Smoking-Cessation Media Campaigns and Their Effectiveness Among Socioeconomically Advantaged and Disadvantaged Populations

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Large antitobacco media campaigns, combined with other tobacco-control activities, have been associated with decreased smoking prevalence and reduced cigarette consumption.[1,2] However, populations with higher socioeconomic status (SES) may benefit from media campaigns more than populations with lower SES, leading to increased disparities over time.[3–6]

Smoking-cessation media campaigns have led to increased quit rates in several countries[7–9] and several states within the United States.[10–12] One third of former smokers cite campaign ads as factors in helping them quit.[13,14] A variety of message strategies have been used by smoking-cessation media campaigns.[14–16] Ads with evocative testimonials about the health effects of smoking have been cited by former smokers as influential in their efforts to quit.[17] Ads emphasizing that quitting is difficult but that smokers should keep trying to quit (KTQ) have been associated with increases in telephone quit line call volume[18,19] and higher quit rates.[20] California's tobacco-control program produced declines in cigarette consumption in part by using ads to convince smokers that secondhand smoke (SHS) harms others.[11,15] No published studies have assessed the relative effectiveness of the various approaches between low- and high-SES populations.

Low-SES populations are a critical target for smoking-cessation campaigns. There are large disparities in smoking rates by SES in the United States.[21] Disparities in smoking by SES have increased dramatically since 1966,[6,22] concurrent with the first surgeon general's reports on the health consequences of smoking[23,24] and the first national antismoking media campaign.[25] Smoking rates are higher among lower-SES than among higher-SES populations in part because they are less likely to quit successfully.[26,27]

Objectives. We examined whether the impact of televised smoking cessation ads differed by a population's education and income.

Methods. We used longitudinal data from the Wisconsin Behavioral Health Survey, a statewide sample of 452 adult smokers who were interviewed in 2003 to 2004 and followed up 1 year later. Logistic regression was used to assess whether baseline recall of secondhand smoke ads and "keep trying to quit" ads was associated with quit attempts and smoking abstinence at 1 year. Interaction terms were used to assess whether these associations differed by the smokers' education and income levels.

Results. Overall, neither keep-trying-to-quit nor secondhand smoke ad recall was associated with quit attempts or smoking abstinence. Keep-trying-to-quit ads were significantly more effective in promoting quit attempts among higher- versus lower-educated populations. No differences were observed for secondhand smoke ads by the smokers' education or income levels.

Conclusions. Some media campaign messages appear less effective in promoting quit attempts among less-educated populations compared with those who have more education. There is a need to develop media campaigns that are more effective with less-educated smokers. (*Am J Public Health.* 2008;98:916–924. doi:10.2105/AJPH.2007.117499)

Combined, these findings suggest that cessation media campaigns may have greater impact among higher-SES versus lower-SES populations.[3–6] Zhu et al. and others have found lower-SES populations to be less likely than higher-SES populations to call telephone quit lines in the context of cessation media campaigns.[28] At the same time, Macaskill et al. and Siahpush et al. have found few differences in media campaign effects by SES[29,30] or a greater volume of calls to telephone quit lines from low-SES populations during media campaign activities.[31,32] Most published evaluations have not included examinations of cessation campaign effects by SES.

A relative ineffectiveness of media campaigns among low-SES populations could be caused by several factors, including differences in (1) exposure and attention to campaign messages, (2) motivational impact of campaign messages, and (3) capacity to make sustained behavioral changes in response to media messages.[5] This framework suggests that lower-SES populations may be less likely

than higher-SES populations to recall messages, attempt to quit, or quit successfully in response to a smoking-cessation media campaign. Cessation campaigns could increase SES disparities in smoking if any of these 3 scenarios occurred.

The Wisconsin Tobacco Prevention and Control Program broadcast televised smoking-cessation media campaign messages between May 2002 and December 2003 to increase the volume of calls to the Wisconsin Tobacco Quit Line, raise awareness of the effects of SHS, and promote quit attempts among Wisconsin smokers. The campaign used 2 message approaches: KTQ and SHS ads.

A series of televised KTQ ads were broadcast between November 2002 and June 2003. These ads emphasized that quitting is difficult but that practice and assistance from the telephone quit line makes quitting easier. The KTQ ads aired most weeks at 40 to 60 gross ratings points per week between November 2002 and June 2003. Forty gross ratings points represent an average of 0.40

exposures per Wisconsin television viewer in a given week. A subset of KTQ ads was targeted to lower-SES and specific racial/ethnic populations by placing these ads in programs with high proportions of low-SES and minority viewers. After 3 hiatus months, KTQ ads were broadcast in October to December 2003 through donated air time.

The campaign also aired a series of televised SHS ads to raise awareness of the health consequences of SHS exposure and, as a secondary goal, to promote quit attempts. Most SHS ads featured short vignettes from individuals affected by SHS. The SHS ads aired at 100 or 150 weekly gross ratings points most weeks between May 2002 and October 2003. A few SHS ads included the quit line number but the majority did not. A subset of SHS ads were targeted to lower-SES and racial/ethnic minority populations.

The Wisconsin Tobacco Prevention and Control Program's use of 2 smoking cessation message approaches (KTQ and SHS ads), combined with longitudinal data from a sample of Wisconsin smokers, allowed us to assess whether these approaches had different impacts on low- and high-SES populations. We did not expect differences in KTQ and SHS ad recall between high- and low-SES populations because the campaign targeted a subset of ads to lower-SES smokers. As a result, any SES differences in recall that might have been expected in the absence of targeting should have been offset by the increased likelihood of exposure to the targeted ad placements by low-SES smokers. Nevertheless, KTQ ads could be less effective for lower- versus higher-SES populations. Lower-SES populations may reject messages promoting quit attempts because they face greater difficulty in quitting.[26,27] SHS ads may not produce differences in quitting by SES because quit attempts are often a secondary goal of these messages. We tested for SES differences in KTQ and SHS ad impact on quit attempts (hypothesis 1) and smoking abstinence (hypothesis 2).

METHODS

We analyzed data from a longitudinal sample of adult smokers who participated in both the 2003 Wisconsin Tobacco Survey (baseline) and the 2004 Wisconsin Behavioral Health Survey (follow-up). The baseline telephone survey was carried out with random-digit dialing to select a representative sample of Wisconsin adults between June 2003 and February 2004 (Council of the American Survey Response Association response rate=51%). The baseline sample included 8111 respondents. Of the 8048 respondents who reported their smoking status, 1544 (19.2%) were classified as smokers (i.e., had smoked at least 100 cigarettes in their lifetime and currently smoked some days or every day).

Data collection for the follow-up survey occurred between August 2004 and March 2005. All baseline smokers were eligible for follow-up but only 1053 agreed to be recontacted. Both surveys were completed by 452 smokers (enrollment rate=29%). Among baseline smokers, follow-up respondents were more likely than were nonrespondents to be older, women, non-Hispanic White, have greater years of education, have higher levels of nicotine dependence, have a greater number of previous quit attempts, and have been advised by a doctor to quit smoking.

Ad Recall

The baseline survey measured recall of the 2 primary Wisconsin media campaign messages that aired in late 2002 and 2003. Baseline respondents were first asked, "Have you seen an antismoking advertisement that showed several different people talking about quitting smoking and how smokers should keep trying?" Respondents who said "yes" were then asked, "What do you think was the primary message of the advertisement?" followed by a series of response categories designed to distinguish between KTQ and SHS ads. Because a few ads had similar formats, we sought to eliminate people that answered "yes" but were referring to SHS ads. We thus considered a respondent to have KTQ ad recall (38% of respondents) if he or she (1) recalled seeing the ad and (2) chose a response category other than "secondhand smoke is harmful" or "people have a right to breathe clean air" as the ad's primary message.

Respondents were then asked, "Have you seen an antismoking advertisement that showed various people talking about the dangers of secondhand smoke?" Respondents who answered "yes" (68%) were considered to have SHS ad recall. We did not require respondents to identify SHS as the ad's primary message because SHS was mentioned in the previous question.

Quit Attempts and Smoking Abstinence at 1-Year Follow-Up

Wisconsin Behavioral Health Survey respondents were asked, "During the past 12 months, have you stopped smoking for 1 day or longer because you were trying to quit smoking?" Respondents who said "yes" (42%) were classified as having made a quit attempt. Wisconsin Behavioral Health Survey respondents were also asked, "Do you now smoke cigarettes every day, some days, or not at all?" Those who said "not at all" and reported a quit attempt in the past 12 months were considered abstinent at follow-up (13%).

Years of Education and Household Income

Education and household income were used as indicators of SES.[21] Baseline respondents were asked, "What is the highest level of school you completed?" We classified respondents into 3 education categories: high school diploma or less (47%), some college (33%), and a college degree (20%). Respondents were also asked, "Is your annual household income from all sources . . ." followed by a set of closed-ended response categories (less than $25 000, less than $35 000, etc.). We classified respondents into 4 income categories: not reported (4%), less than $25 000 (31%), from $25 000 to less than $50 000 (36%), and $50 000 or greater (29%).

Potential Confounding Variables

We measured several control variables likely to be associated with smoking cessation or ad recall. These variables included demographic characteristics (age, gender, race/ethnicity, marital status, presence of children in the household), predictors of cessation (Fagerström Test of Nicotine Dependence,[33] intentions to quit, number of prior quit attempts, past year doctor's advice to quit, household rules against smoking), and media use (average daily television and radio use).

Analytic Approach

We began by examining variable distributions stratified by education and income and

used the *t* test and χ^2 test to assess any differences between low- and high-SES groups. Next, we conducted a series of analyses to ensure that ad recall measures distinguished between KTQ and SHS ads and differentiated these messages from national campaigns (e.g., the Truth campaign, which focused on tobacco industry practices). We examined cross-sectional associations between ad recall and (1) telephone quit line awareness, (2) beliefs about SHS health effects, and (3) beliefs about tobacco industry practices within 2 separate samples: follow-up respondents (the analytic sample; n=452) and nonrespondents (the validation sample; n=1102). We expected KTQ ads but not SHS ads to be associated with quit line awareness, because each KTQ ad (but not each SHS ad) mentioned the quit line. We expected SHS ads but not KTQ ads to be associated with beliefs about the dangers of SHS. We expected neither KTQ nor SHS ads to be associated with beliefs about tobacco industry practices. We assessed the associations overall and separately among both high- and low-SES respondents to ensure consistent validity by SES.

Multivariate logistic regression was used to assess whether the relationship between ad recall and subsequent-year quit attempts differed by education and income. We began by testing for "main effects" of KTQ and SHS ad recall, controlling for potential confounders. Variables that were associated with follow-up quit attempts in bivariate models (*P*<.25) were retained as potential confounders in multivariate models.[34] Next, we added interaction terms involving ad recall and both education and income to assess whether the relationship between ad recall and quit attempts differed by SES. For interaction terms that were statistically significant, we used procedures developed by Allison[35] to test for bias resulting from differences in unobserved heterogeneity between groups. In addition, because some KTQ and SHS ads were targeted to both low-SES and minority populations, significant interactions between ad recall and SES could be confounded by racial/ethnic differences. To test for this explanation, we tested a third model that included interaction terms for (1) ad recall with SES and (2) ad recall with race/ethnicity. As support for hypothesis 1, we expected to observe positive

and statistically significant interaction terms between both types of ad recall and both indicators of SES. We expected these terms to remain significant and of similar magnitude when accounting for unobserved heterogeneity and interactions between ad recall and race/ethnicity.

We used these same procedures to assess whether the relationship between ad recall and smoking abstinence at follow-up differed by education and income. As support for hypothesis 2, we expected to observe positive, statistically significant interactions involving ad recall and both SES indicators.

RESULTS

Sample Demographics

Sample demographic characteristics are presented in Table 1. We observed statistically significant associations between education and race/ethnicity, household income, nicotine dependence, average daily media use, and smoking abstinence at 1 year. We found statistically significant associations between income and marital status, education, home smoking rules, and average daily media use.

Measurement Validity for Ad Recall

Both KTQ and SHS ad recall measures appeared reasonably valid (Table 2). Recall of KTQ ads was positively associated with telephone quit line awareness in both samples but was not associated with SHS beliefs in either sample. These results were consistent across education and income groups. Recall of SHS ads was not associated with quit line awareness in either sample, with the exception of less-educated respondents in the validation sample. Overall, SHS recall was positively associated with both SHS beliefs in the analytic sample and 1 of 2 SHS beliefs in the validation sample. These results were largely consistent by education and income, although stronger among less-educated and lower-income respondents in the analytic sample. Recall of KTQ ads was not associated with tobacco industry beliefs in either sample. Recall of SHS ads was not associated with either industry belief in the analytic sample, but was associated with 1 of 2 beliefs in the validation sample.

Differences in Quit Attempts by Education and Income

Hypothesis 1 received partial support. Neither KTQ nor SHS ad recall was associated with making at least 1 quit attempt in the subsequent year (Table 3, model 1). The interaction between KTQ ad recall and education was positive and statistically significant, but the interaction between KTQ ad recall and income was not significant (model 2). Tests for unobserved heterogeneity bias did not change the strength or significance of the coefficient, and the interaction was robust to the inclusion of a KTQ ad recall and race/ethnicity interaction term (model 3). The interactions involving SHS ad recall and both education and income were not statistically significant (model 4). Neither tests for unobserved heterogeneity bias nor inclusion of an interaction with race/ethnicity changed the sign or significance of these coefficients (model 5).

Figure 1 uses logistic regression model estimates to show the predicted probability of making a quit attempt by KTQ ad recall and education. The figure shows a positive relationship between KTQ ad recall and subsequent-year quit attempts among respondents with a college degree, but a negative relationship between KTQ ad recall and quit attempts among respondents with a high school diploma or less.

Differences in Smoking Abstinence by Education and Income

Hypothesis 2 was not supported. Neither KTQ nor SHS ad recall was associated with smoking abstinence at 1 year (Table 3, model 1). The interactions between KTQ ad recall and both SES indicators were not statistically significant (models 2 and 3). The interactions between SHS ad recall and both SES indicators were not statistically significant (models 4 and 5).

DISCUSSION

We evaluated the notion that some types of smoking-cessation media messages may have greater impact among higher-SES populations than among lower-SES populations. Consistent with hypothesis 1, KTQ ad recall was more strongly associated with subsequent quit

TABLE 1—Characteristics of Adult Smokers, by Education and Income: Wisconsin Tobacco Survey, 2003, and Wisconsin Behavioral Health Survey, 2004

	Overall, % or Mean (SD)	Less than High School Diploma, % or Mean (SD)	At Least Some College, % or Mean (SD)	Income < $50 000, % or Mean (SD)	Income ≥ $50 000, % or Mean (SD)
Total, no.	452	213	236	301	132
Ad recall					
Keep-trying-to-quit ads	38	39	37	40	33
Secondhand smoke ads	68	68	67	68	70
Demographic characteristics					
Age, y	44.8 (13.1)	44.5 (14.6)	44.1 (11.7)	44.9 (13.8)	44.3 (10.5)
Women	60	58	63	58	65
Non-Hispanic White	87	85[a]	90	86	89
Married or living as married	53	54	52	42[b]	77
At least 1 child living in household	45	46	43	42	50
Education					
High school degree or less	47	…	…	55[b]	31
Some college education	33	…	…	32	32
College degree	20	…	…	13[b]	37
Household income, $					
Not reported	4	4	4	…	…
< 25 000	31	35	27	…	…
25 000–49 999	36	42[a]	31	…	…
≥ 50 000	29	19[a]	39	…	…
Predictors of cessation					
Fagerström test score[c]	3.17 (2.45)	3.43[a] (2.38)	2.97 (2.49)	3.29 (2.44)	2.91 (2.48)
Intend to quit smoking in < 6 mo but > 30 d	37	36	39	37	38
Intend to quit smoking in ≤ 30 d	24	26	21	26	20
No. of previous quit attempts[d]	4.26 (3.59)	4.21 (3.56)	4.28 (3.64)	4.32 (3.66)	4.21 (3.40)
Doctor advised to quit in past year	57	56	59	57	58
Smoking prohibited in all areas of home	29	31	28	26[b]	37
Made at least 1 quit attempt in subsequent year (measured at follow-up)	42	40	42	43	37
Smoking abstinence at 1 year (measured at follow-up)	12	8[a]	16	10	15
Average daily media use[e]	3.35 (2.35)	3.73[a] (2.39)	2.96 (2.18)	3.57[b] (2.44)	2.82 (1.95)

Notes. Values reflect baseline responses unless otherwise noted.
[a]Statistically significant difference in mean (*t* test) or proportion (χ^2 test) between high- and low-education groups at *P* < .05.
[b]Statistically significant difference in mean (*t* test) or proportion (χ^2 test) between high- and low-income groups at *P* < .05.
[c]Test of nicotine dependence; range = 0–10.
[d]Range = 0–10.
[e]Hours watching television or listening to the radio; range = 0–16.

attempts among more-highly educated populations compared with less-educated populations. This pattern of results was not observed for SHS ad recall or with income. Contrary to hypothesis 2, we did not find differences in the association between KTQ or SHS ad recall and 1-year smoking abstinence by SES.

Tests of hypothesis 1 provided evidence of differential effects for KTQ ad recall on subsequent quit attempts. Results suggested that

KTQ ads were more effective in promoting quit attempts among higher-educated populations compared with lower-educated ones. Previous studies have found that KTQ ads were effective strategies for increasing the overall volume of calls to a state or national telephone quit line[18,19] and may increase population quit rates.[20] Campaigns may make decisions about message strategies based on observations of how various ads influence quit

line call volume.[36] However, a very small proportion of smokers use telephone quit lines to help them quit,[14,20] so many decisions about smoking-cessation media campaigns are made on the basis of a very small subset of smokers. Quit line call volume data may provide timely feedback, but those who make decisions about campaign strategy should consider the potential for widened SES disparities among those who do not call quit lines.

TABLE 2—Logistic Regression Models Examining Variables Associated With Targeted Knowledge Among Adult Smokers, by Education Level: Wisconsin Tobacco Survey, 2003

	Analytic Sample					Validation Sample				
	Overall, OR (95% CI)	Less Than High School Diploma, OR (95% CI)	At Least Some College, OR (95% CI)	Income <$50 000, OR (95% CI)	Income ≥$50 000, OR (95% CI)	Overall, OR (95% CI)	Less Than High School Diploma, OR (95% CI)	At Least Some College, OR (95% CI)	Income <$50 000, OR (95% CI)	Income ≥$50 000, OR (95% CI)
"Have you ever heard of the Wisconsin Quit Line?" (Yes)										
Recall KTQ ads	2.29***	2.37**	2.23**	2.09**	2.76*	1.55*	1.34	1.86**	1.59*	1.51
	(1.48, 3.52)	(1.27, 4.44)	(1.21, 4.09)	(1.23, 3.56)	(1.27, 6.00)	(1.19, 2.01)	(0.94, 1.90)	(1.24, 2.80)	(1.15, 2.19)	(0.95, 2.39)
Recall SHS ads	1.20	0.88	1.60	1.23	1.26	1.29	1.55*	1.01	1.36	1.18
	(0.78, 1.86)	(0.47, 1.66)	(0.86, 2.97)	(0.71, 2.13)	(0.58, 2.74)	(0.99, 1.68)	(1.09, 2.23)	(0.68, 1.51)	(0.97, 1.91)	(0.76, 1.84)
"Breathing smoke from someone else's cigarette is harmful." (Agree)										
Recall KTQ ads	0.67	0.56	0.77	0.62	0.96	1.11	0.87	1.56	1.05	1.26
	(0.35, 1.29)	(0.20, 1.55)	(0.32, 1.83)	(0.29, 1.33)	(0.26, 3.54)	(0.74, 1.65)	(0.52, 1.46)	(0.80, 3.03)	(0.65, 1.71)	(0.61, 2.60)
Recall SHS ads	2.11*	2.05	2.23	2.44*	1.32	1.88**	1.78*	2.01*	1.77*	2.16*
	(1.11, 3.99)	(0.75, 5.60)	(0.95, 5.24)	(1.14, 5.22)	(0.39, 4.53)	(1.29, 2.76)	(1.07, 2.94)	(1.12, 3.58)	(1.10, 2.84)	(1.13, 4.11)
"Secondhand smoke is not as dangerous as people make it out to be." (Disagree)										
Recall KTQ ads	1.13	1.00	1.31	1.14	0.85	0.96	1.14	0.76	0.91	1.07
	(0.69, 1.85)	(0.48, 2.08)	(0.67, 2.57)	(0.63, 2.04)	(0.51, 3.46)	(0.71, 1.31)	(0.76, 1.72)	(0.47, 1.23)	(0.62, 1.32)	(0.63, 1.83)
Recall SHS ads	1.63*	2.20*	1.23	2.07*	1.22	0.92	1.11	0.73	0.90	0.94
	(1.00, 2.65)	(1.08, 4.48)	(0.63, 2.43)	(1.15, 3.72)	(0.73, 2.04)	(0.68, 1.25)	(0.73, 1.68)	(0.46, 1.15)	(0.61, 1.33)	(0.56, 1.56)
"Tobacco companies lie to get someone hooked on smoking." (Agree)										
Recall KTQ ads	0.83	0.95	0.72	0.85	0.80	1.16	1.07	1.24	1.08	1.31
	(0.53, 1.31)	(0.48, 1.87)	(0.38, 1.34)	(0.48, 1.49)	(0.36, 1.75)	(0.88, 1.54)	(0.73, 1.56)	(0.80, 1.91)	(0.76, 1.54)	(0.81, 2.12)
Recall SHS ads	1.38	1.29	1.43	1.51	1.26	1.40*	1.27	1.55*	1.19	1.84*
	(0.87, 2.20)	(0.66, 2.55)	(0.74, 2.76)	(0.84, 2.69)	(0.57, 2.78)	(1.06, 1.85)	(0.87, 1.87)	(1.02, 2.36)	(0.83, 1.71)	(1.17, 2.89)
"Tobacco companies fool young people into believing smoking is OK." (Agree)										
Recall KTQ ads	1.14	1.27	1.00	1.16	1.22	1.00	0.92	1.14	0.95	1.13
	(0.74, 1.76)	(0.66, 2.44)	(0.55, 1.82)	(0.68, 1.97)	(0.56, 2.66)	(0.77, 1.31)	(0.64, 1.31)	(0.76, 1.72)	(0.68, 1.33)	(0.72, 1.79)
Recall SHS ads	1.33	1.07	1.65	1.19	1.48	1.18	0.99	1.45	0.93	1.71*
	(0.85, 2.08)	(0.55, 2.07)	(0.88, 3.07)	(0.69, 2.08)	(0.67, 3.23)	(0.90, 1.55)	(0.69, 1.43)	(0.97, 2.18)	(0.66, 1.32)	(1.10, 2.66)

Notes. OR = odds ratio; CI = confidence interval; KTQ = keep trying to quit; SHS = secondhand smoke. Variables that were associated with KTQ or SHS ad recall were included as covariates, including age, non-Hispanic White race/ethnicity, marital status, doctor advice to quit, and average daily television viewing.
*P < .05; **P < .01; ***P < .001.

The fact that no differences in SHS ad recall effects on subsequent quit attempts were observed by education suggests that SHS messages may have a lower risk of widening SES disparities in smoking. At the same time, we found no evidence that SHS messages increased quit attempts for any population.

One interpretation of these data is that less-educated individuals may be quite resistant to any sort of cessation messages. Therefore, if a message is to be effective at all, it may tend to be more effective among the more educated. Nevertheless, SHS ads may generate support for clean indoor air laws,[15] which are associated

with reductions in cigarette consumption and increased quit attempts.[37] Further research should assess whether a similar pattern of results is observed in the context of other campaigns or smoking populations.

Educational differences in KTQ ad effects on quit attempts raised questions about the

TABLE 3—Logistic Regression Models Examining Variables Associated With Quit Attempts and 1-Year Abstinence Among 407 Adult Smokers: Wisconsin Tobacco Survey, 2003, and Wisconsin Behavioral Health Survey, 2004

	Models Predicting Quit Attempts					Models Predicting 1-Year Abstinence				
	Model 1, OR (95% CI)	Model 2, OR (95% CI)	Model 3, OR (95% CI)	Model 4, OR (95% CI)	Model 5, OR (95% CI)	Model 1, OR (95% CI)	Model 2, OR (95% CI)	Model 3, OR (95% CI)	Model 4, OR (95% CI)	Model 5, OR (95% CI)
Ad recall										
KTQ Ads	1.03	2.65	1.97	1.00	0.99	0.55	0.75	0.36	0.49	0.48
	(0.63, 1.68)	(0.79, 8.93)	(0.33, 11.80)	(0.61, 1.63)	(0.60, 1.62)	(0.26, 1.15)	(0.15, 3.82)	(0.03, 4.80)	(0.22, 1.05)	(0.22, 1.04)
SHS Ads	1.27	1.25	1.24	1.16	0.27	1.28	1.30	1.32	2.07	3.54
	(0.76, 2.13)	(0.74, 2.10)	(0.74, 2.10)	(0.30, 4.43)	(0.02, 4.83)	(0.60, 2.73)	(0.60, 2.84)	(0.61, 2.89)	(0.33, 12.94)	(0.14, 87.00)
Demographic characteristics										
Age	0.98*	0.98*	0.98*	0.98	0.98	1.00	0.99	0.99	1.00	1.00
	(0.96, 1.00)	(0.96, 1.00)	(0.96, 1.00)	(0.96, 1.00)	(0.96, 1.00)	(0.97, 1.02)	(0.96, 1.02)	(0.97, 1.02)	(0.97, 1.03)	(0.97, 1.03)
Non-Hispanic White race/ethnicity	0.56	0.55	0.45	0.55	0.14	0.69	0.68	0.49	0.63	1.02
	(0.27, 1.18)	(0.26, 1.16)	(0.15, 1.41)	(0.26, 1.16)	(0.01, 1.74)	(0.24, 1.99)	(0.23, 2.00)	(0.12, 1.94)	(0.21, 1.84)	(0.07, 14.37)
Married or living as married	0.73	0.69	0.69	0.73	0.71	1.25	1.25	1.25	1.28	1.29
	(0.43, 1.23)	(0.40, 1.18)	(0.40, 1.18)	(0.43, 1.25)	(0.41, 1.22)	(0.57, 2.78)	(0.55, 2.83)	(0.55, 2.83)	(0.56, 2.92)	(0.57, 2.94)
At least 1 child lives in household	0.92	0.96	0.97	0.96	0.99	0.41*	0.41*	0.42*	0.43*	0.42*
	(0.55, 1.55)	(0.56, 1.63)	(0.57, 1.65)	(0.57, 1.62)	(0.58, 1.68)	(0.19, 0.91)	(0.18, 0.92)	(0.19, 0.95)	(0.19, 0.97)	(0.19, 0.95)
Education										
High school diploma or less	0.64	1.06	0.06	0.67	0.71	0.41	0.47	0.46	0.97	0.94
	(0.33, 1.25)	(0.47, 2.40)	(0.47, 2.41)	(0.23, 1.95)	(0.24, 2.15)	(0.17, 1.00)	(0.16, 1.33)	(0.16, 1.32)	(0.22, 4.33)	(0.21, 4.24)
Some college	0.74	1.00	1.01	0.72	0.80	1.08	0.95	0.97	1.96	1.86
	(0.37, 1.46)	(0.42, 2.35)	(0.43, 2.38)	(0.22, 2.38)	(0.24, 2.73)	(0.44, 2.62)	(0.32, 2.86)	(0.32, 2.91)	(0.41, 9.48)	(0.38, 9.13)
College degree	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Household income, $										
Not reported	2.72	3.01	3.03	1.68	1.65	5.02*	7.31*	7.40*	3.27	3.25
	(0.84, 8.75)	(0.71, 12.79)	(0.71, 12.89)	(0.29, 9.58)	(0.29, 9.37)	(1.21, 20.84)	(1.41, 37.98)	(1.43, 38.40)	(0.38, 28.37)	(0.37, 28.28)
<25 000	1.30	1.09	1.07	0.62	0.49	0.71	0.80	0.75	0.33	0.36
	(0.66, 2.54)	(0.47, 2.51)	(0.46, 2.48)	(0.19, 1.96)	(0.14, 1.72)	(0.27, 1.86)	(0.25, 2.58)	(0.23, 2.47)	(0.05, 2.07)	(0.06, 2.39)
25 000–49 999	1.14	1.24	1.24	1.18	1.17	0.67	0.68	0.69	0.64	0.64
	(0.63, 2.06)	(0.60, 2.56)	(0.60, 2.58)	(0.62, 2.24)	(0.62, 2.22)	(0.29, 1.57)	(0.25, 1.89)	(0.25, 1.90)	(0.26, 1.59)	(0.26, 1.59)
≥50 000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Predictors of cessation										
Fagerström test of nicotine dependence	0.91	0.91	0.91	0.91	0.91	0.89	0.89	0.89	0.87	0.87
	(0.82, 1.01)	(0.82, 1.01)	(0.82, 1.00)	(0.82, 1.01)	(0.82, 1.01)	(0.76, 1.05)	(0.76, 1.05)	(0.76, 1.05)	(0.74, 1.03)	(0.74, 1.03)
Intend to quit smoking in <6 mo, >30 d	2.83***	2.84***	2.83***	2.89***	2.81***	3.00*	3.06*	3.01*	2.99*	3.04*
	(1.63, 4.89)	(1.63, 4.96)	(1.62, 4.95)	(1.66, 5.03)	(1.61, 4.91)	(1.17, 7.71)	(1.18, 7.96)	(1.16, 7.85)	(1.15, 7.76)	(1.17, 7.93)
Intend to quit smoking in ≤30 d	6.56***	6.90***	6.90***	7.07***	6.96***	7.66***	7.44***	7.39***	8.05***	8.23***
	(3.39, 12.71)	(3.51, 13.55)	(3.51, 13.55)	(3.61, 13.85)	(3.55, 13.68)	(2.74, 21.39)	(2.66, 20.86)	(2.64, 20.71)	(2.83, 22.92)	(2.87, 23.61)
No. of previous quit attempts	1.10**	1.10**	1.10**	1.10**	1.10**	1.06	1.06	1.06	1.06	1.06
	(1.04, 1.18)	(1.03, 1.18)	(1.03, 1.18)	(1.03, 1.17)	(1.03, 1.18)	(0.97, 1.17)	(0.97, 1.17)	(0.96, 1.17)	(0.96, 1.17)	(0.96, 1.17)
Doctor advised to quit in past year	1.53	1.53	1.53	1.55	1.54	0.94	0.90	0.88	0.95	0.94
	(0.94, 2.48)	(0.94, 2.51)	(0.94, 2.50)	(0.94, 2.54)	(0.94, 2.52)	(0.46, 1.91)	(0.44, 1.85)	(0.43, 1.83)	(0.46, 1.98)	(0.45, 1.96)
Smoking prohibited in all areas of home	1.97*	2.14**	2.13**	1.93*	1.94*	4.58***	4.49***	4.37***	4.59***	4.63***
	(1.14, 3.38)	(1.22, 3.75)	(1.22, 3.74)	(1.11, 3.34)	(1.12, 3.37)	(2.10, 9.98)	(2.03, 9.92)	(1.97, 9.72)	(2.07, 10.17)	(2.09, 10.28)
Average hours of daily media use	1.03	1.03	1.03	1.03	1.04	1.25**	1.25**	1.25**	1.26**	1.26**
	(0.93, 1.15)	(0.93, 1.14)	(0.93, 1.14)	(0.93, 1.15)	(0.93, 1.15)	(1.09, 1.43)	(1.09, 1.44)	(1.09, 1.44)	(1.10, 1.44)	(1.10, 1.44)

Continued.

TABLE 3—Continued

KTQ ad recall interactions										
Recall × High school degree or less	0.22*	0.22*					0.58	0.62		
	(0.05, 0.94)	(0.05, 0.94)					(0.08, 4.29)	(0.08, 4.63)		
Recall × Some college education	0.42	0.41					1.28	1.25		
	(0.09, 1.89)	(0.09, 1.87)					(0.18, 9.14)	(0.17, 8.96)		
Recall × Income not reported	0.82	0.82					0.18	0.17		
	(0.06, 11.06)	(0.06, 11.06)					(0.00, 6.60)	(0.00, 6.10)		
Recall × < $25 000 income	1.67	1.67					0.74	0.81		
	(0.45, 6.21)	(0.45, 6.21)					(0.12, 4.68)	(0.13, 5.26)		
Recall × $25 000–49 999 income	0.78	0.78					0.85	0.87		
	(0.22, 2.82)	(0.22, 2.82)					(0.13, 5.61)	(0.13, 5.78)		
Recall × Non-Hispanic White		1.39						2.22		
		(0.32, 6.10)						(0.25, 19.63)		
SHS ad recall interactions										
Recall × High school degree or less				0.94	0.89				0.26	0.27
				(0.25, 3.55)	(0.23, 3.41)				(0.04, 1.65)	(0.04, 1.68)
Recall × Some college education				1.00	0.89				0.38	0.40
				(0.23, 4.23)	(0.21, 3.86)				(0.06, 2.51)	(0.06, 2.72)
Recall × Income not reported				1.93	1.92				1.94	2.01
				(0.17, 22.06)	(0.17, 21.78)				(0.10, 38.45)	(0.10, 40.01)
Recall × < $25 000 income				2.33	2.88				2.94	2.63
				(0.52, 10.50)	(0.60, 13.89)				(0.30, 29.19)	(0.26, 27.25)
Recall × $25 000–49 999 income				0.82	0.81				1.08	1.08
				(0.30, 2.25)	(0.30, 2.23)				(0.26, 4.48)	(0.26, 4.49)
Recall × Non-Hispanic White					4.68					0.56
					(0.33, 66.46)					(0.03, 9.93)
Generalized R^2	0.181	0.193	0.193	0.187	0.190	0.230	0.236	0.238	0.240	0.240

Notes. OR = odds ratio; CI = confidence interval; KTQ = keep trying to quit; SHS = secondhand smoke. Female gender was not associated with subsequent-year quit attempts in bivariate models (*P* > .25) and was thus excluded as a covariate.
*P < .05; **P < .01; ***P < .001.

mechanisms responsible for this result. Differences in nicotine dependence, prior quit attempts, quit intentions, and media use may not have been critically involved because they were included as statistical controls. It is possible, however, that KTQ messages were less persuasive among less-educated than more-educated populations. The KTQ ads featured 2 prominent messages: (1) quitting is difficult, but (2) with help it is possible. The experience of less-educated populations in trying to quit may have reinforced the former and undermined the latter. Educational differences in response to KTQ and SHS ads could also have occurred because of differences in the stylistic presentation of these ads. Testimonial ads promote discussion and engagement with an ad.[38] Most KTQ ads did not employ testimonials from former smokers,

whereas several SHS ads used them. Post hoc analyses revealed that smokers with less education were less likely than were those with more education to talk about KTQ ads with others, but they were equally as likely to talk about SHS ads. This finding suggested that lower-SES smokers may have found KTQ ads less compelling than did higher-SES smokers.

Although education was not a significant predictor of subsequent-year quit attempts, it was a significant predictor of 1-year abstinence in bivariate models (Table 1) and approached statistical significance in multivariate models (Table 3). Less-educated populations face more barriers in turning a quit attempt into smoking abstinence, including fewer smoking restrictions at work, greater nicotine dependence, and less access to

evidence-based treatments.[39,40] Future campaigns should keep these barriers in mind when developing campaigns to promote quitting among lower-SES populations.

We found no evidence of ad recall effects on smoking abstinence at year 1 or differences in effects by income or education. Sustained media campaigns and other cessation resources may be necessary to turn quit attempts into long-term abstinence from smoking.[16] It is possible that KTQ or SHS ads were effective in promoting short-term smoking abstinence but that smokers were unable to maintain long-term abstinence. It is also unclear why differences were observed by education but not income. Disparities in smoking rates and quit attempts are often larger by education than by income.[21,26] These factors underscore the importance of future studies
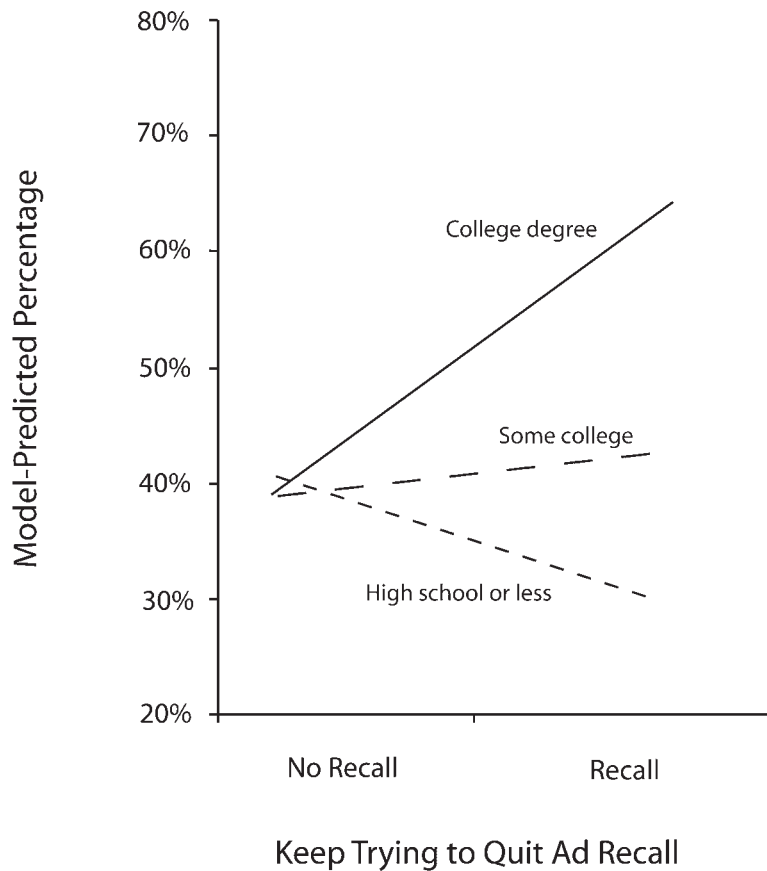
FIGURE 1—Model-predicted association between keep-trying-to-quit ad recall and at least 1 quit attempt in the subsequent year among adult smokers (n = 407), by level of education: Wisconsin Tobacco Survey, 2003, and Wisconsin Behavioral Health Survey, 2004.

that examine sources of disparities and factors that have potential to widen them.

Limitations

The low enrollment rate (29%), combined with differences in Wisconsin Behavioral Health Survey respondent and nonrespondent characteristics, raises questions about how well the sample represented Wisconsin smokers. The low proportion of respondents abstinent from smoking at follow-up (13%) reduced the ability to detect ad recall effects on that outcome.

The directionality of the association between ad recall and quit attempts was unclear. Respondents who recalled KTQ or SHS ads may also differ in ways other than whether or not they saw the ads. For instance, it is

possible that college-educated individuals who quit smoking successfully recalled the KTQ ads because they were already more motivated to quit at the time they saw the ads. The inclusion of several control variables, including baseline quit intentions, provided a safeguard for this explanation. It is nevertheless possible that unmeasured variables accounted for the relationships between ad recall and quit attempts.

Differences in ad effects on quit attempts by education might not be found in the context of larger media campaigns. The Wisconsin Tobacco Prevention and Control Program was funded well below CDC's recommended funding level during 2003 and 2004,[41] and only a portion of the overall budget was spent on media. Future studies

should examine SES differences in the context of larger campaigns, using multiple longitudinal data sources, to see whether these results are replicated.

Conclusions

Some types of smoking cessation media messages may have greater impact on quit attempts among more-educated compared with less-educated populations. Over time, these differences could produce widened disparities in smoking by SES. There is a need to develop media campaigns that are more effective with less-educated smokers, a group that constitutes a disproportionately large portion of the smoking population. ∎

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Contributors

J. Niederdeppe originated the study, conducted all analyses, and prepared the article. M. C. Fiore and T. B. Baker participated in the design of the surveys, helped to conceptualize ideas and interpret findings, and reviewed drafts of the article. S. S. Smith led the design of the surveys, supervised survey data collection, helped to conceptualize ideas and interpret findings, and reviewed drafts of the article.

Human Participant Protection

The study was approved by the University of Wisconsin's institutional review board. Informed consent was obtained from all participants.

References

1. Hopkins DP, Briss PA, Ricard CJ, et al. for the Task Force on Community Preventive Services. Reviews of evidence regarding interventions to reduce tobacco use and exposure to environmental tobacco smoke. *Am J Prev Med.* 2001;20(suppl 2):16–66.

2. Friend K, Levy DT. Reductions in smoking prevalence and cigarette consumption associated with mass-media campaigns. *Health Educ Res.* 2002;17:85–98.

3. Tichenor PJ, Donohue GA, Olien CN. Mass media flow and differential growth in knowledge. *Public Opin Q.* 1970;34:159–170.

4. Ceci SJ, Papierno PB. The rhetoric and reality of gap closing: when the "have-nots" gain but the "haves" gain even more. *Am Psychol.* 2005;60:149–160.

5. Viswanath K, Emmons KM. Message effects and social determinants of health: its application to cancer disparities. *J Commun.* 2006;56(suppl 1):S238–S264.

6. Meara E. Education, infant health, and cigarette smoking. *Ann N Y Acad Sci.* 1999;896:458–460.

7. Pierce JP, Macaskill P, Hill D. Long-term effectiveness of mass media led antismoking campaigns in Australia. *Am J Public Health.* 1990;80:565–569.

8. Mudde AN, De Vries H. The reach and effectiveness of a national mass media-led smoking cessation campaign in the Netherlands. *Am J Public Health.* 1999;89:346–350.

9. McVey D, Stapleton J. Can anti-smoking television advertising affect smoking behaviour? Controlled trial of the Health Education Authority for England's antismoking TV campaign. *Tob Control.* 2000;9:273–282.

10. The COMMIT Research Group. Community Intervention Trial for Smoking Cessation (COMMIT): I. cohort results from a four-year community intervention. *Am J Public Health.* 1995;85:183–192.

11. Hu TW, Sung HY, Keeler TE. Reducing cigarette consumption in California: tobacco taxes vs an antismoking media campaign. *Am J Public Health.* 1995; 85:1218–1222.

12. Hyland A, Wakefield M, Higbee C, Szczypka G, Cummings KM. Anti-tobacco television advertising and indicators of smoking cessation in adults: a cohort study. *Health Educ Res.* 2006;21:348–354.

13. Popham WJ, Potter LD, Bal DG, Johnson MD, Duerr JM, Quinn V. Do anti-smoking media campaigns help smokers quit? *Public Health Rep.* 1993;108: 510–513.

14. Biener L, Reimer RL, Wakefield M, Szczypka G, Rigotti NA, Connolly G. Impact of smoking cessation aids and mass media among recent quitters. *Am J Prev Med.* 2006;30:217–224.

15. Goldman LK, Glantz SA. Evaluation of antismoking advertising campaigns. *JAMA.* 1998;279:772–777.

16. Schar EH, Gutierrez KK. Smoking cessation media campaigns from around the world: recommendations from lessons learned. Copenhagen, Denmark: World Health Organization Regional Office for Europe; 2001.

17. Biener L, McCallum-Keeler G, Nyman AL. Adults' response to Massachusetts anti-tobacco television advertisements: impact of viewer and advertisement characteristics. *Tob Control.* 2000;9:401–407.

18. Carroll T, Rock B. Generating Quitline calls during Australia's National Tobacco Campaign: effects of television advertisement execution and programme placement. *Tob Control.* 2003;12:ii40–ii44.

19. Erbas B, Bui Q, Huggins R, Harper T, White V. Investigating the relation between placement of Quit antismoking advertisements and number of telephone calls to Quitline: a semiparametric modelling approach. *J Epidemiol Community Health.* 2006;60:180–182.

20. McAlister A, Morrison TC, Hu S, et al. Media and community campaign effects on adult tobacco use in Texas. *J Health Commun.* 2004;9:95–109.

21. Mariolis P, Rock VJ, Asman K, et al. Tobacco use among adults: United States, 2005. *MMWR Morb Mortal Wkly Rep.* 2006;55:1145–1148.

22. Husten C, Jackson K. Cigarette smoking among adults: United States, 2002. *MMWR Morb Mortal Wkly Rep.* 2004;53:427–431.

23. *Smoking and Health: Report of the Advisory Committee of the Surgeon General of the Public Health Service.* Washington, DC: US Dept of Health, Education, and Welfare; 1964. PHS publication 1103.

24. *The Health Consequences of Smoking: A Public Health Service Review.* Washington, DC: US Dept of Health, Education, and Welfare; 1967. PHS publication 1696.

25. Warner KE. The effects of the antismoking campaign on cigarette consumption. *Am J Public Health.* 1977;67:645–650.

26. Pierce JP, Fiore MC, Novotny TE, Hatziandreu EJ, Davis RMl. Trends in cigarette smoking in the United States. Educational differences are increasing. *JAMA.* 1989;261:56–60.

27. Pierce JP, Gilpin EA, Farkas AJ. Can strategies used by statewide tobacco control programs help smokers make progress in quitting? *Cancer Epidemiol Biomarkers Prev.* 1998;7:459–464.

28. Zhu SH, Rosbrook B, Anderson C, et al. The demographics of help-seeking for smoking cessation in California and the role of the California smokers' helpline. *Tob Control.* 1995;4:S9–S15.

29. Macaskill P, Pierce JP, Simpson JM, Lyle DM. Mass media-led antismoking campaign can remove the education gap in quitting behavior. *Am J Public Health.* 1992;82:96–98.

30. Siahpush M, Wakefield M, Spittal M, Durkin S. Antismoking television advertising and socioeconomic variations in calls to Quitline. *J Epidemiol Community Health.* 2007;61:298–301.

31. Pierce JP, Anderson DM, Romano RM, Meissner HI, Odenkirchen JC. Promoting smoking cessation in the United States: effect of public service announcements on the Cancer Information Service telephone line. *J Natl Cancer Inst.* 1992;84:677–683.

32. Platt S, Tannahill A, Watson J, Fraser E. Effectiveness of antismoking telephone helpline: a follow up survey. *BMJ.* 1997;314:1371–1375.

33. Heatherton TF, Kozlowski LT, Frecker RC, Fagerström KO. The Fagerström Test for Nicotine Dependence: a revision of the Fagerström Tolerance Questionnaire. *Br J Addict.* 1991;86:1119–1127.

34. Hosmer DW, Lemeshow S. *Applied Logistic Regression.* New York, NY: Wiley; 1989.

35. Allison PD. Comparing logit and probit coefficients across groups. *Sociol Method Res.* 1999;28: 186–208.

36. Wakefield M, Borland R. Saved by the bell: the role of telephone helpline services in the context of mass-media anti-smoking campaigns. *Tob Control.* 2000;9:117–119.

37. Levy DT, Friend KB. The effects of clean indoor air laws: what do we know and what do we need to know? *Health Educ Res.* 2003;18:592–609.

38. Terry-McElrath Y, Wakefield M, Ruel E, et al. The effect of antismoking advertisement executional characteristics on youth comprehension, appraisal, recall, and engagement. *J Health Commun.* 2005;10:127–143.

39. Millar WJ. Reaching smokers with lower educational attainment. *Health Rep.* 1996;8:11–19.

40. Fiore MC, Bailey WC, Cohen SJ, et al. *Treating Tobacco Use and Dependence: A Clinical Practice Guideline.* Rockville, Md: US Dept of Health and Human Services; 2000. AHRQ publication 00-0032.

41. *State of Tobacco Control: 2004.* New York, NY: American Lung Association; 2003.