

Hiding the tobacco power wall reduces cigarette smoking risk in adolescents: using an experimental convenience store to assess tobacco regulatory options at retail point-of-sale

William G Shadel, Steven C Martino, Claude M Setodji, Deborah M Scharf, Daniela Kusuke, Angela Sicker, Min Gong

RAND Corporation, Pittsburgh, Pennsylvania, USA

Correspondence to

Dr William G Shadel, RAND Corporation 4570 Fifth Avenue, Suite 600, Pittsburgh, PA 15213-2665, USA; shadel@rand.org

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ABSTRACT

Objectives This experiment tested whether changing the location or visibility of the tobacco power wall in a life sized replica of a convenience store had any effect on adolescents' susceptibility to future cigarette smoking.

Methods The study was conducted in the RAND StoreLab (RSL), a life sized replica of a convenience store that was developed to experimentally evaluate how changing aspects of tobacco advertising displays in retail point-of-sale environments influences tobacco use risk and behaviour. A randomised, between-subjects experimental design with three conditions that varied the location or visibility of the tobacco power wall within the RSL was used. The conditions were: cashier (the tobacco power wall was located in its typical position behind the cash register counter); sidewall (the tobacco power wall was located on a sidewall away from the cash register); or hidden (the tobacco power wall was located behind the cashier but was hidden behind an opaque wall). The sample included 241 adolescents.

Results Hiding the tobacco power wall significantly reduced adolescents' susceptibility to future cigarette smoking compared to leaving it exposed (ie, the cashier condition; $p=0.02$). Locating the tobacco power wall on a sidewall away from the cashier had no effect on future cigarette smoking susceptibility compared to the cashier condition ($p=0.80$).

Conclusions Hiding the tobacco power wall at retail point-of-sale locations is a strong regulatory option for reducing the impact of the retail environment on cigarette smoking risk in adolescents.

tobacco power walls conspicuously behind the cash register increases the likelihood of consumers being repeatedly exposed to positive tobacco messages.^{7 14} These exposures are thought to normalise tobacco use,¹⁵ increase brand recognition¹⁴ and increase positive brand user imagery.¹⁶

Several countries (eg, Australia, Canada, Ireland) enacted laws which require that power walls are hidden and only customers of legal age may view (and purchase) tobacco products. Findings from the International Tobacco Control Four Country Survey of adult smokers suggest that banning tobacco power walls diminishes impulse tobacco purchases.¹⁷ Surveys (Ireland) have shown that hiding power walls reduces adolescents' perceptions of peer smokers.¹⁵ Experimental studies in Australia and the USA that have manipulated the presence or absence of tobacco power walls have shown that hiding tobacco power walls diminishes adolescents' perceptions of ease of access to cigarettes^{18–20} and reduces their perceptions of peer smoking.¹⁸

The current study sought to expand what is known in this domain by experimentally examining whether changing the placement or visibility of the tobacco power wall in a life sized replica of a convenience store had any effect on susceptibility to future cigarette smoking among adolescents. Extant experimental research that has studied the effect of altering the presence of the tobacco power wall has relied on one of two methods to present the POS environment. In one method, photographs of the POS retail environment are presented to research participants^{18 20} and in the other, the POS retail environment is simulated for research participants using virtual reality.¹⁹ These experimental studies have strengthened the causal inferences that can be made about the effects of changing the presence of the tobacco power wall beyond those that can be made from studies that use survey methods alone. However, both virtual retail experiences and viewing pictorial representations of the POS environment are several steps removed from a real life retail context and shopping experience. This presents a potential threat to ecological validity.

In order to get closer to a real life shopping experience, we conducted this study in the RAND StoreLab (RSL). The RSL is a life sized replica of a convenience store that was designed to experimentally evaluate how to best regulate tobacco product advertising at POS during simulated shopping

INTRODUCTION

In recent years, there has been a substantial shift of tobacco industry dollars away from traditional advertising outlets (eg, magazines, billboards) to point-of-sale (POS) retail locations.^{1–4} Exposure to POS cigarette advertising contributes to risk of cigarette smoking in adolescents and triggers smoking in adult smokers.^{5 6}

An important component of POS advertising is the tobacco 'power wall'.⁷ Tobacco power walls display hundreds of different cigarette brands and other tobacco products. Power walls also feature branded posters, product slogans and prices. The tobacco industry pays substantial sums of money to retailers for centralised in-store placement of their products^{8–10} and a majority of retailers prominently display tobacco power walls.^{11–13} Locating



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experiences. The RSL was modelled after the 'bar labs' that were pioneered in the 1980's to evaluate the effect of near real-life drinking contexts on alcohol consumption.²¹

Using the RSL, this experiment manipulated the location and visibility of the tobacco power wall to evaluate whether such changes had an effect on susceptibility to future cigarette smoking in middle and high school students. The study utilised a three-group, randomised between-subjects design. The three experimental conditions were: *cashier* (the tobacco power wall was located behind the cash register counter); *sidewall* (the tobacco power wall was located on a sidewall away from the cash register counter); or *hidden* (the tobacco power wall was located behind the cash register counter but was hidden behind an opaque wall). The sidewall and hidden condition represented potential regulatory changes for power walls at POS. As such, the study compared whether either of these changes had an effect on susceptibility to future cigarette smoking compared to when the powerwall was located in its typical position, behind the POS cashier. We hypothesised that hiding the tobacco power wall would produce the greatest reductions in susceptibility to future cigarette smoking because positive tobacco messages would be maximally disrupted in this condition (ie, because no pack faces, slogans, logos or prices would be visible).

METHODS

Study participants

Adolescents were recruited using print, internet and radio advertising. Adolescents were the focus of this study because they are particularly vulnerable to tobacco advertising²² and are a focus of tobacco regulatory efforts in the USA.²³ The recruitment ads contained no information about smoking or tobacco in order to reduce potential sample biases and simply indicated that the study focused on teens' purchasing habits at convenience stores.

Parents of interested participants telephoned the study centre to complete a brief eligibility screening.

Participants had to be between the ages of 11 and 17, have no physical or psychiatric problem that would interfere with completing the study (based on parent report), have written parental consent and assent to their own participation. Adolescents were enrolled irrespective of their tobacco use. A total of 302 adolescents were screened, of whom 284 (94%) were eligible and chose to participate. A total of 241 adolescents completed the study (42 were no-shows; one person was a repeat). No-shows were similar to completers on gender, age and smoking history; however, no-shows were significantly more likely to be African-American compared to study completers. Participant characteristics are provided in table 1.

Experimental setting: the RSL

The RSL occupies 1500 square feet inside of an office building (the RSL is only open to research participants). The RSL specifications fall between a 'limited-selection convenience store' and 'traditional convenience store' in terms of store size (between 1200 and 2500 square feet) and number and variety of products sold (stocked products include dairy, bakery, snack foods, beverages, tobacco, grocery, health and beauty aids, confectionery, and magazines/newspapers).²⁴ The RSL was designed this way because mid-sized convenience stores such as these are the most common kind of convenience store.²⁴ Industry guidelines dictated the stocking and arrangement of products in the RSL.²⁴ Over 650 unique products are displayed in the RSL and the listed prices are consistent with Pennsylvania, where the research was conducted.

Figure 1 presents a series of photographs from the store (labelled 1–6). Participants enter a foyer from the research administration room through a door that faces the façade of the RSL (the RSL is hidden from view until the door is opened).

Table 1 Participant characteristics by experimental condition

	Experimental Condition			
	Cashier (n=80)	Sidewall (n=79)	Hidden (n=82)	p Value
Demographics				
Age (mean, SD)	13.8 (2.0)	14.1 (2.0)	13.6 (2.0)	0.23
Female (%)	57.5	48.7	51.9	0.53
Race (%)				
Caucasian	60	57.7	55	0.80
African-American	28.8	26.9	28.8	
Asian	2.5	3.8	1.3	
Multiple endorsed	2.5	7.7	7.5	
Other	6.3	3.8	7.5	
Tobacco use behaviour (%)				
Ever smoked cigarette	10	11.5	6.4	0.52
Ever used any tobacco product*	13	16.7	9.1	0.37
High smoking susceptibility (pre-RSL)	13.9	14.1	17.5	0.78
Convenience store behaviour (%)				
Who shop there more than once/week	78.8	74.4	76.3	0.81
Who spend less than 10 min shopping	81.3	67.9	80	0.09
Who spend less than \$10 shopping	80	74.4	72.2	0.49
Tobacco advertising exposure at convenience stores (%)				
Seeing any cigarette advertising in past month	90	92.4	90.1	0.84
Seeing any tobacco advertising in past month†	92.5	96.2	95.1	0.57

*Ever use of cigarettes, electronic cigarettes, smokeless tobacco or cigars/cigarillos.

†Advertising for cigarettes, electronic cigarettes, smokeless tobacco or cigars/cigarillos. RSL, RAND StoreLab.



Figure 1 Photographs of the inside of the RAND StoreLab.

The façade of the RSL consists of a double glass door and window. A sign hangs above the door signifying the name of the store and various product posters hang in the glass window and door (photo 1; [figure 1](#)). The space includes three shelving units and endcaps where name brand food and small household items can be found (photos 2–4; [figure 1](#)). Two refrigerators, one large freezer and two smaller freezers occupy another wall (photo 5; [figure 1](#)). A coffee maker, microwave oven and pastry display sit on another wall.

Product posters adorn the walls, shelves and windows of the store (see [figure 1](#)). Posters for tobacco products appear in the windows and doors of the RSL, as well as on the tobacco power wall (the same tobacco posters appeared on the RSL windows and doors, regardless of experimental condition). Convenience stores typically display about a dozen tobacco posters,²⁵ with a greater number appearing inside (ie, on the tobacco power wall) than outside. Most posters are less than 8.5×11 inches and 2×3 feet in size.²⁶ The RSL tobacco posters are consistent with these conventions.

The tobacco power wall is located behind the check-out counter ([figure 1](#), photo 6); its dimensions are 63 inches (W)×47¼ inches (H). About 80% of the RSL power wall displays cigarettes and the cigarette brands displayed on the RSL power wall correspond roughly to the U.S. market share for cigarettes. The remaining sections of the power wall are smokeless products and cigars (15%); and electronic cigarettes (5%).

The power wall displays (state-consistent) prices for each tobacco product and posters for specific tobacco brands.

We conducted an iterative series of pilot studies with adolescents and adults to improve the realism of the RSL before conducting any experimental studies. Initial focus group participants suggested that we: add new products that were initially absent (and posters for those products); change the layout to more closely mimic that of a real convenience store; and adjust pricing for some products. All participants in the final focus group concluded that the RSL closely resembled a real life convenience store.

Study design and procedure

The study utilised a three-group, randomised between-subjects design. The three experimental conditions were: *cashier*; *side-wall*; or *hidden*. [Figure 2](#) provides photographs of each condition.

This study was approved by the Human Subjects Protection Committee at the RAND Corporation. The study used an authorised deception to balance the internal validity and ethical integrity of the research. During the consent process, conducted by a trained research assistant, participants and their parents were told about the general parameters of the study (eg, that the study involved assessing adolescents' convenience store shopping habits and was minimal risk) and that there were aspects of the study that they could not be told about because that

Figure 2 Photographs of the three experimental conditions that manipulate the location or presence of the tobacco power wall.



Cashier

Side wall

Hidden

knowledge could affect the study results. They were told that they would be provided with all information about the study at the end of the study. Their consent/assent indicated agreement to participate in the study without full knowledge of the study details.

Participants completed the study individually. Participants completed a pre-RSL questionnaire (see below in pre-RSL measures). This questionnaire contained measures related to smoking and tobacco use, convenience store shopping experiences and a number of filler items that were similar in structure to the smoking/tobacco measures but assessed other unrelated behaviours (eg, consumption of fruits and vegetables, soft drinks and 'junk' food). Filler items were included to disguise the true focus of the study.

After completing the pre-RSL questionnaire, participants were randomised to one of the three experimental conditions. They were provided with \$10 from a study research assistant and instructed to shop for whatever items they would like for as long as they would like. They were told to check-out and pay for the items as they would in any convenience store. A second research assistant (not involved in the consent or survey administration process) acted as the RSL cashier, scanning purchased items for a total price, collecting money, providing change and bagging items purchased.

No restrictions were placed on participants' attempts to purchase tobacco products. If a participant tried to purchase a tobacco product, the research assistant at the cashier counter asked for age verification and refused the participant's request (only one participant made a tobacco purchase attempt (for electronic cigarettes)).

After exiting the RSL, participants completed the dependent measure (susceptibility to future cigarette smoking) along with filler items (post-RSL measures below). They were also asked to guess the true purpose of the study. Any items that participants purchased in the RSL were returned (ie, due to concerns with food safety). Participants were then debriefed and shown a 20 min video about cigarette advertising and media literacy (available at <http://www.tobaccofree.org/video.htm>); they also received written smoking prevention materials. Finally, participants received a \$50 gift card for completing the study and transportation costs were reimbursed to parents.

Pre-RSL measures

Demographics

- Age, gender and race were assessed

Convenience store shopping habits

Three items from the Convenience Customer Insights Panel survey (<http://www.cstoredecisions.com/2011/05/31/targeting-convenience-store-customers/>) were used to measure participants' typical convenience store shopping behaviour. Items asked about the frequency of their shopping; how much time they spend shopping; and how much money they spend on any given shopping experience.

Tobacco advertising exposure at convenience stores

Previous exposure to tobacco advertising in convenience stores was assessed with standard items: "During the last 30 days, about how often have you seen advertisements for (cigarettes/snus/cigarillos, electronic-cigarettes) in convenience stores?" Response options were: never, hardly ever, some of the time and most of the time. Responses to this item were coded as never ('0') or hardly ever, some of the time and most of the time ('1').

Smoking and tobacco use history

Lifetime/ever use of each of four tobacco products (cigarettes, smokeless tobacco, cigarillos, electronic cigarettes) was assessed with the question "Have you ever used/smoked (product) in your life?" and responses 'no or yes'. These are standard questions used to assess tobacco use in middle and high school students.²⁷

Susceptibility to future cigarette smoking

Susceptibility to future cigarette smoking was assessed using a 3-item scale adapted from a measure shown to be predictive of future adolescent smoking:²⁸ "Do you think you will try a cigarette anytime soon?"; "Do you think you will smoke a cigarette anytime in the next year?"; and "If one of your best friends offered you a cigarette, would you smoke it?". Responses were made on a 1 (Definitely Not) to 10 (Definitely Yes) scale and summed to produce a measure of susceptibility to future cigarette smoking on which higher scores indicate greater susceptibility to future smoking ($\alpha > 0.95$). Since the distribution of this measure was skewed (ie, over 75% of participants had the lowest score possible on the scale, ie, a '3'), scores on this scale were dichotomised: those who scored a '3' were recoded as '0' (low susceptibility) and any scores greater than '3' were coded as '1' (high susceptibility). This scoring convention is typically used for this particular assessment.^{28 29}

Post-RSL measures

Susceptibility to future cigarette smoking

The same items that were administered as a pre-RSL measure was administered as a post-RSL measure in order to assess near-term changes in susceptibility to future smoking after spending time in the RSL. The same coding/dichotomising procedures were also followed.

Analytic strategy

Logistic regression was used to model susceptibility to cigarette smoking postshopping from experimental condition. Dummy variables were used to represent the 'hidden' and 'sidewall' experimental conditions; the 'cashier' condition was the reference category.

RESULTS

Descriptive information by condition is in [table 1](#). Randomisation was successful in ensuring parity of participant characteristics across experimental conditions. The sample had an average age of 14 years with a relatively even number of participants at each age. The sample was about half female, and a majority was either Caucasian or African-American. Across conditions, 15% of participants reported prior use of any tobacco product; 9% reported cigarette smoking in their lifetime. Fifteen per cent were susceptible to future cigarette smoking at the pre-RSL point. A majority (77%) of the sample visited convenience stores more than once per week and almost all (95%) participants reported seeing tobacco advertising at convenience stores in the past month.

Only 28% of participants across conditions correctly guessed the purpose of the study. There were no differences in correct guesses between conditions ($p = 0.50$) and the results presented below were generally the same regardless of whether those correctly guessing were included in or excluded from the analyses; as such, they were included.

We evaluated all of the variables in [table 1](#) as covariates in the logistic regression model but only pre-RSL susceptibility to

Table 2 Final logistic regression model predicting cigarette smoking susceptibility (post-RSL) from experimental condition

Predictor	b	SE	OR (95% CI)	Wald χ^2	p Value
Experimental condition*					
Hidden	-1.44	0.61	0.24 (0.07 to 0.78)	5.59	0.02
Sidewall	0.11	0.44	1.11 (0.47 to 2.67)	0.06	0.80
Cashier	—	—	—	—	—
Cigarette smoking susceptibility (pre-RSL)†	4.56	0.72	95.58 (23.57 to 391.51)	40.28	<0.01

*The reference category is the cashier condition (0).

†Participants with scores greater than '3' on this measure were coded as 'at risk' of future smoking susceptibility (1).
RSL, RAND StoreLab.

future cigarette smoking improved model fit; as such, only pre-RSL susceptibility to future cigarette smoking is included in the final model results that are presented in table 2 and illustrated in figure 3 (recycled proportion at risk and 95% CI).^{30 31} Hiding the tobacco power wall significantly reduced the odds of participants' susceptibility to future cigarette smoking when compared to the cashier condition ($p=0.02$). Locating the tobacco power wall on a sidewall away from the cashier had no effect on susceptibility to future cigarette smoking compared to the cashier condition ($p=0.80$).

DISCUSSION

Our results show that hiding the tobacco power wall in a life sized replica of a convenience store reduces susceptibility to future cigarette smoking in adolescents. Large-scale surveys have suggested that hiding tobacco displays reduces adolescents' perceptions of peer smoking¹⁵ and experimental research showing that hiding tobacco power wall displays reduces adolescents' perceptions of access to tobacco products and of peers who smoke.^{18 20} The present study goes beyond this prior research in two ways. First, it demonstrates that hiding the tobacco power wall decreases adolescents' susceptibility to future cigarette smoking compared to when the power wall was clearly visible. This finding is important because the susceptibility to future cigarette smoking assessment measured in this study is a potent predictor of future smoking among adolescents.^{28 29} Second, it uses a life sized experimental context, the RSL and simulates a real life shopping experience. This methodological feature is important because it may have improved ecological validity compared with other experimental preparations.

Countries like Canada and Ireland have banned (hidden) tobacco power wall displays. The results of this research provide confirmation that this approach to tobacco control at POS retail locations is a valid one. These results also provide information for the US Food and Drug Administration Centers for Tobacco Products (FDA-CTP) which was created as part of the 2009 Family Smoking Prevention and Tobacco Control Act (TCA) to generate regulations to reduce the impact of cigarette advertising.²³

Implementing POS advertising regulations in the USA is an uncertain undertaking. For example, in 2012, the town of Haverstraw, New York passed a law whereby no tobacco products could be visibly displayed at convenience stores.³² Legal challenges by the tobacco industry eventually led the town to rescind the law. The success of overcoming legal challenges and implementing any TCA-driven advertising regulations at POS is

dependent, in part, on the extent to which a given regulatory approach is supported by the empirical literature.²³ The results of the current study provide evidence that could help to inform regulatory decisions at POS for the FDA-CTP.

One question that the results of this study raise is why moving the tobacco power wall from behind the cash register to a sidewall was not effective at reducing adolescents' susceptibility to cigarette future smoking. One of the ways that tobacco power wall displays are thought to influence tobacco use is by increasing the salience of pro-tobacco messages.¹⁴ Whereas hiding the power wall effectively disrupts these messages (because it hides hundreds of pack faces, posters, logos and pricing information), moving the power wall to a side wall does not (or at least not to the same degree). Although participants in the 'sidewall' condition might not have had as prolonged an exposure to these messages as participants in the 'cashier' condition, they nonetheless passed by the power wall and were able to see it in the RSL. These results cast doubt on moving the tobacco power wall as an effective way to reduce future cigarette smoking risk in adolescents.

A number of other regulatory options are possible at convenience stores, but research will need to document their effectiveness before they are enacted.²³ For example, future studies could examine whether altering the size of the tobacco power wall influences future cigarette smoking risk. Studies could also evaluate whether introducing antismoking posters at retail POS locations or altering the number, size and colour of tobacco posters has any influence on future smoking risk or other smoking-related outcomes. Finally, research could evaluate how tobacco purchases using experimental preparations like the RSL align with tobacco purchases in the real world.

Limitations of this study are as follows. First, the sample was reactively recruited and African-Americans were less likely to show-up for the study after being scheduled compared with youth from other racial groups. Moreover, ever users of tobacco products were under-represented in our sample compared with the youth population of the USA.²⁷ These features of our study limit generalisability. Second, we focused only on susceptibility to future cigarette smoking because cigarette packages composed most of the area of the tobacco power wall. It is not

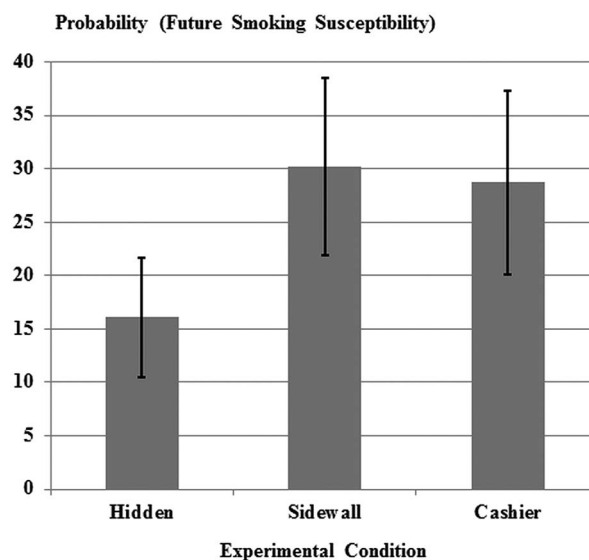


Figure 3 Recycled proportion (95% CI) for future smoking susceptibility (post-RAND StoreLab) between participants in the three conditions.

known whether hiding a tobacco power wall that more prominently featured alternative tobacco products would have a similar effect on risk of use of these products. Third, although our dependent measure, susceptibility to future cigarette smoking, has been shown to be a potent predictor of smoking in adolescents in several studies,^{28 29} we did not measure actual smoking behaviour in this experiment. Finally, the environment of the RSL, though closely modelled after a real convenience store, is still an artificial one. The POS environment affects consumer behaviour in complex ways in the real world, and other variations in the retail environment (eg, store cleanliness, store size) could influence tobacco use in ways that are not captured by the RSL. The RSL does not allow modelling of the entire process of how the POS environment influences adolescent smoking. Rather, the RSL allows us to look closely at a carefully chosen 'slice' of this entire process and provide information for how altering specific features of the POS retail environment (that are amenable to regulatory intervention) influence near term changes in tobacco use risk.

What this paper adds

- Exposure to point-of-sale (POS) cigarette advertising contributes to risk of cigarette smoking initiation in adolescents and triggers smoking in adult smokers. An important component of POS advertising is the tobacco power wall.
- Experimental evidence that more closely approximates a real life shopping context is needed to determine whether hiding the tobacco power wall reduces risk of smoking in adolescents.
- By being conducted in a replica POS convenience store, the current experiment provides evidence that hiding the tobacco power wall is a strong regulatory option for reducing the impact of the retail environment on cigarette smoking risk in adolescents.

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