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The data associated with this publication are in the supplemental files.

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$PM_{2.5}$ Concentrations in the Smoking Lounge of a Cannabis Store

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ABSTRACT

To assess the exposure of patrons and workers to secondhand cannabis smoke in the smoking lounge of a cannabis store, we measured airborne $PM_{2.5}$, cannabinoids, and nicotine in a cannabis store and a nearby coffee shop. $PM_{2.5}$ concentration was measured with laser photometers. $PM_{2.5}$ samples were collected on filters and cannabinoids were quantified by liquid chromatography with tandem mass spectroscopy and nicotine was quantified by gas chromatography. Activity and demographic data were recorded. The average $PM_{2.5}$ concentration over nine experiments conducted between September 2018 and August 2019 was 840 (standard deviation of 674 $\mu g/m^3$). Concentrations of THC, CBD, and CBN in the particulate matter averaged 79.0 $\mu g/m^3$, 0.708 ng/m^3, and 8.60 ng/m^3, respectively. Nicotine concentrations were below the level of quantification. Although a variety of consumption methods were observed, 91% of the observed consumption events were smoking. The business installed a ventilation system halfway through our study. Before the ventilation system was installed, the average $PM_{2.5}$ was 905 $\mu g/m^3$, afterwards it was 795 $\mu g/m^3$. This 12.2% decrease was

not statistically significant. Our results show that smoking cannabis indoors can create high concentrations of particulate air pollution that are known to cause adverse health effects.

KEYWORDS

Cannabis, marijuana, secondhand, environmental, smoke, pollution, $PM_{2.5}$, particulate, dispensary

SYNOPSIS

$PM_{2.5}$ concentrations in a cannabis store smoking lounge averaged 840 μg/m^3, high enough to increase the risk of heart attack.

INTRODUCTION

While the harmful health effects of secondhand tobacco smoke exposure and the benefits of smokefree policies are well known[1], there is little known about the pollutants that arise from cannabis use. Cannabis smoke is chemically similar to tobacco smoke[2, 3] and $PM_{2.5}$ exposure is a known cause of cardiopulmonary and metabolic disease[4, 5]. However, some communities allow cannabis smoking as an exception to existing smokefree laws and many more communities are considering similar legislation. To assess the air pollution associated with cannabis use, we measured airborne $PM_{2.5}$, cannabinoid and nicotine concentrations in a cannabis store in California that permitted smoking, vaporizing, and dabbing in an on-site consumption area (smoking lounge)[6].

MATERIALS AND METHODS

Study Design

We chose a dispensary that was noisy enough to mask the sound of our air sampling instruments. Nine visits were made; four in 2018 and five in 2019. All experiments were conducted between 15:00 – 19:00 (Table 1). Airborne particles 2.5 μm in diameter and smaller ($PM_{2.5}$) were measured in the cannabis consumption lounge using laser photometers. $PM_{2.5}$ samples were collected on filters to quantify nicotine and cannabinoids. Background samples were collected within 100 meters of the dispensary; either outdoors, in a pedestrian plaza, or indoors, in a coffee shop. The instruments were carried in backpacks and the experiments were conducted without permission from the businesses. The dispensary enforced a 30-minute limit in the lounge during most of our visits. When possible, the backpacks were relayed between researchers to collect multiple readings in a single experiment. The instruments were turned off each time one researcher left the lounge and turned back on after the next researcher entered the lounge. Experiment durations ranged from 32 to 152 minutes (Table 1).

Dispensary $PM_{2.5}$ Measurements

$PM_{2.5}$ concentrations were measured in real time using laser photometers operated according to the manufacturer's instructions (Sidepak model AM510, and DustTrak model 8532, TSI Inc., Shoreview MN). The instruments were turned off prior to entering the dispensary, because bags were checked at the door. Photometers were paired with air pumps in each backpack, to collect samples on filters to measure cannabinoids and nicotine. After entering the smoking lounge, the researchers chose a seat that was not near the entrance or the emergency exit. The instruments were then turned on and the backpacks were placed on the tables with the sampling inlets located at the shoulder level of seated patrons. The instruments were switched off before the researchers left the lounge. For more details on the air pumps, filters, filter cassettes and flow calibrations, please refer to the Supplementary Materials. We used impactors (Personal

Modular Impactor, SKC, Pittsburgh, PA and inbuilt Sidepak and Dusttrak impactors) and cyclones (Triplex Personal Sampling Cyclone, BGI Mesa Labs, Butler, NJ) to exclude particles over 2.5 μm in diameter from all samples and measurements.

Background Measurements

For the first three experiments, measurements and samples were collected in a public plaza, before and after sampling in the dispensary. For the remaining six experiments, measurements and samples were collected in a coffee shop at the same time as they were collected in the dispensary.

Quantification of Cannabinoids and Nicotine

Cannabinoid content of the particulate material on the front filters was quantified at the Organic Analytical Laboratory of the Desert Research Institute (Reno, NV), as described in the Supplementary Materials. The limits of detection (LOD) were 1.85, 0.67, and 1.90 ng per filter for THC, CBD, and CBN, respectively. The limits of quantitation (LOQ) per sample varied, depending on the volume of air sampled: 0. 995 - 11.6 ng/m^3 for THC, 0.36-4.2 ng/m^3 for CBD and 1.0 – 12 ng/m^3 for CBN. Nicotine was quantified by gas chromatography as described previously [7], modified by using a capillary column and using 5-methylnicotine as the internal standard. The LOQ ranged from 16 ng/m^3 to 29 ng/m^3.

Demographic and Behavioral Data Collection

Cannabis consumption behavior was recorded to identify and count emitting sources. Researchers also observed and counted the occupants in the lounge. On separate counts, the perceived gender (women/men), and role (customers/employees) of the people in the lounge were tallied. People were counted as employees only if they were wearing dispensary ID and clearly working. Employees on break were counted as customers. Researchers and employees were included in the occupancy counts.

Gravimetric Photometer Calibration: Data from routine cigarette smoke generation experiments[8] were used to derive calibration factors for the photometers. Gravimetric samples were collected and weighed before and after each cigarette smoke experiment. We plotted the unadjusted average photometer data against the gravimetric data and forced the line through zero. The slope was the calibration factor. The field photometric data were multiplied by the calibration factors to yield the final particle concentration values.

Data Analysis: Descriptive statistics were calculated using Microsoft Excel, 2016. We estimated data below the limit of quantitation as the limit of quantitation/2. Regressions and overall test for coincidence of regression lines were calculated using Sigmaplot v. 14.

RESULTS

Smoking Lounge Structure and Operations

The lounge was ~ 6 by 15 meters and ~4 meters high (360 m^3) and separated from the rest of the business by a door that was kept closed. On admission, a timer set for 30-40 minutes was handed to each group. When the timer sounded, the customers left.

Smoking Lounge Ventilation

During the first four experiments, we observed one air vent (~ 101 by 41 cm) located high on the wall in the smoking lounge. When we began the fifth experiment, a new ventilation duct, ~ 30 cm in diameter x 6 meters long with four vents of ~30 x 13 cm, had been installed, near the ceiling of the lounge. Because we conducted these experiments surreptitiously, we were unable to measure the air exchange rate in the dispensary or examine the ventilation equipment closely.

Table 1: Occupants, Emitting sources, $PM_{2.5}$ Concentrations							
Date	**Start**	**Stop**	**Minutes**	**Avg. occupants per count**	**Avg. sources* per count**	**Avg. $PM_{2.5}$ $\mu g/m^3$ (Stdev)**	**$PM_{2.5}$ per occupant ($\mu g/m^3$ * occupant)**
9/28/2018	17:20	18:03	43	25	9	1,173 (376)	50
10/12/2018	16:12	16:44	32	44	8	699 (494)	18
10/16/2018	16:23	17:00	37	18	8	889 (1,128)	50
11/30/2018	15:50	16:24	34	21	11	867 (1,249)	41
11/30/2018	16:45	17:30	45	23	11	1,123 (645)	48
11/30/2018	17:39	18:16	37	24	10	911 (362)	38
11/30/2018	18:42	19:18	36	24	11	670 (845)	28
Pre-vent Avg				**26**	**9**	**905 (728)**	**39**
3/8/2019	15:21	15:45	24	26	9	845 (964)	32
3/8/2019	16:14	16:42	28	n/a	na	977 (717)	na
3/8/2019	17:03	17:27	24	29	15	758 (369)	26
3/8/2019	17:45	18:08	23	26	10	1,232 (1,216)	47
5/29/2019	16:52	17:29	37	20	9	539 (201)	30
7/18/2019	16:12	16:51	39	28	15	1,266 (1,479)	52
7/25/2019	16:04	16:56	52	33	11	586 (347)	19
8/1/2019	15:14	15:55	41	14	5	514 (518)	36
8/1/2019	16:24	16:59	35	19	12	534 (186)	28
8/1/2019	17:24	17:57	33	27	11	705 (363)	26
Post-vent Avg				**25**	**11**	**795 (636)**	**33**
Overall Avg				**25**	**10**	**840 (674)**	**34**
There are multiple measurements for 11/30/2018, 3/8/2019 and 8/1/2019 because we entered the dispensary multiple times on these dates. *Sources included joints, bongs, dabs, pipes, vape pens and blunts.							

$PM_{2.5}$ in the Smoking Lounge

Over nine visits and 10 hours of measurements, the average $PM_{2.5}$ concentration in the dispensary smoking lounge was 840 $\mu g/m^3$, with a standard deviation of 674 $\mu g/m^3$ (Table 1). During the four visits conducted before the new ventilation system was installed, the average $PM_{2.5}$ was 905 $\mu g/m^3$, with a standard deviation of 728 $\mu g/m^3$. During the five visits conducted after the ventilation system was installed, the average $PM_{2.5}$ concentration was 795 $\mu g/m^3$, with a standard deviation of 636 $\mu g/m^3$. To determine whether the $PM_{2.5}$ concentration was significantly lower after the installation of the new ventilation system, we performed an overall test for coincidence of two regression lines. The p value was 0.16, indicating that the 12.2 % decrease in $PM_{2.5}$

concentration was not statistically significant. The number of cannabis articles that were actively emitting smoke or other aerosols (sources) was counted at least twice per visit, except during the second relay on 3/8/2019 when source counts were not recorded. To assess the relationship between $PM_{2.5}$ concentration and average number of sources per count, we performed a regression. The R^2 was 0.100, with a p-value of 0.219, indicating that there was not a statistically significant relationship between $PM_{2.5}$ concentrations and the average number of cannabis articles emitting aerosols (Figure 1). The relationship between $PM_{2.5}$ concentrations and the number of occupants was also tested and found not significant ($R^2 = 0.0016$, $p = 0.058$). The occupant-normalized $PM_{2.5}$ concentration ranged from 18-52 $\mu g/m^3$ * persons.

Background $PM_{2.5}$ Concentrations

The average $PM_{2.5}$ concentration measured in the public plaza was 4 $\mu g/m^3$, with a standard deviation of 1 $\mu g/m^3$ (Supplementary Table 1). The average $PM_{2.5}$ concentration in the coffee shop was 3 $\mu g/m^3$, with a standard deviation 0.7 $\mu g/m^3$. The size and occupancy levels of the coffee shop and the dispensary lounge were similar. We observed some smoking activity (both cannabis and tobacco) outdoors, in the plaza and in the alley near the entrance to the coffee shop.

Figure 1: $PM_{2.5}$ vs Average Number of Sources Emitting Aerosols

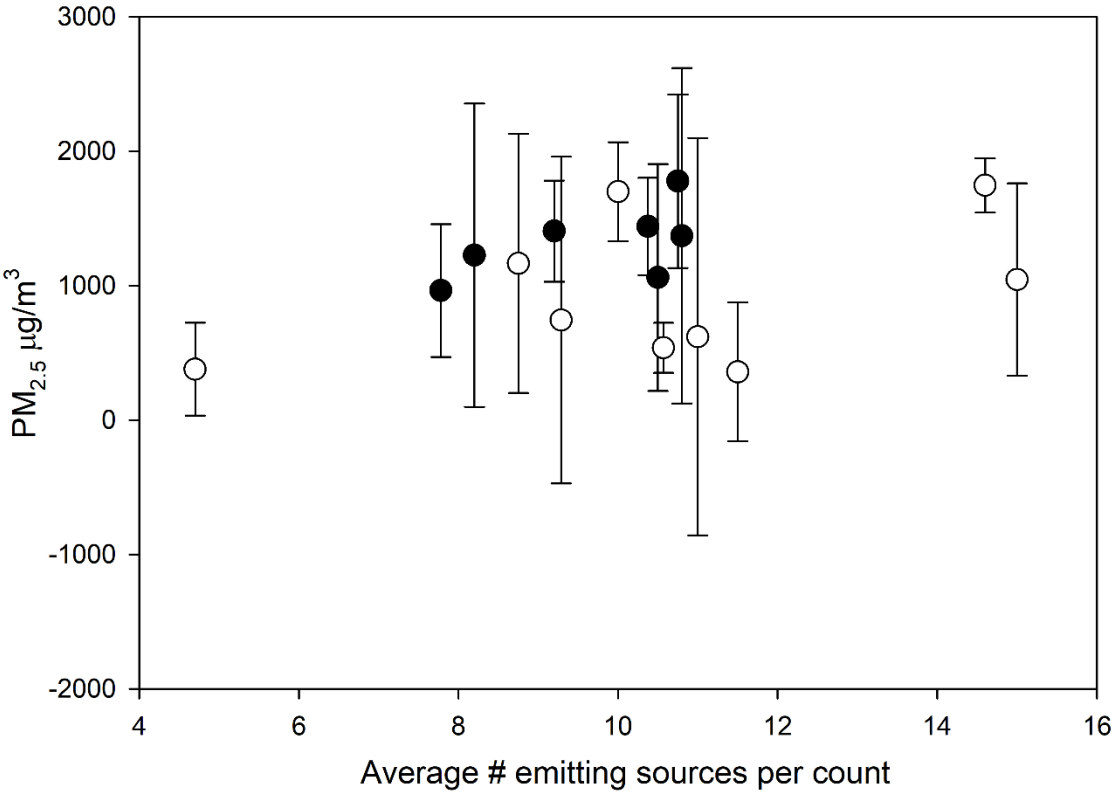

Figure 1: Scatter plot of $PM_{2.5}$ (µg/m^3) vs average count of sources emitting aerosol. Error bars = standard deviation of $PM_{2.5}$. Adjusted R^2 =0.100, p-value = 0.219, Each point is one interval of 23-52 minutes of air sampling (see Table 1). Sources included joints, bongs, dabs, pipes, vape pens and blunts.

Cannabinoid and Nicotine Concentrations

We measured cannabinoids in the two longest experiments and the average concentrations in the lounge for THC, CBD, and CBN were 79.0 µg/m^3 (standard deviation = 60.8 µg/m^3), 0.71 µg/m^3 (standard deviation = 0.55 µg/m^3), and 7.2 µg/m^3 (standard deviation = 5.1 µg/m^3) respectively (Table 2). Background averages for THC, CBD, and CBN were 0.0464 µg/m^3, 0.0077 µg/m^3 and 0.0052 µg/m^3 respectively (Table 2). Nicotine concentrations were all below the limits of quantitation.

Table 2: Cannabinoid Concentrations				
Date	**Type**	**THC (ug/m^3)**	**CBD (ug/m^3)**	**CBN (ug/m^3)**
11/30/2018	Event	59.6	1.6	16
		192	0.97	9.6
	Background	0.0702	0.017	<LOQ
		0.116	0.0053	0.020
8/1/2019	Event	9.78	0.14	1.9
		67.3	0.89	7.3
		59.6	0.31	4.0
		85.4	0.34	4.34
	Background	0.0381	0.0059	<LOQ
		<LOQ	0.010	<LOQ
		0.00601	<LOQ	<LOQ
Overall Averages	**Event**	**79.0**	**0.71**	**7.2**
	Background	**0.0464***	**0.0077***	**0.0052***
There are multiple measurements for 11/30/2018 and 8/1/2019 because we entered the dispensary multiple times on these dates. Each row is a single filter sample from a single entry. *Values below the limit of quantitation were estimated as LOQ/2 to calculate the averages.				

Behavioral and Demographic Data

In descending order of prevalence, the following cannabis products and modes of use were observed at the dispensary: cannabis in rolling paper (pre-rolled and hand-rolled joints), cannabis in water pipes (bongs), cannabis concentrates consumed by dabbing, cannabis in hand pipes, cannabis vape pens and blunts. Overall, 91% of the cannabis consumed in the lounge was smoked, 5% was consumed by dabbing (applying cannabis concentrates to a heated surface and inhaling the aerosol) and 4% was consumed by using a vape pen. 71% of patrons smoked joints (cannabis cigarettes). We did not observe any tobacco use. At any given time, approximately 43% of all people within the lounge were actively using a cannabis product. The patrons were 69% male and 31% female (Supplementary Table 2). Employees were observed working in the lounge at every visit (Supplementary Table 2); supervising, loaning out equipment, emptying ash trays, cleaning the tables and interacting with customers.

Photometer Calibration Factors

Using gravimetric comparison to Marlboro cigarette smoke, generated under controlled laboratory conditions, we derived a calibration factor of 0.267 for the Sidepak instruments and 0.232 for the DustTrak (Supplementary figures 1 and 2).

DISCUSSION

The $PM_{2.5}$ concentrations we observed are similar to the highest published concentrations measured in public places where people were smoking tobacco [9]. Because the nicotine concentrations in the dispensary were below 0.10 $\mu g/m^3$, the cannabinoid concentrations were high and the background particle concentrations outdoors and in a nearby business were low, we believe that nearly all the $PM_{2.5}$ measured in the dispensary derived from cannabis consumption. Our prior study of a lounge in a dispensary where only non-combustible methods of consumption were permitted, found median $PM_{2.5}$ concentrations during peak business hours almost 10-fold lower than the medians observed in this dispensary (76 $\mu g/m^3$ vs 840 $\mu g/m^3$)[10]. The average concentrations in this study are similar to the maximum $PM_{2.5}$ concentrations that Ott et al. observed after smoking a single joint in a small, unventilated bedroom[11]. Unlike tobacco cigarettes, cannabis does not come in a single, standardized portion, and people do not always consume the same amount per session. This variation may explain why we did not find a correlation between $PM_{2.5}$ concentrations and the average number of aerosol-emitting sources or the number of occupants.

Our finding that the installation of a new ventilation system did not cause a large or statistically significant decrease in $PM_{2.5}$ concentrations suggests that it was not effective in reducing pollutant concentrations. Prior research has shown that ventilation alone is not sufficient to control $PM_{2.5}$ from tobacco cigarettes [12].

There is very little data available on the concentration of cannabinoids in secondhand or environmental cannabis aerosols. Wiegand et al. found THC concentrations ranging from 53-330 ng/m^3 in particle samples collected at concerts in an outdoor football stadium[13]. THC concentrations in our background samples (46 ng/m^3) were similar to the lowest of Wiegand's non-background samples and the concentrations in the lounge (average 79 µg/m^3) were ~200-1,500 thousand times higher.

Psychoactive effects from secondhand exposure to cannabis smoke are a long-standing concern that our data address. With a resting tidal volume of 7 ml/kg and a respiratory rate of 16 breaths per minute, a 68 kg (150 lb) person would inhale 38 µg of THC per hour in the lounge: ($7\frac{ml}{kg*breath} * 68\ kg * 16\frac{breaths}{min} * 60\frac{min}{h} * \frac{1}{10^6} m3/ml * 76\frac{\mu g}{m3} = 38\ \mu g/h$). The psychoactive effects of THC are typically felt at a dose of 2-10 mg for an adult of average size and tolerance. This means that psychoactive effects were unlikely at the concentrations in the dispensary. These findings agree with Herrmann et al. who found subjective psychoactive effects in nonsmokers after one hour of secondhand exposure in a sealed and unventilated 12 m^3 chamber during which 14.4 grams of cannabis with 11% THC were smoked, but not after exposure to a similar amount of cannabis smoke when the chamber was ventilated[14].

Cannabinol (CBN) is an oxidation product of THC that can form during combustion or storage[15], so CBN concentrations one tenth those of THC are plausible. The low concentrations of CBD suggest that THC-dominant products were in use. Average nicotine concentrations in businesses with active smoking indoors range from 0.6 to 76 µg/m^3[9]. The fact that nicotine samples from the dispensary were all below the limits of quantitation (0.013 to 0.10 µg/m^3) validates our observation that no one was smoking tobacco in the dispensary.

Because the concentrations of $PM_{2.5}$ were so high, it is likely that the employees of this dispensary were at risk of health effects from secondhand cannabis smoke exposure. Although cannabis has a number of scientifically-validated and positive medicinal effects[16], cannabis smoke contains carcinogens and $PM_{2.5}$[2, 3]. If an employee was exposed for two hours at 840 $\mu g/m^3$ and for 22 hours at 4 $\mu g/m^3$, their 24-hour average exposure would be 72 $\mu g/m^3$. The US Environmental Protection Agency air quality index for this amount of air pollution is "Unhealthy"[17] and the anticipated health effects are "Increased aggravation of heart or lung disease and premature mortality in persons with cardiopulmonary disease and the elderly; increased respiratory effects in general population." Research on bar workers, comparing their respiratory health before and after tobacco smoking bans, found that bans improved respiratory symptoms[18, 19] and lung function[19] in both smokers and nonsmokers. This suggests that dispensary employees may incur health risks from their exposure to secondhand cannabis smoke at work, even if they are smokers of cannabis.

It is also possible that the secondhand exposure may increase nasal congestion and diminish cardiovascular function in the dispensary customers. Research from our laboratory has shown that a 30-minute exposure to secondhand cigarette smoke, at 1,000 $\mu g/m^3$ $PM_{2.5}$, can increase nasal congestion in healthy, young nonsmokers[20]. Endothelial dysfunction, the loss of the ability of the cells lining the arteries to respond to normal increases in blood flow by dilating, is a risk factor for myocardial infarction[21]. Multiple studies have shown that short exposures to secondhand tobacco smoke at concentrations well below those seen in this dispensary cause endothelial dysfunction in healthy, young nonsmokers [22-24] and in healthy young smokers[25, 26]. One study has shown that exposures to cannabis smoke cause endothelial dysfunction in animals [27].

Limitations

We studied a business that was well-patronized and the $PM_{2.5}$ and cannabinoid concentrations we measured may be higher than the concentrations in other dispensaries that allow smoking. We performed these experiments during peak business hours. Four of the experiments were conducted on Fridays, three on Thursdays, one on a Wednesday and one on a Tuesday. At other times of day or days of the week, there may have been less activity and lower concentrations of $PM_{2.5}$. However, our experiments were conducted over 11 months, were not scheduled to coincide with special events and showed consistently high $PM_{2.5}$ concentrations at all visits (Table 1), so we believe our findings represent conditions at this business accurately.

The Sidepak laser photometer calibration factor of 0.28-0.32 for secondhand cigarette smoke is well established [28-30]. The calibration factors we derived (0.267 for the SidePaks and 0.232 for the DustTrak) are slightly lower and may reflect individual variations in our instruments. After we did this research, Zhao et al. published Sidepak calibration factors of 0.39 for joints, 0.40 for cannabis smoked in a bong and 0.31 for cannabis smoked in a small, glass pipe. All but the small pipe calibration factor are higher than typical cigarette smoke calibration factors. By calibrating our instruments to machine-smoked cigarette smoke, we may have underestimated the true $PM_{2.5}$ concentration in the dispensary.

Our findings show that allowing customers to smoke cannabis indoors can create conditions that are known to be hazardous. Improvements to the ventilation system during the experiment had no effect on the $PM_{2.5}$ concentrations. Exposure to $PM_{2.5}$ from cannabis consumption is likely to have negative effects on the respiratory and

cardiovascular health of the employees and may have negative effects of the respiratory and cardiovascular health of vulnerable patrons.

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SUPPLEMENTARY METHODS

Air Pumps and Filters

Air pumps (#800485, Sensidyne L.P., St. Petersburg, FL, and #1003002K SKC Inc., Eighty Four, PA) were fitted with two filters stacked in a polystyrene cassette (#225-2250, SKC, Inc.) or impactor cassette (#225-352, SKC, Inc.). Front filters were (#WHA1851047 and # WHA1822037, MilliporeSigma, Burlington, MA). The rear filters (Emfab, Pall Corporation, Cortland, NY) were treated with sodium bisulfate to bind vapor-phase nicotine[31].

Photometer and Air Pump Calibrations

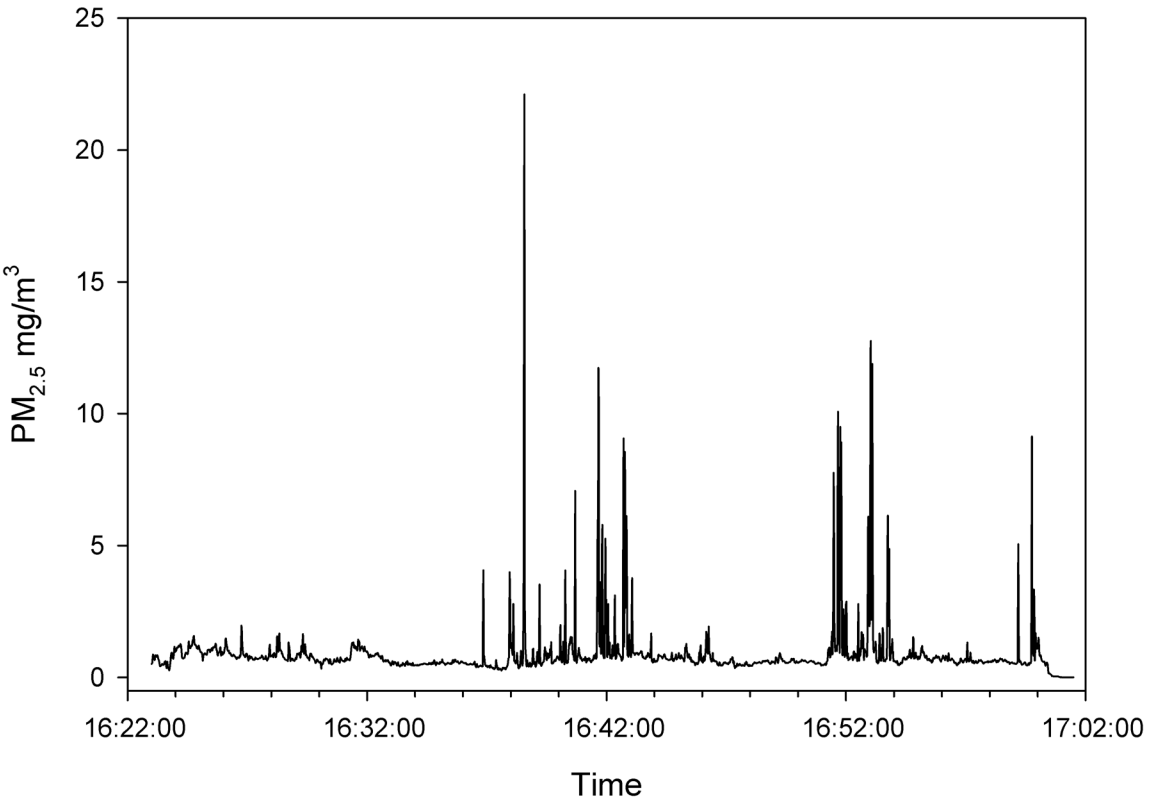
The air flow rates of all instruments were calibrated before and after each experiment with a soap bubble spirometer (Gilibrator-1, Sensidyne, LP. St Petersburg, FL). The photometers were zero calibrated before each experiment.

Cannabinoid Quantification

Filters were spiked with 0.5 µg of Δ9-THC-d9 (delta-9-tetrahydrocannabinol, Cayman Chemical) and CBD-d3 (cannabidiol, Cayman Chemical, Ann Arbor, MI) as internal standards, then extracted using methanol with sonication. External calibrations (5 ng/ml – 5 µg/ml) were made for Δ9-THC (Sigma, St. Louis, MO), CBD (Cayman Chemical, Ann Arbor, MI), and CBN (cannabinol, Cerillant, Round Rock, TX). Sample aliquots were injected into a Waters ACQUITY UPLC (ultra-performance liquid chromatography) system coupled with a Waters Quattro-micro MS/MS system (Waters, Milford, MA). Analytes were separated using a BEH C18 1.7 µm 2.1x50mm column (Waters, Milford, MA) with eluent gradients of (A: H_2O with 0.1% formic acid, B: acetonitrile with 0.1% formic acid): 50% A at 0 min, 50% A at 03 min, 29% A at 0.5 min, 21% A at 4.0 min, 90% A at 4.5 min, 50% A at 5.1 min, and 50% A at 6 min. Analytes were quantified using positive ionization tandem mass spectroscopy.

SUPPLEMENTARY RESULTS

Figure S1: Example of Photometric $PM_{2.5}$ Data



$PM_{2.5}$ vs time from 10/16/2018. Average $PM_{2.5}$ = 889 µg/m^3, stdev = 1128 µg/m^3, median = 672 µg/m^3, skewness = 8.9.

Table S1: Background $PM_{2.5}$ Concentrations

Date	Start	Stop	Minutes	Mean (Stdev)
9/28/2018	15:53	16:53	60	5 (2)
10/12/2018	15:29	16:05	36	3 (1)
10/16/2018	15:32	16:03	31	2 (1)
11/30/2018	15:02	19:24	262	3 (1)
3/8/2019	15:04	18:17	193	2 (0.5)
5/29/2019	16:48	17:35	47	3 (1)
7/18/2019	16:04	16:56	52	2 (0.5)
7/25/2019	15:53	16:58	65	3 (0.5)
8/1/2019	15:05	18:05	180	2 (1)

Table S2: Demographic Data						
Date	**Occupants**	**Employees**	**Customers**	**% Women#**	**% Men#**	**% Active Users***
9/28/2018	25	2	23	38	62	39
10/12/2018	44	5	39	n/a	n/a	20
10/16/2018	18	1	17	n/a	n/a	47
11/30/2018	25	2	23	36	64	45
Pre-vent Avg	28	2	26	37	63	38
3/8/2019	29	2	27	24	76	39
5/29/2019	20	2	18	18	82	51
7/18/2019	28	3	25	24	76	60
7/25/2019	33	3	30	45	55	36
8/1/2019	20	1	19	30	70	42
Post-vent Avg	26	2	24	28	72	47
Overall Avg	**27**	**2**	**25**	**31**	**69**	**43**
Overall Sum	244	21	223			
Occupants, Employees and Customers are average counts for each visit. #Male and Female are % of Occupants. *Active Users are % of total Customers.						

Figure S1: Sidepak Calibration

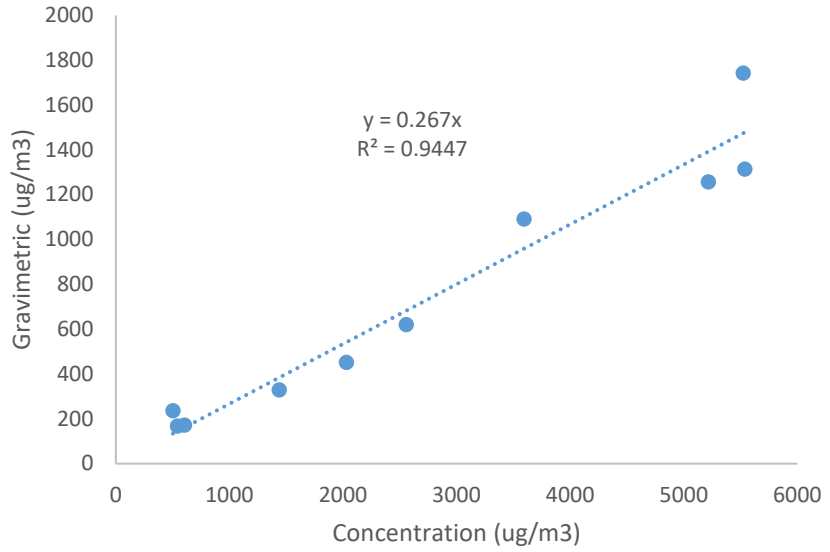


Figure S2: Dusttrak Calibration