

Secondhand Smoke in Israeli Bars, Pubs and Cafes

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Key words: secondhand smoke, hospitality venues, respirable suspended particles, indoor air pollution

Abstract

Background: Secondhand smoke poses a serious health hazard. In Israel the recent passage of a law designed to protect people from secondhand smoke in public places was greeted with controversy. The debate is taking place without data on actual levels of pollution for secondhand smoke in public places.

Objectives: To estimate levels of small respirable suspended particles, atmospheric markers of secondhand smoke, in Israeli bars, pubs and cafes, to compare them with levels in other countries, and to analyze RSP determinants.

Methods: This study was conducted in bars, pubs and cafes in Jerusalem and Tel Aviv prior to passage of the enforcement bill. Venues were randomly sampled from lists available in the local mass media.

Results: The average level of RSPs across all venues, 283 $\mu\text{g}/\text{m}^3$, was nearly identical to levels in countries without enforced smoking bans. Bars and pubs had higher values than cafes ($P = 0.0101$). The effect of smoker concentration was borderline significant ($P = 0.0540$), with RSP levels increasing as smoker concentration increased. The effect of venue height was also borderline significant ($P = 0.0642$), with RSP levels decreasing as venue height increased.

Conclusions: Levels of indoor air pollution from secondhand smoke in Israeli bars, pubs and cafes prior to the recent passage of the enforcement bill were similar to levels in countries without enforced smoking bans, and roughly 10 times as high as countries with enforced smoking bans. Whether the new law will successfully promote clean air in Israeli bars, pubs, cafes, and other indoor places is yet to be seen.

IMAJ 2008;10:584–587

Secondhand smoke has been estimated to be the third leading preventable cause of death [1]. Secondhand smoke is a leading public health issue worldwide [2], affecting both adults and children, with children being especially susceptible due to their size and developmental stage. In adults, secondhand smoke causes serious disease and shortens life [3]. In infants and children, it causes sudden infant death syndrome, reduced birth weight, middle ear disease, asthma, pneumonia, and lowered lung function [4]. Children exposed to secondhand smoke have more days of absence from school and more days of restricted activity

than unexposed children [5]. Detrimental health effects of this exposure have been shown to persist into adulthood [6].

In 1983, a landmark law [7] prohibiting smoking in public places in Israel put an end to the smoking that was common on public transportation and in movie theaters. The law also applied to other public places, such as hospitals and schools, but was not effectively enforced in those places. Amendments to the law in subsequent years extended the restrictions to virtually all public places, including workplaces. However, these laws were only partially implemented [7].

In summer 2007, a new law was passed that placed the onus of enforcing antismoking regulations within an establishment on the proprietor of the establishment, and raised fines for individuals caught smoking [8]. This law went into effect on 7 November 2007. The recommended fines that the proprietor would have to pay for failing to prevent smoking were set at NIS 5000 [9], which is 64% of the average gross monthly income for salaried individuals [10]. Fines that the smokers themselves would have to pay were tripled to NIS 1000, or 13% of average gross monthly income.

Secondhand smoke exposure is measured in various ways in the environment and in individuals. Atmospheric markers such as respirable suspended particles or $\text{PM}_{2.5}$ (i.e., particulate matter < 2.5 microns in diameter) are often used for measurement in the environment [4]. RSPs, which pose health risks because they can easily be inhaled deep into the lungs, are released in large quantities by burning cigarettes. High levels of RSPs have been shown to be attributable almost exclusively to tobacco smoke in hospitality venues [11].

The debate in Israel today on the new law's impact and justification [12] is taking place without data on actual levels of pollution from secondhand smoke in public places, and without any idea of how these levels compare with those in other countries. In this report, we present the results of our research on the levels of small respirable particles in a sample of Israeli bars, pubs and cafes.

The primary goal of this study was to estimate levels of small respirable particles in Israeli bars, pubs and cafes, and compare them with levels in other countries with and without effective clean indoor air laws. A secondary goal was to explore differences between levels of RSPs in different types of venues and to analyze determinants of RSP levels. As the study was being planned, the above-mentioned new law was under discussion in

RSP = respirable suspended particles

NIS = New Israeli Shekel

the Knesset (the Israeli parliament). Thus, an additional goal was to obtain data on exposure that could be used in a subsequent evaluation of the law if it were passed.

Methods

This observational study was conducted in bars, pubs and cafes in Jerusalem and Tel Aviv during the spring and early summer of 2007. All observations were completed before passage of the new law by the Knesset in August 2007, which imposed fines on proprietors and increased fines to individuals.

Venues were sampled in two of Israel's three largest cities, Jerusalem and Tel Aviv. Venue lists that were readily available in the mass media (internet and local press) were used for sampling purposes. Bars and pubs in Jerusalem were sampled from several editions of the weekly "Top Five" list (*Hamishia Potachat*) published in *Kol Ha'ir*, a popular Jerusalem weekly paper. Bars and pubs in Tel Aviv were sampled from a listing of best Israeli bars published in the popular magazine *Blazer* [13]. Cafes from both cities were sampled from the internet site "City Mouse." The full list of possible venues for each city (Jerusalem, Tel Aviv) and venue type (bar/pub, cafe) was entered into the computer, and a random number generator provided by SAS [14] assigned a random number to each venue. For each city and venue-type combination (Jerusalem bar/pub, Tel Aviv bar/pub, Jerusalem café, Tel Aviv café), the venues were ordered according to the rank of the assigned random number. Those with the highest values were chosen for inclusion in the study.

Observers visited each venue unobtrusively and collected three types of information, following the protocol of a large study comparing indoor air pollution in 24 countries [15]. First, they measured the size of the room with a hand-held sonic measuring device. Second, they recorded numbers of patrons and numbers of burning cigarettes at three time points: at entry, after approximately 15 minutes, and at approximately 30 minutes (before exit). Third, they measured air quality, using a specialized air quality monitor (TSI Sidepack AM510 Personal Aerosol Monitor). The air monitor measures RSPs in the air, and takes continuous readings of the concentration of particles smaller than $2.5 \mu\text{m}^3$. The resulting data, which are provided on a per minute basis, are transferred to computers for analysis using specialized software [16].

Observers took three air quality readings per venue. Just before entry to the venue, air quality was recorded for 5 minutes. Inside the venue, air quality was recorded for 30 minutes. After exit from the venue, air quality was recorded for 5 minutes. This protocol differed slightly from that used in other studies, as it involved turning off the machine before entry to and exit from the venue [16]. This change was made in order to avoid problems with the security guard at the entrance to the venue. One observer did not follow this protocol exactly, but instead turned the machine on before entry and left it running until after exit. Consequently, the first and last 3 minutes of that observer's recordings were deleted prior to analysis.

Three of the sampled venues had separate smoking and non-smoking sections. In those cases, data on RSP levels, numbers

of burning cigarettes, and smoker concentration were averaged in order to produce a single overall observation for the venue.

Statistical analyses

Simple descriptive analyses were done to compare mean RSP levels in Israel with mean reported levels from other countries with and without enforced clean air laws. Analysis of covariance was used to determine the effect of venue type, city, room height, and smoker concentration on RSP levels. Smoker concentration was calculated as the average number of burning cigarettes during the 30 minute visit (the average of the three observations taken inside the venue) divided by the volume of the room.

We calculated air exchange rate using a known formula [17] which describes the relationship between air flow, smoker density (D_s), and RSP due to secondhand smoke (RSP_{ETS}). We calculated RSP_{ETS} by taking an average of RSP levels in several smoke-free environments, and then subtracting the background RSP level of $13 \mu\text{g}/\text{m}^3$ from the RSP values we recorded in the venues. Smoker density was defined as the number of smokers per 100m^3 . The formula used to calculate air exchange rate was:

$$\text{Air exchange rate} = C_v = 650 * D_s / RSP_{ETS}$$

Results

It was not possible to enter all sampled venues. Several no longer existed, one was under renovation, some were too crowded to enter, and some admitted only adults over the age of 25, excluding our younger observers. Observers were provided with names and addresses of additional venues according to the ordered list on an as-needed basis.

A total of 34 venues were included in the final sample: 9 Tel Aviv bars and pubs, 7 Jerusalem bars and pubs, 8 Jerusalem cafes, and 10 Tel Aviv cafes. Data from one recording session are displayed in Figure 1. The observer began recording just before entry to the bar and continued recording until after exit from the bar. The RSP level jumped immediately upon entry, fluctuated during the course of the visit, and dropped precipitously upon exit.

The average RSP level across all venues was $283 \mu\text{g}/\text{m}^3$. Figure 2 shows how this level compares with those observed in other countries [11]. Israeli levels are far above those in Ireland ($29 \mu\text{g}/\text{m}^3$) and U.S. states that have enforced smoking bans ($53 \mu\text{g}/\text{m}^3$)

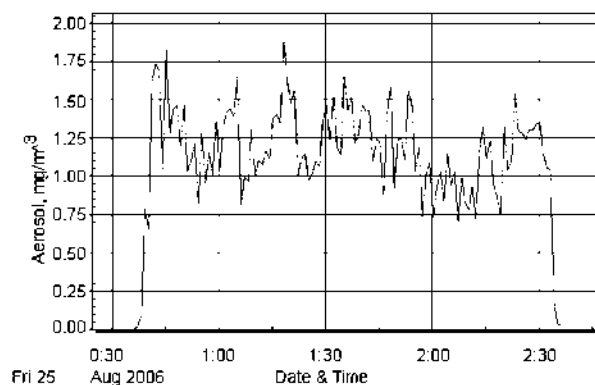


Figure 1. RSP levels during visit to an Israeli bar

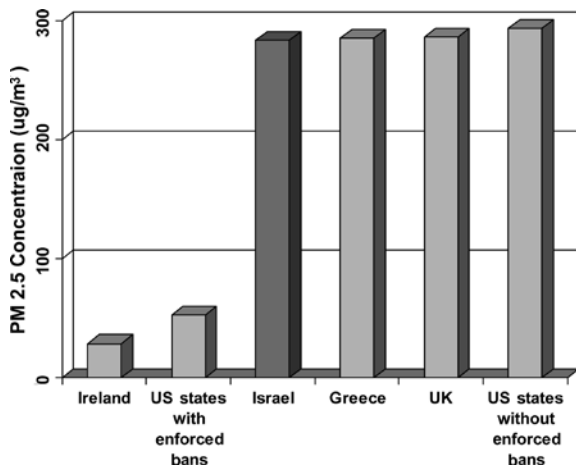


Figure 2. International comparisons of RSP levels

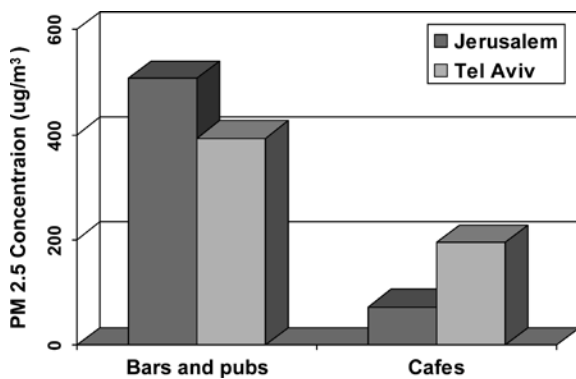


Figure 3. RSP levels in bars, pubs and cafes in Israel by city and type of venue

m³), but almost identical to the levels in the UK prior to the implementation of the smoking ban there (286 µg/m³), the levels in U.S. states without smoking bans (293 µg/m³), and the levels in Greece (285 µg/m³).

As Figure 3 shows, the average RSP level varied by venue type. Bars and pubs had higher values (Jerusalem 507 µg/m³, Tel Aviv 393 µg/m³) than cafes (Jerusalem 73 µg/m³, Tel Aviv 195 µg/m³). Venue type significantly affected RSP level (*P* = 0.0101). The effect of smoker concentration was borderline significant (*P* = 0.0540), with RSP levels increasing as smoker concentration increased (β = 1.66). The effect of venue height was also borderline significant (*P* = 0.0642), with RSP levels decreasing as venue height increased (β = -0.089). City did not affect RSP levels (*P* > 0.05).

Mean smoker density is presented in Table 1. Smoker density ranged from 0 to 23.3 smokers per 100 m³. Mean smoker density was higher in bars (6.69 smokers per 100 m³) than in cafes (1.81 smokers per 100 m³). The calculated air exchange rate (changes/hour) was higher in cafes (19.2 changes/hour) than in bars (12.9 changes/hour).

Discussion

The high average levels of RSP in the sampled venues show that Israel's bars, pubs and cafes were heavily polluted at the time of this study, which was conducted prior to the recent implementation of a new enforcement law regarding smoking in public places. The observed levels were very similar to those found in countries without enforced smoking bans. Several variables were found to be related or potentially related to the RSP level within a venue. Because of the random selection of venues from the Israeli mass media lists, these results are generalizable to bars, pubs and cafes that are listed in local mass media. Individuals who frequent or work in these venues in Israel are exposed to far higher RSP levels than the upper annual limit of 15 µg/m³ set by the U.S. Environment Protection Agency in 1997 [18].

Implications for research

Previous analyses of the determinants of RSP levels have examined the number of burning cigarettes, venue volume, air exchange rate, chemical transformations, and other variables [4]. The importance of smoker concentration, found to be of borderline significance in this study, was previously documented. To the best of our knowledge, the effect of room height on RSPs has not been previously investigated. The borderline statistical significance of room height in our study suggests that this variable may indeed have an effect. The effect of room height may have been more apparent had the sample been larger.

Several previous reports [11,19,20] regarding factors affecting RSP levels presented only basic descriptive statistics and/or simple univariate non-parametric tests examining just one factor at a time. The standard multivariate techniques that we employed provide a clearer understanding of the determinants of RSP levels.

We observed a great deal of within-venue variability in both the RSP levels (over time) and the number of burning cigarettes (across the three observations within each venue). The data from the RSP readings are uploaded from TrakPro software on a per minute basis. Careful recording of the time of each observation of the number of lit cigarettes would allow for more precise analysis of the relationship between smoker volume and RSP level. Although such recording is not currently part of the standard protocol for air quality studies, we recommend it to future researchers.

Table 1. Average levels of smoker density, RSP, and air exchange rate by venue and city

	Mean smoker density (smokers/100 m ³)	Mean RSP	Mean air exchange rate (changes/hr)
Jerusalem bars	10.47	507	14.0
TA bars	3.76	393	12.0
Jerusalem cafes	0.78	73	15.1
TA cafes	2.63	195	22.5
All bars	6.69	443	12.9
All cafes	1.81	141	19.2
All	4.11	283	16.3

Implications for health

The high recorded RSP levels in Israeli bars, pubs and cafes represent a serious danger to the health of those who work in and patronize these venues. In California, the health of hospitality workers (e.g. waiters) was seen to improve dramatically within months of implementation of a smoking ban [21], and the recent implementation of a smoking ban in New York was followed by a 19% decrease in hospital admissions for myocardial infarctions in the general population [22]. In addition to decreasing exposure of non-smokers to secondhand smoke, smoking bans have been shown to decrease both the prevalence of smoking and the quantity of tobacco products consumed [23]. Israel, with its current smoking prevalence of 23.2% has much to gain from tobacco control measures [24]. A recent study showed that nearly 20% of long-term Israeli smokers over the age of 45 develop chronic obstructive lung disease [25]. This represents only one aspect of the devastating health effects of tobacco consumption, which include heart disease, many forms of cancer, and lung disease in adults and children. If effectively implemented, the new Israeli law offers the potential for an important public health benefit.

Conclusions

Levels of indoor air pollution from secondhand smoke in Israeli bars, pubs and cafes are similar to those in countries without enforced smoking bans, and roughly 10 times as high as those in countries with enforced smoking bans. The concentration of RSPs is nearly 20 times the maximum allowable annual level for exposure set by the U.S. Environmental Protection Agency. Whether the recently passed Israeli law will successfully promote clean air in Israeli bars, pubs, cafes and other indoor places is yet to be seen.

Acknowledgments: The authors gratefully acknowledge funding for this study from the Flight Attendant's Medical Research Institute (FAMRI), through the Harvard School of Public Health. The authors wish to thank Dr. Carrie Carpenter of the Harvard School of Public Health for her thoughtful contributions to the design and analysis of this study. The authors also wish to thank the following individuals for data collection: Yafit Harari, Dvora Angel and Yitzchak Rosen.

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