assessed whether smoking status moderates the relationship between tobacco-specific media exposure and policy attitudes. Weighted multivariable logistic regression models were employed.

Results: Results suggest that knowledge of the negative effects of tobacco and smoking status are associated with attitudes toward tobacco control and that exposure to tobacco-specific information in the media plays a role only in some instances. We found no evidence of effect modification by smoking status on the impact of exposure to tobacco-specific media on attitudes toward tobacco control.

Discussion: Understanding the impact of readily modifiable factors that shape policy attitudes is essential if we are to target

outreach and education in a way that is likely to sway public support for tobacco control.

Introduction

Tobacco use is the leading cause of preventable death in the United States; cigarette smoking causes an estimated 438,000 deaths (or about one of every five deaths) each year, including 38,000 deaths from secondhand smoke exposure (Centers for Disease Control and Prevention, 2005). Secondhand smoke is associated with several tobacco-related illnesses, such as lung cancer in adults and asthma, ear infections, and bronchitis in children (National Cancer Institute, 1999). In August 2007, the President's Cancer Panel released its report, *Promoting Healthy Lifestyles: Policy, Program, and Personal Recommendations for Reducing Cancer Risk*, wherein members urged the leadership of the nation to "summon the political will to address the public health crisis caused by tobacco use" (President's Cancer Panel, N, 2007).

Efforts involving mass media, including media coverage, communication campaigns, and advocacy efforts illuminating the negative effects of tobacco and the dangers of secondhand smoke, have led to policy efforts aimed at denormalizing tobacco use and protecting nonsmokers in the United States and around the world (Arnott, Dockrell, Sandford, & Willmore, 2007; Hammond, Fong, Zanna, Thrasher, & Borland, 2006).

There is no dearth of public opinion polls that examine support for and opposition to tobacco control measures. At both national and state levels, media outlets and policy makers gauge public support for various policy measures intended to curb the negative effects of tobacco; moreover, antitobacco advocacy

Kelly D. Blake, Sc.D., *Department of Society, Human Development and Health, Harvard School of Public Health, Boston, MA and Dana-Farber Cancer Institute, Boston, MA*

K. Viswanath, Ph.D., *Department of Society, Human Development and Health, Harvard School of Public Health, Boston, MA and Dana-Farber Cancer Institute, Boston, MA*

Robert J. Blendon, Sc.D., *Department of Health Policy and Management, Harvard School of Public Health, Boston, MA*

Donna Vallone, Ph.D., *American Legacy Foundation, Washington, DC*

Corresponding Author:

Kelly D. Blake, Sc.D., *Dana-Farber Cancer Institute, 44 Binney Street, MS LW703, Boston, MA 02115, USA. Telephone: 617-632-1964; Fax: 617-582-8728; E-mail: kellyblake@post.harvard.edu*

doi: 10.1093/ntr/ntp184

Advance Access published on December 17, 2009

Received May 6, 2009; accepted November 4, 2009

© The Author 2009. Published by Oxford University Press on behalf of the Society for Research on Nicotine and Tobacco. All rights reserved. For permissions, please e-mail: journals.permissions@oxfordjournals.org

groups and tobacco industry interests also utilize polling in order to gauge public sentiment and inform strategies to sway political will in their desired directions (National Cancer Institute, 2008). Despite the measurable benefits of policy-level interventions and population strategies (Rose, 1985), the often conflicting perspectives of social responsibility and self-reliance (Gorovitz, Mosher, & Oertschuk, 1998) are reflected in the complexity of opinions that exist toward tobacco control measures.

Perhaps, one of the broadest reviews of U.S. public opinion toward tobacco was conducted by Blendon & Young (1998) to assess current and historical patterns of attitudes toward tobacco control measures, in order to explain the failure of the 1998 U.S. Senate comprehensive tobacco legislation ("National Tobacco Policy and Youth Smoking Reduction Act," 1998), which would have enacted a range of policies from Food and Drug Administration (FDA) tobacco product regulation to indoor air legislation to advertising restrictions. The authors found that several factors played a role in the bill's demise, including a lack of broad public support for such comprehensive sweeping legislation. In reviewing responses to more than 1,000 questions asked in more than 100 national opinion surveys between 1957 and 1998, they found that incremental changes may have been more successful as the public largely favored more government action on the issue, particularly to protect youths; however, Americans also favored limits on tobacco taxes and government regulation of the tobacco industry. The study showed that support for outlawing the sale of cigarettes was low and remained constant from 1965 to 1981 (with 19%–20% of Americans favoring) and then declined in 1997 (with 15% favoring), that restricting tobacco use in public places and most workplaces had 75% favorable support overall, and that banning smoking in restaurants had 38% support (Blendon & Young).

Some multivariable studies have been conducted to examine individual characteristics that independently predict attitudes toward tobacco control policy. For example, Doucet, Velicer, & Laforce (2007) examined demographic differences in support for tobacco policies and found that women had significantly more favorable attitudes toward tobacco control policies than men; Blacks had significantly more favorable attitudes than Whites toward policies to increase public education and environmental restrictions (e.g., indoor air laws); older people were more supportive than younger people of restrictions on advertising, increasing public education, and increasing environmental restrictions; and those with higher levels of education were more likely to support increasing taxes and fees and environmental restrictions on tobacco. Several studies also have shown that smoking status is a major predictor of opposition to tobacco control policy measures (Ashley, Bull, & Pederson, 1995; Clegg Smith et al., 2008; Hamilton, Biener, & Rodger, 2005; Poland et al., 2000). Few studies have assessed the independent role of tobacco-related knowledge or tobacco-related media exposure on attitudes toward tobacco control.

The current study differs from previous public opinion studies in the area of tobacco control policy in two ways. First, it examines the unique contribution of both *knowledge* of the negative effects of tobacco and *tobacco-specific media exposure* (exposure to antitobacco messages, news coverage of tobacco issues, and protobacco advertising) as predictors of U.S. adults' attitudes toward tobacco control measures that suggest limits

on tobacco company sales and on exposure to secondhand smoke. Although one content analysis published in 2008 found a limited association between state print news coverage of tobacco and positive public sentiment toward smoking bans (Clegg Smith et al., 2008) and another study showed an association between knowledge of the risks of secondhand smoke and support for a clean indoor-air policy (Quick, Bates, & Romina, 2009), little previous research has assessed the independent contribution of both knowledge and media exposure on general attitudes toward tobacco control. Because knowledge and media exposure are modifiable factors, understanding their role in shaping adult attitudes toward tobacco control is essential, as they may be considered intervention points for education and outreach. Second, the current study assesses whether the impact of tobacco-specific media exposure on policy attitudes may be differential for smokers and nonsmokers, such that never-smokers and former smokers may be more receptive than current smokers to tobacco-specific messages in the media and form their attitudes toward tobacco control accordingly. We test for this potential effect modification explicitly, noting that the literature suggests no selective attention bias for smokers versus nonsmokers on exposure to at least one form of tobacco-specific media—anti-secondhand smoke messages (Evans et al., 2006).

Methods

Data

This study utilizes the American Smoking and Health Survey 2 (ASHES-2), a random digit dial survey sponsored by the American Legacy Foundation, designed to assess a range of tobacco topics, including tobacco use, cessation, knowledge and attitudes about smoking, and awareness of antitobacco media messages and advertising. The survey was designed to produce a nationally representative sample of adults aged 18 years and older and was conducted in two cross-sectional waves in 2002 and 2003. ASHES-2 (2003) contains 2,849 completed interviews of U.S. adults. Survey administration entailed a complex sampling design, whereby strata were formed to control sample distribution by Census Region, and Blacks and Hispanics were oversampled. Further sampling and data collection details have been outlined elsewhere (Healton et al., 2007). Analysis weights were calculated for household probability of selection and adjusted for nonresponse within each sampling stratum and were poststratified to the most current census population estimates by Census Region, age, gender, and racial/ethnic group to obtain final analysis weights. The response rate for ASHES-2 was 27.8%. Sponsors of the study conducted an experimental analysis to test for systematic differences between responders and nonresponders by demographics, smoking status, and other measures; the analysis showed no evidence of differential response rates across groups, and the resultant ASHES-2 sample tracked closely with U.S. Census data (Healton et al.). Sample characteristics are outlined in Table 1.

Outcome variables: Attitudes supportive of tobacco control

Although ASHES-2 was not designed as a tool to measure policy attitudes explicitly, some items on the survey assess general public attitudes that may have policy implications, including attitudes about the industry's ability to sell harmful products,

Table 1. Sample characteristicsAmerican Smoking and Health Survey 2 (2003) *N* = 2,849

Mean age	42
Female gender (% respondents)	65
Smoking status	
Current smoker	22
Former smoker	21
Never-smoker	57
Total household income in 2002 (% respondents)	
< \$30,000	45
> \$30,000	55
Education (% respondents)	
Less than high school	16
High school graduate+	57
College degree or more	27
Race/ethnicity (% respondents)	
White	45
Black	26
Hispanic	23
Other	6

regulations on clean indoor air, and regulations to limit the portrayal of smoking in movies. The three dependent variables in the current investigation include responses that reflect positive attitudes toward limits on the industry and on secondhand smoke, including the following: (a) Tobacco companies should not be allowed to sell a product that harms people, (b) there are not enough restrictions on where people can smoke cigarettes, and (c) government should be involved in regulating where people can smoke cigarettes. Outcome variables were dichotomized for the purpose of logistic regression, modeling respondent probability of holding positive attitudes toward restrictions versus disagreeing, or taking a neutral stance. Unadjusted prevalence estimates for each outcome variable are presented in Table 2.

Predictor variables

Key predictor variables assessed respondents' exposure to tobacco-specific media messages, including exposure to anti-tobacco advertising, news coverage of tobacco issues, and protobacco advertising as well as knowledge of the negative effects of tobacco and smoking status.

Tobacco-specific media exposure questions were asked only of respondents who reported at least some media exposure in the past 30 days (via television, radio, newspaper, magazine, or Internet). Exposure to news coverage of tobacco issues was assessed using two items that asked whether, in the past 30 days, the respondent had seen news coverage of the dangers of children being around cigarette smoke or about efforts to ban smoking in public places. Exposure to antitobacco advertising was assessed in a similar way using two items that asked whether, in the past 30 days, the respondent had seen advertising about the dangers of children being around cigarette smoke or about efforts to ban smoking in public places. Exposure to protobacco messaging was assessed using three items that asked whether, in the past 30 days, the respondent had seen advertising, promotions for cigarettes, or other tobacco products in (a) newspapers, (b) magazines, or (c) on the Internet.

Table 2. Prevalence estimates (unadjusted): U.S. adults' attitudes toward tobacco control

American Smoking and Health Survey 2 (2003)	% Agree	% Disagree	% Neutral/ no opinion
Tobacco companies should not be allowed to sell a product that harms people (<i>N</i> = 2,819)			
Total	64	25	11
Never-smokers	68	20	12
Former smokers	61	26	13
Current smokers	54	34	12
There are not enough restrictions on where people can smoke cigarettes (<i>N</i> = 2,823)			
Total	46	46	8
Never-smokers	56	35	9
Former smokers	46	45	9
Current smokers	19	74	7
Government should be involved in where people can smoke cigarettes (<i>N</i> = 2,810)			
Total	56	34	10
Never-smokers	61	27	12
Former smokers	54	35	11
Current smokers	40	51	9

Note. Cell counts may not add to 100% due to refused or missing responses. Sample size for each question varies due to refused and missing responses.

To assess the contribution of knowledge of the negative effects of tobacco, we employed three items reflecting agreement that (a) smoking cigarettes has been proven to cause lung cancer, (b) secondhand smoke causes lung cancer in nonsmokers, and (c) smoking around a baby increases its chances of dying from sudden infant death syndrome (SIDS).

To assess the contribution of smoking status to attitudes toward tobacco control, current smokers were defined as having smoked 100 cigarettes over the lifetime and currently smoking every day or some days; former smokers were defined as having smoked 100 cigarettes over the lifetime and now not smoking at all; and never-smokers were defined as not having smoked 100 cigarettes over the lifetime.

Covariates

Sociodemographic variables were included to control for education, income, race/ethnicity, age, sex, and state of residence.

Statistical analysis

Multivariable logistic regression was used to model the predicted probability that exposure to tobacco-specific media messages (with referent categories representing no exposure), knowledge of the negative effects of tobacco (with referent categories representing lack of knowledge), and smoking status (never-smokers and former smokers compared with current smokers) are associated with U.S. adults' attitudes toward the three tobacco control measures under investigation, controlling for education, income, race/ethnicity, age, sex, and state of residence. All key media exposure and knowledge variables were entered into each model simultaneously to control for their independent contribution in

what is a crowded and sometimes conflicting information environment. Separate full models for each outcome under study included all predictor variables and covariates.

To assess whether smoking status modified the relationship between tobacco-specific media exposure and attitudes toward tobacco control, we included interaction terms for each media exposure variable and smoking status variable (along with their respective main effects variables) in the previously described models. This enabled us to examine whether exposure to tobacco-specific media messages may matter more for never-smokers and former smokers than for current smokers in the development of attitudes toward tobacco control measures.

A complete case analysis was utilized. Tests of significance were estimated at the $p < .05$ level. To adjust for unequal probabilities of selection due to the complex sampling design and oversampling Blacks and Hispanics and to adjust for potential nonresponse bias, individual weighting factors were applied to all estimates.

Results

Unadjusted prevalence estimates indicate mostly positive attitudes toward tobacco control, though less than half of adults (46%) thought that there are not enough restrictions on where people can smoke cigarettes. A majority of adults (64%) believed that tobacco companies should not be allowed to sell a product that harms people, and 56% of adults thought that the government should be involved in regulating where people can smoke (see Table 2).

Pursuant to our research questions, we found that knowledge of the negative effects of tobacco and smoking status were associated with almost all tobacco control attitudes under study and that exposure to tobacco-specific information in the media played a role in the prediction of supportive attitudes toward tobacco control only in some instances. Exposure to protobacco advertising did not seem to influence attitudes toward any of the tobacco control measures under study. Moreover, we found no evidence of effect modification by smoking status on the impact of exposure to tobacco-specific media on policy attitudes. Policy-specific findings are summarized below, and Table 3 reports odds ratios (ORs) and 95% CIs for multivariable-fitted logistic regression models that describe respondent odds of holding supportive attitudes toward tobacco control, by exposure to tobacco-specific media messages, knowledge of the negative effects of tobacco, and smoking status. Appendix Table 1 contains results from full models.

Limits on tobacco companies' ability to sell a harmful product

Those who had seen advertising/counter-marketing related to smoking bans and the dangers of children being around cigarette smoke were ~40% more likely than those who had not been exposed to such counter-marketing to support limits on sales of a harmful product (ORs = 1.40 and 1.41, respectively). Those who were knowledgeable about the dangers of secondhand smoke also were significantly more likely to support such limits, those holding knowledge that secondhand smoke causes lung cancer in nonsmokers were more than two times as likely as those without such knowledge to support limits (OR = 2.11),

and those holding knowledge that smoking around a baby can cause SIDS were over one and a half times as likely as those without knowledge of the secondhand smoke/SIDS relationship to have supportive attitudes toward sales limitations (OR = 1.66). Never-smokers and former smokers were significantly more likely than current smokers to say that tobacco companies should not be allowed to sell a product that harms people (ORs = 1.52 and 1.35, respectively).

Support for restrictions on where people can smoke

Knowledge and smoking status were associated with attitudes toward restrictions on where people can smoke cigarettes. Those who were knowledgeable that smoking causes lung cancer were ~60% more likely than those without such knowledge to support smoking restrictions (OR = 1.59), those who were knowledgeable that secondhand smoke causes lung cancer in nonsmokers were more than two and a half times as likely as those without such knowledge to support restrictions (OR = 2.66), and those with knowledge of the SIDS link were ~40% more likely than those without knowledge of the SIDS link to support restrictions (OR = 1.39). Never-smokers were almost four times as likely as current smokers (OR = 3.89) and former smokers were almost three times as likely as current smokers (OR = 2.93) to support restrictions on where people can smoke cigarettes.

Exposure to tobacco-specific messages in the media did not differentially predict support for smoking restrictions. Those who were exposed to news coverage of tobacco issues, antitobacco advertising, and protobacco advertising were not more or less likely to support restrictions than those unexposed to such information in the media.

Support for government involvement in where people can smoke

Knowledge and smoking status were associated with attitudes about government involvement in where people can smoke. Those who were knowledgeable that smoking causes lung cancer were more than twice as likely as those without such knowledge to hold supportive attitudes about government involvement (OR = 2.38), those who were knowledgeable that secondhand smoke causes lung cancer in nonsmokers were almost two times as likely as those without such knowledge to hold supportive attitudes about government involvement (OR = 1.89), and those with knowledge of the SIDS link were ~30% more likely than those without knowledge of the SIDS link to support government involvement in where people can smoke (OR = 1.29). Never-smokers and former smokers were significantly more likely than current smokers to support government involvement (ORs = 1.66 and 1.29, respectively). Similar to support for restrictions on where people can smoke, exposure to tobacco-specific messages in the media, in any form, did not differentially predict support for government involvement in the issue.

Effect modification by smoking status

While never-smokers and former smokers were significantly more likely than current smokers to hold supportive attitudes toward all tobacco control measures under study (Table 3), we found no evidence that tobacco-specific media exposure is differentially attended to or perceived by smokers versus non-smokers in relation to forming attitudes toward tobacco control.

Table 3. Multivariable logistic regression models predicting odds of holding supportive attitudes toward tobacco control, by exposure to tobacco-specific media, knowledge of the negative effects of tobacco, and smoking status

	Response indicating supportive attitudes toward tobacco control		
	Tobacco companies should not be allowed to sell a harmful product (N = 2,256)	There are not enough restrictions on where people can smoke cigarettes (N = 2,252)	Government should be involved in where people can smoke cigarettes (N = 2,248)
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Exposure to neutral or antitobacco information ^{a,b} (ref. no exposure)			
News: Efforts to ban smoking in public places	0.85 (0.65–1.16)	0.81 (0.62–1.06)	0.93 (0.71–1.20)
News: Dangers to kids	1.17 (0.95–1.46)	1.08 (0.87–1.35)	1.13 (0.92–1.40)
Ads: Efforts to ban smoking in public places	1.40** (1.07–1.81)	1.15 (0.89–1.50)	1.02 (0.79–1.32)
Ads: Dangers to kids	1.41** (1.13–1.77)	1.01 (0.80–1.26)	1.06 (0.85–1.32)
Exposure to protobacco advertising ^{a,c} (ref. no exposure)			
Ads for cigarettes in newspaper	1.03 (0.84–1.29)	1.04 (0.85–1.29)	0.95 (0.77–1.17)
Ads for cigarettes in magazine	0.84 (0.68–1.04)	1.20 (0.98–1.48)	0.92 (0.76–1.13)
Ads for cigarettes on Internet	0.78 (0.58–1.04)	0.76 (0.57–1.02)	0.88 (0.67–1.18)
Knowledge (ref. disagree, neutral, or don't know)			
Smoking has been proven to cause lung cancer	1.06 (0.84–1.34)	1.59*** (1.26–2.01)	2.38*** (1.92–2.97)
Secondhand smoke causes lung cancer in nonsmokers	2.11*** (1.62–2.74)	2.66*** (1.97–3.59)	1.89*** (1.46–2.46)
Smoking around a baby increases its chance of dying from SIDS	1.66*** (1.37–2.01)	1.39*** (1.15–1.67)	1.34** (1.11–1.61)
Smoking status (ref. current smoker)			
Never-smoker	1.52** (1.20–1.93)	3.89*** (3.02–5.03)	1.66*** (1.32–2.09)
Former smoker	1.35* (1.02–1.78)	2.93*** (2.17–3.95)	1.29* (1.02–1.70)

Note. American Smoking and Health Survey 2 — 2003. ORs, and 95% CIs for fitted logistic regression models that describe respondent odds of holding supportive attitudes toward tobacco control, by exposure to tobacco-specific media messages, knowledge of the negative effects of tobacco, and smoking status, controlling for education, income, race/ethnicity, age, sex, and state-specific indicator variables. All estimates are weighted. OR = odds ratio. Bold values represent statistical significance at $p < .05$.

^aQuestions representing exposure to neutral, antitobacco, and protobacco advertising were asked only of respondents who reported at least some media exposure in the past 30 days (e.g., television, radio, newspaper, magazine, or Internet).

^bIn past 30 days, saw news coverage or advertising about efforts to ban smoking in public places, such as restaurants, bars and cocktail lounges, and about the dangers of children being around cigarette smoke.

^cIn past 30 days, saw advertising or promotions for cigarettes or other tobacco products in newspaper, magazine, or on the Internet.

* $p < .05$, ** $p < .01$, *** $p < .0001$.

Table 4. Multivariable logistic regression models showing no effect modification by smoking status on odds of holding supportive attitudes toward tobacco control, by exposure to tobacco-specific media

	Response indicating supportive attitudes toward tobacco control measures		
	Tobacco companies should not be allowed to sell a harmful product (N = 2,318)	There are not enough restrictions on where people can smoke cigarettes (N = 2,319)	Government should be involved in where people can smoke cigarettes (N = 2,312)
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Exposure to Neutral or Antitobacco Information × Smoking Status			
News: Efforts to Ban Smoking in Public Places × Never-Smoker	1.21 (0.63–2.34)	1.45 (0.70–3.01)	1.60 (0.83–3.08)
News: Efforts to Ban Smoking in Public Places × Former Smoker	0.95 (0.43–2.09)	1.46 (0.63–3.36)	1.53 (0.70–3.32)
News: Dangers to Kids × Never-Smoker	1.48 (0.89–2.46)	0.81 (0.45–1.45)	1.26 (0.76–2.09)
News: Dangers to Kids × Former Smoker	1.42 (0.75–2.69)	0.75 (0.37–1.51)	0.84 (0.44–1.59)
Ads: Efforts to Ban Smoking in Public Places × Never-Smoker	0.84 (0.43–1.63)	0.97 (0.45–2.10)	0.74 (0.37–1.44)
Ads: Efforts to Ban Smoking in Public Places × Former Smoker	0.69 (0.32–1.51)	0.86 (0.36–2.05)	0.96 (0.44–2.11)
Ads: Dangers to Kids × Never-Smoker	0.87 (0.51–1.48)	0.52 (0.28–1.01)	0.57 (0.33–1.02)
Ads: Dangers to Kids × Former Smoker	0.86 (0.44–1.65)	0.57 (0.27–1.21)	0.78 (0.47–1.30)
Exposure to Protobacco Advertising × Smoking Status			
Ads for Cigarettes in Newspaper × Never-Smoker	0.67 (0.40–1.13)	1.26 (0.71–2.24)	0.78 (0.47–1.30)
Ads for cigarettes in Newspaper × Former Smoker	0.82 (0.43–1.55)	0.85 (0.43–1.66)	0.62 (0.33–1.15)
Ads for Cigarettes in Magazine × Never-Smoker	1.65 (0.99–2.75)	0.59 (0.33–1.05)	0.75 (0.45–1.24)
Ads for Cigarettes in Magazine × Former Smoker	1.44 (0.78–2.66)	0.75 (0.39–1.45)	0.68 (0.37–1.25)
Ads for Cigarettes on Internet × Never-Smoker	0.90 (0.45–1.76)	0.96 (0.44–2.06)	1.11 (0.56–2.16)
Ads for Cigarettes on Internet × Former Smoker	0.97 (0.40–2.35)	1.60 (0.61–4.14)	1.46 (0.60–3.55)

Note. American Smoking and Health Survey 2—2003. ORs and 95% CIs for fitted logistic regression models that include interaction terms for tobacco-specific media exposure and smoking status (never-smokers and former smokers compared with current smokers). All models control for the main effects of all media exposure and smoking status variables, education, income, race/ethnicity, age, sex, knowledge of the negative effects of tobacco, and state-specific indicator variables. All estimates are weighted. OR = odds ratio.

That is, the impact of tobacco-specific media exposure on policy attitudes did not differ for never-smokers and former smokers compared with current smokers (see Table 4).

Discussion

Our study examined the association of smoking status, knowledge of the negative effects of tobacco, and tobacco-specific media exposure (exposure to antitobacco messages, news coverage of tobacco issues, and protobacco advertising) on U.S. adults' attitudes toward tobacco control measures regarding limits on tobacco company sales and exposure to secondhand smoke and assessed whether the impact of tobacco-specific media exposure on policy attitudes may be differential for never-smokers and former smokers compared with current smokers.

While some research has linked health information exposure to accurate knowledge of cancer risks and cancer screening behaviors (Shim, Kelly, & Hornik, 2006; Stryker, Moriarty, & Jensen, 2008; Viswanath et al., 2006) and other research suggests that accurate knowledge has been a central component of effective health promotion in several areas (Evans et al., 2006; Finney Rutten, Meissner, Breen, Vernon, & Rimer, 2005; Glantz & Jamieson, 2000; Weinstein, Slovic, Waters, &

Gibson, 2004), there has been little evidence thus far to show an association between knowledge, media exposure, and attitudes toward tobacco control, with a few exceptions (Clegg Smith et al., 2008; Quick et al., 2009). The current study has addressed this gap using data from a nationally representative sample of adults. Our findings contribute a few key insights.

First, we found knowledge of the negative effects of tobacco to be predictive of supportive attitudes toward tobacco control. Specifically, knowledge pertaining to the links between secondhand smoke and both lung cancer in nonsmokers and SIDS is associated with holding supportive attitudes toward tobacco control measures that suggest limits on tobacco companies' ability to sell a harmful product and on indoor air restrictions. Similarly, knowledge that smoking causes lung cancer in smokers is associated with holding supportive attitudes about indoor air restrictions. While the dangers of smoking and secondhand smoke have been widely publicized, the literature suggests that knowledge of the risks associated with tobacco use is not evenly distributed (Ayanian & Cleary, 1999; Finney Rutten, Auguston, Moser, Beckjord, & Hesse, 2008). Of note, only 49% of respondents to our survey were knowledgeable of the secondhand smoke/SIDS link, while 74% were knowledgeable that secondhand smoke causes lung cancer in nonsmokers, and 81% were knowledgeable

that smoking has been proven to cause lung cancer. While the latter represent a majority, it is clear that a substantial part of the population still lacks knowledge about the dangers of tobacco.

Second, our results suggest that tobacco-specific media exposure plays a role in shaping attitudes toward tobacco control only in some cases; antitobacco advertising/counter-marketing about efforts to ban smoking in public places and about the dangers of children being around cigarette smoke is associated with holding positive opinions toward limits on tobacco companies' ability to sell a harmful product. However, antitobacco advertising, news coverage of tobacco issues, and exposure to protobacco advertising by the industry were not found to affect policy-related attitudes differentially for those exposed versus those unexposed. (It is conceivable that tobacco-specific media exposure, in any form, may lead to knowledge, which is associated with attitudes toward tobacco control. In ASHES-2, media exposure and knowledge were significantly correlated in many cases, with some media exposure and knowledge variables having correlations of $r = .25$. These associations could be explored further in future research.) Specific to our finding that exposure to counter-marketing was found to influence adult support for limits on the tobacco industry's ability to sell a harmful product, but news coverage of tobacco issues had no effect in this area, we offer a few potential explanations. It is plausible that because antitobacco advertising/counter-marketing tends to be explicit with its messaging and is strategically placed in targeted communication vehicles, exposure to these types of ads is repeated, resonates, and results in greater attention to the message, subsequently leading to support for banning tobacco product sales. Conversely, news coverage of tobacco issues can be less explicit in using antitobacco frames and is more happenstance in its placement, depending on the daily news cycle and other competing stories. Therefore, exposure may be incidental and occasional, thus resulting in less attention to the information and ultimately less impact on opinions toward the industry's ability to sell a harmful product.

Third, we found that smoking status is a major predictor of attitudes toward tobacco control, which is consistent with previous research (Ashley et al., 1995; Clegg Smith et al., 2008; Hamilton et al., 2005; Poland et al., 2000). Across all outcomes under study, never-smokers and former smokers were significantly more likely than current smokers to hold supportive attitudes toward tobacco control. However, our findings also indicate that never-, former, and current smokers' attitudes are not differentially affected by exposure tobacco-specific messages in the media; we found no evidence that tobacco-specific media exposure is differentially attended to or perceived by smokers versus nonsmokers in relation to forming attitudes toward tobacco control.

Understanding the factors that shape adult attitudes toward tobacco policy is essential for public health advocates as political will is a necessary component of effective public health policy implementation (Richmond & Kotelchuck, 1991), and public opinion influences political will (Asher, 2004; Kingdon, 1995). Despite almost 40 years of efforts to ban smoking in public places (Swartz, 1971) and the Surgeon General's declaration that "there is no safe level of exposure to secondhand smoke . . . ever" (Centers for Disease Control

and Prevention, 2006), at the time this article went to press, only 24 states had implemented comprehensive smoking bans, though efforts are ongoing in many states. Other types of tobacco policy continue to be introduced at city, county, state, and federal levels, including FDA regulation of tobacco (Brandt, 2008). Our study has elucidated readily *modifiable* factors that shape adult attitudes toward tobacco control. Knowledge of the negative effects of tobacco, exposure to tobacco-specific messages in the media, and smoking status are three such modifiable factors that contribute to attitude formation. Interventions aimed at influencing these factors can help to sway public support for more and continued regulation of tobacco.

Results from this study should be considered in light of a few limitations. First, the outcome variables under study provide us with a glimpse of people's attitudes toward tobacco control measures in the areas of limiting sales and regulating secondhand smoke exposure, but given their broad wording, they are not ideal items to assess precisely people's attitudes toward outlawing cigarettes and/or nicotine or toward banning smoking in all public places. Surveys and polls that employ specific wording related to actual policies under consideration may provide a more precise assessment of public attitudes toward tobacco control. Moreover, there is a possibility that our models may slightly overestimate the role of media exposure and knowledge on the given policy attitudes because ASHES-2 does not contain items that measure other typical determinants of policy preferences, such as political ideology and party identification. While ideology variables would not confound the observed relationships, they may be stronger predictors of tobacco policy support and thereby provide more meaningful insights. ASHES-2 is a cross-sectional survey, which limits our ability to establish temporality; it is possible that respondents held their attitudes about tobacco control before they were or were not exposed to tobacco messages in the media or before they held knowledge of the negative effects of tobacco. Finally, our 27% response rate may be considered a limitation, though previous analyses revealed no differences between respondents and nonrespondents on key demographic and smoking status variables (Healton et al., 2007).

Funding

This study was made possible by the Harvard Education Program in Cancer Prevention and Control, grant 5R25CA057711-14 from the National Cancer Institute.

Declaration of Interests

None declared.

Acknowledgments

The authors would like to thank Howard K. Koh, M.D., M.P.H., for his generosity of time and advice throughout the research process.

Appendix Table 1. Full multivariable logistic regression models predicting odds of holding supportive attitudes toward tobacco control, by exposure to tobacco-specific media, knowledge of the negative effects of tobacco, smoking status, and sociodemographics. American Smoking and Health Survey 2–2003. All estimates control for respondent state of residence. All estimates are weighted

	Response indicating supportive attitudes toward tobacco control		
	Tobacco companies should not be allowed to sell a harmful product (N = 2,256)	There are not enough restrictions on where people can smoke cigarettes (N = 2,252)	Government should be involved in where people can smoke cigarettes (N = 2,248)
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Exposure to neutral or antitobacco information ^{a,b} (ref. no exposure)			
News: Efforts to ban smoking in public places	0.85 (0.65–1.16)	0.81 (0.62–1.06)	0.93 (0.71–1.20)
News: Dangers to kids	1.17 (0.95–1.46)	1.08 (0.87–1.35)	1.13 (0.92–1.40)
Ads: Efforts to ban smoking in public places	1.40** (1.07–1.81)	1.15 (0.89–1.50)	1.02 (0.79–1.32)
Ads: Dangers to kids	1.41** (1.13–1.77)	1.01 (0.80–1.26)	1.06 (0.85–1.32)
Exposure to Protobacco advertising ^{a,c} (ref. no exposure)			
Ads for cigarettes in newspaper	1.03 (0.84–1.29)	1.04 (0.85–1.29)	0.95 (0.77–1.17)
Ads for cigarettes in magazine	0.84 (0.68–1.04)	1.20 (0.98–1.48)	0.92 (0.76–1.13)
Ads for cigarettes on Internet	0.78 (0.58–1.04)	0.76 (0.57–1.02)	0.88 (0.67–1.18)
Knowledge (ref. disagree, neutral, or don't know)			
Smoking has been proven to cause lung cancer	1.06 (0.84–1.34)	1.59*** (1.26–2.01)	2.38*** (1.92–2.97)
Secondhand smoke causes lung cancer in nonsmokers	2.11*** (1.62–2.74)	2.66*** (1.97–3.59)	1.89*** (1.46–2.46)
Smoking around a baby increases its chance of dying from SIDS	1.66*** (1.37–2.01)	1.39*** (1.15–1.67)	1.34** (1.11–1.61)
Smoking status (ref. current smoker)			
Never-smoker	1.52** (1.20–1.93)	3.89*** (3.02–5.03)	1.66*** (1.32–2.09)
Former smoker	1.35* (1.02–1.78)	2.93*** (2.17–3.95)	1.29* (1.02–1.70)
Sociodemographics			
Age ≤ 65 years (ref. > 65)	0.76 (0.53–1.07)	1.10 (0.80–1.51)	0.97 (0.71–1.34)
Female (ref. male)	1.28** (1.05–1.56)	1.13 (0.93–1.37)	1.11 (0.92–1.35)
High school degree + (ref. no high school degree)	0.80 (0.60–1.08)	1.20 (0.90–1.59)	1.18 (0.90–1.54)
College degree (ref. no high school degree)	0.65 (0.46–1.09)	1.51 (0.98–2.10)	1.64** (1.18–2.25)
Income \$30,000+ (ref. < \$30,000)	0.77* (0.63–0.95)	1.27 (0.98–1.55)	0.99 (0.81–1.21)
Black race (ref. White)	1.78*** (1.39–2.28)	1.08 (0.85–1.38)	0.98 (0.77–1.24)
Other race (ref. White)	1.49** (1.17–1.90)	0.78 (0.62–0.98)	0.93 (0.74–1.17)

Note. OR = odds ratio. Bold values represent statistical significance at $p < .05$.

^aQuestions representing exposure to neutral, antitobacco, and protobacco advertising were asked only of respondents who reported at least some media exposure in the past 30 days (e.g., television, radio, newspaper, magazine, or Internet).

^bIn past 30 days, saw news coverage or advertising about efforts to ban smoking in public places, such as restaurants, bars and cocktail lounges, and about the dangers of children being around cigarette smoke

^cIn past 30 days, saw advertising or promotions for cigarettes or other tobacco products in newspaper, magazine, or on the Internet.

* $p < .05$, ** $p < .01$, *** $p < .0001$.

References

- Arnott, D., Dockrell, M., Sandford, A., & Willmore, I. (2007). Comprehensive smoke-free legislation in England: How advocacy won the day. *Tobacco Control*, 16, 423–428.
- Asher, H. (2004). *Polling and the public: What every citizen should know* (6th ed). Washington, DC: CQ Press.
- Ashley, M. J., Bull, S. B., & Pederson, L. L. (1995). Support among smokers and nonsmokers for restrictions on smoking. *American Journal of Preventive Medicine*, 11, 283–287.
- Ayanian, J. Z., & Cleary, P. D. (1999). Perceived risks of heart disease and cancer among cigarette smokers. *Journal of the American Medical Association*, 281, 1019–1021.
- Blendon, R. J., & Young, J. T. (1998). The public and the comprehensive tobacco bill. *Journal of the American Medical Association*, 280, 1279–1284.
- Brandt, A. M. (2008). FDA regulation of tobacco—Pitfalls and possibilities. *New England Journal of Medicine*, 359, 445–448.
- Centers for Disease Control and Prevention. (2005). Annual smoking-attributable mortality, years of potential life lost, and productivity losses—United States, 1997–2001. *MMWR Morbidity and Mortality Weekly Report*, 54, 625–628.
- Centers for Disease Control and Prevention. (2006). *The health consequences of involuntary exposure to tobacco smoke: A report of the surgeon general*. Atlanta, GA: U.S. Department of Health and Human Services.
- Clegg Smith, K., Siebel, C., Pham, L., Cho, J., Friedman Singer, R., Chaloupka, F. J. et al. (2008). News on tobacco and public attitudes toward smokefree air policies in the United States. *Health Policy*, 86, 42–52.
- Doucet, J. M., Velicer, W. F., & Laforge, R. G. (2007). Demographic differences in support for smoking policy interventions. *Addictive Behavior*, 32, 148–157.
- Evans, W. D., Crankshaw, E., Nimsch, C., Morgan-Lopez, A., Farrelly, M. C., & Allen, J. (2006). Media and secondhand smoke exposure: Results from a national survey. *American Journal of Health Behavior*, 30(1), 62–71.
- Finney Rutten, L. J., Auguston, E. M., Moser, R. P., Beckjord, E. B., & Hesse, B. W. (2008). Smoking knowledge and behavior in the United States: Sociodemographic, smoking status, and geographic patterns. *Nicotine & Tobacco Research*, 10, 1559–1570.
- Finney Rutten, L. J., Meissner, H. I., Breen, N., Vernon, S. W., & Rimer, B. K. (2005). Factors associated with men's use of prostate-specific antigen screening: Evidence from the Health Information National Trends Survey. *Preventive Medicine*, 40, 461–468.
- Glantz, S. A., & Jamieson, P. (2000). Attitudes toward secondhand smoke, smoking, and quitting among young people. *Pediatrics*, 106, 82–84.
- Gorovitz, E., Mosher, J., & Oertschuk, M. (1998). Preemption or prevention? Lessons from efforts to control firearms, alcohol, and tobacco. *Journal of Public Health Policy*, 19(1), 36–50.
- Hamilton, W. L., Biener, L., & Rodger, C. N. (2005). Who supports tobacco excise taxes? Factors associated with towns' and individuals' support in Massachusetts. *Journal of Public Health Management and Practice*, 11, 333–340.
- Hammond, D., Fong, G. T., Zanna, M. P., Thrasher, J. F., & Borland, R. (2006). Tobacco denormalization and industry beliefs among smokers from four countries. *American Journal of Preventive Medicine*, 31, 225–232.
- Healton, C. G., Gritz, E. R., Davis, K. C., Homsy, G., McCausland, K., Haviland, M. L. et al. (2007). Women's knowledge of the leading causes of cancer death. *Nicotine & Tobacco Research*, 9, 761–768.
- Kingdon, J. W. (1995). *Agendas, alternatives, and public policies* (2nd ed.). Glenview, IL: Addison-Wesley Educational Publishers Inc.
- National Cancer Institute. (1999). *Smoking and tobacco control monograph 10: Health effects of exposure to environmental tobacco smoke*. Bethesda, MD: Department of Health and Human Services, National Institute of Health.
- National Cancer Institute. (2008). *Smoking and tobacco control monograph 19: The role of the media in promoting and reducing tobacco use*. (NIH Publication No 07-6242 ed.). Bethesda, MD: Department of Health and Human Services, National Institutes of Health.
- Poland, B. D., Cohen, J. E., Ashley, M. J., Adlaf, E., Ferrence, R., Pederson, L. L. et al. (2000). Heterogeneity among smokers and non-smokers in attitudes and behaviour regarding smoking and smoking restrictions. *Tobacco Control*, 9, 364–371.
- President's Cancer Panel, N. (2007). *Promoting healthy lifestyles: Policy, program, and personal recommendations for reducing cancer risk*. Retrieved January 2009, from <http://deainfo.nci.nih.gov/advisory/pcp/pcp07rpt/pcp07rpt.pdf>
- Quick, B. L., Bates, B. R., & Romina, S. (2009). Examining antecedents of clean indoor air policy support: Implications for campaigns promoting clean indoor air. *Health Communication*, 24, 50–59.
- Richmond, J. B., & Kotelchuck, M. (1991). Co-ordination and development of strategies and policy: The United States example. In W. W. Holland, R. Detels & G. Knox (Eds.), *Oxford textbook of public health* (Vol. 2, pp. 441–454). Oxford, England: Oxford University Press.
- Rose, G. (1985). Sick individuals and sick populations. *International Journal of Epidemiology*, 14, 32–38.
- Shim, M., Kelly, B., & Hornik, R. (2006). Cancer information scanning and seeking behavior is associated with knowledge, lifestyle choices, and screening. *Journal of Health Communication*, 11(Suppl. 1), 157–172.
- Stryker, J. E., Moriarty, C. M., & Jensen, J. D. (2008). Effects of newspaper coverage on public knowledge about modifiable cancer risks. *Health Communication*, 23, 380–390.

Role of tobacco-specific media

- Swartz, H. (1971). Tobacco smoke: A noxious air pollutant. *Review of Allergy*, 25, 490–505.
- Viswanath, K., Breen, N., Meissner, H., Moser, R. P., Hesse, B., Steele, W. R. et al. (2006). Cancer knowledge and disparities in the information age. *Journal of Health Communication*, 11(Suppl. 1), 1–17.
- Weinstein, N., Slovic, P., Waters, E., & Gibson, G. (2004). Public understanding of the illnesses caused by cigarette smoking. *Nicotine & Tobacco Research*, 6, 349–355.