

Review

A Systematic Review on the Impact of Point-of-Sale Tobacco Promotion on Smoking

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Abstract

Introduction: The tobacco retail environment is a crucial marketing medium for the industry. A 2009 review found evidence of a positive association between exposure to point-of-sale (POS) tobacco promotion and increased smoking and smoking susceptibility, though limitations in the evidence base were identified.

Aim and Methods: We reviewed and critically appraised recent evidence documenting the influence of POS tobacco promotion, and POS tobacco display bans, on smoking-related behavior and cognitions. We reviewed original quantitative and qualitative research that examined the relationship between POS tobacco promotion and smoking prevalence, individual-level smoking and quitting and tobacco purchasing behavior, smoking susceptibility, and smoking-related cognitions.

Results: Twenty peer-reviewed studies (18 quantitative and 2 qualitative) met the inclusion criteria; each study reported findings consistent with a positive association between exposure to POS tobacco promotion and smoking or smoking susceptibility. Several studies met key criteria for causality: 4 indicated a dose–response association, 2 prospective studies were identified, and evidence from intervention studies supported the reversibility of the association. Findings were consistent across different study designs, settings, and measures.

Conclusions: The existing evidence supports a positive association between exposure to POS tobacco promotion and smoking. This review provides evidence to support the continuation of POS tobacco display bans in those jurisdictions where such legislation has been introduced and strengthens the evidence encouraging similar policies in jurisdictions without a POS display ban.

Introduction

As restrictions on tobacco advertising in traditional media have increased, the industry has become more reliant on the retail environment as a marketing medium.^{1,2} In 2011, the U.S. tobacco industry paid \$7 billion in incentives to retailers and wholesalers, representing 84% of the total expenditure on advertising and promotion by

the largest cigarette manufacturers in the country.³ These incentives encourage retailers to use point-of-sale (POS) advertising, signage, and product “slotting” (preferred positions in displays)^{1,4,5} and demonstrate the importance of the retail environment to the industry. Industry documents suggest that POS marketing aims to increase “category growth,” or tobacco consumption,² and marketing publications have described POS displays as, “the last resort in advertising

tobacco products.”^{6(p8)} Data from the United States suggest that POS tobacco promotion may increase sales by 12%–28%,⁷ so it is unsurprising that the industry has opposed moves to ban the open display of tobacco products in retail outlets^{8,9} and mounted legal challenges to this policy.^{7,10}

In 2009, a systematic review identified 12 peer-reviewed articles examining the impact of POS tobacco promotion¹¹: 10 on smoking initiation among children and 2 on adult smokers. The evidence was consistent with a positive association between exposure to POS tobacco promotion and increased smoking; however, areas of weakness in the evidence base were highlighted. The need for more prospective studies was identified, as well as for studies on POS promotion and quitting and research pre- and postimplementation of POS display bans. Several jurisdictions have banned POS tobacco displays, and six of these took effect since the 2009 review was published (Ireland, Australia, Norway, New Zealand [NZ], Finland, and the United Kingdom). As a larger evidence base documenting the impact of POS tobacco display bans now exists, we aimed to update and extend the 2009 review and examine how recent research affects evidence of an association between POS tobacco promotion and smoking. Updating earlier evidence is important to ensure a comprehensive and current research base, providing a resource for tobacco control researchers and advocates. Tobacco industry-commissioned research has heavily criticized the evidence linking POS tobacco displays and smoking (B. Gunter, PhD, unpublished data, 2010).^{12,13} Such criticisms may impede the development of effective tobacco control policies, hence the importance of updating reviews of the evidence base. This review provides an opportunity to examine and put into perspective these criticisms.

Methods

Literature Search Strategy

Relevant literature published since 2008 was identified initially through keyword searches in MEDLINE (OvidSP), Scopus, and Web of Science. The search terms were similar to those used by Paynter and Edwards¹¹: the keywords “tobacco” or “smoking” or “cigarette” were combined with “point-of-sale,” “point of sale,” “POS,” “point-of-purchase,” “point of purchase,” “POP,” “power wall,” or “retail.” Subsequent searches combined “quit,” “relapse,” or “cessation” and “ban*,” “remov*,” “prohibit*,” or “evaluation” with the retail search terms. The titles of retrieved articles were reviewed and references were discarded if they were not related to tobacco control. The titles and abstracts of the remaining references were used to identify whether articles were relevant and met the inclusion criteria below. The full text of articles was obtained where further clarification on the measures and study objective was needed. Further searches were conducted using the reference lists and “cited by” lists of retrieved articles and through “related article” searches on Google Scholar. The 2013 online editions of *Tobacco Control* and *Nicotine & Tobacco Research* were scanned for relevant articles. The literature searches were conducted in October 2013. Searches were conducted by the lead author. LR and RM independently reviewed the articles for eligibility for inclusion.

Inclusion Criteria

We included original qualitative or quantitative research published in a peer-reviewed journal between January 1, 2008, and October 30, 2013, and written in English. Similar to Paynter and Edwards¹¹ criteria, research was eligible if it included either self-reported or

objective measures of exposure to POS tobacco promotion (e.g., awareness of POS promotion, visits to stores where POS promotion was present, assessments of the quantity of POS tobacco promotion within a specified study area); this criterion included both “real-world” exposure to POS tobacco promotion and simulated exposure in experimental research. Exposure data relating to cigarette brand awareness were included only if the measure specifically identified brands in a retail setting. For all studies, the inclusion criteria for outcome measures were population-level smoking prevalence, individual-level smoking behavior (experimentation, smoking initiation, regular smoking, quitting behavior and relapse, and cigarette purchasing behavior), smoking-related cognitions (e.g., smoking susceptibility, cravings to smoke, perceived likelihood of future smoking, perception of peer smoking prevalence), and population-level cigarette sales data. For research examining the impact of removing POS tobacco promotion, quantitative studies were eligible if the exposure measure included implementation of legislation restricting POS displays and promotion, and a comparison of pre- and postlegislation outcome measures was reported. Qualitative research was eligible if it examined smoking behaviors or smoking-related cognitions following exposure to, or in relation to the removal of, POS tobacco promotion.

Several potentially relevant articles identified during the literature search process did not meet inclusion criteria, including studies of (a) access to tobacco retailers and smoking,^{14–19} (b) retailer compliance with POS display bans,^{20–23} (c) support for POS display bans,^{24,25} and (d) the relationship between exposure to tobacco advertising and smoking.^{26,27}

Critical Appraisal

The methodological strengths and weaknesses of quantitative studies were systematically examined by the lead author. Specifically, the validity and suitability of the exposure and outcome measures, the risk of bias and confounding at outcome and study levels, external validity, effect sizes, and overall strength of evidence were assessed for each study. Evidence supporting a causal relationship was assessed according to strength, consistency, reversibility and plausibility of association, and evidence of a dose–response association and a temporal relationship.²⁸ Qualitative studies were critically appraised in terms of the suitability of the sample, methods of data collection and analysis, generalizability of findings and extent of reflexivity.²⁹ Data were extracted to a summary table and final summaries were agreed upon following discussion between the lead author and RM.

Results

The initial literature searches yielded 803 potential articles ([Supplementary Appendix](#)). Of these, 19 were judged to have met the inclusion criteria for the review. Supplementary searches using the 19 articles resulted in the identification of one additional study meeting inclusion criteria, giving a total of 20 articles that were fully reviewed. Nine examined the association between exposure to POS tobacco promotion and smoking among children and young people. Of these, five were cross-sectional, one was experimental, and three were longitudinal. Six articles examined quitting and tobacco purchasing behaviors among adult smokers: four were cross-sectional, one was longitudinal, and one was qualitative. A further five studies evaluated the impact of POS display bans; these were predominantly quantitative pre- and postlegislation surveys, and one qualitative study was identified.

Findings From Studies of Children and Young People

Cross-Sectional Studies

These studies used large-scale surveys to collect both exposure and outcome data cross-sectionally (Table 1); two linked outcome data to objective estimates of retail tobacco advertising within a school neighborhood or at the county level.^{30,31} Other exposure measures included self-reported awareness of, or attraction to, POS displays, store-visiting frequency, and cigarette brand recognition. Outcome measures were predominantly individual level; the exception was school smoking prevalence.³⁰ Two were conducted in the United States, two in the United Kingdom, and one in NZ, and samples comprised schoolchildren aged between 9 and 17 years old. Each of the five studies reported a positive association between exposure and outcome. This was the case across varied outcomes, including prosmoking attitude, smoking susceptibility, experimental smoking, current smoking, and school smoking prevalence, regardless of whether the exposure was frequency of visiting stores where tobacco was displayed or frequency of noticing tobacco in-store (Table 1).

The most common outcome examined was smoking susceptibility. Susceptibility is an indicator of a never-smoker's predisposition to smoking, based on intentions and expectations of future behavior, and has been found to be a valid predictor of future smoking among adolescents.³⁶ Compared with outcomes such as being a current or experimental smoker, the susceptibility measure provides greater confidence about the direction of an association between POS tobacco promotion and smoking. This is because increased susceptibility among never-smokers is unlikely to result in greater exposure to POS tobacco since these individuals are not yet buying tobacco. The U.K. study sample consisted solely of children who reported having never smoked.³³ Both self-reported noticing of and attraction to POS tobacco displays were independently associated with increased smoking susceptibility after controlling for demographic and other smoking-related variables, thus providing convincing evidence of a true association, albeit with a small effect size (adjusted odds ratios [AORs]: 1.07 and 1.77). Paynter et al.³⁴ and Spanopoulos et al.³⁵ used the same susceptibility measure but also examined current and experimental smoking as outcomes. Each study used self-reported store-visiting frequency and frequency of noticing tobacco in-store as exposure measures. Together, these methodologically robust studies provide strong evidence of a small-to-moderate effect of POS tobacco displays on increased smoking and smoking susceptibility among children (AORs: 1.04–3.15), even after controlling for an extensive range of potential confounding factors.

Two studies used an ecological design, which minimizes recall or social desirability bias in exposure assessment.^{30,31} Henriksen et al.³⁰ measured exposure by assessing the density of tobacco retail advertising around schools. Schools with any retail tobacco advertising in their neighborhood had a smoking prevalence approximately 2% greater than those with none, though there was no association with number of cigarettes smoked in the past 30 days. However, the exposure assessment was limited since other factors, such as participants' store-visiting frequency, were not assessed. Kim et al.³¹ used county-level estimates of POS tobacco advertising and price promotions as exposure measures and a range of cognitive and behavioral smoking-related outcomes. Living in a county with greater retail tobacco promotion was associated with greater odds of being a current smoker and of having a prosmoking attitude (AORs: 1.57 and 1.15, respectively). However, there were inconsistencies in the results according to geographical area, and several analyses resulted in non-statistically significant results. It is plausible that the county-level

exposure estimate may have masked variation in the actual exposure which, if nondifferential, would have biased the results toward the null and may accounted for some of the nonstatistically significant results. Uncontrolled confounding associated with differences between urban areas and the rest of the state may also explain the inconsistent results.

Experimental Study

Kim et al.³² used an online scenario in which participants were asked to select any four items for purchase within a virtual store and complete an online survey. Current smokers and never-smokers not exposed to POS tobacco displays in the scenario were less likely to attempt to purchase cigarettes compared to those who were exposed to POS tobacco displays (AOR: 0.22–0.39). Removing retail cigarette advertisements alone had little effect on purchasing behavior, which suggests POS displays in particular may be most salient to youth. The randomized design is a particular strength of the study, as the observed differences between the experimental conditions are highly unlikely to have been confounded by an unmeasured variable. Although external validity is a limitation of this type of research, the strength of randomized experimental studies such as this is that they provide convincing evidence of a causal relationship.

Cohort Study

Shadel et al.³⁷ used ecological momentary assessment (EMA), whereby participants used smartphones to log the number of real-time exposures to POS tobacco advertising encountered over a 21-day period (Table 2). Outcome data were self-reported smoking susceptibility ratings, and participants were found to report higher levels of smoking susceptibility following exposure to POS tobacco advertising, compared to random intervals during the day. An important limitation to these findings is that 61% of participants were ever-smokers and 37% of these reported smoking in the past month; therefore, this measure of susceptibility is not as strong as the validated measure used in other studies (e.g., Mackintosh et al.³³).

Dauphinee et al.³⁸ examined the relationship between never-smokers' cigarette brand recognition at baseline and risk of smoking initiation over 12 months. Exposure to POS tobacco promotion was estimated by students' ability to name three brands represented in photographs of retail tobacco advertisements with brand names removed. Never-smokers at baseline who recognized the Newport brand were significantly more likely to report having tried smoking 12 months later (AOR: 1.49, 95% CI = 1.04–2.15). Neither recognition of Camel nor Marlboro was associated with ever-smoking. A limitation with this exposure measure is that children's recognition of cigarette brands may follow exposure to the packs smoked by parents or friends or to advertisements at locations other than the POS. These factors make it difficult to conclude that the association with Newport brand is specifically a result of POS promotion. However, the analyses controlled for friend and family member smoking, and a store-visiting frequency measure was also included in the statistical models. Store-visiting frequency was not significantly associated with smoking initiation, though the ORs were in the expected direction (range 1.12–1.17). Thirty-eight percent of the sample ($n = 726$) was lost to follow-up, and those students lost had significantly higher store-visiting rates at baseline, meaning that the reported results may be biased toward a null association.

A prospective cohort study among never-smokers³⁹ used frequency of store-visiting and of noticing tobacco as exposure measures and a more objective composite variable based on tobacco

Table 1. Cross-Sectional and Experimental Studies of Smoking and Exposure to POS Tobacco Promotion in Children and Young People

References	Location, study year, participants	Study design	Exposure(s)	Outcome(s)	Analytical method	Adjustment	Results
Henriksen et al. ³⁰	California, United States, 2005–2006; 135 high schools (age of students unstated)	Cross-sectional, statewide school survey	1. Density of retail cigarette adverts in school neighborhood (none, moderate, high)	a. School smoking prevalence b. No. of cigarettes in past 30 days	Ordinary least squares regression	School-level ethnicity and SES, school achievement, neighborhood SES and population density, neighborhood type (urban/rural)	1a. Positive association: approx. 2% increase in school smoking prevalence in neighborhoods with any advertising vs. no advertising 1b. Not statistically significant
Kim et al. ³¹	NY state, United States, 2004–2008; 58,964 students aged 9–17 years	Cross-sectional, statewide school surveys	1. Mean cigarette adverts per store at county level 2. Mean price promotions per store at county level	a. Prosmoking attitude b. Smoking susceptibility c. Retail stores usual source of tobacco d. Current smoking e. Frequent smoking f. Cigarettes per day	Logistic and linear regression. Stratified by smoking status and area	Age, ethnicity, gender, student income, school smoking prevalence, living with smoker, county of residence, survey year	1a. Positive association among nonsmokers living outside of New York City (NYC) (AOR: 1.15, 95% CI = 1.05–1.25) 2b. Negative association for nonsmokers living in NYC (AOR: 0.64, 95% CI = 0.48–0.86) 2d. Positive association for NYC youth (AOR: 1.57, 95% CI = 1.01–2.44) No other statistically significant associations between remaining exposure and outcome variables
Kim et al. ³²	United States, year of data collection not stated, 1,216 children aged 13–17 years	Experimental study; virtual shopping scenario	Random assignment to one of six conditions: C1. Open POS display, ads in store C2. Enclosed display, ads in store C3. Enclosed display, ads in store, cabinet ads C4. Open display, no ads in store C5. Enclosed display, no ads in store C6. Enclosed display, no ads in store, cabinet ads	a. Tobacco purchase attempt in virtual store b. Perceived ease of purchasing tobacco in real store	Logistic regression. Stratified by smoking status	Age, ethnicity, sex, sensation seeking, friends smoking, living with smoker, store-visiting frequency, perceives virtual store resembles real store. Current smoker models controlled for usual source of cigarettes	a. Compared to C1, the display ban conditions (C2, C3, and C6) were each associated with decreased odds of purchase attempt among never-smokers (AORs: 0.22–0.28) and current smokers (AORs: 0.27–0.39) b. Compared to C1, C5 was associated with decreased odds of perceiving cigarettes to be hard to purchase, among never-smokers only (AOR: 0.49, 95% CI = 0.28–0.85)

Table 1. Continued

References	Location, study year, participants	Study design	Exposure(s)	Outcome(s)	Analytical method	Adjustment	Results
MacKintosh et al. ³³	United Kingdom, 2008; 946 never-smokers aged 11–16 years	Cross-sectional, nationwide survey	1. Noticing POS tobacco displays during past month (yes/no) 2. Attraction to POS displays (continuous)	a. Smoking susceptibility	Logistic regression	Age, gender, social grade, parental smoking, close friend smoking, sibling smoking, Attraction to POS display model controlled for display noticing	1a. Positive association (AOR: 1.77, 95% CI = 1.15–2.73) 2a. Positive association (AOR: 1.07, 95% CI = 1.03–1.11)
Paynter et al. ³⁴	New Zealand, year of data collection not stated; 27,757 students aged 14–15 years	Cross-sectional, nationwide survey	1. Store-visiting frequency (at least daily, two to three times week, weekly, less than weekly) 2. Frequency of noticing tobacco in-store (every time, most times, sometimes, hardly ever, never)	a. Experimental smoking (vs. never-smoking) b. Smoking susceptibility c. Current smoking	Three-level mixed effect logistic regression	Age, sex, ethnicity, peer and parental smoking, school-level SES, smoking in the home *unadjusted odds reported	1a. Positive association: (AOR: 2.7, 95% CI = 2.4–3.1) 1b. Positive association: (AOR: 1.8, 95% CI = 1.6–2.2) 1c. Positive association: (OR*: 4.1, 95% CI = 3.4–4.9) 2a. Positive association: (AOR: 1.5, 95% CI = 1.3–1.7) 2b. Positive association: (AOR: 2.0, 95% CI = 1.7–2.3) 2c. Positive association: (AOR: 3.5, 95% CI = 2.8–4.4) Associations above refer to most frequent vs. least frequent exposure (i.e., ref)

Table 1. Continued

References	Location, study year, participants	Study design	Exposure(s)	Outcome(s)	Analytical method	Adjustment	Results
Spanopoulos et al. ³⁵	Nottingham, England, 2011; 5,376 children aged 11–15 years	Cross-sectional, citywide survey	1. Store-visiting frequency (almost every day, two to three times a week, once per week, less than once per week) 2. Frequency of noticing tobacco in-store (every time, most times, sometimes, hardly ever, never) 3. Cigarette brand recognition from retail tobacco displays (number identified)	a. Ever-smoking (vs. never-smoking) b. Smoking susceptibility	Logistic regression analysis	Gender, SES, school year, ethnicity, perceived academic performance, rebelliousness/sensation seeking, parent and sibling smoking, home smoking status, friends smoking, perceived peer smoking prevalence	1a. Positive association: (AOR: 2.23, 95% CI: 1.40–3.55) 1b. Positive association: (AOR: 1.62, 95% CI: 1.25–2.10) 2a. Not statistically significant (AOR: 1.67, 95% CI: 0.85–3.28) 2b. Positive association: (AOR: 3.15, 95% CI: 1.52–6.54) 3a. Positive association: (AOR: 1.05, 95% CI: 1.03–1.06) 3b. Positive association: (AOR: 1.04, 95% CI: 1.02–1.05) Associations above refer to most frequent vs least frequent exposure (i.e. ref).

Ads = advertisements; AOR = adjusted odds ratio; CI = confidence interval; POS = point-of-sale; ref = reference group; SES = socioeconomic status. All relevant statistically significant associations are reported in the “Results” column, and the label for each association (e.g., 1a, 2b, etc.) refers to the exposure and outcome analyzed, as indicated by the labels in the “Exposure” and “Outcome” columns.

Table 2. Longitudinal Studies of Smoking and Exposure to POS Tobacco Promotion in Children and Young People

References	Location, study year, participants	Study design	Exposure(s)	Outcome(s)	Analytical method	Adjustment	Results
Dauphinee et al. ³⁸	Tracy, California, 2006–2008; 1,179 never-smokers aged 11–15 years at baseline	Prospective cohort study, 12-month follow-up	1. Cigarette brand recognition (yes/no for three brands) 2. Store-visiting frequency (sum of visits per week for three store types)	a. Ever-smoking (vs. never-smoking)	Hierarchical general linear models	Gender, ethnicity, school year, survey year, school performance, unsupervised days after school, risk-taking propensity, smoker at home, friend who smokes	1a. Positive association for Newport brand recognition (AOR: 1.49, 95% CI = 1.04–2.15). Associations for Camel and Marlboro not statistically significant 2a. Associations not statistically significant (AOR: 1.12–1.17)
Henriksen et al. ³⁹	Tracy, California, 2003–2005; 1,356 never-smokers aged 11–14 years at baseline	Prospective cohort study, 12-month and 30-month follow-up	1. Store-visiting frequency (low, moderate, high) 2. Frequency of noticing tobacco advertising in-store (often vs. less than often) 3. Composite “brand exposure” measure (based on store-visiting frequency and objective assessment of in-store advertising: low, moderate, high)	a. Ever-smoking (vs. never-smoking)	Logistic and linear regression analysis	Gender, ethnicity, racial minority status, parent/household smoking, friend smoking, exposure to tobacco in movies/TV, school year, academic performance, risk-taking propensity, and unsupervised time after school. Brand exposure model controlled for noticing tobacco in-stores	1a. Positive association both at 12-month (AOR: 2.58, 95% CI = 1.68–3.97) and 30-month follow-up (AOR: 1.42, 95% CI = 1.19–1.69) 2a. Not statistically significant at 12 months (AOR: 0.90, 95% CI = 0.74–1.1) but positive association at 30-month follow-up (AOR: 1.11, 95% CI = 1.02–1.22) 3a. Positive association both at 12-month (AOR: 2.36, 95% CI = 1.55–3.61) and 30-month follow-up (AOR: 1.58, 95% CI = 1.05–2.37) Associations above refer to most frequent/highest vs. least frequent/lowest exposure (i.e., ref)
Shadel et al. ³⁷	Location unspecified, United States, 2010–2011; 134 college students (mean 21 years)	EMA	1. Real-time viewing of POS tobacco promotion (total number in 21 days)	a. Smoking susceptibility	Hierarchical linear mixed model	Gender, ethnicity, day of week, smoking status	1a. Positive association: higher susceptibility following exposure to POS tobacco promotion compared to the randomly sampled prompts (adjusted <i>B</i> coefficient = 0.13, <i>p</i> < .001)

AOR = adjusted odds ratio; CI = confidence interval; EMA = ecological momentary assessment; POS = point-of-sale; ref = reference group. All relevant statistically significant associations are reported in the Results column and the label for each association (e.g., 1a, 2b, etc.) refers to the exposure and outcome analyzed, as indicated by the labels in the “Exposure” and “Outcome” columns.

promotion in stores around participating schools. The outcome, smoking initiation, was found to be positively associated with each exposure measure at both 12 and 30 months (with one exception), even after controlling for a range of confounding variables. Findings were consistent with cross-sectional studies,^{11,33,35} with small-to-moderate effect sizes observed (ORs 1.11–2.58), and provide strong evidence of a causal relationship.

Findings From Studies Examining the Impact of POS Promotion on Adult Smoking

These studies varied in design (Table 3): two comprised postpurchase interviews,^{7,40} one was a diary-style study,⁴¹ and two were surveys⁴², one with an 18-month follow-up.⁴³ Four were conducted in Australia and one in the United States. Exposure measures included viewing tobacco at POS, self-reported store-visit frequency, and noticing of POS displays. Each study examined individual-level outcomes, including smoking-related, quitting-related, and tobacco purchasing-related behaviors, and perceptions about the influence of POS promotion. Samples comprised adult smokers, with recent quitters also included as a subgroup in one study. Differences in study design limit comparisons, though in the three studies that used regression analyses, the findings were consistent overall. Positive associations were reported between exposure to POS tobacco promotion and smoking and tobacco purchasing (including urge to purchase and impulse purchase) and a negative association between exposure to POS tobacco and abstinence from smoking.

Both postpurchase survey studies^{7,40} found that a small-to-moderate proportion of tobacco purchases were made on impulse, and approximately one third of smokers agreed POS promotion made quitting smoking more difficult (a similar finding was also reported by Wakefield et al.⁴²). Immediate postpurchase interviews minimize any recall bias associated with retrospective reporting of impulse purchasing. However, each study used only self-reported data, and the use of direct, and potentially leading, questioning about the role of POS displays (e.g., “Did the cigarette displays encourage you in any way to purchase cigarettes in this instance?”⁷) may have influenced participants’ responses. The studies largely rely on descriptive data and do not have comparative information from controls not exposed to POS displays; these attributes limit conclusions that can be drawn about an association between POS display exposure and tobacco purchasing behavior.

The large, population-based survey by Wakefield et al.⁴² is a more methodologically robust examination. More frequent noticing of POS tobacco displays was associated with greater odds of impulse purchasing and having an urge to purchase tobacco, and daily store visiting was also associated with greater urge to purchase tobacco (AORs: 2.11–3.88). This study has limitations as both the exposure and outcome measures relied on self-reported data, with impulse purchasing of tobacco reported retrospectively. Due to their nature, unplanned purchases may be underreported, though if this were the case, it would have biased the associations toward the null, resulting in an underestimate of the association. Retrospective reporting of quit attempts during the past 12 months may also have been underestimated, though any effect would have been a reduction in the size of this subgroup of participants, rather than changing the associations that were reported.

Collecting real-time exposure and outcome data, as one study did,⁴¹ overcomes limitations associated with self-reported data. Participants recorded whether they had seen cigarettes for sale during each 4-hr period that they were awake over 4 days. A lagged

analysis was used to examine whether exposure to POS displays in one period predicted tobacco purchase in the following period while controlling for prior period purchase. Participants who had purchased tobacco in the same 4-hr period as their recorded exposure to POS displays were excluded from the analyses, providing more certainty as to the direction of the association observed. The main finding was a small and marginally significant association between exposure to POS displays and subsequent purchase of tobacco. This approach would likely have provided a more conservative estimate of the true size of the association since the excluded data would have included those participants who made their tobacco purchase decision as a result of a separate, prior exposure to POS displays within the same 4-hr period, or on impulse.

A methodologically robust prospective study of smokers in Australia⁴³ found that smokers who were more sensitive to POS displays were around 70% less likely to have quit smoking at 18-month follow-up compared to those who were less sensitive. Sensitivity to POS displays was not associated with attempts to quit during the follow-up. The use of a composite sensitivity variable (based on three measures of exposure to POS promotion) is a strength although each of the measures was self-reported. The attrition rate between baseline and follow-up was 51%: it is not known whether those lost to follow-up differed from the remaining sample in terms of quit status though there were no differences between groups in POS sensitivity or number of cigarettes per day. The likely effect of the high attrition would be reduced power due to the smaller sample size at follow-up, though in spite of this limitation, the association between exposure and the main outcome was statistically significant.

Qualitative Study

A NZ study conducted with a sample of smokers used in-depth interviews to investigate how tobacco retail displays affect smoking behavior and quit attempts.⁴⁴ Thematic analysis suggested that the size, prominence, and position of tobacco displays were aspects of the POS environment relevant to smokers and recent quitters. Some participants felt unaffected by tobacco displays, while others felt tempted by them, and cravings often prompted purchase. Exposure to tobacco brand imagery often primed sensations relating to smoking rituals and their perceived benefits to the smoker. The in-depth interview approach was an appropriate methodology, and the overall approach was pragmatic, with an emphasis on policy implications. The sampling approach was consistent with “typical case sampling,”²⁹ and the sample representative of typical long-term smokers in NZ.

Studies Evaluating the Impact of POS Tobacco Display Bans

Two studies used nationwide pre- and postlegislation surveys^{45,46} and one used a longitudinal cross-country comparison¹⁰; in each study, the postlegislation follow-up period was 12 months or less. The remaining studies included an analysis of national retail tobacco sales⁴⁷ and a qualitative methodology⁴⁸ (Table 4). Two were conducted in Ireland, one in Norway, and the multicountry study included Australia, Canada, the United States, and the United Kingdom. The varied samples comprised population-based samples of adults, young people, smokers, and former smokers. A variety of smoking and tobacco purchasing-related outcome measures were examined. While there are some inconsistencies in the findings, the studies provide evidence that POS bans may contribute to a shift

Table 3. Quantitative Studies of Smoking and Exposure to POS Tobacco Promotion Among Adult Smokers

References	Location, study year, participants	Study design	Exposure(s)	Outcome(s)	Analytical method	Adjustment	Results
Burton et al. ⁴¹	New South Wales, Australia, 2007–2008; 1,109 adult smokers (mean age not stated)	Diary-style study	1. Real-time viewing of POS tobacco displays over 4-day study period (yes/no within each 4-hr interval)	a. Smoking within 4-hr interval b. No. of cigarettes smoked in 4-hr interval c. Tobacco purchase in 4-hr interval	Multilevel regression modeling and lagged regression analysis	Age, gender, smoking status, SES, presence of friend/family smoking, presence of others smoking. Participants that saw POS displays and purchased tobacco in same interval were excluded. Lagged analysis adjusted for purchase of cigarettes in previous 4-hr period	1a. Positive association: (AOR: 1.45, 95% CI = 1.36–1.55) 1b. Positive association: (event rate ratio: 1.21, 95% CI = 1.16–1.26) 1c. Marginally significant association (AOR: 1.15, 95% CI = 0.99–1.34, $p = .066$)
Carter et al. ⁷	Perth, Australia, year of study not stated; 206 adult daily smokers (mean age 37 years)	Face-to-face postpurchase survey	All participants exposed to POS tobacco display while purchasing tobacco in store immediately prior to survey	a. Unplanned tobacco purchase b. Factors in-store that prompted purchase c. Agreed POS display encouraged purchase d. Purchased nonusual brand e. Factors that prompted nonusual brand purchase f. Agreed POS display encouraged nonusual brand purchase g. Agreed removing POS displays would make quitting easier	Descriptive statistics and chi-square test	Not applicable	a. 22% ($n = 45$) made unplanned purchases b. 8% ($n = 16$) spontaneously said POS display prompted purchase c. 19% ($n = 40$) agreed POS display had encouraged purchase. Greater tendency to report being influenced by tobacco displays among unplanned than planned purchasers (47% vs. 12%, $p < .001$) d. 5% ($n = 11$) purchased nonusual brand e. None spontaneously said POS display prompted nonusual brand purchase f. 3% ($n = 6$) said POS display had encouraged nonusual brand purchase g. 28% ($n = 58$) agreed removing POS displays would make quitting easier

Table 3. Continued

References	Location, study year, participants	Study design	Exposure(s)	Outcome(s)	Analytical method	Adjustment	Results
Clattenburg et al. ⁴⁰	Vermont, United States, 2010; 301 adult smokers (median age 32 years)	Face-to-face postpurchase survey	All participants exposed to POS while purchasing tobacco in store immediately prior to survey	a. Unplanned tobacco purchase b. Factors in-store that prompted unplanned purchase c. Agreed POS tobacco promotion influences cigarette brand or product purchased d. Purchased nonusual brand e. Agreed POS promotion makes quitting harder	Descriptive statistics	Not applicable	a. 11% (<i>n</i> = 34) made unplanned purchases b. 76.5% (<i>n</i> = 26) said POS promotion prompted unplanned purchase c. 13% (<i>n</i> = 39) agreed POS influences brand/product choice d. 14% (<i>n</i> = 43) purchased nonusual brand e. 31% (<i>n</i> = 94) agreed POS promotion makes quitting harder
Germain et al. ⁴³	Victoria, Australia, 2008, 222 adult smokers (mean age 42.6 years)	Prospective cohort study, 18-month follow-up	1. POS display sensitivity (low, medium, high)	a. Having quit smoking (vs. smoking) b. Quit attempt in previous 18 months	Logistic regression analysis	Sex, SES, age, and no. of cigarettes per day	1a. Negative associations: (AOR: 0.27, 95% CI = 0.08–0.91), for high vs. low POS sensitivity. Also significant for medium vs. low POS sensitivity (AOR: 0.32, 95% CI = 0.14–0.74) 1b. No statistically significant associations
Wakefield et al. ⁴²	Victoria, Australia, 2006, 2,996 adults (506 smokers, 67 recent quitters; average age not stated)	Cross-sectional, statewide survey	1. Store-visiting frequency daily (vs. not daily) 2. Frequency of noticing tobacco in-store at least sometimes (vs. rarely/never)	a. Impulse purchasing cigarettes due to POS displays b. Agreement that removing POS displays would make quitting easier c. Urge to buy cigarettes after seeing POS displays (among attempting quitters)	Descriptive statistics and logistic regression	Age, sex, SES, cigarette consumption level, quit attempt in past 12 months, considering quitting in next 6 months	Descriptive statistics: a. 25% purchased due to seeing POS displays at least sometimes b. 31% agreed/strongly agreed removing POS displays would help quitting c. 38% said seeing POS displays had caused urge to buy cigarettes Regression: 1a. Association not statistically significant (AOR: 1.39, 95% CI = 0.86–2.24) 1b. Association not statistically significant (OR not reported) 1c. Positive association: (AOR: 2.11, 95% CI = 1.05–4.25) 2a. Positive association: (AOR: 2.49, 95% CI = 1.29–4.80) 2b. Positive association: (AOR: 2.38, 95% CI = 1.35–4.17) 2c. Positive association: (AOR: 3.88, 95% CI = 1.36–11.03)

AOR = adjusted odds ratio; CI = confidence interval; POS = point-of-sale.

Table 4. Quantitative Studies Evaluating the Impact of Removing POS Tobacco Promotion on Smoking and Cigarette Sales

References	Location, study year, participants	Study design	Exposure(s)	Outcome(s)	Analytical method	Adjustment	Results
Li et al. ¹⁰	Australia, Canada, United States, and United Kingdom, adult smokers, Wave 5 (<i>n</i> = 8,242) 2006–2007; Wave 6 (<i>n</i> = 8,193) 2007–2008; Wave 7 (<i>n</i> = 7,206) 2008–2009; Wave 8 (<i>n</i> = 5,939) 2010–2011	ITC Four Country Survey	1. Presence of POS displays country level; (present in the United Kingdom and United States; banned in Canadian and Australian jurisdictions) 2. Individual level; resides in display ban area (vs. area without ban)	a. Impulse purchase as a result of seeing POS promotion (Wave 8 only) b. Nonusual brand purchase due to POS promotion (Waves 6–8)	Descriptive statistics; logistic regression for same year cross-country comparison; GEE modeling for over-wave comparison	Age, sex, education level, income, and cigarettes per day	1a. Positive association: greater odds of impulse purchase due to POS displays in the United States (OR: 3.26, 95% CI = 2.13–4.99) and United Kingdom (OR: 2.49, 95% CI = 1.58–3.91) compared to Canada; no significant difference in odds of impulse purchase between Canada and Australia 1b. The odds of nonusual brand purchase were significantly lower in Wave 8 vs. Wave 6 in Australia (AOR: 0.71, 95% CI = 0.53–0.95) and Canada (AOR: 0.58, 95% CI = 0.46–0.73), though not in the United Kingdom (OR: 0.89, 95% CI = 0.73–1.08). In the United States, there was a significant decline in purchase of nonusual brands because of POS across waves, though this was high at each wave 2a. Negative association: residing in area with display ban associated with lower impulse purchase (AOR: 0.39, 95% CI = 0.27–0.54) 2b. Negative association: residing in area with display ban associated with lower nonusual brand purchase due to display (AOR: 0.35, 95% CI = 0.24–0.52)
McNeill et al. ⁴⁵	Ireland; data collection 2002–2010; (a) 1,000 adults (mean age unstated); (b) 180 youth aged 13–15 years	Pre- and postlegislation study, comprising (a) monthly survey of adults and (b) 2 surveys of youth	1. Legislation banning POS tobacco promotion (pre- vs. postimplementation)	a. Smoking prevalence (adults) b. Perception that ban made quitting easier (adult smokers) c. Smoking status (children) d. Perception that attempted tobacco purchase would be successful (children) e. Overestimation of peer smoking prevalence (children) f. Perception that ban makes it easier not to smoke (children)	Time-series analysis; descriptive statistics and chi-square analysis; logistic regression analysis	Survey data weighted for demographic factors. Time-series analysis adjusted for underlying trends and autocorrelation	1a. No statistically significant difference 1b. Decreased from 20% three months pre ban to 10% three months post ban (<i>p</i> < .001), then rose to 14% seven months post ban 1c. No statistically significant difference 1d. No statistically significant difference 1e. Lower odds of children overestimating peer smoking prevalence post ban (OR: 0.30, 95% CI = 0.16–0.57) vs. pre ban 1f. No statistically significant difference

Table 4. Continued

References	Location, study year, participants	Study design	Exposure(s)	Outcome(s)	Analytical method	Adjustment	Results
Quinn et al. ⁴⁷	Ireland, 2006–2009; nationwide sample ($n = 1,956$ in 2009) of retail outlets	Pre- and postlegislation study, analysis of cigarette-pack sales data	1. Legislation banning POS tobacco promotion (pre- vs. postimplementation)	a. National-level retail cigarette-pack sales	Time-series analysis	Seasonality, trading-day and cyclical variation, secular trends	1a. No impact on retail cigarette pack sales attributable to the legislation
Scheffels and Lavik ⁴⁶	Norway, 2009–2010; (a) three surveys, approx. 900 adults 15–54 years for each survey; (b) 62 smokers and ex-smokers aged 16–50 years (focus groups)	Pre- and postlegislation study, comprising (a) three surveys of adults; (b) focus groups	1. Legislation banning POS tobacco promotion (pre- vs. postimplementation)	a. Reported temptation to buy tobacco when exposed to POS displays (pre ban) b. Perception that ban would make/has made quitting easier c. Perception that ban would make/has made smoking uptake more difficult d. Agreement that ban has made brand choices more difficult (third survey only) e. Agreement that ban has made buying tobacco more difficult (third survey only)	Descriptive statistics	Not applicable	1a. 26% of smokers reported being tempted when exposed to POS displays often or sometimes 1b. From timepoints 1–3, a progressively lower proportion of occasional smokers ($p = .05$) thought the ban would make it easier to quit (55% pre ban vs. 39% nine months post ban). Same trend for daily smokers (27% pre ban vs. 21% nine months post ban) 1c. Overall agreement that ban would make uptake more difficult—no significant difference by timepoint, but agreement highest among nonsmokers, lowest among daily smokers 1d. 32% agreed ban had made it more difficult to choose brand 1e. 20% agreed ban had made it more difficult to buy tobacco

AOR = adjusted odds ratio; CI = confidence interval; GEE = generalized estimating equations; POS = point-of-sale.

in perceptions about smoking and lower rates of impulse tobacco purchasing. There was no evidence of a short-term impact of POS display bans on population-level smoking outcomes.

The multicountry prospective longitudinal study¹⁰ provides good evidence of lower rates of impulse purchasing of tobacco in Canadian and Australian jurisdictions that have POS display bans, compared to the United Kingdom and United States. This was the case whether impulse purchasing was measured by direct self-report or by self-reported nonusual brand purchase. A strength of the study is its use of both country-level and individual-level exposure data, particularly because Australian states varied in the status of POS display bans at the time of data collection, and the findings were consistent regardless of the exposure measure used. The use of retrospective self-reported outcome measures is a limitation. It remains plausible that other differences between the countries' tobacco control policies may have influenced the results, though this is unlikely given that the survey questions were specifically worded to assess the role of POS promotion on purchasing.

The Norwegian study evaluated consumers' perceptions of the POS display ban implemented in January 2010.⁴⁶ Around a quarter of smokers reported being tempted to buy tobacco when exposed to POS displays prelegislation, and most agreed the ban would make smoking uptake more difficult. Nine months post ban around 20% agreed the ban had made it more difficult to buy tobacco. Overall, the surveys provide a subjective indication of the impact of POS bans, given the reliance on self-reported perceptions of the ban and descriptive data analyses. In the qualitative component, some occasional and former smokers reported that the POS display ban could prevent impulse purchasing, and smoking initiation by reducing brand attachment, and denormalization of smoking. The semi-structured interview approach was appropriate for the research question and provides useful detail about possible mechanisms linking POS tobacco displays and smoking.

An Irish study examined survey data before and after a ban on POS displays and advertising in July 2009.⁴⁵ Post ban, children were significantly less likely to overestimate peer smoking prevalence compared to pre ban, which suggests that the removal of POS tobacco displays may contribute to the denormalization of tobacco products among children. The proportion of adult smokers who believed that the ban would make quitting easier increased from 10% three months post ban to 14% seven months post ban. No statistically significant changes in smoking behavior were observed, which is unsurprising given the short-term nature of this study and the small sample size for the surveys of children. The authors note that it was not possible to disentangle the independent effects of a POS display ban and a concurrent ban on in-store tobacco advertising on participants' responses. Secondly, other tobacco control measures such as annual tax increases on tobacco may have confounded the results. Lastly, the use of quota sampling (as opposed to random selection) may have introduced bias and may also limit the generalizability of the findings. Another Irish study examined retail cigarette sales data as the outcome measure and found no difference in the level of retail cigarette sales as a result of the display ban.⁴⁷

Qualitative Study

An Australian study, comprising in-depth interviews and diary-style data collection with 31 smokers and attempting quitters, investigated how the tobacco retail environment affected tobacco purchases or smoking after the implementation of POS display bans.⁴⁸ Thematic analysis of interviews suggested that a decrease of environmental

smoking cues reduces temptation to smoke and contributes to lower smoking. However, even in the absence of POS tobacco promotions, participants reported that images of tobacco retailers, and of tobacco storage cupboards, triggered thoughts about smoking. The diary-style data indicated that, in a real-world situation, seeing a tobacco retailer often prompted smoking or tobacco purchase. Little detail on the sampling strategy was provided, making the sample representativeness difficult to ascertain.

Assessment of Causality

The AORs reported in observational studies of children and young people ranged between 1.04 and 3.15 for smoking susceptibility, between 1.05 and 2.7 for experimental or ever-smoking, and between 1.57 and 3.50 for current smoking. In studies with adult smokers, the AORs ranged from 1.15 to 2.49 for impulse purchasing or self-reported smoking, from 2.11 to 3.88 for urge to purchase, and 0.27 to 0.32 for abstinence from smoking. The consistency of results—both internally within each study and across different countries, settings, study designs, and measures—provides further support for a causal association between POS tobacco promotion and smoking behavior and cognitions. Five studies were able to assess dose–response relationships,^{11,30,34,39,43} and of these, four provided strong evidence of a positive dose–response association between POS promotion exposure and smoking or smoking susceptibility. The remaining studies did not attempt to assess dose–response associations.

Two prospective cohort studies each found statistically significant associations between POS display exposure or sensitivity and smoking behavior over the follow-up period, providing good evidence of a temporal relationship. Further support for a temporal relationship is provided by the three studies that found statistically significant associations with POS promotion exposure and susceptibility among never-smokers. Smoking susceptibility is useful in terms of assessing causality since, for never-smokers, tobacco purchasing cannot plausibly have influenced exposure to POS tobacco promotion (therefore, the reverse causation explanation is not valid). One study used lagged analysis to control for tobacco purchasing behavior that occurred in the same time period as the exposure, though the results were marginally significant. The intervention studies provide evidence of the reversibility of the effect of POS tobacco promotion on impulse purchasing and on overestimating smoking prevalence. Significant associations between POS promotion exposure and measures such as prosmoking attitudes, urges to purchase, and unplanned tobacco purchases support the plausibility of a relationship between POS tobacco promotion and increased smoking, and the qualitative studies provide further support to this end.

Discussion

Our study extends the work by Paynter and Edwards¹¹ and reports similar findings, using an evidence base that is now much more extensive than that which existed prior to 2008. We identified a total of 18 quantitative studies and 2 qualitative studies, each of which reported results consistent with a positive association between exposure to POS tobacco promotion and smoking.

In terms of research with children and youth, we reviewed nine studies that were heterogeneous in their design, study location, and exposure and outcome measures, similar to the range reviewed by Paynter and Edwards.¹¹ Both reviews found that the majority of evidence indicated a positive association between exposure to POS

tobacco promotion and smoking, regardless of whether the outcome was prosmoking attitudes, smoking susceptibility, smoking status, or school smoking prevalence. The 2009 review reported ORs for daily or current smoking ranging from 1.1 to 3.0, for ever-smoking from 1.1 to 2.0, and for susceptibility from 1.3 to 1.6, which are consistent with those in studies we have reviewed. The main difference between our review and Paynter and Edwards' is that the recent studies appear to provide even stronger evidence of an association than those reviewed by Paynter and Edwards.¹¹ Firstly, smoking status was the most common outcome examined in the earlier studies, which limited conclusions regarding the direction of the association: starting to smoke could plausibly cause more store visits or greater awareness of POS tobacco promotion. However, more of the recent studies examined susceptibility among never-smokers. Evidence of an association between POS promotion and susceptibility is particularly compelling because, since these individuals are not smoking, tobacco purchasing behavior cannot have caused more exposure to POS tobacco promotion. Secondly, no studies in the 2009 review assessed dose–response relationships, whereas five of the studies we reviewed did, of which four were consistent with a dose–response association.

Regarding research with adult smokers, a comparison of this evidence between the two reviews is limited since only two adult studies were included in the 2009 review, one of which was an experimental study that included a craving outcome measure⁴⁹ not used in any of the more recent studies. We identified five quantitative studies and one qualitative study with adult smokers; each study suggested that exposure to POS tobacco promotion was associated with increased risk of smoking, impulse purchasing of tobacco, or having an urge to buy tobacco. While strengths of these studies include “real-world” retail settings, they used subjective outcome measures and descriptive statistical analyses, and there is a need for more research in this area. Only one provided robust evidence consistent with a causal relationship, since it met criteria for both a dose–response association and a temporal relationship.⁴³

To our knowledge, our review provides the first analysis of the available evidence examining the impact of POS tobacco display bans. A cross-country comparison of smoking survey data suggests that there are lower rates of impulse purchase of tobacco in jurisdictions that have implemented POS display bans. Evidence also suggests that the introduction of POS display bans may contribute to a decrease in children's perception of peer smoking prevalence, which has important implications for the denormalization of tobacco. To date, there is no evidence that POS display bans have reduced smoking prevalence, though this is unsurprising given no studies have yet assessed outcomes over a period of more than a year post ban. Bans on POS tobacco displays and promotion are likely to affect smoking behavior through the denormalization of tobacco and by providing a supportive environment for smokers to quit. Thus, any impact on smoking as a result of these processes is likely to be observed over a longer term period.

Tobacco industry-funded reports published since Paynter and Edwards¹¹ review have claimed that the evidence for an association between POS tobacco marketing and smoking is methodologically flawed (B. Gunter, unpublished data).^{12,13} The criticisms in these industry-funded reports center on (a) the validity and reliability of the exposure and outcome measures, (b) the “small” effect sizes and nonstatistically significant results, (c) a lack of “real-world” research, and (d) a lack of randomized controlled trials. However, many of these assertions are inaccurate and do not appear to consider epidemiological principles.

In fact, several of the exposure measures used have been previously validated.⁵⁰ In any epidemiological research, the crucial consideration is whether any inaccuracy related to the exposure is in some way systematically associated with the outcome, as such a bias could account for the observed associations. The fact that smoking susceptibility was used as an outcome in several studies largely overcomes this potential bias, since it is highly unlikely that susceptible never-smokers and nonsusceptible never-smokers differ in the accuracy of their reporting of store-visit frequency. The use of nonbehavioral outcome measures, such as attitudes and perceptions about smoking, has also received criticism. However, tobacco industry documents themselves suggest the importance of influencing perceptions about smoking as a mechanism to recruit new smokers.⁵¹ The validity of the smoking susceptibility measure in particular has been questioned, despite evidence that this measure is a significant predictor of smoking behavior among never-smokers over a 4-year period.³⁶ Industry-funded reports have attempted to argue that the limitations associated with exposure and outcome measures used in this body of research render the evidence flawed. In fact, from an epidemiological perspective, the consistency of findings across different study designs and measures provides highly convincing evidence to support the association between POS tobacco promotion and smoking.

One industry-funded report criticizes the effect sizes that have been found,¹² yet while these may be considered small to moderate, effects such as these accumulate to produce meaningful outcomes at a population level. Furthermore, it is plausible that the existing research may underestimate the true effect size, which may also account in part for some of the nonstatistically significant results. Studies may underestimate or fail to detect an association where the exposure to a risk factor is homogenous in a population, such as in the case of ubiquitous POS tobacco promotion.⁵² Other studies we reviewed are likely to have provided a conservative estimate of the true association, such as those by Henriksen et al.³⁹ (differential loss to follow-up) and Burton et al.⁴¹ (exclusion of same-time-period impulse purchases). The use of unplanned purchasing as an outcome is likely to provide a conservative estimate of an association, since these purchases by their very nature are likely to be underreported. Several studies were conducted in jurisdictions with prohibitions on in-store tobacco advertising and promotion, other than POS displays, which suggests that stronger associations may be found in countries with more extensive retail tobacco advertising.

Criticisms have also been made both in terms of the lack of “real-world” research and the lack of randomized controlled trials. However, there is an emerging body of “real-world” research conducted using EMA, diary-style and postpurchase interview protocols, which provide valuable data. Studies using these more novel methods have produced data supporting the same conclusions as those arising from studies using more traditional methodologies. Randomized controlled trials may be an especially rigorous study design in terms of showing causal relationships, yet these would be extremely difficult to conduct in this area given that smoking outcomes in two similar communities, which differ only in terms of POS marketing legislation would need to be compared, and retailers persuaded to take part in a study where they agreed to be assigned at random to having POS displays removed. These conditions would be difficult to meet, particularly as there will be a perception that participation could result in competitive disadvantage and reduced sales and income. However, the experimental study design by Kim et al.³² is as close to a randomized controlled trial as is feasible and provides good evidence that banning POS tobacco promotion may be associated with lower risk of tobacco purchasing among youth.

Some limitations to the existing evidence should be noted. Studies carried out in jurisdictions with few or no restrictions on retail marketing of tobacco do not enable us to disentangle the independent effect of the POS display on smoking outcomes from the overall effect of in-store tobacco promotion. The majority of existing research is cross-sectional, and further prospective studies are needed to strengthen the evidence of a causal association. Most of the studies controlled for a comprehensive range of confounding factors though, as with any observational research, it is possible that an uncontrolled confounding factor, such as greater access to tobacco retail outlets, may have impacted the results. More research on the relationship between POS promotion and quitting-related outcomes is needed. There is also a need for longer term evaluations of the impact of POS display bans, as no studies have yet been published examining outcomes beyond 12 months. Further research in this area will be invaluable for countries that have not yet implemented POS display bans. Three studies we reviewed consisted of qualitative research, and in all qualitative studies, there is the potential for power relationships between researchers and participants to have affected participants' expressed views. As a behavior that has become less socially desirable, participants may tend to attribute responsibility for their smoking toward environmental cues such as tobacco displays when discussing their opinions with an interviewer. Equally possible is the "third-person effect"⁵³ in which participants tend to underestimate any influence of environmental factors on their own behavior while acknowledging that the same effects are likely to impact on others' behavior. However, the importance of qualitative studies is in the detail they provide about possible mechanisms underpinning a relationship between POS tobacco promotion and smoking, rather than evidence of an association.

In conclusion, the existing evidence supports a positive association between exposure to POS tobacco promotion and smoking. The evidence supporting a causal association has increased, with a number of studies having demonstrated findings consistent with a dose-response relationship, a temporal sequence between exposure and outcome, a high level of consistency of results across different study methodologies, locations and the use of different measures, and some evidence of reversibility of the association. This review provides evidence that supports the continuation of POS tobacco display bans in those jurisdictions where such legislation has been introduced and should encourage similar policies in jurisdictions still to implement a POS display ban.

Supplementary Material

Supplementary Appendix can be found online at <http://www.ntr.oxfordjournals.org>

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Declaration of Interests

None declared.

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