Tobacco smoke pollution associated with Irish pubs in New Zealand: fine particulate (PM$_{2.5}$) air sampling

New Zealand has made progress over recent decades with reducing air pollution from tobacco smoke, especially in indoor environments. Nevertheless, there are no national laws that attempt to prevent smoke attributed to outdoor smoking from drifting indoors.

Previous New Zealand work on urban pubs and rural pubs has found evidence for such drift from “outdoor smoking areas” to indoor areas (via open windows and doors). Other studies overseas have found air quality of indoor areas adjacent to outdoor smoking areas compromised, with similar levels of secondhand smoke (SHS) exposure in hallways and near outdoor main entrances where smoking is permitted, such as entrances to office buildings.

A study measuring airborne nicotine concentrations to monitor SHS in different locations of a hospital before and after a smoking ban showed the smallest reduction at the hospital main entrance and hallway compared with all other areas.

Drifting SHS is likely to have health implications, and be an irritant and nuisance to workers (especially hospitality workers). This impact will be particularly felt by patrons using outdoor dining areas (as per Australian work). Work in the United States indicates significant increases in markers for tobacco smoke absorption by non-smokers (salivary cotinine and a urinary marker [NNAL]) following outdoor SHS exposure in the bar and restaurant settings.

In this current study we aimed to measure the drift of SHS from outdoor areas to indoor smokefree areas by focusing specifically on more “typical” pubs than in previous New Zealand work (which has generally involved purposeful selection of urban pubs with highly enclosed smoking areas).

Other advantages of studying Irish pubs were that there was comparable international data on air quality in such pubs, and they provide opportunities to study air quality on relatively high use occasions (i.e. St Patrick’s Day).

Methods—We took a convenience sample of three Irish pubs in the central business district of a large New Zealand urban area which we visited on two successive Saturdays in March 2012 (see Table 1).

Data were obtained from three different positions:

(i) The outdoor smoking area/s;

(ii) Within the pub (but within 2 metres of the door to the outdoor smoking area); and

(iii) As far as possible within the pub away from the door to the outdoor smoking area. The order of these positions was predetermined by random number selection, and each area was sampled for at least 15 minutes. To
avoid affecting occupants’ behaviour, the observers behaved discretely and as typical customers (i.e. purchased drinks).

In all the settings we discretely looked for evidence of smoking behaviour (actual observable smoking, the presence of ash trays and discarded cigarette butts). The investigators also counted the number of pub customers who were smoking at two time points: when entering the specific area for monitoring and at the mid-point of the 15-minute time in each area.

The use of the air quality monitor followed a protocol modified from one developed for a global air quality monitoring project and which has been used in other New Zealand studies. In the sampling, fine particulates were measured (PM$_{2.5}$, i.e., particulate matter ≤2.5 µm in diameter) using a portable real-time airborne particle monitor (i.e., the TSI SidePak AM510 Personal Aerosol Monitor, TSI Inc, St Paul, USA). The air monitor was carried hidden in a bag on the back of one of the observers to sample the ambient air close to the breathing zone.

A calibration factor (0.32) for SHS based on empirical validation studies with the SidePak monitor was applied (i.e. adjusted in the monitor’s internal settings). The monitor was zero-calibrated prior to each day of field work, was fitted with a 2.5 µm impactor, had an air flow rate of 1.7 L/min and had a logging period of 30 seconds.

A length of Tygon™ tubing was attached to the inlet of the monitor, with the other end left protruding slightly outside the bag it was carried in. Ethical approval for the study was obtained through the University of Otago (Category B ethics approval process) and the researchers were cognisant of the ethical issues involved in this type of research.

Results and Discussion—There was no clear gradient found in mean fine particulate levels between the three types of settings, but maximum levels were several times higher in outdoor smoking areas compared to the two indoor settings (see Table 1). For all mean estimates, the air in and around pubs had higher particulate levels than the ambient air monitored while walking between pubs. This is consistent with the drift of tobacco smoke from outside to indoors of the pubs. Indeed, these results are also consistent with the researchers recording smelling tobacco smoke indoors (in two of the three pubs on both nights), and having eye and throat irritation symptoms at the end of both evenings.

While fine particulate levels in the outdoor smoking areas reached high maximums, the mean values were not particularly high, possibly because of smoke dispersal from the wind in the relatively exposed outdoor smoking areas (see Table 1 footnotes). Wind flow could also have been lowering indoor levels near doors (as all the doors in the three pubs and windows in two pubs were continuously open during the sampling periods).

The results also indicate higher particulate levels for all three settings on St Patrick’s Day compared to the previous Saturday (e.g., 15.5 vs 7.2 µg/m$^3$ for designated open air smoking areas, see Table 1). This was also the pattern for the ambient outdoor air monitored while walking between the pubs (i.e. 7.4 vs 5.4 µg/m$^3$). These results were all consistent with our observation of there being more people and more smokers (Table 1), at the pubs on St Patrick’s Day.
Table: Results of air quality monitoring (fine particulates, PM$_{2.5}$) in three Irish pubs on two separate occasions, including a relatively busy occasion, St Patricks Day (sampling times 15 minutes per site*)

<table>
<thead>
<tr>
<th>Setting</th>
<th>Saturday preceding St Patrick’s Day (1650h to 2055h)</th>
<th>St Patrick’s Day (a Saturday) (1650h to 2115h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean PM$_{2.5}$ (µg/m$^3$)</td>
<td>Minimum PM$_{2.5}$ (µg/m$^3$)</td>
</tr>
<tr>
<td>Smoking area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irish Pub A (on footpath)</td>
<td>2.6</td>
<td>2.0</td>
</tr>
<tr>
<td>Irish Pub A (on balcony)***</td>
<td>12.4</td>
<td>2.0</td>
</tr>
<tr>
<td>Irish Pub B (on footpath)</td>
<td>4.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Irish Pub C (on balcony)</td>
<td>11.6</td>
<td>5.0</td>
</tr>
<tr>
<td>All three (mean of all results)</td>
<td>7.2</td>
<td>2.0</td>
</tr>
<tr>
<td>Indoors (but within 2 metres of the door connecting to the outdoor smoking area)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irish Pub A (near footpath)</td>
<td>4.3</td>
<td>3.0</td>
</tr>
<tr>
<td>Irish Pub B</td>
<td>7.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Irish Pub C</td>
<td>17.4</td>
<td>15.0</td>
</tr>
<tr>
<td>All three (mean of all results)</td>
<td>9.7</td>
<td>3.0</td>
</tr>
<tr>
<td>Indoors (but as far as possible away from the door to the outdoor smoking area i.e., at &gt;8 metres)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irish Pub A</td>
<td>4.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Irish Pub B</td>
<td>15.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Irish Pub C</td>
<td>14.0</td>
<td>10.0</td>
</tr>
<tr>
<td>All three (mean of all results)</td>
<td>11.3</td>
<td>4.0</td>
</tr>
<tr>
<td>Ambient outdoor air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>While walking between pubs#</td>
<td>5.4</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Notes:

* If the time period of sampling slightly exceeded 15 minutes, we took the most central 15 minute segment of the recording period. All outdoor smoking areas had building walls on only one side, but at one site on St Patrick’s Day there was also some wind protection from canvas tenting on one side and for another venue, some wire mesh may have slowed the wind flow. For all venues on both occasions there were continuously open doors between the smoking area and the indoor area; and similarly for windows (except Pub C where windows were closed on both occasions).

** These are smokers who were outdoors and seen via windows and open doors by the researchers when positioned indoors and near the smoking area. No smoking inside was observed in any of the pubs. The results are averaged between the two researchers doing the counting.

*** The observation period had to be truncated at the mid-point due to a within-pub event starting and forcing relocation of all patrons.

# 47.5 minutes on the Saturday preceding St Patrick’s Day, and 42.5 minutes on St Patrick’s Day.
As with previous New Zealand work,¹⁻³ there was complete compliance with the smokefree law for the inside areas of these three pubs. There was also no evidence of indoor ash trays, though one cigarette butt was noticed in a wall crevice in an interior area deep inside one pub.

The mean level of fine particulates in this study for all indoor measurements was 12.9 μg/m³ (all three pubs, both indoor settings, both nights), which compares to 329 μg/m³ for 87 Irish pubs internationally that permitted indoor smoking and 23μg/m³ for those 41 Irish pubs which were smokefree.¹⁰ This again highlights the benefits of indoor smokefree hospitality settings in New Zealand.

Of note is that this study has various methodological limitations, particularly the convenience sample, and the small sample size. In one pub hot food was also served and so there is some potential for measurements being increased by fine particulates from the cooking.¹⁵

Future studies could collect data from a wider range of Irish pubs—including from multiple New Zealand cities. Nevertheless, the apparent smoke drift/particulate accumulation found in indoor areas in this study occurred in the context of complete compliance with current smokefree legislation.

Therefore to maximise the health protection of pub workers and patrons, there is a case for upgrading the relevant legislation (the Smoke-free Environments Amendment Act 2003) to do one or more of the following:

(i) Partially or completely restricting outdoor smoking from occurring near to indoor areas;
(ii) Having regulations requiring the shutting of windows and doors that connect to outdoor smoking areas; and
(iii) Ban smoking entirely from busy city streets.

Indeed, smokefree street policies have now started to appear in some other parts of New Zealand,¹⁶,¹⁷ and smokefree street laws are used in a number of jurisdictions internationally.¹⁸⁻²⁰

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References:


