PUBLIC HEALTH RESEARCH

Perception of Urban Air Pollution among Working Individuals during Work-Related Commute in the Klang Valley

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ABSTRACT

Introduction	Malaysia's rapid economic growth, urbanization and motorization cause air pollution problems in addition to intense regional transboundary air pollution. The Klang Valley is often plagued by low-visibility air pollution, which has a negative impact on the physical and mental well-being of the public. This study aims to explore the commuters' perception of air quality during their daily commute to work.
Methods	A self-administered questionnaire was used to collect data on air quality perception and travel behavior among working adults (N = 197). Pearson's Chi-Square analysis was used to analyse public perceptions on air quality with demographic data, transportation modes and health concerns. Sixty-seven percent of the respondents perceived that the air quality was unhealthy.
Results	There were no significant associations between air quality perception with gender, age, or health status. However, air quality perception was significantly associated with educational background ($p<0.05$). A very small number (9.1%) of respondents checked the air quality status daily prior to leaving their dwelling.
Conclusions	There was widespread awareness of the health concerns posed by air pollution when commuting to work, however, none of the respondents significantly altered their commuting route. Our findings are broadly consistent with those of others and underscore a need for improved communication to the public of risks posed by air pollution.
Keywords	Air pollution; Risk perception; Work commute.

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INTRODUCTION

Air pollution is a major environmental risk to human health stemming from natural sources such as volcanic eruptions, organic decomposition or forest fires, and anthropogenic sources resulting from power generation, industrialization, and transportation.[1] Due to rapid urban growth and development on the Malaysian Peninsular, air quality issues are faced by most cities.[2] The rate of urbanization has increased to 75.1% (24.4 million) in 2020 from 70.9 percent (19.5 million) in 2010 and 65% in 2005 with the state of Selangor recording the highest urban population at 27.5 % (6.7 million).[3] Airborne substances that contribute to air pollution include carbon monoxide, nitrates, sulfur dioxide, ozone, lead, particulate matter, polyaromatic hydrocarbons, and various other air toxics. Particulate matter emission is contributed mainly by power plants (39%), industrial activities (29%), residential, commercial, and agricultural combustion (20%) and transportation (12%). Approximately, 62% of both nitrogen dioxide and sulfur dioxide emissions come from power plants while motor vehicles account for 24 % of nitrogen dioxide emissions.[4]

Air pollution can cause ill health and the burden of disease to exposed individuals such as heart disease, lung cancer, stroke, and chronic and acute respiratory diseases including asthma and premature death.[5] In 2019, it was reported that 99% of the population on the planet reside in areas where air quality guidelines set by the World Health Organisation were not met prompting an estimated 4.2 million premature deaths worldwide.[6] In Malaysia, an estimated 32,000 preventable deaths occur yearly due to ambient air pollution with an estimated annual economic cost of MYR 303 billion as a result of healthcare and medical spending and losses in economic productivity.[7]

One of the daily activities that exposes people to the most air pollution is commuting to work. Exposure levels to pollutants are influenced by the mode of transport, route, and type of vehicle. In the Klang Valley, commuting to work by private vehicle is higher than cycling, walking, or using public transport such as e-hailing car, van, bus, or train. There have been varying findings on which type of commute will expose people to greater concentrations of pollutants due to varying background concentrations, different particle samplers, and fluctuating daily climatic conditions. Motorized commuters using private cars or taking the bus or train are exposed to greater traffic-related air pollutants[8] compared to walking or cycling,[9] with an opposing finding if the commute is on a higher-traffic route.[10] People in cars breathe more particulate matter because polluted air gets trapped inside vehicles and they sit close to exhaust emissions, while outdoor air for walkers and cyclists disperses pollution more quickly.

Relationships between environmental air pollution exposure with mental and physical health are facilitated by peoples' risk perceptions of the exposure.[11] Perceptions of risk play a vital role in public health situations, as they influence which hazards people pay attention to and how they choose to respond. Higher risk perceptions may produce stress reactions negatively impacting mental health while underestimated risks might cause people to not take fitting actions to protect themselves which may impact their physical well-being.[12] In a more indirect manner, attitudes arising from risk perceptions may facilitate the potentially detrimental effects of air pollution on human health because they may lead to modifications in behavior and support of policies intended to reduce air pollution.[13]

Air pollution exposure has a significant negative impact on people's health and well-being in nations like Malaysia that are rapidly urbanizing. However, there is limited information regarding air pollution with public perceptions, awareness, attitudes, and commute to the workplace. Hence, interpreting how individuals perceive air pollution is crucial to improving public health. Thus, this study aimed to assess the public perceptions of air quality during the journey to and from work.

METHODS

Data Collection

The study took place in the Klang Valley, which is the most densely populated area encompassing Kuala Lumpur and the urban areas of Selangor. The sampling frame included both private automobile and non-automobile commuters with the questionnaire shared through social media networks using an anonymous link. The questionnaire used for this research was adapted from Oltra and Sala,[14] and structured into three main parts: Demographic information (Section A), Work Commute (Section B), and Air quality perceptions (Section C). Over the course of 20 days, 197 replies to the surveys each taking five to six minutes to complete were gathered.

Data Analysis

The demographic information of the respondents and their opinions regarding the quality of the air was compiled using descriptive and inferential statistics. The quantitative data was used to compute the mean and standard deviation. To ascertain the relationships between the categories, the chi-squared test was utilized. A p-value of <0.05 was considered significant.

RESULTS

Demographic Characteristics of Respondents

The demographic data and characteristics of the one hundred and ninety-seven individuals who completed the survey are summarized in Table 1. There were slightly more females who responded 57.9% compared to males. The majority of respondents were 18 – 24 years old (47.2%), while the lowest participation was from the groups aged 35-44 years and above 45 years at 11.7% respectively. The vast majority of the respondents (75.6%) reported to be urban dwelling with the remaining 24.4% from rural areas. Education background varied from being school leavers (38.6%) and having a college degree (56.2%) to having postgraduate education (5.1%). Lastly, the percentage of respondents who self-reported as asthmatic and having a respiratory disease caused by poor air quality was 16.2 % and 23.4%, respectively.

Table 1 Demographic data of respondents

	Frequency	Percentage
Demographics	n = 197	
Age groups		
18-24	93	47.2
25-34	58	29.4
35-44	23	11.7
45 and above	23	11.7
Gender		
Male	83	42.1
Female	114	57.9
Ethnic group		
Malay	180	91.4
Chinese	9	4.6
Indian	4	2.0
Others	4	2.9
Educational Level		
High School	41	20.8
Diploma	76	38.6
Degree	70	35.5
Postgraduate	10	5.1
Residency		
Urban	149	75.6
Rural	48	24.4
Diagnosed with Asthma		
Yes	32	16.2
No	165	83.8
Respiratory Disease Caused by Poor Air Quality		
Yes	46	23.4
No	151	76.6

Air Quality Information Sources and Evaluation Prior to Travel

Most of the respondents reportedly looked outside to the sky (95.9%) or the mountains (64.9%) to gauge the air quality. Less than 50% of respondents declared they obtained air quality information from a reputable source such as the radio, internet, mobile app, television, or newspaper. The newspaper was the least favourite source of choice with a percentage of only 8.6.

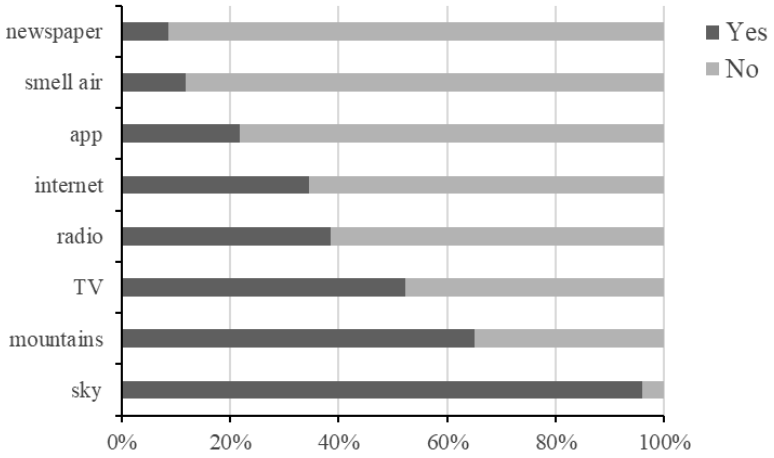

Figure 1 Sources of information on air quality

Table 2 Frequency and associations between participants who checks air quality and health status

Check air quality	Asthma		Total (%)		
	Yes (%)	No (%)			
Never	1.5	24.9	26.4	Pearson	8.393
Almost never	5.1	26.4	31.5	Chi-Square	
Sometimes	5.6	14.7	20.3	df	4
Often	2.0	10.7	12.7		
Always	2.0	7.1	9.1	Asymp.	0.078
Total	16.2	83.8	100.0	Sig.	

Twenty-six percent of respondents never checked the air quality prior to leaving their dwelling while 9.1% reported to always check the air quality status. Respondents were classified into 2 groups based on self-reported asthma status. The air quality checking pattern of respondents with and without asthma is tabulated in Table 2. In general, 25% of individuals with asthma and 21.3% of individuals who did not have asthma reported to check the air quality levels either often or always. Additionally, there was no significant relationship between being asthmatic and checking the air quality levels prior to leaving the house, X^2 (4, N = 197) = 8.39, p = 0.078.

Public Perceptions of Air Quality and Travel Behaviour

Figure 2 shows the respondents perceptions of air quality during commuting to work. Twenty percent of respondents perceived air quality as very unhealthy, 18% as unhealthy, 29% as unhealthy for sensitive groups, 22% as moderately healthy, and only 11% of the respondents perceived that the air quality was good. Subsequently, analysis showed a significant variation between air quality perception and education background [X^2 (12, N = 197) = 26.95, p = 0.008]. The perception of air quality between different age groups and gender was negligible and insignificant (p > 0.05).

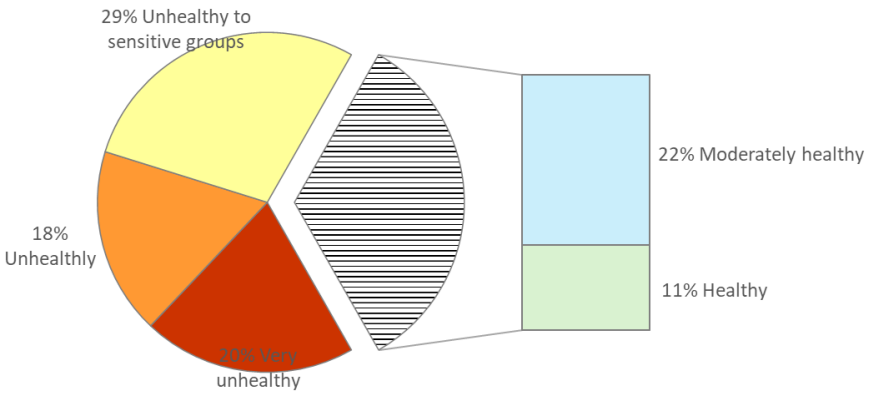

Figure 2 Perceptions on air quality

Table 3 Response of commuters to using a different route to reduce air pollution exposure.

Transportation Mode	Users	Mean	Description		
Private	151	2.5	Disagree /Neutral	Pearson Chi-Square	8.327[a]
Public	30	2.5	Disagree /Neutral		
Active Transport	16	2.0	Disagree	df	8
				Asymp. Sig.	0.402

The percentage of respondents who reported using private, public, or active transport (non-motorized) when commuting to work were 76.6%, 15.3%, and 8.1% respectively. Commuters reported that they did not choose an alternate route to work to reduce air pollution exposure. Additionally, there was no significant difference between the three different types of commuters. Commuters may not choose alternate, less-polluted routes because they often don't know the cleaner options,[8] perceive detours as inconvenient or time-consuming, feel their individual actions won't make a difference, or prioritize speed and habit over environmental concerns.[10]

DISCUSSION

Poor air quality is a common issue and has become a worldwide concern since most of the population resides in high-pollution-level areas. The study found that there are different ways participants obtained information regarding air pollution. Many of the participants were using visible cues by looking outside regarding air pollution compared to accessing reputable sources of air quality data. The sources from which individuals obtained information about air pollution were not significantly influenced by their education level, age, or gender. Smartphone applications, or "apps," for air quality offer localized, real-time data on air quality and have the ability to educate users about the negative health effects of air pollution and empower them to take preventative measures. APIMS (Air Pollutant Index Management System dashboard) and MyIPU (smartphone application) are essential tools designed by the Malaysian government to inform the public about air quality and recommend countermeasures. Hourly air pollutant index (API) data and main pollutant contributors can be viewed in addition to announcements of haze or other incidents. The application was found to be severely underutilized as only 21% of respondents reported obtaining air quality data from apps. This suggests that education and promotion about existing tools are needed to enable the public to obtain reliable data and make informed decisions.

Many of the respondents acknowledged that traveling to and from work in poor air quality had adverse effects on their health, which is consistent with the data currently available on the association between air pollution and health risks. The results suggest that commuters within the Klang Valley perceived the air was unhealthy and were concerned that air quality affected their health and well-being. Chronic respiratory conditions and asthma increase a person's susceptibility to air quality and have been linked to increased suffering in the past.[15] The association between asthma morbidity and air pollution is strong in adolescents and adults in an urban population.[16] Worsening air quality exacerbates respiratory illnesses such as asthma and bronchitis, greatly increases the risk of severe diseases like cancer, and imposes a substantial financial strain on the healthcare system. However, this study found no differences in air quality perceptions for either group whether they have been diagnosed or not with respiratory illnesses. Most of the public has likely been made more aware of the risks of air pollution owing to the frequent haze episodes in Malaysia.[17]

Education level was positively associated with both air quality perception and health concerns. Respondents with at least a tertiary education were more likely to report being extremely concerned about air quality. This finding aligns with previous research, which has consistently shown that individuals with higher educational attainment tend to have greater knowledge about air pollution and heightened awareness of its potential health impacts.[18-20] Hence, targeted health education to the public about the impacts of air quality is needed to enhance public comprehension, in situations of adverse conditions such as transboundary haze, and unfavorable conditions when there is a risk from air quality but is given less consideration.

An interesting finding was that only 9% (Table 2) of the respondents always check the quality of the air when they go outdoors although most respondents agree that the air quality was unhealthy. Strengthening risk perception may enhance the intention behind this behaviour, as familiarity with the risk can influence such behaviour. The majority of respondents comprised mainly of young people (88% under 45 years) and were not hampered by health issues. The low prevalence of asthma or chronic respiratory illness among respondents (fewer than 25%) contributed to their limited concern about air pollution, as those without such conditions may not feel compelled to check daily air quality information. Air quality was not identified as a major barrier to people who engaged in active transport to and from work, and

respondents did not change their commute route to minimize air pollution exposure. This could be attributed to most of the respondents commuted to work by private vehicles and only a small percentage reported air pollution as a significant deterrent in work-related transport. The use of private vehicles for transport in the Klang Valley is greater than public or active transport as most people prefer cars to travel.[21] The significant dependency on private vehicles for traveling to work may be attributed to factors such as the absence of public transportation or unfavourable environmental conditions that hinder the use of public or active transportation. As previously reported, 55% of respondents whose commute to work exceeded a five-kilometer range indicated that infrastructure barriers prevented them from using active transportation for job-related purposes.[22]

Although previous research has shown that active commuters often benefit from lower pollution exposure when using off-road or low-traffic routes due to horizontal dispersion effects,[23] such a pattern did not emerge in this study. One possible explanation is that respondents may have a reduced perceived personal vulnerability and may not have viewed their commuting environments as particularly high-risk. Consequently, a probable justification is also that levels of air pollution were not thoroughly elevated during the study period to alter respondents' perception of risk to cause adaptations of commute routes. Although research has shown variations in air quality levels by mode of transportation, the findings of this study imply that health risks associated with air pollution are not affected differently by the form of transportation used for work.[24]

CONCLUSION

This study contributes to the existing literature by examining the relationship between subjective perceptions of air quality and related health concerns among adults who commute to work. No significant associations between air quality perception and respondents' gender, age, or health status were found, however, air quality perception was significantly associated with educational background ($p < 0.05$). Only a small proportion of respondents (9.1%) reported checking the air quality status on a daily basis before leaving their homes. Nevertheless, the findings presented in this work should be regarded cautiously for several reasons. Firstly, the results may have been impacted by the higher percentage of individuals using private transportation and perhaps not representative of all types of travel modes. Additionally, along the commuter routes, no objective measurements of air pollution were made. Nonetheless, the results of this research suggest that the air quality is perceived to be unhealthy. Heavy usage of automobiles further aggravates local air pollution as vehicles are a major contributor to polluting the environment. Air pollution has greater negative externalities than other environmental pollutants since it is more invasive, affects a larger population, and does not discriminate against any particular group of people. In order to effectively convey hazards and implement regulations that protect human health by restricting exposure to air pollutants, health promoters must continue to understand people's perceptions and concerns, as these have a significant impact on their actions and decisions. There is no "safe" level of exposure to air pollution; more work must be done to improve air quality by lowering emissions and raising public awareness of it. Approaches to support active transport engagement should reinforce the health gains from physical activity increases in addition to lowering traffic-related pollution.

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CONFLICT OF INTEREST

The author declares no conflict of interest.

ETHICAL CLEARANCE

We obtained approval from the UiTM Research Ethics Committee registered under REC/11/2021 (MR/858).

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