SYSTEMATIC REVIEW

Location Restrictions on Smoking: Assessing their Differential Impacts and Consequences in the Workplace

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ABSTRACT

Objectives: To analyze existing evidence on the impact of two types of location restrictions on smoking: workplace bans and bans in hospitality settings, and to assess the extent to which they differentially affect subpopulations.

Methods: A review of international studies on location restrictions on smoking published between 1990-2007.

Results: Although workplace smoking bans reduce exposure to second-hand smoke (SHS) at work, their effects on overall cigarette consumption and smoking prevalence may be uneven across the population. Bans in hospitality settings reduce SHS exposure among workers, but have potentially uneven effects based on the interactions between gender, socio-economic status (SES) and ethnicity. The unintended consequences of smoking bans are also more likely to be experienced by low SES groups.

Conclusions: Although location restrictions on smoking reduce SHS exposure and may serve to positively impact smoking behaviours, there is preliminary evidence that they may have a reduced impact on subpopulations such as low-income groups, although further research is needed.

Key words: Smoking restrictions; secondhand smoke; literature review; diversity; health disparities; tobacco policies

La traduction du résumé se trouve à la fin de l'article.

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Exposure to second-hand smoke (SHS) can pose serious health risks, including death, disease and disability to both smokers and non-smokers. In response, there has been an increasing drive to implement wide-scale smoke-free legislation in Canada and many other countries. While the goal of this legislation is ostensibly to reduce the health effects of exposure to tobacco smoke,[1] a reduction in smoking prevalence is often deemed to be an ancillary benefit.[2,3]

As the evidence base regarding the impact of smoking restrictions has continued to grow, several reviews have attempted to quantify the effects of workplace smoking bans on smoking behaviour. A Cochrane Review[4] and a meta-analysis[5] both conclude that smoking bans reduce SHS exposure in the workplace; however, their conclusions regarding the impact of restrictions and bans on daily cigarette consumption and smoking prevalence differ. The Cochrane Review[4] found consistent evidence that workplace smoking bans decrease cigarette consumption during the working day. However, the reviewers found less consistent evidence that overall daily cigarette consumption decreases as a result of workplace smoking bans. They also report that the evidence on whether smoking restrictions or bans in the workplace lead to a reduction in smoking prevalence is inconclusive. The meta-analysis,[5] on the other hand, found that totally smoke-free workplaces are associated with 3.1 fewer cigarettes smoked per day per continuing smoker and a 3.8% reduction in smoking prevalence.

Although these reviews provide an important contribution to public health evidence regarding the impact of workplace smoking bans on smoking behaviours, they focus exclusively on the impact of smoking bans at a broader population level. Yet, although tobacco control policies tend to be aimed at the general population, increasingly smoking is confined to particular socio-economic groups. A significant proportion of smokers in industrialized countries now reside on the lowest rungs of the socio-economic ladder, and men and women on low incomes are both more likely to smoke and to be exposed to SHS.[6-9] Such socio-economic inequalities in smoking are one of the main factors responsible for the gap in life expectancy between rich and poor.[7,10,11] Moreover, the gap between the smoking rates of the highest and lowest social classes appears to be widening as there has been a sharper decline in smoking prevalence among the middle class than the working class.[11] In addition, tobacco use and uptake have typically followed gendered patterns, with global male rates having peaked and female rates poised to escalate in the 21st century.[12] These trends call for tailored policy responses reflecting these different patterns as well as the gendered status and income inequities that negatively and particularly impact on women.[12,13]

Smoke-free legislation is not necessarily the panacea for these inequalities. Indeed, tobacco control policies have historically had a differential impact according to social class and have tended to increase rather than reduce health inequalities.[11,13-17] Thus, as Sir Donald Acheson has noted, "a well intended policy which improves average health may have no effect on inequalities. It may

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widen them by having a greater impact on the better off."[11] It is therefore crucial that research and reviews of the evidence go beyond the broader population-level effects of tobacco control policies such as smoking bans and explore their effects on subpopulation groups – especially men and women on low income. This review contributes to addressing this oversight by summarizing existing evidence on the impact of smoking restrictions in workplaces and hospitality settings, based on factors such as gender, education, socio-economic status (SES) and ethnicity.

METHODS

Inclusion and exclusion

This review is restricted to studies published in English between 1990 and 2007. In exploring the impact of location restrictions on smoking, we have restricted this review to research undertaken in two settings: indoor workplaces and indoor hospitality settings. The primary outcome measure of interest was changes in the consumption of cigarettes following the implementation of smoking restrictions (with biochemical validation where recorded). Other outcome measures of interest included changes in SHS exposure and smoking prevalence following the implementation of bans. This review highlights in particular those studies that analyzed these outcomes based on setting and subpopulation groups such as women, low-income workers and ethnic minorities. In light of the existence of two previous reviews of smoking restrictions in indoor workplaces,[4,5] we have chosen to exclude studies featured in these reviews that do not break down their results based on the subpopulations of interest.

Search strategy

Two literature searches for this review were carried out, the first in May 2006 and the second in September 2007. Articles were searched in the major bibliographic databases; a full list of databases and search strategies is available on request. The literature searches generated a total of 13,683 citations – many of which were largely unrelated to the topic of the review. These citations were initially scanned by one reviewer who removed the clearly irrelevant titles. The remaining 240 abstracts were independently scrutinized by two reviewers and those that clearly did not fulfil the inclusion criteria were eliminated; disagreements on which studies should be included were resolved by a third reviewer. From the 240 abstracts, 33 studies, reports and reviews were acquired for assessment. At this stage, most studies that were excluded either did not evaluate the outcomes of interest or were already included in the two aforementioned reviews on workplace interventions and did not include any specific discussion of the populations of interest. Finally, 16 published studies met the inclusion criteria for this review – 11 explored the impact of bans in the workplace, while 5 studies explored bans in hospitality settings.

Study quality

None of the available studies on the differential impact of location restrictions on smoking are experimental in design, although 1 quasi-experimental study and 3 cohort studies are included in the review. The majority of studies (N=12) detail findings from cross-sectional surveys, which are limited in their ability to yield causal attributions. Another limitation of the majority of studies incorporated in this review is their reliance on self-report measures of tobacco use, which are subject to recall and desirability bias. Changes in tobacco consumption were not biochemically validated in any of the studies reviewed, although biochemical markers of SHS exposure were used in 3 studies. In light of the generally low quality of the evidence, studies have not been individually rated in order to exclude those that fail to meet basic quality criteria. Rather, given the importance of the topic and the lack of extant research, the review team deemed it necessary to consider all available evidence.

RESULTS

Indoor workplace smoking bans

Although several reviews of the impact of workplace smoking bans on smoking behaviour among the general population exist, relatively few studies have explored the differential impact of workplace smoking bans on population subgroups, and the available evidence is limited to cross-sectional studies. Two studies[18,19] which break down their results by sex, income level and ethnicity have concluded that workplace smoking ordinances have similar effects on smoking cessation across different segments of the population. However, the remaining studies report evidence of uneven impact.

Three studies[20-22] found that workplace smoking restrictions appear to have a larger impact on men than women. Heloma and Jaakola[20] found that while workplace legislation in Finland was associated with a continuous decline in smoking prevalence among men, this trend was not observed consistently in women – whose smoking prevalence increased after an initial drop. Similarly, Farrelly et al.[21] found that a complete smoking ban appeared to have a slightly larger effect for men compared to women. Finally, Kinne et al.[22] report that while men's cigarette consumption on work- and non-work days was lower in worksites with smoking restrictions, women's cigarette consumption was unrelated to the presence of work restrictions.

There is also evidence from three studies[21,23,24] that workplace bans have the greatest impact on workers with more than a college degree or higher income levels. Farrelly et al.[21] report that workers with a college degree exhibited the largest percentage decline in smoking prevalence, while workers who had dropped out of high school had the smallest decline, although this latter group did have a high decline in cigarette consumption. Gritz and Thompson[23] found substantial differences in outcome based on education, and Levy and Mumford,[24] in their research into the impact of restrictive smoking policies on women, report that although current smoking among low-education females is inversely related to the index of clean air laws, this correlation is significant *only* in the subpopulation of medium-education females.

Smoking Bans in Hospitality Settings

Allwright[25] and Mulcahy et al.[26] have found that cotinine concentrations in staff working in pubs and hotels in the Republic of Ireland have reduced dramatically since the implementation of national smoke-free legislation (see Table 2). A third study by Fong et al.[27] also found that the percentage of smokers who were observed smoking in key venues in Ireland reduced from 98% to 5% in bars and pubs, and from 85% to 3% in restaurants following the smoke-free legislation.

Unfortunately, none of these studies break down their results by sex, SES or ethnicity, or analyze them with a gender lens, and it is therefore unclear whether effects were equal for all staff and

Table 1. Summary of Studies Exploring Smoking Bans in Workplaces

Study Details	Population	Topic/Outcome Measure (OM)	Results
Baile et al.[31] USA Cross-sectional	Total N=349 N=83 smokers: 76% F & 24% M. 52% high school & 39% college ed. N=266 non-smokers: 79% F & 21% M. 22% high school & 55% college ed. N=5 quitters	Impact of complete smoking ban on employees at cancer treatment centre. OM: Self-report	54.2% reported decrease in cigarette consumption; 43.8% reported increasing use before or after work.
Chapman et al.[33] Australia Cross-sectional	Smokers outside office blocks (N=143); N=113 smokers in social settings (N=113) General population	Investigates whether smokers outside offices with bans smoke "harder" than those smoking in social settings. OM: Puff frequency & cigarette duration	Outside workplace: significantly higher mean # puffs/ cigarette (T=5.58, df 253, p<0.001) & 30.4% shorter mean cigarette duration.
Farrelly et al.[21] USA Cross-sectional	97,882 indoor workers Breaks results down by sex, age, education level, occupation & ethnicity	Estimates impact of workplace smoking restrictions on prevalence & intensity of smoking among indoor workers. OM: Self-report	Complete smoking ban slightly larger effect on smoking prevalence for M, relative to F. Largest decline observed for workers with college degree (28.4% ↓); least for workers <high school education (13.7% ↓).
Gritz et al.[23] USA Cross sectional	N=4663 F, 10,919 M Focuses on gender; breaks results down by sex, ethnicity, occupation & education level	Compares effects of workplace smoking restrictions & smoking cessation strategies on cessation rates among men & women. OM: Self-report	No significant differences in M & F long-term quit rates. M & F with >high school education quit at higher rate (p<0.001) than those with <high school education. Both M & F white-collar workers had higher quit rates than blue-collar workers (p<0.001)
Heloma & Jaakkola[20] Finland Cross-sectional	8 workplaces representing private & public sectors General population; breaks results down by sex, workplace category	Assesses possible impact of workplace legislation on employee exposure to SHS, smoking habits, attitudes. OM: Self-report	Smoking prevalence: survey 1: M 30%, F 22%; survey 2: M 26.9%, F 18.4%; survey 3: M 24.8%, F 26.1%. Long-term reductions in smoking confined to men.
Kinne et al.[22] USA Cross-sectional	N=1228 employed adults in Washington state; breaks results down by sex, workplace category	Describes employed persons' reports of smoking habits & content & impact of smoking restrictions in worksites. OM: Self-report	Men in worksites with policies restricting smoking smoked fewer cigarettes on both work & non-work days (p<0.0001). Policy restrictions were unrelated to women's reported cigarette consumption (p<0.0001).
Levy et al.[24] USA Cross-sectional	N=75,130 Women ≥18 with <high school education; breaks results down by ethnicity	Examines role of tobacco control policies on women of low socio-economic status. OM: Self-report	Clean air laws: current smoking among low education F inversely related to clean air laws (OR = 0.91, 0.80-1.03) but significant only in medium ed. F (OR = 0.88, 0.83-0.94)
Moskowitz et al.[18] USA Cross-sectional	N=4680 respondents reporting smoking 6 months prior to survey General pop; breaks results down by age, sex, ethnicity, education	Assesses effect of workplace smoking laws in California on increasing smoking cessation. OM: Self-report	Smokers in localities with strong workplace ordinance more likely to report quitting smoking in prior 6 months (OR = 1.5; 95% CI = 1.1-1.7). Impact of age, sex, ethnicity, education not significant.
Owen & Borland[19] Australia Cohort	N=107 smokers from 46 worksites who continued to smoke 6 months & 2 years after implementation of a workplace ban	Evaluates impact of workplace smoking bans on cigarette consumption among continuing smokers over 2 years. OM: Self-report	From period 1 mth before to 6 mths after ban, consumption decreased 5.2 cigarettes/day. From 6 mths-2 yrs, consumption increased 1.7 cigarettes/day (p<0.01). No differences found in consumption changes between men & women or by age.
Parry et al.[30] Scotland Cross-sectional	N=3592 46.9% (1675) M; 53.1% (1898) F. General population	Investigates consequence of smoking bans in relocating smoking & considers implications for smokers & non-smokers. OM: Self-report	Smokers who smoke outside work: those claiming ↑ in consumption < than those claiming ↓ or quitting. 76.8% reported increase in smoking on University property & 80.2% indicated increase at entrances.
Wakefield et al.[32] Australia Cross-sectional	N=1929 workers of different occupational categories	Examines relative level of smoking on weekdays compared with leisure days for those exposed to smoking restrictions at work. OM: Self-report	Ban on smoking associated with reduced level of reported workday cigarette consumption for all occupational categories, compared with amount smoked on leisure days. But unclear if leisure consumption increases.

patrons. However, baseline information detailed in Mulcahy et al.'s[26] study does provide an indication of potential gendered differences in exposure. The researchers note that the highest cotinine concentrations at follow up were found in bar staff and wait staff. Although they do not break down the baseline information for bar staff, they do provide mention of a higher proportion of female than male wait staff (37% vs. 25%), thus it is quite likely that gendered differences were seen in levels of exposure to SHS.

Indeed, recent research exploring compliance with smoke-free laws in Californian bars found that compliance with the legislation

Table 2. Summary of Studies Exploring Smoking Bans in Hospitality Settings

Study Details	Population	Topic/Outcome Measure (OM)	Results
Adda & Cornaglia[34] USA Cross-sectional	N=29,667 non-smokers. General population; results broken down by income	Evaluates effects of excise taxes & bans on smoking in public places on SHS exposure among non-smokers. OM: Cotinine concentrations	Bans in public transport or schools ↓ exposure of non-smokers, bans in recreational settings can ↑ exposure by displacing smoking to private places. Bans affect SES groups differently, bans ↑ exposure of poor and ↓ exposure of wealthier.
Allwright et al.[25] Ireland Controlled before and after	N=226 bar workers at baseline & 213 at follow-up General sample	Assessed impact of national smoking ban on non-smoking bar staff using lab assessments of second-hand smoke exposure. OM: Cotinine concentrations	Work-related second-hand smoke exposure dropped more in Republic of Ireland (RI) ($p<0.001$) than in N. Ireland (NI) ($p=0.02$). Cotinine concentrations in non-smokers in RI dropped by 71%, (NI 34%).
Fong et al.[27] Ireland Cohort	Representative sample of adult smokers in Ireland (N=769) & UK (N=416). General pop.	Evaluates psychosocial & behavioural impact of comprehensive workplace smoke-free law in Ireland. OM: Self-report	Irish law decreased reported smoking in workplaces (62% to 14%), restaurants (85% to 3%), and bars (98% to 5%).
Moore et al./Lee et al.[28,29] USA Cross-sectional	Study 1: N=121 bars; Study 2: N=90 bars. 28 bars Asian patrons, 25 Latino patrons, 37 Irish patrons	Assessed relationship between bartender gender & smoke-free workplace compliance in bars. OM: Systematic observations of smoking, presence of ash trays, etc.	Smoke-free policy noncompliance associated with bars in which women were bartenders. Asian & Irish dominated bars were positively related to patron noncompliance, but Latino bars were not.
Mulcahy et al.[26] Republic of Ireland Cohort	35 hotel workers in sample of 15 hotels 19 F & 17 M (ages: 18-50)	To investigate whether Irish smoking ban has had impact on second-hand smoke exposures for hospitality workers. OM: Cotinine concentrations	Cotinine concentrations reduced from 1.6 ng/ml to 0.5 ng/ml median (SD 1.29; $p<0.005$). 74% of subjects experienced decreases, with 60% showing halving of exposure levels at follow-up.

was affected by the mix of the gender of bartenders and the demographic characteristics of bars and their clientele.[28,29] The researchers report that smoking inside bars was significantly more likely to occur with the presence of female bartenders – especially in the bars serving primarily Asian or Irish clientele. The authors concluded that the weak positions of the waitresses *vis à vis* the male patrons and managerial staff often appeared to have direct consequences for female bartenders' abilities to control the environment within which they worked.

Unintended consequences of smoking bans

Although smoking bans have many positive benefits, it is also important to consider any unintended side effects. There is evidence that smoking bans may lead to an increasing concentration of smoking at building entrances and exits, thereby creating more intensive SHS exposure at these locations.[26,30] Smoking bans may also lead to unhealthy changes in smoking behaviour. Two studies indicate that smoking bans may lead to increased cigarette consumption before and after work among some groups.[30,31] Although a third study reports a reduced level of workday cigarette consumption following a workplace smoking ban, it is unclear whether leisure day consumption increased or decreased.[32] Moreover, while *overall* cigarette consumption may decrease, according to one study, smokers subject to bans tend to smoke 'harder' during breaks, increasing their puff frequency and reducing the time taken to smoke each cigarette compared to smokers in unconstrained social settings.[33]

There is also recent evidence[34] that smoking bans in the workplace and hospitality settings may actually displace smoking into the home itself, thereby increasing the exposure of household members (potentially children) to SHS. Based on a secondary analysis of data from a series of National Health and Nutrition Examination Surveys between 1988 and 2002, Adda and Cornaglia[34] argue that although smoking bans in public transport, shopping malls, etc., decrease the exposure of non-smokers, bans in bars, restaurants and recreational facilities appear to increase the exposure of non-smokers, particularly young children from lower socio-economic backgrounds. They interpret this as the 'substitution effect' between leisure activities in public places where regulation can be enforced and in private places where it cannot.

DISCUSSION

Workplace smoking bans have become the norm in recent years and they clearly have an impact on SHS exposure among employees. Although there are indications that such bans do have a positive impact on smoking behaviours, this impact may not be uniform across the population, and there is some evidence that workplace smoking bans have a smaller effect on low-income groups – particularly low-income women. Similarly, research on smoking bans in hospitality settings provides important insights into the potentially uneven effects of smoke-free legislation *within* hospitality settings based on the interactions between gender, SES and ethnicity. However, given the limitations of the available evidence, these findings are indicative rather than conclusive.

The unintended consequences of such bans are also likely to be felt more acutely by low-income groups. One negative side effect of smoking bans that is evident in both workplace and hospitality settings is the increasing concentration of smoking at certain locations such as building entrances and exits. Given the high prevalence of smoking among low-SES groups, it is likely that disparities will continue to exist in the amount of SHS exposure that employees in blue collar workplaces and hospitality settings experience following the implementation of smoking bans. There is also evidence that smoking bans may lead to unhealthy smoking behaviours such as compensatory smoking, 'harder' smoking and displaced smoking – which are more likely to be experienced by heavily addicted, low-income smokers.

Although location restrictions on smoking entail net health benefits, this review brings together an emerging body of evidence that

suggests that their benefits may be differentially distributed. Although further research is urgently needed, there are indications that the apparent success of restrictive smoking policies at the population level may mask their reduced impact for many disadvantaged groups. Smoke-free legislation does not automatically provide an incentive to quit or reduce consumption, and many of the challenges that disadvantaged groups currently face in attempting to quit smoking will not disappear with the implementation of wide-scale smoking bans. Policy-makers need to recognize the constellation of disadvantage that confronts most low-SES smokers (particularly females).[35] Tobacco control research and policy need to be constructed sensitive to gender and diversity; these steps will be essential in ameliorating the potentially uneven benefits of smoking bans.

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RÉSUMÉ

Objectifs : Analyser les données actuelles sur l'impact de restrictions relatives à l'usage du tabac dans deux types d'endroits : en milieu de travail et dans les bars et restaurants. Évaluer comment ces restrictions touchent différemment les sous-populations.

Méthode : Analyse d'études internationales publiées entre 1990 et 2007 sur les restrictions à l'usage du tabac dans les lieux publics.

Résultats : Bien que l'interdiction de fumer réduise l'exposition à la fumée secondaire au travail, les effets sur la consommation générale de cigarettes et sur la prévalence du tabagisme peuvent être inégaux dans la population. L'interdiction de fumer dans les bars et restaurants réduit l'exposition à la fumée secondaire chez le personnel, mais peut potentiellement avoir des effets inégaux selon les interactions entre le sexe, le statut socio-économique et l'origine ethnique. Les conséquences imprévues des interdictions de fumer auront tendance à être ressenties davantage par les personnes de statut socio-économique faible.

Conclusions : Les restrictions à l'usage du tabac dans certains lieux réduisent l'exposition à la fumée secondaire et peuvent avoir des effets positifs sur l'usage du tabac, mais les données préliminaires démontrent qu'elles peuvent avoir moins d'impact dans des sous-populations telles que les groupes à faible revenu; il faudrait toutefois pousser la recherche en ce sens.

Mots clés : restrictions relatives à l'usage du tabac; fumée secondaire; analyse documentaire; diversité; disparités en santé; politiques sur le tabac