Smoke-free Patios –

A Study of Air Quality on Patios that permit or restrict smoking in the city of Ottawa.

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BACKGROUND:

Second-hand smoke (SHS) is a known human carcinogen.[1] In 2006, the US Surgeon General concluded:

> "The scientific evidence indicates that there is no risk-free level of exposure to second-hand smoke." [2]

Therefore, public health authorities, and tobacco control advocates have an interest in eliminating exposure to SHS in public places and workplaces to reduce any possible health risk.

In Ottawa, smoking is permitted on patios provided they are not covered by a roof, in accordance with the Smoke-free Ontario Act.[3] The Ottawa Council on Tobacco and Health requested an air quality study to be conducted on different patios in the Ottawa area to understand if tobacco smoke can be present.

STUDY OBJECTIVE:

To quantify if tobacco smoke impacts air quality on outdoor patios in Ottawa.

METHODS:

Air quality monitoring was conducted using established research methods described by Travers et al. (2008).[4] A convenience sample of patios was identified by the Ottawa Council on Tobacco and Health. Areas with high concentrations of patios were chosen to make sampling efficient. Researchers decided to measure air quality on a patio if it was determined that there were patrons actively smoking at the outdoor venue, or patrons had cigarettes visible on tables with ashtrays indicating that they may smoke.

At each patio, respirable suspended particles ($PM_{2.5}$) were measured using a TSI SidePak AM510 Personal Aerosol Monitor (TSI, St. Paul, Minnesota, USA).[5] $PM_{2.5}$ is an established proxy measure for tobacco smoke. The SidePak uses a built-in sampling pump to draw air through the device where the particulate matter in the air scatters the light from a laser. The mass concentration of particles is determined by the amount of light scattering. The SidePaks used in this study were fitted with a 2.5 μm impactor in order to measure the concentration of particulate matter with a mass-median aerodynamic diameter less than or equal to 2.5 mm. Tobacco smoke particles are almost exclusively less than 2.5 μm with a mass median diameter

of 0.2 μm. The TSI SidePak measures PM2.5 concentrations in the air every second; the data logger was set to report average readings every 10 seconds.

Visual observations were made at each patio noting times when patrons started or stopped smoking and the distance the monitor was from active cigarette smoking. Most venues were samples for a minimum of 30 minutes.

Ambient background readings were taken throughout the sample period at locations with no smoking, such as downtown parks or on the sidewalk when no smokers were present. Ambient background readings were also checked and verified to be within the range specified by the Ontario Ministry of Environment as acceptable background levels for clean air.

SAMPLE:

Ten patios were sample where smoking was permitted, and 2 patios were sampled that were smoke-free. A range of venue types was sampled including family restaurant, pub/bar, restaurants and coffee shops.

Samples were collected on Friday August 20, and Monday August 23, 2010.

RESULTS:

Ambient $PM_{2.5}$ was low during the sampling periods; Friday August 20, the Ministry of Environment reported $PM_{2.5}$ levels in the range of 2-7 $\mu m/m^3$, and Monday August 23 levels reported ranged from 4-8$\mu m/m^3$. $PM_{2.5}$ levels <12 $\mu m/m^3$ are considered 'very good' on the Air Quality Index.

The 2 smoke-free patios were measured on August 20, and had $PM_{2.5}$ levels of 5 $\mu m/m^3$, and 7 $\mu m/m^3$; consistent with ambient background levels.

Some patios that permitted smoking had average $PM_{2.5}$ levels close to background levels; this was explained by little or no active smoking during the visit or smoking taking place in excess of 10m away. However, most patios had peak readings significantly higher than background levels indicating that second-hand smoke drifted by the table.

Three of the patios with active smoking in relatively close proximity to the monitoring equipment, however, did have significantly higher $PM_{2.5}$ concentrations, and are detailed in Table 1.

Table 1. $PM_{2.5}$ readings on Patios with active smoking

Patio	Description	Ambient $PM_{2.5}$ reading	Average $PM_{2.5}$ reading	Peak 10 second $PM_{2.5}$ reading
Patio 1	Open Air Pub; in enclosed courtyard	4 $\mu g/m^3$	18 $\mu g/m^3$	716 $\mu g/m^3$
Patio 4	Open Air Restaurant near street	5 $\mu g/m^3$	13 $\mu g/m^3$	44 $\mu g/m^3$
Patio 6	Pub, Under Overhang, near street	6 $\mu g/m^3$	16 $\mu g/m^3$	104 $\mu g/m^3$
Patio 7	Coffee Shop, smoking area, open air	4 $\mu g/m^3$	10 $\mu g/m^3$	83 $\mu g/m^3$
Patio 7	Coffee Shop, non-smoking area, open air	4 $\mu g/m^3$	23 $\mu g/m^3$	213 $\mu g/m^3$
Patio 12	Restaurant, umbrellas	8 $\mu g/m^3$	26 $\mu g/m^3$	253 $\mu g/m^3$

Similarly, $PM_{2.5}$ readings were collected in a park in the downtown away from busy streets and smokers; the 5 minute average $PM_{2.5}$ reading the evening of Friday August 20 was 4 $\mu g/m^3$. A 30 minute air quality sample was taken on Tuesday August 24, along Laurier Avenue at rush hour; the average $PM_{2.5}$ level during that sample was 3 $\mu g/m^3$.

DISCUSSION

When researchers visited patios that permitted smoking, and were in close proximity to the smokers, the proxy measure for tobacco smoke ($PM_{2.5}$) was detected by the air quality monitoring device (TSI SidePak). These findings indicate that tobacco smoke can impact air quality on outdoor patios and that patrons visiting these environments can be exposed to second-hand smoke. Further, outdoor environments designated as smoke-free may experience even higher levels of second-hand smoke if they are downwind of smoking sections, as was experienced at Patio 7.

CONCLUSIONS

It is possible to be exposed to SHS on patios, even under windy conditions.

Non-smoking sections of a patio or indoors do not necessarily protect people from being exposed to SHS if adjacent spaces permit smoking.

PM2.5 levels on a smoky patio are much higher than a busy road.

[1] National Cancer Institute. Health Effects of Exposure to Environmental Tobacco Smoke: The Report of the California Environmental Protection Agency. Smoking and Tobacco Control Monograph no.10. Bethesda, MD. U.S. Department of health and Human Services, National Institutes of Health, National Cancer Institutes, NIH. No. 99-4645, 1999.

[2] U.S. Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General—Executive Summary.* U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2006

[3] Ministry of Health Promotion, May 2010. Smoke-free Ontario Act: How the Act Affects Bar and Restaurants, including Patios (fact sheet). Accessed August 24, 2010. Available here: http://www.mhp.gov.on.ca/en/smoke-free/factsheets/bars_restaurants.pdf

[4] Hyland A, **Travers** MJ, Dresler C. 2008 A 32-country comparison of tobacco smoke derived particle levels in indoor public places. *Tob Control* 2008 17: 159-165

[5] Information about the TSI SidePak can be found here: http://www.tsi.com/en-1033/products/2112/sidepak%E2%84%A2_am510_personal_aerosol_monitor.aspx