

The effect of the Irish smoke-free workplace legislation on smoking among bar workers[†]

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Background: On 29 March 2004, the Republic of Ireland (ROI) became the first EU country to introduce a nationwide ban on workplace smoking. While the focus of this measure was to protect worker health by reducing exposure to second-hand smoke, other effects such as a greater reduction in smoking prevalence and consumption were likely among bar workers. **Methods:** A random sample of bar workers from Cork city were surveyed before ($n=129$) and after ($n=107$; 82.9% follow-up rate) implementation of the smoke-free legislation. Self report and combined self report and cotinine concentration were used to determine smoking status. For comparison a cross-sectional random telephone survey of the general population (ROI) was conducted before and 1 year after the smoke-free legislation. There were 1240 pre- and 1221 participants post-ban in the equivalent age and occupational subset of the general population. **Results:** There was a non-significant decline in smoking prevalence among bar workers 1 year post-ban (self report: -2.8% from 51.4% to 48.6%, $P=0.51$; combined self report and cotinine: -4.7% from 56.1% to 51.4%, $P=0.13$), but a significant decline in consumption of four cigarettes (95% CI 2.21–6.36) per day. Within the occupationally equivalent general population sub-sample there was a significant drop (3.5%, $P=0.06$) in smoking prevalence but no significant change in consumption. **Conclusions:** Ireland's smoke-free workplace legislation was accompanied by a drop in smoking prevalence in both bar workers and the general population sub-sample.

Keywords: All Ireland Bar Study, bar workers, cigarette consumption, smoke-free legislation, smoking prevalence, tobacco control.

Introduction

On 29 March 2004, the Republic of Ireland (ROI) introduced the first nationwide ban on workplace smoking including bars and restaurants in the EU. The focus of this measure was to protect worker health by reducing exposure to secondhand smoke (SHS). It was expected that other benefits would emerge from the introduction of the ban. With fewer opportunities to smoke, possible changing of social norms¹ and extensive health campaigns on the harmful effects of active smoking and SHS coinciding with the ban,^{2–5} a reduction in both smoking prevalence and consumption was likely.

Bar workers, identified as a high risk occupational group, gained a lot of attention in relation to this tobacco control measure. First, before the introduction of the smoke-free workplace legislation in Ireland, bar workers were suspected and subsequently were found to have had substantial exposure to SHS.^{6–8} Second, bar workers have been identified as an occupational group with high smoking prevalence.^{9–11} The impact of the smoke-free legislation on smoking prevalence and consumption was expected to be greater on bar workers than on the general population as the law would have an immediate influence on bar workers' occupational setting as well as a societal change.

Workplace and general population studies have indicated that smoking policies and restrictions are associated with a reduction in the number of cigarettes smoked by continuing smokers and an increase in quitting rates^{1,12–19} although Eisner, Smith and Blanc²⁰ found no change. It remains to be confirmed if these changes are maintained over longer study periods. Few studies have examined changes in smoking behaviour after a national smoke-free workplace legislation among affected workers in general,¹⁵ or hospitality industry workers in particular.^{12,20} All were based on self-reported smoking status and did not take secular trends into account, for example by comparing changes with changes in the general population. None specifically looked at a representative group of bar workers before and after comprehensive smoke-free legislation.

This study assesses changes in smoking prevalence and cigarette consumption among a random sample of bar workers before and 1 year after the introduction of the workplace legislation. We used the general population as a comparison group and compared changes in prevalence and consumption in corresponding occupational, age and gender strata of the general population during the same period. We hypothesized (i) significant drops in prevalence and cigarette consumption in bar workers and (ii) that these changes would be greater in bar workers than in the general population due to the nature of bar work and the fact that, unlike for other occupations, no occupational smoke-free policies existed for bar workers prior to the legislative ban.

Methods

We used two separate datasets: (i) a follow-up sample of bar workers from Cork city from the 'SmokeFree Ireland (SmoFrI) Study', part of a larger study, the 'All-Ireland Bar Study' reported elsewhere⁶ and (ii) repeated cross-sectional samples from a general population (ROI) telephone survey conducted by TNS mrobi, a commercial research company.

[†] This work was presented at the UK Society for Social Medicine Conference in Glasgow (September 2005) and at the 13th World Conference on Tobacco or Health, Washington DC USA (June 2006)

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Sample selection

Bar workers

A three-step cluster sampling strategy was used and is outlined in detail elsewhere.⁹ Participants were interviewed between January and March 2004 (before implementation of the smoke-free workplace legislation) and again during January–March 2005 (1 year after implementation). We enrolled both smoking and non-smoking bar workers and all occupational positions i.e. owners, managers, full- and part-time bar staff. Included in our follow-up were those no longer working as bar workers (separate analyses were completed with and without those no longer in bar work).

General population sub-sample

General population data were obtained from an ongoing monthly telephone survey commissioned by the Office of Tobacco Control conducted by TNS mrbi of 1000 randomly selected individuals (15+ years) during the same time period as the bar workers survey (January–March 2004 and January–March 2005). Participants were selected based on randomly generated phone numbers; targets were met in relation to sex, age, occupational class and region. For comparison we restricted the sample to participants of similar age (18–78 years) and occupational class, referred to as the general population sub-sample. Cross-sectional samples of 1240 and 1221 individuals were generated pre-ban and 1 year post-ban respectively from the general population sub-group. Un-weighted data were used to compare estimates within age, sex and occupational class strata.

Measures

Bar workers

Survey administration including salivary cotinine sampling procedures and respiratory health symptom questions have been described in more detail elsewhere.⁶

Sociodemographics. Questions on sex, age and occupational position were asked. Occupational class was determined by involvement in the pub: owners and managers were categorized as ‘manager’ (occupational class C2), temporary and permanent staff as ‘staff’ (occupational class DE). The term ‘bar worker’ refers to the entire sample. The occupational class classification was taken from the Irish Central Statistics Office (CSO) classification which is based on the UK Standard Occupational Classification.

Smoking status. Questions regarding participants’ current smoking status, average number of cigarettes consumed per day, smoking history and perceived influence of the ban on smoking behaviour were asked. Two different measures of smoking status were used for bar workers: ‘self reported’ and ‘combined self report and cotinine’ smoking status. Self-reported smoking status (current smoker versus current non-smoker) was used in comparisons with the general population as only self-reports were available for the general population. The combined self report and cotinine measure, as the more accurate measure of smoking status, was used for examining the changes in smoking status of bar workers. In cases where cotinine was not available due to refusals, insufficient or contaminated samples, the self reported smoking status was used. In cases where disagreements occurred between the self reported smoking status and the cotinine measure, cotinine was then used as the overriding measure of smoking status. Pre-ban 28 cotinine values were unavailable, 14 (50%) due to refusal, the remaining due to insufficient or contaminated

samples. No sex, age or occupational differences were evident among those individuals without cotinine samples. Post-ban 43 cotinine values were unavailable, 23 (54%) due to refusals, the remaining 20 were due to insufficient or contaminated samples.

General population sub-sample

Sociodemographics and smoking status. Participants were asked about their sex, age group, occupational class, self reported smoking status (‘Do you smoke >1 cigarette per week?’), self reported daily cigarette consumption and occupation. To make comparisons with the bar workers sample, occupational classes equivalent to the bar managers and owners (occupational class C2) and bar staff (occupational class DE) were selected.

Statistical analysis

Data analysis was conducted using SPSS 12.0.1 (SPSS, Chicago, IL).

Bar workers

McNemar chi-squared tests were used to examine prevalence changes within each sex, age group and occupational class between pre- and post-ban. Paired sample *t*-tests were used to test changes in consumption. In the case of a statistically significant result for the entire sample, three separate two-factorial analysis of variance models with repeated measures were built using the General Linear Model function (GLM) in SPSS, testing for statistical interaction of subgroups and the introduction of the ban. Models included pre- versus post-ban as within-subject variable and sex, age group and occupational class as between-subject factors, respectively.

General population sub-sample

Pearson’s chi-squared or Fisher’s exact test was used to examine differences in prevalence within each sex, age and occupational class. Independent sample *t*-test was used to test for differences in consumption.

Results

Bar worker study participation

Pub participation rate was 69.5% (98/141). Altogether 129 bar workers were enrolled in the study; 67 pubs had one and 31 pubs had two participants interviewed. A replacement bar worker was required in 9% of cases. One year after the ban 107 of the 129 bar workers participated again (82.9%). Of these 107 participants, 16 were no longer in bar work; therefore 91 active bar workers participated in the post-ban survey (follow-up rate of 70.5%). The analysis of the follow-up group included the 16 no longer in bar work unless otherwise stated.

Table 1 shows the demographic characteristics at baseline of the 107 bar workers who participated at follow up. Seventy-one percent of these bar workers were male, with mean age 33 years; 58% were temporary or permanent ‘staff’ (equivalent to occupational class DE) and 51% were smokers. They were not significantly different in terms of sex, age, occupational class and smoking status from the 22 bar workers who were lost to follow up, although there was a slight tendency for dropouts to be younger, manager and current smoker. Three participants were re-classified as smokers using cotinine validation.

In comparison to the general population sub-sample, bar workers at baseline were more likely to be male and younger (88% under 49 years of age compared to 52% of the general population sub-sample).

Table 1 Baseline characteristics of Cork bar workers followed up post-ban ($n = 107$) and bar workers lost to follow-up ($n = 22$)

	Bar workers ($n = 107$)	Bar workers lost to follow-up ($n = 22$)
Sex		
Male	76 (71%)	13 (59%)
Mean age in years (SD)		
Total	33.2 (12.1)	30.69 (12.31)
Males	33.3 (11.6)	31.30 (12.17)
Females	32.8 (13.5)	29.80 (13.2)
Age group		
18–28 years	53 (49.5)	12 (54.5)
29–38 years	24 (22.4)	6 (27.3)
39–48 years	18 (16.8)	1 (4.5)
49–58 years	7 (6.5)	2 (9.1)
>59 years	5 (4.7)	1 (4.5)
Occupational class		
'Manager' (Bar owner/ bar manager)	45 (42)	12 (54.5)
'Staff' (Permanent/ Temp bar workers)	62 (58)	10 (45.5)
Self-reported smoking status		
Regular/Occasional smoker	52 (48.6)	15 (68)
Ex-smoker/Never smoked	55 (51.4)	7 (32)
Combined self report and cotinine^a		
Smoker	55 (51.4)	15 (68)
Non-smoker	52 (48.6)	7 (32)

Figures are n (%) unless otherwise specified

a: 24 out of the 107 (post ban samples) and 4 out of the 22 (lost to follow-up sample) are missing cotinine values

Changes in smoking prevalence and consumption rates among bar workers

Table 2 shows changes in self report and 'combined self report and cotinine' smoking prevalence among Cork bar workers by sex, age and occupational class. Self-reported prevalence of smoking in bar workers was 51.4% (95% CI; 41.9–60.9%) pre-ban with a non-significant drop of 2.8% post-ban to 48.6% (95% CI 39.1–58.1%). A larger but still non-significant drop (4.7%) was seen using the 'combined self report and cotinine' measure of smoking status. The drop was more pronounced in men, in staff and in the younger age groups (18–38 years). Female bar workers (67.7–64.5%), those in the 18–28 year range (72–66%) and staff (66.1–59.7%) continued to have high smoking rates post-ban.

The mean number of cigarettes consumed per day (self-reported) among smoking bar workers was 18.1 (SD = 11.8) pre-ban, dropping significantly by four cigarettes per day ($P < 0.001$) to 13.9 (SD = 8.6) post-ban (table 2). The drop was similar among males and females and among staff and managers and was most pronounced in the 29–38 year old age group (9.0 cigarettes). In order to test whether the drop in consumption affected particular groups more than other groups, we tested for statistical interaction of pre- versus post-ban measurement and sex, age group and occupational class in three separate analysis of variance models with repeated measures; none of the interaction terms were statistically significant.

Within the follow-up sample of bar workers 16 participants were no longer working in a pub at the time of the second interview. Of those 16 participants, 14 were smokers (combined self report and cotinine). We conducted analysis separately for those no longer working in bars resulting in similar results for prevalence (two participants quit, $P = 0.5$) and consumption (mean drop of 9.25, $P = 0.001$ among 12 smokers).

Changes in smoking prevalence and consumption rates in the general population sub-sample

Prevalence of self-reported smoking in this general population sub-sample was 28.3% pre-ban with a near significant drop of 3.5% 1 year post-ban to 24.8% ($P = 0.06$) (table 3). Significant declines were seen among males (29.1–23.1%; $P = 0.02$); 18–28 year olds (36.4–26.6%; $P = 0.05$) and the managerial occupational class C2 (30.6–25.0%; $P = 0.04$).

Smoking consumption dropped within this general population sub-sample from 16.9 per day to 16.0 per day post-ban ($P = 0.19$) (table 4), with no significant changes by sex or age. However, the drop in consumption among the DE category (equivalent to bar staff) from 17.6 cigarettes per day to 15.8 post-ban approached significance ($P = 0.08$).

Discussion

The Irish national smoke-free workplace legislation was associated with a reduction in cigarette consumption among an 'at risk' occupational group with a very high smoking prevalence. The decline was most notable among the 18–28-year-old age group. A drop in consumption was anticipated as several studies have suggested that policies and restrictions on smoking result in lower consumption among smokers. The drop in consumption of four cigarettes per day found in our study was slightly higher than the 3.1 cigarettes per day drop (95% CI 2.4–3.8) reported by a systematic review of the impact of smoking policies or restrictions.¹⁶ As this review included studies conducted among various occupations, the smaller decrease in cigarette consumption is not surprising. In Ireland, bar workers were one of the few occupational groups that were allowed to smoke without any restrictions while working in an environment where smoking constituted part of their occupational culture. The decline in cigarette consumption was mirrored by the bar workers' perceptions: when the smokers were asked how they feel the smoking ban will influence or has influenced the amount smoked, 53% anticipated that they would at least reduce the amount they smoked and 67% reported that they actually reduced their consumption post-ban.

Although we found a considerable reduction in smoking prevalence among bar workers, we were not able to rule out the role of chance due to the relatively small numbers of smoking bar workers for whom data were available for pre- and post-ban analysis. Fichtenberg and Glantz¹⁶ review of workplace-specific smoke-free policies on smoking prevalence estimated that these policies were associated with a decrease in smoking prevalence of 3.8% (95% CI 2.8–4.7%).

This estimate was remarkably similar to the observed drop of 3.5% in our general population sub-sample and similar to the observed prevalence changes in bar workers.

Consistent with our expectations bar workers showed a much stronger decrease in cigarette consumption than the general population sub-sample. This is true for all subgroups such as sex, age and occupational class.

Contrary to our expectations, the prevalence drop among bar workers was not statistically significant and smaller (2.8%, 95% CI 1.1–1.6) than the drop within the general population sub-sample (3.5%, 95% CI 0.00–7.00). The general population sub-sample had a larger sample size providing sufficient statistical power to show significant drops in prevalence among males, 18–28-year-olds and managers.

Study limitations

While attempts were made to create a suitable comparison group for bar workers from within the general population

Table 2 Changes in smoking prevalence ($n=107$; self-reported and combined self report and cotinine) and cigarette consumption per day ($n=49$) among Cork bar workers; pre- and post-ban comparisons

	Smoking prevalence				Cigarette consumption				
	Total	Pre-ban <i>N</i> (%) smokers	Post-ban <i>N</i> (%) smokers	Difference from pre- to post-ban <i>P</i> -value ^a	<i>N</i>	Pre-ban Mean (SD)	Post-ban Mean (SD)	Within-subject changes (pre- versus post-ban) <i>P</i> ^b	Between-subject differences ^b <i>P</i> ^{**}
Current smoker (self report)	107	55 (51.4)	52 (48.6)	0.508	49	18.1 (11.8)	13.9 (8.5)	<0.001	–
Current smoker (combined self report and cotinine)	107	60 (56.1)	55 (51.4)	0.125	–	–	–	–	–
Sex^c									
Male	76	39 (51.3)	35 (46.1)	0.22	32	18.2 (11.7)	14.2 (8.2)	<0.001	0.823
Female	31	21 (67.7)	20 (64.5)	1.00	17	17.8 (12.4)	13.3 (9.3)		
Age group^c									
18–28 years	53	38 (72.0)	35 (66.0)	0.38	30	14.8 (6.9)	12.5 (7.7)	0.001	0.20
29–38 years	24	12 (50.0)	11 (45.8)	1.00	10	23.6 (15.8)	14.6 (10.2)		
39–48 years	18	7 (38.9)	7 (38.9)	1.00	7	23.4 (18.5)	18.4 (9.9)		
49–58 years	7	2 (28.6)	2 (28.6)	1.00	2	20.0 (14.1)	15.0 (7.0)		
>59 years	5	0 (00.0)	0 (00.0)	–	0	0.0	0.0		
Occupational class^c									
Manager (Bar owner/ bar manager)	45	19 (42.2)	18 (40.0)	1.00	17	17.0 (13.0)	13.0 (9.4)	<0.001	0.617
Staff (permanent/ temp. bar workers)	62	41 (66.1)	37 (59.7)	0.22	32	18.6 (11.3)	14.3 (8.2)		

a: *P*-values for smoking prevalence were calculated using Mc Nemar chi-squared test

b: *P*-values for cigarette consumption were calculated using GLM

c: smoking prevalence by sex, age & occupation are for combined SR & cotinine

Table 3 Changes in self-reported smoking prevalence among the Republic of Ireland general population sub-sample; pre- and post-ban comparisons

	Pre-ban		Post-ban		Difference from pre- to post-ban	
	Total	<i>n</i> (%)	Total	<i>n</i> (%)	<i>P</i> -value ^a	95% CI
Current smoker (self report)	1240	351 (28.3)	1221	303 (24.8)	0.055	0.000–0.07
Gender						
Male	619	180 (29.1)	585	135 (23.1)	0.02	0.01–0.11
Female	621	171 (27.5)	636	168 (26.4)	0.66	–0.04 to 0.06
Age group (years)						
18–28 years	184	67 (36.4)	188	50 (26.6)	0.05	0.004–0.19
29–38 years	215	85 (39.5)	212	76 (35.8)	0.49	–0.06 to 0.13
39–48 years	243	73 (30.0)	241	76 (31.5)	0.77	–0.10 to 0.07
49–58 years	214	66 (30.8)	210	48 (22.9)	0.08	–0.004 to 0.16
>59 years	384	60 (15.6)	370	53 (14.3)	0.68	–0.04 to 0.06
Occupational class						
Manager (bar owner/bar manager)	563	172 (30.6)	543	136 (25.0)	0.04	0.002–0.11
Staff (permanent/temp. bar workers)	677	179 (26.4)	678	167 (24.6)	0.46	–0.03 to 0.06

a: *P*-values were calculated using Pearson's chi-squared test

sample by selecting a similar age and occupational sub-group, important differences still exist between the two groups. Bar workers are a unique occupational group with a very high smoking prevalence and were exposed to very high levels of workplace SHS before the implementation of the ban.

Differences in methodology may also have biased results. Bar workers were interviewed in a face to face interview while the general population were interviewed over the telephone. Evidence suggests that interviewees are more likely to give socially desirable answers during a telephone interview.²¹ While this bias may have resulted in an underestimation of the smoking prevalence and consumption in the general population, it was not likely to systematically bias the estimates of the changes from pre- to post-ban.

This work forms part of a larger 'All Ireland Bar Study', which included bar workers from across Ireland. Bar workers from Cork were the only workers recruited randomly within the AIBS and as such we believe that Cork bar workers, even considering the small sample size and large confidence intervals, can provide the most accurate measure of the absolute magnitude of prevalence changes for this occupational group.

Cork city is a small urban area comprising 123 000 citizens at the time of surveying. Due to the sampling strategy and low refusal rate, the results can be regarded as representative of bar workers in an urban area. It is possible that smoking behaviour among bar workers in rural areas may differ from those in urban areas; however the sample also included participants

Table 4 Changes in self-reported cigarette consumption per day among the Republic of Ireland general population sub-sample (smokers only); pre- and post-ban comparisons

	Pre-ban n = 342 ^a		(1-year post-ban) n = 299 ^b		Pre- to 1-year post-ban change	
	Total	Mean (SD)	Total	Mean (SD)	Mean difference (CI)	P ^c
Smoker	342	16.9 (9.8)	299	16.0 (8.4)	-0.95 (-0.5-2.4)	0.19
Sex						
Male	175	18.5 (11.4)	132	17.6 (8.9)	-0.85 (-1.5 to 3.2)	0.46
Female	167	15.3 (7.6)	167	14.7 (7.8)	-0.64 (-1.0 to 2.3)	0.45
Age group (years)						
18-28 years	65	14.7 (10.9)	50	13.3 (7.3)	-1.36 (-2.2 to 4.9)	0.45
29-38 years	83	16.5 (7.3)	74	15.2 (7.3)	-1.30 (-1.0 to 3.6)	0.27
39-48 years	72	18.0 (8.8)	76	16.8 (8.6)	-1.22 (-1.6 to 4.1)	0.39
49-58 years	64	19.4 (12.5)	48	17.8 (10.4)	-1.54 (-2.9 to 6.0)	0.48
>59 years	58	16.1 (9.2)	51	16.9 (8.1)	+0.74 (-4.1 to 2.6)	0.66
Occupational class						
C2 manager	169	16.3 (8.4)	135	16.2 (9.0)	-0.03 (-2.0 to 2.0)	0.98
DE staff	173	17.6 (11.1)	164	15.8 (7.9)	-1.82 (-0.02 to 3.9)	0.08

a: Nine missing values for cigarette consumption among the general population sub-sample pre-ban

b: Four missing values for cigarette consumption among general population sub-sample post-ban

c: P-values were calculated using independent samples t-test

living outside the city (estimated at about 20%).⁹ There is no reason to expect significant differences in smoking patterns among bar workers within the ROI generally.

With regard to the telephone survey assessment of population smoking rates, there is possible under-sampling of population groups who are less likely to have telephone land lines. Smoking rates in such groups may be higher than in the general population. Other ROI general population surveys such as SLÁN (Survey of Lifestyle, Attitudes and Nutrition) do exist, but were either unavailable for our analysis or outdated (SLÁN)^{22,23}; we therefore considered our dataset to be the best available estimate of general population smoking rates for that time period.

Without a formal control group we cannot rule out that the observed decline in prevalence and cigarette consumption was part of a secular trend in the entire Irish population independent of the smoke-free legislation. However, the emphasis of the present study was not to assess the impact of the smoking ban on smoking behaviour in the general population, but to assess the effect of the legislation on bar workers *in comparison* to the general population to elucidate whether this occupational group benefited more from the smoking ban than the general population.

As it is envisaged that the health impact of this legislation will only be truly evident in years to come, an additional follow-up with the same bar workers 2 years after the ban is being undertaken to help determine the long-term effects of smoke-free legislation on smoking behaviour.

In summary, our findings suggest that the Irish smoking ban was potentially successful in encouraging smokers to reduce the number of cigarettes consumed within an occupational specific context but not necessarily within the same occupational classes in the general population. However, as the general population sub-sample showed, in contrast to the bar workers, a significant decrease in prevalence in some groups we therefore conclude that the smoking ban affected the general population more in terms of giving up rather than just cutting down. It needs to be observed whether these changes will be sustained over time as the potential effects of the smoking ban may 'wear off'. However, a national smoking ban should be judged as only one approach to tobacco control. Multifaceted approaches to tobacco control including legislation, fiscal and educational components are considered most effective for reducing smoking prevalence.^{24,25}

Ethical approval

The clinical research ethics committee of the Cork Teaching Hospitals, research ethics committee of the Faculty of Public Health Medicine, Royal College of Physicians of Ireland provided the ethical approval for this study.

Acknowledgements

We thank Sangeetha N Kalimuthu, Meenakshi Uppel, Katherine O'Mahony, Micheál Breen and Mairead McMahon for help with interviewing; Ann Kelly for help with data entry, Dr Tony Fitzgerald for statistics advice. We especially thank the bar workers who participated in this study. We thank the Office of Tobacco Control for providing us with the general population data.

Funding

Health Research Board of Ireland (Research project grant RP/2005/290) Principle Investigator Dr Birgit Greiner, Department of Epidemiology and Public Health, University College Cork; Office of Tobacco Control through the Research Institute for a Tobacco Free Society (Republic of Ireland); the National Cancer Institute of the United States (R01 CA90955); Irish Cancer Society; Irish Heart Foundation. All authors' work was independent of all funders.

Conflicts of interest: SA is a member of the Board of the Irish Office of Tobacco Control (unpaid position). IJP is the unpaid chair of the Irish Research Institute for a Tobacco Free Society.

Key points

- The reduction in cigarette consumption among bar workers and the decline in smoking prevalence among the equivalent groups in the general population provide some evidence that the Irish smoke-free workplace legislative was effective as a tobacco control measure.
- Multifaceted tobacco control efforts need to continue in Ireland to build on the positive implications of this legislation on smoking prevalence.

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Received 4 September 2008, accepted 10 January 2009