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Perception and reality of particulate matter exposure in New York City taxi drivers

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Abstract

Background—Exposure to fine particulate matter (PM_{2.5}) and black carbon (BC) have been linked to negative health risks, but exposure among professional taxi drivers is unknown. This study measured drivers' knowledge, attitudes, and beliefs (KAB) about air pollution compared to direct measures of exposures.

Methods—Roadside and in-vehicle levels of PM_{2.5} and BC were continuously measured over a single shift and compared to central site monitoring. Participants completed an air pollution KAB questionnaire.

Results—Taxicab PM_{2.5} and BC concentrations were elevated compared to central monitoring. Average PM_{2.5} concentrations per 15-minute interval were 4 - 49 µg/m³; 1-minute peaks measured up to 452 µg/m³. BC levels were also elevated; reaching > 10 µg/m³. 56 of 100 drivers surveyed believed they were more exposed than non-drivers; 81 believed air pollution causes health problems.

Conclusions—Air pollution exposure among drivers likely exceeds EPA recommendations. Future studies should focus on reducing exposures and increasing awareness among taxi drivers.

Keywords

air pollution; particulate matter; black carbon; taxi drivers; knowledge/attitudes/beliefs

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Introduction

Particulate matter (PM) is one of the six EPA-regulated community air pollutants, and is a widespread threat to human health (1). It is a complex mixture of extremely small particles and liquid droplets that are often categorized by size. *Coarse particles*, such as sand and large dust particles, are larger than 2.5 μm in aerodynamic diameter. *Fine particles*, largely generated from gases emitted from power plants, industries and automobiles, are found in smoke and haze, and are < 2.5 μm in aerodynamic diameter (PM_{2.5}) (1, 2). PM_{2.5} can pass through the nose and throat and enter the lungs, and can cause serious health effects when inhaled (1, 2). Even smaller particles are classified as *Ultrafine* (UFP) or nanoparticles, with a diameter of less than 100 nm (3, 4). Severity of effects have been most often linked to smaller particle sizes that can most efficiently penetrate into the deep lung (2). While PM is a widely accepted primary indicator of human exposure and health impact of air pollutants, black carbon (BC), a component of PM_{2.5}, commonly called “black soot”, is often used as another metric for evaluation of PM exposure, especially to diesel exhaust PM (5).

Exposure to both BC and PM_{2.5} have been linked to negative health risks, including cardiovascular disease and lung cancer (6-12). The adverse health effects of UFP are of particular interest given their large cumulative surface area, ability to translocate through epithelium, and high proportion of metals and organic material which give them high oxidative potential (13-15). Exposure to UFP has been associated with altered autonomic modulation of the heart among cyclists (16), increased risk of arrhythmia in men with coronary heart disease (17), and decreased heart rate variability (18). The health effects of BC mirror those of PM, though there is debate among researchers about the disproportionately greater risk posed by BC in comparison to other PM components, depending on the health outcome considered (5).

The U.S. EPA 24 hour National Ambient Air Quality Standard (NAAQS) for PM_{2.5} is 35 $\mu\text{g}/\text{m}^3$ (19). Several studies have found that, in comparison to outdoor/indoor microenvironments, in-vehicle PM levels are often very high, originate from external sources, including road traffic (20), and can exceed ambient PM₁₀ values by 1.7 to 4 times (21). One study by Adams et al. (2001) found that, in London, the concentration of PM_{2.5} inside motor vehicles was on average two times the urban background concentration (22). A study among state troopers in North Carolina also demonstrated significant in-vehicle exposure to PM_{2.5} (23). The ratio of in-vehicle and on-road UFP concentrations is associated with the air exchange rate (AER), or the particle influx rate; the AER in turn is influenced by a number of factors including vehicle speed, ventilation setting (recirculation or outside air intake) and fan speed, and age or mileage of the vehicle (3). UFP concentrations on roadways, or in the vicinity of roadways, are often almost one order of magnitude higher than remote ambient levels (3, 24, 25), although there are large variations in exposure in vehicles dependent on the AER (3). In Los Angeles with open window conditions, less than 10% of daily time spent in vehicles was estimated to contribute to 35-50% of total exposure to UFP (3, 26, 27). In-vehicle BC concentration is dependent upon other vehicles in the microenvironment. For example, in-vehicle concentrations are significantly higher in a car driving behind a diesel-powered vehicle versus a gasoline-powered one (28, 29).

While occupational exposure to PM has been studied across several industries including mining, construction, and factory work (8), there is a dearth of literature on occupational PM exposure in the U.S. among a potentially extremely high-risk population – urban taxi drivers. New York City (NYC) is home to over 100,000 taxi drivers, of whom 94% are immigrants (30). The largest share (40%) of those drivers are of South Asian descent (originating from India, Pakistan, Bangladesh, Nepal, and Sri Lanka), followed by large numbers of drivers from the Dominican Republic, Mexico, the former USSR, Haiti, Nigeria, Ethiopia, Columbia, Ecuador, and Jamaica (31). Taxi drivers appear to be at increased risk for cardiovascular disease and cancer due to a number of occupation-related factors, including a poor diet and sedentary lifestyle (31-35). Several studies have demonstrated a high prevalence of lung cancer among taxi drivers, without known additional risk factors such as smoking, suggesting a possible association with traffic-related PM exposure (11, 12). NYC taxi drivers work long hours (10-12 hours/day shifts ~ 6 days/week) (31) most often in heavy traffic. Thus, a large part of their day is spent inside a vehicle cabin where they are potentially exposed to high levels of traffic-related air pollution.

Reductions in exposure to air pollution (notably PM_{2.5}) are possible with efforts that target sources of the pollution, as well as efforts to reduce personal exposure to pollutants. For instance, a study by Pui et al. demonstrated that recirculating air filtration in homes and in vehicles reduced UFP exposure to levels that could potentially improve vascular function (4). However, few studies have examined PM concentrations in taxi cabs, and even fewer have reported on urban taxi drivers' knowledge and beliefs about air pollution and its risks, and about measures to potentially mitigate this exposure (36).

This novel study includes air monitoring of both PM_{2.5} and BC levels in NYC taxi cabs and at roadside taxi stands, combined with survey assessments of taxi drivers' knowledge, attitudes, and beliefs related to air pollution and its associated health risks.

Methods

This study was conducted by the Immigrant Health and Cancer Disparities Service (IHCD) at Memorial Sloan-Kettering Cancer Center, in partnership with the New York University National Institute of Environmental Health Sciences (NIEHS) Center and the South Asian Council for Social Services, a South Asian-serving community-based organization. The study included both in-vehicle taxi and roadside air monitoring of PM and BC concentrations in New York City, and a survey to assess taxi drivers' knowledge, attitudes, and beliefs about the risks associated with air pollution and possible strategies to reduce this exposure. The study began in October, 2012 and was completed in April, 2013.

This study was approved by the Institutional Review Boards at Memorial Sloan-Kettering Cancer Center and New York University Langone Medical Center.

Exposure Monitoring

Taxi cab in-vehicle monitoring and subjects—Two aerosol monitors, the personal DataRam (BGI, Waltham, MA) and the MicroAethalometer (AE51, AethLabs, San Francisco, CA), were used to measure fine PM and BC levels, respectively, inside NYC

cabs. In-vehicle and roadside PM fine mass concentration data were continuously recorded in 1-minute intervals using the personal DataRam, BC data were simultaneously recorded in 1-minute intervals by the MicroAethalometer. Participating drivers were approached and recruited for the study at taxi stands and dispatch bases, and through community sites frequented by taxi drivers. Eligible drivers were at least 18 years of age, non-smokers, fluent in English, and able to participate in the study for a minimum of a single, six-hour shift. Monitors were secured on front passenger seats or consoles for six to twelve hour periods, depending on the duration of the drivers' shifts. Drivers operated under normal work conditions for the duration of the monitoring, and all shifts overlapped with either morning (7AM to 10AM) or evening (4PM to 7PM) rush hours. Research assistants verbally consented drivers at the beginning of their shift at a convenient location. At the end of the driver's shift, research assistants met drivers to retrieve the monitoring devices and administer a questionnaire assessing drivers' recall of changes to indoor conditions of the vehicle during the shift, such as frequency of open windows, and use of air conditioning and/or heating.

Roadside taxi stand air monitoring—As a comparison for in-vehicle values, PM and BC levels at three major taxi stands at central Manhattan locations were measured using real time personal Dataram monitors and the MicroAethalometer. The specific locations were chosen for their prominence as hubs for taxi dispatches, as well as for high road and passenger traffic. Consistency in weather conditions was taken into consideration – all monitoring occurred on days with wind speeds less than 10 mph, and temperatures ranging from 45 to 60 degrees Fahrenheit. Ambient taxi stand monitoring by research assistants occurred over 2 to 3 hour periods during morning and/or evening rush hours. Devices were placed at two locations during monitoring periods: one within 15 feet of taxi stands and the other at a location approximately 1-2 city blocks away from the taxi stand, designated as a 'control' site.

Drivers' Knowledge, Attitudes, and Beliefs

An 18-item knowledge, attitudes, and beliefs (KAB) street intercept survey developed by IHCD was administered by trained research staff to 100 NYC taxi drivers. This instrument was modified from a 2001 British questionnaire evaluating public perceptions of air pollution, and was piloted with 8 drivers prior to study initiation (36). Survey items included questions on drivers' knowledge of, and perceived health risks associated with, air pollution, practices thought to reduce vehicular pollution exposure (i.e. opening windows, use of air conditioning and/or heating, use of recirculating air filtration), and sociodemographic and occupational history. Research assistants approached respondents consecutively at locales known to be taxi driver hubs, including taxi stands, taxi garages, and ethnic restaurants. All drivers on-site during data collection hours were approached for participation in the study, and the survey was conducted after verbal informed consent was obtained. Eligible drivers were males at least 18 years old. Due to time restrictions faced by taxi drivers, surveys were also conducted over the phone for those unable to participate at the time of contact.

Data Analysis

For analysis of taxicab monitoring, average PM and BC concentrations were computed per shift; within each shift, PM concentrations were also averaged at each 15-minute interval. For roadside monitoring data, average PM and BC concentrations were computed per taxi stand site. Peak levels and trends were also evaluated for both roadside and taxicab data. Levels in taxicabs and roadside PM and BC were subsequently compared using descriptive statistics. Mean PM and BC levels from the closest central site ambient (roof top) air monitoring site of the New York State Department of Environmental Conservation (NYSDEC), which regularly logs PM levels at designated locations throughout the year, were used as comparisons (37).

Descriptive analyses were performed using SPSS v.19 to characterize survey respondents' socio-demographic characteristics, occupational history, and perceived KAB of air pollution and its health risks. Chi-square tests were conducted to identify any significant ($p < 0.05$) correlations between sociodemographic and occupational variables and KAB related to air pollution.

Results

Exposure Monitoring

Taxi cab in-vehicle monitoring—Seven taxi drivers were recruited for this air monitoring study. Each driver participated for a single shift under normal conditions, ranging from 6 to 12 hours. Make and model of vehicles varied; three vehicles were Lincoln Towncars, two were Ford Crown Victorias, and the remaining two were a Ford Mercury and a Ford Escape. All participants drove primarily in Manhattan, and traveled between 22 - 65 miles during each shift. Most drivers kept windows closed for a majority of their shift time; no drivers reported using air conditioning, while only four reported use of heating for a minimal amount of time ($< 30\%$ of total monitoring time). The potential effect of smoking by passengers was minimal: only 1 driver reported a single passenger smoking inside the vehicle during a study shift.

Taxicab PM_{2.5} and BC concentrations were elevated compared to ambient (central site) monitoring levels. Average concentrations of PM_{2.5} per 15-minute interval for all seven shifts (between the hours of 7AM and 10PM) indicated large intra- and inter-car variability (Figure I). Per shift average PM_{2.5} concentrations ranged from 4 $\mu\text{g}/\text{m}^3$ to 49 $\mu\text{g}/\text{m}^3$ and 1-minute peak levels measured up to 452 $\mu\text{g}/\text{m}^3$. Black carbon levels were also elevated, and reached over 10 $\mu\text{g}/\text{m}^3$. Peak in-vehicle PM levels were short and sporadic, and may have been influenced by external events, such as opening of doors and windows. (Table I)

Roadside taxi stand air monitoring—Roadside air monitoring was conducted at three large taxi passenger pick-up stands in midtown Manhattan, all located at traffic hubs and mass transport terminals, and at designated control sites approximately 1-2 blocks from the stands. Monitoring during morning and evening rush hours revealed ambient PM levels to be near or greater than the EPA 24 hour NAAQS of 35 $\mu\text{g}/\text{m}^3$ for PM_{2.5}. Average levels at each taxi stand were 44 $\mu\text{g}/\text{m}^3$ (SD ± 32), 58 $\mu\text{g}/\text{m}^3$ (SD ± 10), and 76 $\mu\text{g}/\text{m}^3$, (SD ± 43) and peak

levels were as high as 434 $\mu\text{g}/\text{m}^3$, mirroring peak in-vehicle values. Levels of black carbon were also found to be high; peak levels at one taxi stand were as high as 12 $\mu\text{g}/\text{m}^3$. Average BC and average PM levels were comparable between stands and their roadside control sites, with no significant differences (data unreported here). However, average taxi stand BC and PM levels were significantly higher than levels recorded at the closest NYSDEC's air monitoring site (Division Street) (37). (Table I & Figure II)

Drivers' Knowledge, Attitudes, and Beliefs—One hundred drivers, including both yellow taxi (N=77) and livery (N=23) cab drivers, were surveyed. The refusal rate was approximately 50%, with drivers primarily citing lack of time as the reason for refusal.

Sixty-seven percent of respondents had worked as drivers for at least three years, with 17% having worked more than 15 years. Drivers were evenly dispersed in age, with 17% between 18 and 30 years old, 24% between 31 and 40 years old, 26% between 41 and 50 years old, and 32% over 50. Eighty-eight percent of all drivers were foreign-born, hailing from Africa (27%), South Asia (24%), the Caribbean (13%), South and Central America (8%), the Middle East (6%), East Asia (5%), and Europe (4%). Almost half (46%) of the foreign-born drivers had resided in the United States for more than 15 years. (Table II)

Over half of all surveyed drivers (56%) believed that they are exposed to more air pollution than non-taxi drivers, while 25% did not believe as such, and 19% were unsure. Most drivers thought that air pollution in general causes health problems (81%), while 19% did not agree or were unsure. A belief that air pollution causes health problems was significantly associated ($p<0.05$) with drivers who had at least 10 years of taxi driving experience. Thirty-four percent of respondents stated they were “not worried” about being exposed to air pollution while driving, while another 40% said they were “a little or somewhat worried”. Nineteen percent reported that they believed they had a health problem attributable to air pollution exposure, including ‘lung-related issues’ (55), ‘heart-related issues’ (25), ‘brain-related issues’ (12), and ‘allergies’ (34).

There was an even distribution of drivers who thought they were most exposed immediately outside the car (33%) vs. those who thought they were most exposed inside the car (33%). Twenty-six (27%) stated they were equally exposed inside and out. A majority of drivers (54%) believed opening windows was a better way to limit the amount of pollution they were exposed to, compared to closing windows and/or turning the air conditioner/heater on. For those who used air conditioning/heating, 34% reported usually selecting the outside air filtration feature, while 39% usually selected the recirculating air filtration feature. Many (19%) were unsure of which filtration option they usually selected.

Discussion

In this study using in-taxi and roadside measurement of $\text{PM}_{2.5}$, personal exposure to PM among taxi drivers was significantly elevated compared to ambient central site levels. Based on the existing literature on in-vehicle $\text{PM}_{2.5}$ levels (20-23), we anticipated that PM levels inside NYC taxi and livery cabs would be higher than in the outdoor urban environment. While we might expect levels of PM at roadside taxi stands to be higher during traffic rush

hours compared to the 24 hour measurements taken at the closest NYSDEC air monitoring site, the fact that the taxi stand levels were several times higher than the air monitoring site (and higher than the EPA 24 hour national air quality control standard) provides context for the excessively high PM levels found at taxi stands.

Additionally, this investigation found that air monitoring results contrast somewhat with the knowledge, attitudes, and beliefs regarding air pollution among taxi drivers. Due to the nature of their occupation and the chronicity of exposure, drivers are likely at increased risk of long-term adverse health effects (31-35). Survey results, however, show that even with general knowledge about the risks associated with occupational exposure to air pollution, drivers did not view their exposure and/or potential related risks to their health as priorities in the context of other health concerns. This may have been due to a lack of awareness of the specific risks and the degree of risk posed by high levels of exposure to air pollution, or possibly due to other pressing health, financial, or family concerns.

As a sedentary occupational group with a disproportionately high prevalence of cancer, heart disease, and other chronic conditions (31-35), taxi drivers are likely at great risk from air pollutant exposure. Given the high levels of diesel soot and fine PM that these drivers are exposed to, and the fact that multiple studies have indicated adverse health effects in diesel truck drivers (38, 39), this study's results suggest that taxi drivers may be at significantly greater lung cancer and cardiovascular disease risk, and further investigation of their health risks is needed. Limited research on potential interventions to mitigate these risks has emerged in recent years. A study by Pui et al. showed that while built-in recirculation air filtration in vehicles can reduce exposure to large particle pollutants ($>0.3 \mu\text{g}$) to acceptable levels, most vehicles do not filter ultrafine particles such as black carbon (typical BC particles are less than $0.3 \mu\text{g}$) (4, 40). Other interventions, such as portable air filtration systems that remove ultrafine particles, may have the potential to improve microvascular function (the link between PM and cardiovascular disease is thought to be possibly mediated through endothelial dysfunction) (41). One 2008 study found improvement in microvascular function, assessed by measuring digital peripheral artery tone after arm ischemia, after 48 hours of filtration of recirculated indoor air (41). The link between recirculating air filtration and improved health outcomes, however, has never been studied among taxi drivers and is an important intervention to explore. Future interventions should incorporate theoretical frameworks related to risk perception and barriers to behavioral change, such as Glasgow's Logic Model of Role of Perceived Barriers and Related Constructs to Patient Self Management/Adherence (42). The concept of perceived barriers has long been a focus area in many health behavior theories (42). In the Health Belief Model (HBM), perceived barriers, benefits, and threats contribute to decision making about taking a recommended action (43). The concept of perceived barriers has also been invoked in Social Cognitive Theory (44) and Social-ecological Theory (45). Judgments of barriers in social ecology are often used as a proxy for multi-level determinants of behavior (42). In Glasgow's Model, perceived barriers are defined as 'a person's estimation of the level of challenge of social, personal, environmental, and economic obstacles to a specified behavior or their desired goal status on that behavior' (42). Factors other than 'objective' barriers affect an individual's perception of barriers, such as past history, perceived risk, perception of available social support, and the social and physical environment (42).

This study has limitations. The assessment of strategies (such as using the taxi cab's recirculating air filtration feature) that may reduce air pollutant exposure levels was limited in this study, given the lack of real time logging of changes in vehicle conditions. However, drivers were unaware of this as even being a possibility to mitigate risk. An expanded investigational study that monitors a larger number of outdoor sites and taxicabs, collects detailed data on vehicle conditions (i.e. windows opened/closed, age of vehicle, speed.), and exposure to air pollution at different times of the day and during different seasons, could address these weaknesses. Future longitudinal studies should also include health data of participants, such as existing medical problems, cancer and cardiovascular disease risk factors, healthcare access, and health behavior. Larger studies may also be able to provide more information on whether demographic and health variables are associated with differences in knowledge, attitudes, and beliefs related to air pollution and its health risks. Finally, the survey refusal rate for this study was approximately 50%. While it is possible that those who participated in the study may have been more knowledgeable and interested than those who refused, there is no indication that this was the case.

Educational interventions to address taxi drivers' prioritization of their health risks associated with air pollution might also increase the acceptability and uptake of future strategies to reduce exposure. Further work in this area should include the detailing of ongoing PM and BC exposures among urban taxi drivers, longer-term studies on the relationship between air pollution exposure and related health outcomes, the development, implementation, and evaluation of taxi driver health education programs, and the implementation of interventions to mitigate air pollution exposure and its health risks.

Conclusions

This study found that NYC taxi drivers' in-cab levels of BC and fine PM exposure are elevated relative to levels found at central site ambient air monitors, but not higher than levels along the roadsides experienced by pedestrians. Taxi drivers were generally unaware of the risks of occupational exposure.

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Figure I. 15 Minute Interval In-Vehicle Particulate Matter (PM) Concentrations (between 7AM and 10PM)

Figure II. 1-Minute Interval Taxi Stand PM Concentration

Table I
In-Vehicle and Roadside Particulate Matter and Black Carbon Levels

Vehicle Type/Site	PM (µg/m³)		BC (µg/m³)		NYSDEC* Air Monitoring Site PM ₂₅ (µg/m³) Mean ± SD
	Mean ± SD	Median (Maximum)	Mean ± SD	Median (Maximum)	
a. In-vehicle Levels per Taxicab Monitoring Shift					
Crown Vic 2011	13 ± 28	10 (452)	2.9 ± 2.3	2.4 (31.2)	8.6±3.2
Towncar 2004	7 ± 8	5 (48)	1.8 ± 2.3	1.3 (23.9)	5.9±2.5
Mercury 2004	49 ± 23	49 (123)	3.4 ± 7.8	3.3 (108.7)	15.1±2.8
Towncar 2003 (1)	34 ± 15	32 (98)	2.1 ± 2.1	1.5 (29.3)	12±3.3
Crown Vic 2012	12 ± 9	11 (75)	2.5 ± 1.9	2.1 (16.9)	4.5±2.3
Towncar 2003 (2)	10 ± 6	9 (39)	1.9 ± 1.1	1.7 (7.4)	7.3±2.2
Escape 2009	4 ± 7	3 (68)	2.3 ± 1.2	2.1 (6.6)	6.9±3.2
b. Roadside Levels by Taxi Stand Site					
Pennsylvania Station	58 ± 10	56 (121)	2.8 ± 0.9	2.7 (5.1)	10.6±1.2
Port Authority Terminal	76 ± 43	76 (214)	5.3 ± 2.6	5.3 (12.0)	11.8±0.4
Grand Central Terminal	44 ± 32	40 (434)	N/A	N/A	5.5±2.6

* NYSDEC = New York State Department of Environmental Conservation

Table II
Driver Knowledge, Attitudes, and Beliefs Survey Results

<i>Demographics (N=100)</i>	n (%)
Driver Type	
Livery	23(23)
Yellow Taxi	77(77)
Years Driving Taxi *	
Less than 1 year	14(14)
1-2 years	17(17)
3-5 years	27(27)
6-9 years	11(11)
10-15 years	12(12)
More than 15 years	17(17)
Missing	2
Age	
18 to 30	17(17)
31 to 40	24(24)
41 to 50	26(26)
51 to 65	29(29)
Over 65	3(3)
Missing	1
Country/Region of Birth	
Africa	27(27)
South Asia	24(24)
Caribbean (Cuba, Dominican Republic, Haiti)	13(13)
United States	12(12)
South and Central America	8(8)
Middle East	6(6)
East Asia	5(5)
Europe	4(4)
Refused	1
Years residing in the United States	
1-2 years	4(5)
3-5 years	11(13)
6-9 years	16(18)
10-15 years	16(18)
More than 15 years	40(46)
N/A [born in the U.S.]	12
Refused	1
<i>Knowledge, Attitudes, and Beliefs (N=100)</i>	n (%)
Do you think that you are exposed to more air pollution than other people (who are not taxi Drivers)?	

Demographics (N=100)	n (%)
Yes	56(56)
No	25(25)
Don't Know	19(19)
Do you think that air pollution in general causes health problems? *	
Yes	80(81)
No	13(13)
Don't Know	6(6)
Missing	1
Do you have any health problems that you think have been caused by air pollutants?	
Yes	19(19)
No	70(70)
Don't Know	11(11)
How worried are you about being exposed to air pollution while driving?	
Not worried	34(34)
A little or somewhat worried	40(40)
Very Worried	22(22)
Don't know	4(4)
To protect your health, which do you think is a better way to limit the amount of air pollution you are exposed to while driving? **	
Air Conditioning / Heating	37(41)
Opening Windows	49(54)
Closing Windows	18(20)
None of the above	7(8)
Don't know	5(6)
Refused	3
Missing	7
When you use AC/heating in your taxi, do you usually filter outside air or re-circulate inside air?	
Filter outside air	25(34)
Re-circulate inside air	29(39)
Both, or alternating	6(8)
Don't know	14(19)
Not Applicable [Does not use A/C or heat]	18
Refused	4
Missing	4
Where do you think you are exposed to the most air pollution?	
Outside the car	31(33)
Inside the car	31(33)
Either	26(27)
Other	2(2)
Don't Know	5(6)
Refused	1
Missing	4

* There was a significant association between driving for at least 10 years and believing that air pollution causes health problems ($p < .05$).

** Total $n > 100$ because question was a 'check all that apply' item.

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