Public support for pictorial warnings on cigarette packs: An experimental study of US smokers

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Abstract

Background—Understanding factors that influence public support for "nudging" policies, like pictorial cigarette pack warnings, may offer insight about how to increase such support. We sought to examine factors that influence smokers' support for requiring pictorial warnings on cigarette packs.

Methods—In 2014 and 2015, we randomly assigned 2,149 adult US smokers to receive either pictorial warnings or text-only warnings on their cigarette packs for four weeks. The outcome examined in the current study was support for a policy requiring pictorial warnings on cigarette packs in the US.

Results—Support for pictorial warnings was high at baseline (mean: 3.2 out of 4). Exposure to pictorial warnings increased policy support at week 4 (β=.05, p=.03). This effect was explained by increases in perceived message effectiveness (p<.001) and reported conversations about policy support (p<.001). Message reactance (i.e., an oppositional reaction to the warning) partially diminished the impact of pictorial warnings on policy support (p<.001).

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Compliance with Ethical Standards

Conflict of Interest: Kurt M. Ribisl and Noel T. Brewer have served as paid expert consultants in litigation against the tobacco industry. Cass R. Sunstein helped oversee federal regulation in the US government between 2009 and 2012, and he worked on the topic of graphic health warnings. The other authors declare that they have no conflict of interest.

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

Conclusions—Exposing people to a new policy through implementation could increase public support for that policy by increasing perceived effectiveness and by prompting conversations about the policy. Reactance may partially weaken the effect of policy exposure on public support.

Keywords

Public support; policy support; graphic warnings; pictorial warnings; tobacco control; reactance; nudging

Introduction

Human behavior causes much of the burden of death and disease (World Health Organization, 2009). Behavior is notoriously difficult to change (Marteau, Hollands, & Fletcher, 2012), but "nudges" that alter the environment where behavior occurs are a promising way of influencing behavior (Marteau et al., 2012; Thaler & Sunstein, 2008). Nudges – such as warnings, financial incentives, and taxation – guide people toward a healthier decision while still allowing them freedom to make their own choices (Thaler & Sunstein, 2008). When weighing the decision to implement a new policy, policymakers may consider the public acceptability of the policy in addition to other factors including its effectiveness, reach, and cost (Diepeveen, Ling, Suhrcke, Roland, & Marteau, 2013). Public support for policies can influence not only their adoption but also their implementation, enforcement, and the eventual effectiveness of the policy or intervention (Diepeveen et al., 2013). Research on public support for nudging interventions is growing, and suggests majority support in many nations (Sunstein, Reisch, & Rauber, 2017), but important gaps remain.

Tobacco is the leading cause of morbidity and mortality worldwide (World Health Organization, 2012). Pictorial cigarette pack warnings are a promising solution for curbing the tobacco epidemic because they change key antecedents of behavior (e.g., negative emotions, talking about health effects and quitting, quit intentions) (Hammond, 2011; Noar et al., 2017; Noar, Hall, et al., 2016; Yong et al., 2014) and increase quitting (Brewer et al., 2016; Noar, Francis, et al., 2016). Despite the mounting evidence supporting the effectiveness of pictorial warnings, nearly 100 countries covering 42% of the world's population – including the US – do not yet have pictorial warnings on cigarette packs (Canadian Cancer Society, 2016). Estimates of public support for pictorial warnings from nationally representative studies in the US range from 45% (Rose et al., 2015) to 74% (Kamyab, Nonnemaker, & Farrelly, 2015). Importantly, non-smokers are consistently more supportive of pictorial warnings (and other tobacco control policies) than smokers (Diepeveen et al., 2013; Kamyab et al., 2015; Rose et al., 2015).

Prior research suggests that public support generally increases after a new policy is implemented (Diepeveen et al., 2013), although this question has not previously been explored in the context of pictorial warnings. Moreover, studies have not yet examined the reasons why exposure to a policy increases public support (i.e., mediators). For instance, prior research suggests that exposure to a policy increases public support through changes in one's perceptions of policy effectiveness (Bos, Lans, Van Rijnsoever, & Van Trijp, 2015;

Mazzocchi et al., 2015; Pechey, Burge, Mentzakis, Suhrcke, & Marteau, 2014; Petrescu, Hollands, Couturier, Ng, & Marteau, 2016; Promberger, Dolan, & Marteau, 2012; Sunstein, 2016). Moreover, social interactions have been shown to be a mechanism of change in smoking-related campaigns (Jeong & Bae, 2017) and therefore could explain the impact of policy exposure on public support. Finally, building on reactance theory (Brehm, 1966; Brehm & Brehm, 1981) and research about reactance to pictorial warnings (Erceg-Hurn & Steed, 2011; Hall et al., In Press; Hall et al., 2017; LaVoie, Quick, Riles, & Lambert, 2015), it is plausible that reactance could weaken the impact of pictorial warning exposure on policy support.

In the current study, we aimed to experimentally test whether exposure to pictorial warnings on smokers' own cigarette packs increased their support for a policy requiring pictorial cigarette pack warnings in the US. We focused on smokers because the most important and relevant complaints about interventions may come from the people such interventions directly affect. We also sought to explore the mechanisms explaining the impact of pictorial warning exposure on policy support. Finally, we explored whether other demographic and personality characteristics influenced support for requiring pictorial warnings on cigarette packs.

Methods

Participants

From September 2014 to August 2015, we recruited a convenience sample of adult smokers in North Carolina and California, US to participate in a trial comparing the impact of pictorial versus text-only warnings. Details of the trial including protocols, survey development, and participant recruitment have been previously published (Brewer et al., 2016). Other papers using this dataset have explored mediators (Hall et al., In Press; Hall et al., 2017; Morgan et al., 2017) and trajectories (Parada, Hall, Boynton, & Brewer, 2017) of pictorial warnings' impact, as well as attitudes toward the US Food and Drug Administration's (FDA) regulation of tobacco products (Kowitt, Goldstein, Schmidt, Hall, & Brewer, 2017). In contrast, this paper explores public support of pictorial cigarette pack warnings. Participants were age 18 or older, proficient in English, and current smokers, defined as having smoked at least 100 cigarettes during their lifetime and now smoking every day or some days. Exclusion criteria included pregnancy, current enrollment in a smoking cessation trial, smoking only roll-your-own cigarettes, smoking fewer than seven cigarettes per week, and living in the same household as another trial participant.

Procedures

Smokers received warnings on their own cigarette packs for four weeks using a protocol developed by our team whereby participants brought in an eight-day supply of cigarettes weekly (Brewer et al., 2015; Brewer et al., 2016). They were randomly assigned to have one of four pictorial warnings applied to the top half of the front and back panels of their cigarette packs (Online Resource 1), or one of four text-only warnings applied to the side of their cigarette packs placed over the current Surgeon General's warning, for the duration of the trial. Randomization created groups that did not differ on demographics assessed (Online

Resource 2, all p>.05) (Brewer et al., 2016). Trial participants were diverse, including a substantial number of sexual minority, African American, low-education, and low-income smokers (Online Resource 2).

Participants completed two computer surveys at the first visit (at baseline and immediately after seeing their assigned warning), and one survey at each visit thereafter. Participants received a cash incentive at the end of each visit, totaling up to $185 in North Carolina and $200 in California. Participation incentives were higher in California due to higher cost of living. At the end of the final follow-up appointment, participants received information about local smoking cessation programs. The University of North Carolina Institutional Review Board approved the procedures for this trial.

Measures

The baseline and week 4 follow-up surveys assessed support for the US requiring pictorial warnings on cigarette packs (i.e., "policy support," Table 1). Mediating variables (Table 1) included perceived effectiveness of the warning, conversations about policy support (Hall et al., 2015), and message reactance (Hall et al., 2017). Correlates of baseline policy support were measured at the first visit and included demographic characteristics, previous exposure to pictorial warnings ("Have you ever seen a graphic warning on a cigarette pack sold in another country?"), trait reactance (Hong and Page (1989), 11 items, α=.87, e.g., "I become angry when my freedom of choice is restricted."), and quit intentions (Klein, Zajac, and Monin (2009), three items, a=.87, e.g., "How interested are you in quitting smoking in the next month?").

Data analysis

Analyses used Stata/SE version 14.1 and Mplus version 8 with two-tailed tests and a critical alpha of .05. We report most results as standardized coefficients (βs). First, we conducted between-group t-tests to compare policy support by trial arm at baseline and at the end of the trial (week 4 follow-up survey).

Next, for multi-item mediators, we examined the association between items and their latent constructs using a measurement model (Model 1); this model fit the data well (root mean square error of approximation (RMSEA=.039) (Steiger, 1990), Bentler Comparative Fit Index (CFI=.999) (Bentler, 1990), and Tucker-Lewis Index (TLI=.998) (Tucker & Lewis, 1973). Then, we used a structural equation model to examine the impact of trial arm on policy support at the end of the trial (Model 2). This model was just-identified and therefore did not produce fit statistics (Bollen, 1989). The final structural equation model (Model 3) explored variables that explained the impact of warnings on policy support (i.e., mediator and suppressor variables). A variable is a mediator that contributes to the effect if the direct effect (from warnings to policy support) and mediated effect (from warnings through the third variable to policy support) have the same sign (MacKinnon, Krull, & Lockwood, 2000). In contrast, suppression occurs when the direct and mediated effects have opposite signs, in this case demonstrating that the mediator detracts from the effect of pictorial warning exposure on policy support (MacKinnon et al., 2000). Model 3 included all mediators (i.e., multiple mediation) and employed full information maximum likelihood

estimation to handle missing data, an approach commonly recommended to make use of all available data (Bollen, 1989; Kline, 2011; Peters & Enders, 2002). This model used bootstrapped 95% confidence intervals with 1,000 repetitions, as this approach does not assume that indirect effects are normally distributed (Hayes, 2009). We allowed the errors of the latent constructs of message reactance and perceived effectiveness to correlate based on modification indices during the model respecification process. Model 3 also had acceptable fit (RMSEA=.042, CFI=.996, TLI=.993).

Finally, we conducted exploratory bivariate regressions to examine correlates of pictorial warning policy support at baseline. We then entered variables with p values <.10 into a single multivariable model. Analyses used listwise deletion for missing data, including cases with complete data on the predictors and outcome.

Results

Impact of pictorial cigarette pack warnings on policy support

Policy support did not differ by trial arm at baseline (p=.76, Online Resource 2). Policy support at the end of the trial was higher in the pictorial warning arm than in the text-only warning arm (mean: 3.35 [SE=.027] vs. 3.26 [SE=.027] out of 4, β=.05, p=.03). As predicted, perceived effectiveness of the warning mediated the impact of pictorial warning exposure on policy support (Table 2). Exposure to pictorial warnings increased perceived effectiveness (β=.36, p<.001) which, in turn, was associated with greater policy support (β=.24, p<.001; mediated effect=.09, p<.001). Conversations about policy support also mediated the association; pictorial warning exposure increased conversations (β=.30, p<.001), which subsequently were associated with greater policy support (β=.14, p<.001; mediated effect=.04, p<.001). Finally, as predicted, pictorial warnings increased message reactance (β=.24, p<.001), which was associated with lower policy support (β=−.27, p<.001; mediated effect= −.07, p<.001).

Correlates of policy support at baseline

In adjusted analyses at baseline, higher trait reactance was associated with lower policy support (β=−.11, p<.001, Table 3), and higher quit intentions were associated with greater policy support (β=.26, p<.001). Variables associated with greater pictorial warning policy support in bivariate but not multivariable analyses were African American race (p=.01) and smoking fewer cigarettes per day (p=.003).

Discussion

Our study found high support for requiring pictorial warnings on cigarette packs among adult smokers in two US states. Exposure to pictorial warnings on smokers' own cigarette packs for four weeks led to a small but statistically significant increase in support for requiring pictorial warnings on cigarette packs. This effect was explained by increases in perceived effectiveness of the warnings and reported conversations about policy support. Message reactance weakened the effect of pictorial warning exposure on policy support, but only partially.

In most cases, people tend to prefer nudges that target deliberative processing (such as text-only warnings), compared to those that target automatic processing (such as pictorial warnings) (Sunstein, 2016). Although we did not examine support for text-only warnings, we found high support for pictorial warnings on packs, suggesting that many smokers may find pictorial warnings acceptable and even desirable. Indeed, while tobacco industry litigation prevented the FDA from implementing pictorial warnings similar to those tested in our trial (Kraemer & Baig, 2013; R.J. Reynolds Tobacco Company vs United States Food and Drug Administration, 2011), our results demonstrate that smokers strongly support such a policy. Monitoring public support for pictorial warnings is important given that in most countries, elected officials (e.g., parliament or the legislature) have the authority to change cigarette labeling requirements. Not all evidence-based policies have public support, but our data suggest that smokers support pictorial warnings, which should give government officials more confidence to implement such policies.

Research has also found that people's preferences for nudges are malleable (Sunstein, 2016). Indeed, we found that placing pictorial warnings on smokers' own cigarette packs increased policy support. This finding builds on prior research finding that policy interventions, including plain packaging for cigarettes (Swift et al., 2015) and smoking bans (Diepeveen et al., 2013), tend to become more popular after implementation. For example, in the year following new indoor smoking bans in three Australian states, support for this policy doubled among smokers (Cooper, Borland, Yong, & Hyland, 2010). Thus, governments might expect to see an increase in support for pictorial warnings after the policy goes into effect. As pictorial warning policies become more common globally, smokers, especially ones who travel or see news stories about warnings, may increasingly support pictorial warnings even if they live in countries that have not yet required them on packs.

Perceived effectiveness was the most important driver of the impact of exposure to pictorial warnings on support for pictorial warnings. This finding builds on prior research that higher perceived effectiveness leads to greater acceptability of interventions (Bos et al., 2015; Mazzocchi et al., 2015; Pechey et al., 2014; Petrescu et al., 2016; Promberger et al., 2012; Sunstein, 2016). Perceived effectiveness may be especially useful for increasing support for pictorial warnings; Sunstein (2016) found that telling people that pictorial warnings were more effective than text warnings elicited greater support for pictorial warnings (but telling people that text warning were more effective did not change support for text warnings) (Sunstein, 2016). As evidence accumulates about the effectiveness of pictorial warnings (Brewer et al., 2016; Noar et al., 2017; Noar, Francis, et al., 2016; Noar, Hall, et al., 2016), policymakers and the tobacco control community could consider campaigns that educate the public about the beneficial impact of pictorial warnings on behavior to increase perceived effectiveness at the population level. These campaigns could not only increase public support for pictorial warnings, but could vividly remind the public about tobacco's harmful effects and also guard against potential counterarguments from the tobacco industry.

Another important driver of the impact of pictorial warning exposure on public support was talking to other people about whether pictorial warnings should be on US cigarette packs. Social interactions are a key mechanism through which pictorial warnings exert their effect on behavior (Brewer et al., 2016; Thrasher et al., 2015), but the influence of interpersonal

communication on public support for pictorial warnings has not previously been studied. Social interactions may be particularly important in the context of tobacco control because smoking is heavily influenced by peer and social networks (Christakis & Fowler, 2008). Future studies should examine conversations' impact on public support of interventions that target less social behaviors (e.g., vaccination requirements) and in the context of real-world policy implementation.

Finally, pictorial warnings increased message reactance in our trial. Message reactance, in turn, was associated with lower support for pictorial warnings. Prior research has focused on whether message reactance hinders the effectiveness of pictorial warnings on intentions and behavior (Brewer et al., Under Review; Hall et al., In Press). However, our study suggests that reactance may also partially undermine support for pictorial warnings on cigarette packs. At baseline, trait reactance (one's predisposition to being reactant across various situations) was also associated with lower policy support. Given that reactance is characterized by a strong desire for autonomy and freedom, it is unsurprising that both message and trait reactance were associated with less support for pictorial warnings. At baseline, smokers with lower quit intentions were also less supportive of putting pictorial warnings on cigarette packs, in line with previous research (Kamyab et al., 2015; Kowitt, Noar, Ranney, & Goldstein, 2017). Garnering public support among smokers with high message reactance, high trait reactance, and low quit intentions may prove difficult and could require targeted messaging designed for these populations. However, public officials considering implementing stronger cigarette pack warnings should be reassured by the high level of public support in our study and in several nationally representative studies (Kamyab et al., 2015; Kowitt, Noar, et al., 2017; Wade, Merrill, & Lindsay, 2011).

Study strengths include the use of an experimental design and a large and diverse sample of smokers. Our trial is one of the few studies of policy support that randomly assigned people to experience a policy. However, participant self-selection could have led to a study population with greater public support for cigarette pack warnings than the general population of smokers. The generalizability of our findings to different contexts (e.g., outside the US, with different types of nudging interventions) remains to be established. Finally, a limitation is that the trial examined the potential effect of adding pictorial warnings to cigarette packs as well as implementing other label formatting changes required by the 2009 Tobacco Control Act compared with the present text-only warnings in the US. Examining these changes together opens the possibility that the observed experimental effects may be due to the combination of adding pictures and changing the warning placement and size.

Conclusions

Understanding factors that influence public support for nudging policies offers insights about how to increase public support. Specifically, exposing people to a policy, educating them about its effectiveness, and stimulating conversations about the policy could increase public support. Continued assessment of public support for health policies and studying predictors of public support can prepare regulators for challenges that might occur during all phases of policy implementation.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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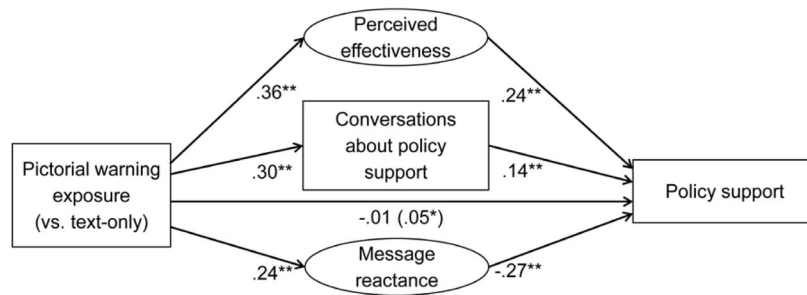
Figure 1.
Impact of pictorial warning exposure on pictorial warning policy support (*n*=2,149).
Structural equation model shows standardized path coefficients (*β*s). Value in parentheses (.05) is the unadjusted effect of pictorial warning exposure on policy support. For simplicity, the figure omits residuals and the correlation between the errors of perceived effectiveness and message reactance (*r*=−.29).
* *p*<.05, ** *p*<.001.

Table 1

Variables used in the multiple mediation model (*n*=2,146)

Variable (Timepoint used in analysis)	Item wording [response scale]	Factor loading
Perceived effectiveness of the warning (Immediate post-test)	How much will having this warning on your cigarette packs make you want to quit smoking? [not at all (1), a little (2), somewhat (3), a lot (4)]	.95
	How much will having this warning on your cigarette packs make you concerned about the health effects of smoking? [not at all (1), a little (2), somewhat (3), a lot (4)]	.92
	How will having this warning on your cigarette packs affect how much you smoke? [smoke a lot more (1), smoke a little more (2), no effect on my smoking (3), smoke a little less (4), smoke a lot less (5)]	.61
Conversations about policy support (Cumulative)	Think about the conversations you had about the warning in the last week. What came up during these conversations? Whether the warning should be on cigarette packs in the US. [recoded as: no policy support conversations during the study (0), at least one policy support conversation during the study (1)]	--
Message reactance (Immediate post-test)	Please say how much you agree or disagree with each statement below about the warning we put on your packs. This warning is trying to manipulate me. [strongly disagree (1), somewhat disagree (2), neither agree nor disagree (3), somewhat agree (4), strongly agree (5)]	.80
	The health effect on this warning is overblown. [strongly disagree (1), somewhat disagree (2), neither agree nor disagree (3), somewhat agree (4), strongly agree (5)]	.78
	This warning annoys me. [strongly disagree (1), somewhat disagree (2), neither agree nor disagree (3), somewhat agree (4), strongly agree (5)]	.76
Policy support (Week 4)	If the US required that graphic warnings covered the top half of the front and back of cigarette packs, would you… [strongly oppose this policy (1), somewhat oppose this policy (2), somewhat support this policy (3), strongly support this policy (4)]	--

Note. Table reports standardized factor loadings. Cumulative = based on assessments at week 1, week 2, week 3, and week 4 follow-up survey. Immediate post-test = after participants first saw their assigned warning. -- manifest variable. Analyses exclude data from 3 participants who were missing data on all items in the measurement model.

Table 2

Multiple mediation of the impact of pictorial warning exposure on pictorial warning policy support at end of trial (week 4) (*n*=2,149)

Mediator variable	*a* pathway		*b* pathway		Mediated effect	
	$\boldsymbol{\beta_a}$	*p*	$\boldsymbol{\beta_b}$	*p*	$\boldsymbol{\beta_a * \beta_b}$ (95% CI)	*p*
Perceived effectiveness of the warning	.36	<.001	.24	<.001	.09 (.07, .11)	<.001
Conversations about policy support	.30	<.001	.14	<.001	.04 (.02, .06)	<.001
Message reactance	.24	<.001	−.27	<.001	−.07 (−.08, −.05)	<.001

Note. Table reports standardized path coefficients and mediated effects. *a* pathways are the associations between pictorial warning exposure and the mediators. *b* pathways are the associations between the mediators and policy support, controlling for pictorial warning exposure and the other mediators.

Table 3

Correlates of pictorial warning policy support at baseline (n=1,899)

	Bivariate		Multivariable	
	β	p	β	p
Previous exposure to pictorial warnings				
No (ref)	--	--	--	--
Yes	−.02	.37	--	--
Trait reactance	−.14	<.001	−.11	<.001
Age	.02	.50	--	--
Sex				
Male (ref)	--	--	--	--
Female	.00	.92	.00	.95
Transgender	−.04	.07	−.04	.12
Sexual orientation				
Straight or heterosexual (ref)	--	--	--	--
Gay, lesbian, or bisexual	−.03	.16	--	--
Hispanic ethnicity				
Not Hispanic (ref)	--	--	--	--
Hispanic	.00	.98	--	--
Race				
White (ref)	--	--	--	--
Black or African American	.06	.01	−.04	.18
Other	.03	.19	−.02	.52
Education				
High school degree or less (ref)	--	--	--	--
Some college	.00	.89	.00	.90
College graduate	−.05	.06	−.03	.23
Low income (< 150% of Federal Poverty Level)				
No (ref)	--	--	--	--
Yes	.02	.51	--	--
Study site				
California (ref)	--	--	--	--
North Carolina	−.04	.07	−.04	.10
Number of cigarettes smoked per day	−.07	.003	−.03	.25
Quit intentions	.28	<.001	.26	<.001

Note. Table reports standardized regression coefficients. Analyses included data for 1,899 smokers, a sample that reflects the exclusion of 250 participants with missing data on the predictors or outcome. The multivariable model included variables with p values <.10 in bivariate analyses.