



## Research Article

JMR 2023; 9(5):116-128  
September- October  
ISSN:2395-7565  
© 2023, All rights reserved  
www.medicinarticle.com  
Received:06-08-2023  
Accepted:25-09-2023  
DOI: 10.31254/jmr.2023.9505

# The Prevalence and Risk Factors of Self-Reported Respiratory and Other Health Symptoms among Street Vendors in Gaborone, Botswana

**Patience Erick<sup>1</sup>, Modisaotsile Ntesang<sup>1</sup>, Tshephang Tumoyagae<sup>1</sup>, Baemedi Letsholo<sup>1</sup>, Bontle Mbongwe<sup>1</sup>, Roy Taper<sup>1</sup>**

<sup>1</sup> Department of Environmental Health, Faculty of Health Sciences, University of Botswana, Gaborone, Botswana

## Abstract

**Background:** Air pollution is a serious public health concern, killing an estimated 800,000 people annually in developing and developed nations. In urban areas, traffic is one of the most significant sources of hazardous exhaust pollutants. Street vendors are often exposed to air pollutants as a result of their proximity to busy roads and intersections where vehicle emissions are high. Street vendors form an integral part of urban life globally as they provide convenience, affordable goods, and services to the general public. **Aim:** This study aimed to assess the prevalence and factors associated with respiratory and other health symptoms among street vendors in Gaborone, Botswana. **Materials and Methods:** A descriptive cross-sectional study was conducted using a self-administered questionnaire distributed to randomly selected street vendors. The questionnaire gathered information on demographic characteristics and respiratory and other health symptoms among street vendors. Data was analysed using logistic regression. **Results:** About 392 street vendors participated in the study, with 71% females. The mean age (M±SD) of the respondents was 46±13 years, with an age range of 25–66 years. About 46% and 38% attained senior and junior secondary school certificates, respectively and 78% worked for >8 hours/day. Coughing, headache and dizziness were reported by 89%, 62% and 58% of respondents respectively. Female vendors were at increased risk of wheezes (Odds Ratio (OR): 3.12, 95% Confidence Intervals (CI):1.24-7.85) and headaches (OR: 4.61, 95% CI: 2.02-10.54) when compared to males. Increasing age and working for >5 days/week were significantly associated with respiratory and other health symptoms such as sore throat, nasal congestion and wheezes. Tobacco smoking and alcohol consumption predisposed street vendors to nasal congestion (OR: 4.34, 95% CI: 1.28-14.72) and shortness of breath (OR: 3.70, 95% CI: 1.29-10.65), respectively. Physical exercise provided a protective effect against chest tightness (OR: 0.133, 95% CI: 0.03-0.06) and dizziness (OR: 0.73, 95% CI: 0.15-0.35). **Conclusion:** Street vendors reported a high prevalence of respiratory and related health symptoms. Factors such as increasing age, tobacco smoking and alcohol consumption have been associated with respiratory and related health symptoms among street vendors. Large scale research that quantifies TRAP pollutants and health symptoms is needed to inform policy development.

**Keywords:** Upper respiratory symptoms, Lower respiratory symptoms, Street vendors, Street traders, Traffic related air pollutants, Health conditions.

## INTRODUCTION

Air pollution is a serious public health concern [1], killing an estimated 800,000 people annually in developing and developed nations [2]. Globally, traffic-related air pollution (TRAP) is a major contributor to air pollution [2] and around 600 million people in urban areas worldwide are exposed to hazardous levels of TRAP [3]. TRAP is a mixture of compounds generated by vehicle exhausts emissions [4]. Motor vehicles emit substantive amounts of primary compounds such as carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides NO<sub>x</sub>, sulphur dioxides (SO<sub>2</sub>), particulate matter (PM) and volatile organic compounds (VOCs) which are also known as mobile source air toxins (MSATs) [5]. Secondary pollutants such as fine PM, nitrates, inorganic and organic acids, and ozone (O<sub>3</sub>) may be generated [5]. These pollutants are known to have adverse exposure effects on human health and the environment [6].

TRAP exposure has been associated with respiratory diseases such as chronic obstructive pulmonary disease (COPD) and asthma [5, 7, 8]. PM is the TRAP component associated with respiratory morbidity [9], with NO<sub>x</sub> associated with both the new onset of COPD and asthma [8, 10]. Several other respiratory conditions, such as wheezing, chronic bronchitis, chronic phlegm and reduced lung function, have been reported in populations living in areas with documented TRAP [11-16], with prevalence rates ranging between 1.7% and 81.6% [4, 11, 15-20]. The adverse health effects of TRAP are usually greater than industrial pollutants, as TRAP is released near ground level and remains there for longer periods. As such, individuals working or residing adjacent to roads with heavy traffic are persistently exposed to high levels of TRAP [21].

### \*Corresponding author:

**Dr. Patience Erick**

Department of Environmental Health, Faculty of Health Sciences, University of Botswana, Gaborone, Botswana  
Email: erickp@ub.ac.bw

Street vending is one such work that individuals work and spend time outdoors.

Street vending is an activity that provides easy access to a variety of services or goods in public spaces, such as clothing, electronics, traditional medicines, fresh vegetables and prepared food [22]. It is a dominant occupation in urban areas of many developing countries due to large numbers of rural urban migration owing to economic challenges [23]. Botswana, a developing country, is currently experiencing high youth rural-urban migration in search of jobs [24] due to high unemployment rates (19.2%) [25]. Compared to other occupational groups, street vendors are a susceptible and vulnerable group at increased risk to exposure to TRAP [26] and its associated adverse health effects [4]. According to Noomnual and Shendell [4] street vendors mostly work and spend time outdoors. They are therefore, continuously exposed to TRAP along roadsides [16]. Street vendors do not have the infrastructure and work long hours [22]. Long working hours extend TRAP exposure time and reduce recovery time of street vendors from the exposures.

In recent years, there has been a rapid increase in number of vehicles in Botswana due to vehicle importation especially of cheap used Japanese origin. These vehicles are reconditioned older model cars discarded from industrialised countries. Most of these are usually not properly maintained after purchase. There is also a notable number of privately owned vehicles, leading to increased traffic congestion on the roads despite the poor state of road network. The rising number of automobiles leads to high levels of TRAP [27]. As of 2020, Botswana had 242 vehicles per 1000 people, placing her among countries with the highest vehicle density. More than three-quarters of the firstly registered vehicles (79.2%) were used while 20.7% and 0.1% were brand new and rebuilt vehicles, respectively [28].

Due to exclusionary social policies and the continued increase in unemployment in Botswana, street food vending, has evolved to be a survivalist activity among the unemployed [29]. Demographic profiles of urban street vendors in Botswana have been changing, indicating an increase in the number of single and married women street vendors, increased young people and more educated people street vending [30]. Research focusing on TRAP exposure and the respiratory health of street vendors in Botswana is scant. Therefore, this study was conducted to estimate the prevalence and determine factors associated with respiratory symptoms among street vendors in Gaborone, the capital city of Botswana.

## METHODOLOGY

### Study design

A descriptive cross-sectional study was carried out among street vendors in Gaborone, the capital city of Botswana, between January and April 2022. In recent years, Gaborone has experienced population growth due to rural-urban migration caused by a lack of opportunities, poverty and unemployment in rural areas.

### Study population

This study focused on stationary street vendors in different city areas, such as along roadsides, parking lots of shopping complexes, bus stations and around tertiary institutions. The exact number of street vendors is not known.

### Sample size and sampling

Since the number of street vendors is unknown, the Cochran formula below was used to estimate the sample size (SS).

$$SS = \frac{Z^2 p(1-p)}{e^2}$$

Where Z-score is 1.96, p is prevalence, and e is the margin of error. Substituting in the formula given,  $1.962 \times [0.5(1-0.5)]/0.05^2 = 384.94$  and 10% for non-response. The prevalence is unknown hence it is estimated by 50%. Therefore, 424 street vendors were invited to participate in this study.

Gaborone was clustered into political constituencies: Gaborone North, Central, South, Bonnington North and Bonnington South. All constituencies were included in this study and an equal number of 85 street vendors was then randomly selected from each cluster to get 424 participants. Simple random sampling was used to select street vendors in different areas within a cluster. If a randomly selected street vendor did not want to participate in the study, another was invited.

### Data collection tool

A self-administered questionnaire was used to collect data from street vendors. Questionnaires were anonymously answered, with consent sought from participants. The questionnaire was divided into four sections, with the first part seeking demographic information about the participants, such as gender, age, education level and marital status. The second part sought information on self-reported respiratory symptoms and other adverse health effects associated with vendors' work. Street vendors were asked if, in the past 12 months, they had ever experienced symptoms such as cough, sputum, runny nose, sore throat and shortness of breath, asthenia, headache, and eye symptoms. The last part sought to determine factors associated with exposure to TRAP. Respondents were asked questions like number of years trading as a street vendor, daily working hours, days worked per week. Upper and lower respiratory tract symptoms in this study were categorized in line with studies by Serya and others [31] and Françoise and others [32]. Note that headache can be reported under both lower and upper respiratory tract symptoms. In our study we headache was classified under other symptoms since it is not specific to any of the two.

### Ethical consideration

The study commenced only after research permit was issued by Ministry of Health. The study's objectives were outlined to the participants, who were informed that participation was voluntary and that they had the right to withdraw from the study. Informed consent was implied by voluntarily completing and returning the questionnaire.

### Statistical analysis

SPSS version 27 was used to analyze the data. The prevalence of respiratory symptoms and other adverse health-related effects due to TRAP exposure were calculated. Descriptive results were expressed as frequency (n), percentage (%), and mean with standard deviation (SD). Logistic regression was used to predict factors associated with respiratory symptoms and other adverse health effects. Adjusted odds ratios (AORs) and 95% confidence intervals (CIs) for risk factors were calculated. A P-value less than 0.05 was considered statistically significant.

## RESULTS

Of the 424 street vendors invited to participate in the study, 392 (92.4%) responded. Of these, 279 (71.2%) were females, with mean age and standard deviation (M±SD) of 46.3±13.1 years (age range 23 to 67 years). About half (206) of the participants were single while one third were married (134), 182 (46.4%) had Botswana General Certificate of Secondary Education (BGCSE) and 16 (4.1%) had undergraduate qualifications. As shown in Table 1, 76 (19.4%) street vendors smoked tobacco products while 28 (7.1%) quit smoking. There was significant association between gender and smoking. One third of males smoked compared to 13.3% of females (p=0.001). About 223 (56.9%) street vendors consumed alcohol and only 18 (4.6%) reported engagement in physical exercise. Most males had BGCSE (72.6%) while

females had Junior Certificate education (JCE) (41.9%). Almost 6% of female vendors had certificates or diplomas.

### Prevalence of self-reported health conditions

Table 2 shows that street vendors experience different health conditions associated with their job. Of the 392 street vendors who participated in the study, 349 (89%), 245 (62.5%) and 228 (58.2%) reported cough, headache and dizziness, respectively. The second common lower respiratory condition was chest tightness, as reported by 185 (47.2%) street vendors. The most prevalent upper respiratory condition was nasal congestion which was reported by 109 (27.8%) participants. The least reported upper and lower respiratory symptoms were laryngeal irritation (48, 12.2%) and phlegm (35, 8.9%), respectively. Of all the other reported health symptoms, the most common symptoms were headache and dizziness, whilst bronchial asthma was the least reported (31, 7.9%).

Table 3 shows that there was an association between upper respiratory conditions and gender, age, education level, tobacco smoking and vending days per week. Female street vendors had significantly high prevalence rates for all upper respiratory conditions compared to males ( $p < 0.001$ ). Street vendors aged over 60 years and those who had been street vending for more than 10 years had significantly high prevalence rates of nasal congestion ( $p < 0.001$ ). No association was found between upper respiratory conditions and physical exercise.

Table 3 shows that females had significantly high shortness of breath, phlegm, wheezes and sputum prevalence rates than males ( $p < 0.001$ ). Married, divorced or widowed street vendors had a high prevalence of coughing compared to single vendors ( $p < 0.001$ ). Similarly, majority of those who have been vending for 6 to 10 years and more than 10 years than those with 5 or less experience. There was no association between sputum and wheeze and alcohol consumption and physical exercise ( $p > 0.05$ ) respectively.

Apart from lower and upper respiratory symptoms, street vendors also reported asthma, headache, eye irritation, dizziness and allergic sinusitis. As shown in Table 4, all these conditions were significantly associated with individual, lifestyle and vending factors except for headache and experience as a street vendor ( $p = 0.09$ ) and alcohol consumption ( $p = 0.163$ ). No association was established between asthma, allergic sinusitis and physical exercise and between dizziness and vending hours per day ( $p = 0.703$ ).

### Factors associated with self-reported respiratory symptoms and other health conditions

A logistic regression model was used to test the predictive power and assess the relative contribution of independent variables that were associated with self-reported respiratory symptoms and other health conditions. Individual factors such as gender, age, marital status, and level of education were associated with respiratory conditions and/or other reported health symptoms. As shown in Table 5, street vendors aged more than 50 years were 12 times and 4 times more likely to report sore throat and wheezes compared to those aged 50 years and less. Level of education was associated with an increased risk of sore throat and laryngeal irritation. Divorced or widowed street vendors were at increased risk of nasal congestion (OR: 5.84, 95%CI: 1.63-20.86), chest tightness (OR: 5.82, 95%CI: 2.12-16.01), wheezes (OR: 3.61, 95%CI: 1.32-9.89) and headache (OR: 5.41, 95%CI: 1.65-17.77).

Among lifestyle factors, street vendors who drink alcohol were at an increased risk of shortness of breath (OR: 3.70, 95%CI: 1.29-10.65) and sputum (OR: 3.45, 95%CI: 1.23-9.45). Tobacco smoking predisposed street vendors to chest tightness (OR: 3.60, 95%CI: 1.23-10.56). Vending factors such as the number of years one has been a street vendor and vending hours per day were associated with increased odds of reported upper respiratory symptoms and allergic sinusitis. Street vendors who had been vending for more than five years were nine

times and six times more likely to report sore throat (OR: 9.21, 95%CI: 2.45-34.62) and nasal congestion (OR: 5.84, 95%CI: 1.63-20.86), respectively than those who had worked for five years or less. Similarly, vendors who had been street vendors for more than five years were six times more likely to report allergic sinusitis compared to those who have worked for less years (OR: 6.30, 95%CI: 2.58-15.41).

On the other hand, married street vendors were less likely to report upper sore throat (OR: 0.44, 95%CI: 0.08-0.79), laryngeal irritation (OR: 0.44, 95%CI: 0.004-0.455), dizziness (OR: 0.30, 95%CI: 0.10-0.97) and allergic sinusitis (OR: 0.25, 95%CI: 0.09-0.67) when compared to single vendors. Having BGCSE, certificate and diploma was associated with decreased odds of reporting nasal congestion (OR: 0.09, 95%CI: 0.04-0.22), sore throat (OR: 0.12, 95%CI: 0.02-0.66), wheezes (OR: 0.40, 95%CI: 0.19-0.83), sputum, headache (OR: 0.13, 95%CI: 0.51-0.31) and eye irritation (OR: 0.23, 95%CI: 0.18-0.76). Females were also less likely to report coughing and eye irritation. Physical exercise was associated with reduced risk of dizziness (OR: 0.73, 95%CI: 0.15-0.35).

### DISCUSSION

This study sought to estimate the prevalence of respiratory symptoms and other health symptoms associated with exposure to traffic-related air pollutants (TRAP). Globally, TRAP is increasing, and so is its exposure to outdoor workers. Air pollution poses severe health-related issues<sup>[33]</sup>. Previous studies show that the prevalence of respiratory symptoms among street vendors is increasing<sup>[34]</sup>.

#### Prevalence of self-reported upper respiratory symptoms

In the current study, the prevalence of upper respiratory symptoms ranged between 12% and 28%. Over one quarter of street vendors reported nasal congestion, similar to the results of young adult street vendors in Bangkok, Thailand, in which 20% of respondents reported nasal congestion<sup>[4]</sup>. However, a high prevalence of nasal congestion was reported among street vendors in Johannesburg, South Africa (34%)<sup>[35]</sup> and Egypt (47.4%)<sup>[31]</sup>. Higher prevalence (67.2%) was reported among street vendors in the city of Doula, Cameroon<sup>[32]</sup>. Sore throat was reported by 14% of street vendors, slightly higher than of a more recent study of outdoor workers in India where 10% reported sore throat<sup>[18]</sup>. A lower average prevalence rate of 8% was reported among street vendors in Bangkok, Thailand<sup>[15]</sup>. Studies conducted among street vendors in South Africa, Egypt and Klang Valley, Malaysia, 3 times (42%)<sup>[20]</sup>, 2.3 times (32%)<sup>[31]</sup> and 2.2 times (31%)<sup>[16]</sup> higher prevalence respectively on sore throat. Laryngeal irritation was reported by 12% of street vendors in our study, which was lower when compared to the prevalence reported by street vendors in Cameroon which was 4.7 times (56%)<sup>[32]</sup>.

#### Prevalence of self-reported lower respiratory symptoms

The most commonly reported lower respiratory symptom in the current study was coughing (89%), followed by chest tightness (47.2%) and wheezes (27.8%). When compared to previous studies, our study found high prevalence rates of lower respiratory symptoms. For example, in Klang Valley, Malaysia and Brunei Darussalam, the cough was the most common lower respiratory symptom reported by 29.1%<sup>[34]</sup> and 24.7%<sup>[16]</sup> of street vendors, respectively. In Johannesburg, South Africa and Egypt, the cough was reported by 39%<sup>[20]</sup> and 42.8%<sup>[31]</sup> street vendors, respectively. A lower prevalence rates have been reported in, for example, study carried out in Cameroon, where 18.8% of vendors reported cough. In Bangkok, Thailand it was found that on average 7.81% of street vendors reported experiencing cough<sup>[15]</sup>. In Ghana, only 3% of vendors reported experiencing a cough frequently whilst 2.5% and 28% experienced cough one to two months or occasionally, respectively<sup>[17]</sup>.

In our study chest tightness was the second most prevalent lower respiratory symptom reported by almost half of the participants. Except for the studies conducted among Cameroonian<sup>[32]</sup> and Egyptian

[31] vendors where one-third of them reported chest tightness, chest tightness was relatively common among our vendors. Other studies reported prevalence rates ranging between 0.59% and 15% [4, 11, 15, 18, 34].

Wheezes were also common in the current study. Similar results were found in Telemark County, Norway, among adults in an area with modest levels of traffic as 20% of them reported wheezes [11]. Other studies on street vendors reported lower prevalence rates ranging between 0.24% to 14.1% [4, 15, 18, 20, 34]. A higher prevalence rate of wheezes was, however reported among Egyptian street vendors [31].

Shortness of breath, phlegm and sputum were less common in our study. This was also similar with previous research which found that vendors were less likely to report these compared to the three lower respiratory symptoms discussed above [6, 15, 16, 18, 20, 23, 34].

### **Prevalence of other self-reported symptoms**

Headache, dizziness and eye irritation were the most commonly reported other health symptoms. About two-thirds of street vendors in this study reported experiencing headaches similar to the results of a study by Amegah, Dakuu [17] who found that 64.8% of street vendors in Ghana reported headaches which could have occurred frequently, one to two times in a month or occasionally. However, our prevalence of headaches was high when compared to prevalence rates of headaches among street vendors in Delhi, India (43%) [18], Johannesburg, South Africa (26%) [20] and Bangkok, Thailand (20%) [4]. Lower prevalence rates were reported in another study that was conducted in Bangkok, Thailand where on average, 4.49% of vendors reported headache [15]. As with headache, the prevalence rates of dizziness and eye irritation in our study were high compared to previous studies [15, 18, 20]. However, our findings were similar to that of a study conducted in Ghana in which 38% of street vendors reported dizziness [17].

Allergic sinusitis in our study was reported by almost two-thirds of respondents. This prevalence is high when compared to results of studies conducted in Ghana [17] and Egypt [31] where 8.9% and 6.6% of vendors reported allergic sinusitis, respectively. Bronchial asthma was the least reported other respiratory symptom, reported to have been experienced by almost 8% of the vendors. This prevalence was lower when compared to those of other studies in which 18.4% of Egyptian [31] and 0.9% of Ghanaian [17] street vendors reported bronchial asthma. Among South African street vendors in Johannesburg, only 0.8% reported asthma [20]. Other studies did not report on bronchial asthma.

Our study has found high prevalence rates of respiratory and other health symptoms among stationary street vendors. These vendors are likely to be exposed to traffic related air pollutants as they operate along roadsides and parking lots. Outdoor workers are at risk of exposure to airborne pollutants. Exposure to high levels of air pollution from motor vehicles is frequently associated with respiratory diseases such as bronchitis and respiratory tract infections [36]. Conditions such as coughing, sneezing, sharp chest pains, headache and dizziness have been associated with exposure to particulate matter [17]. Exposure to TRAP has also been associated with increased risk of the development of symptoms such as eye irritation, phlegm, chest tightness and other upper respiratory symptoms among street vendors [18]. Street vendors are also at risk of respiratory conditions as they work long hours exposed to air pollutants.

### **Associated individual risk factors**

The second objective of this study was to determine factors associated with reporting respiratory and other health conditions by street vendors.

#### *Gender*

Female gender was positively associated with reporting wheezes and headache in the current study. Female vendors were three times more likely to report wheezes (OR: 3.12, 95% CI: 1.24-7.85). Similarly, gender was associated with reporting of wheezes among vendors in South Africa ( $p=0.023$ ) [20]. Our results however differ with study by Amaran, Zainal Abidin [37] which found that female vendors were less likely to report wheezes compared to males (OR: 0.26, 95%CI: 0.08-0.86). On the other hand, gender was not associated with respiratory symptoms among Malaysian [16] and Brunei [34] vendors.

#### *Age*

Our study has found that street vendors aged over 50 years were at increased risk of sore throat, wheezes and allergic sinusitis. An association was determined between wheezing and age among street vendors in Johannesburg, South Africa ( $p=0.046$ ) [20]. However, there was no association between age and these conditions in studies conducted in Brunei Darussalam [34] and Klang Valley, Malaysia [16].

#### *Marital status*

Married, widowed and divorced street vendors were more likely to report nasal congestions, chest tightness and eye irritation. Widowed and divorced vendors were furthermore likely to report wheezes and headache. On the contrary, married, widowed and divorced vendors were less likely to report sore throat. Married vendors were further less likely to report dizziness (OR: 0.304, 95%CI: 0.095-0.967) and allergic sinusitis (OR: 0.247, 95%CI: 0.089-0.685) when compared to single vendors. These results are divergent to results of a study on respiratory health symptoms among street vendors in Serdang, Malaysia which did not find statistical association between marital status and any respiratory symptoms [37].

#### *Level of education*

Street vendors with BGSCE or higher were more likely to report sore throat and laryngeal irritation than those who had JCE or lower education. On the other hand, those who had BGSCE or higher were less likely to report nasal congestion, shortness of breath, wheezes, sputum, headache and eye irritation. None of the studies reviewed attempted to establish association between respiratory symptoms and level of education. Education level was not associated with any respiratory symptoms among Malaysian street vendors in Serdang [37]. Other studies on TRAP exposure and health conditions among street vendors did not determine association between level of education and respiratory symptoms. Street vendors with higher education are more likely to be aware of the health hazards associated with street vending and protect themselves from these.

### **Associated lifestyle risk factors**

#### *Tobacco smoking*

Current smokers were at increased risk of nasal congestion and headache while ex-smokers were at risk of chest tightness. Although our study did not find association between smoking and other respiratory symptoms, association has been found in a study in Iran where smokers were three times more likely to report wheezing (OR: 3.34, 95%CI: 1.04-10.67) and coughing (OR: 2.96, 95%CI: 1.01-8.53) [37]. Smoking was however not associated with any respiratory symptoms in study conducted among vendors in Brunei [34]. Both female and male smokers were at risk of wheezing in a study of TRAP and respiratory symptoms among adults in an area with modest levels of traffic. Male smokers were further at increased risk of chest tightness and dyspnoea [11]. Majority of street vendors in this study never smoked tobacco (73.5%).

#### *Alcohol consumption*

Street vendors who drink alcohol were at increased odds of reporting shortness of breath. Alcohol has been found to have adverse effects on lungs [38] and impairs lung defences [39].

#### *Physical exercise*

Street vendors who exercised regularly had decreased odds for development of chest tightness and dizziness compared to those who did not exercise.

#### **Associated work-related risk factors**

##### *Duration as a street vendor*

Street vendors who had worked for more than five years were at increased odds of reporting sore throat, nasal congestion and allergic sinusitis when compared to those who had been vendors for five or less years. In their study, Sepadi et al [20] found that duration of work was significantly associated with sore throat ( $p=0.015$ ) and nasal congestion ( $p=0.005$ ). No significant association was reported between these conditions and work duration in among vendors in Malaysia [16]. Cough on the other hand has been previously associated with street vending for more than five years ( $p=0.007$ ) [34]. These symptoms in vendors in the current study could be attributed to long-term exposure to pollutants which has resulted in irritation to the nose and airway.

##### *Working days*

Street vendors who worked for more than five days per week were three times more likely to report nasal congestion compared to those who worked for five or less days per week (OR: 2.88; 95%CI: 1.32-6.27). This is in agreement with results of a study in South Africa that reported significant association between working hours and nasal congestion ( $p<0.001$ ) [20]. Although our study did not find association between working hours and other respiratory symptoms, others studies did [16, 20]. This association is attributable to that long working hours in outdoor environment consequently lead to extended time of exposure to TRAP. Half of vendors in this study reported working for more than eight hours per day. These reduce recovery time of vendors. Inevitably, before vendors recover from past exposure, they are reintroduced to the same work stressor. This over a long-term exposure lead to chronic irritation of nose and airways leading to symptoms discussed above. Increased exposure to TRAP has been reported to increase odds of the development of respiratory and other health symptoms [15].

#### **CONCLUSION**

The health of street vendors is a significant and, unfortunately, understudied subject. This study found high prevalence rates of upper and lower respiratory symptoms and other health symptoms among street vendors in Gaborone. The results further suggest that street vendors are at increased risk of respiratory and other health symptoms associated with exposure to traffic-related air pollutants. The increasing age and experience as a street vendor were predisposed vendors to nasal congestion and allergic sinusitis. Smokers and alcohol drinkers are at increased risk of experiencing respiratory symptoms. On the other hand, physical exercise protects street vendors against chest tightness and dizziness. To reduce the prevalence of respiratory and other health symptoms among vendors, they should be trained to raise awareness on their exposure to TRAP during work and how to protect self. Furthermore, the results provide a basis for future studies where objective exposure measurements should be included to explore the relationship between TRAP levels and respiratory symptoms.

#### **Study limitations**

Data were self-reported as such miss-reporting was possible, whether deliberate or inadvertent. The presence of pain depended entirely on the subjective self-report of the participants and not based on an objective and clinically verified diagnosis of a specialist. Since the study

was cross-sectional, no inferences of causality can be made. We also did not include previous work experience in the questionnaire. The confidence intervals were wide due to the presence of profiles with a frequency equal to 0.

#### **Acknowledgements**

The authors would like to thank Gomolemo Kgolego and Prince Mmualefe for data entry and street vendors who participated in this study.

#### **Disclosure**

Approval of the research protocol: This study was conducted in line with the principles of the Declaration of Helsinki. Approval was obtained from Institutional Review Board of University of Botswana and Ministry of Local Government and Rural Development (CLG14/14/3/1 II (486)).

#### **ORCID ID**

Patience Erick: <https://orcid.org/0000-0002-6397-3040>  
Modisaotsile Ntesang: <https://orcid.org/0009-0000-3579-4160>  
Tshephang Tumoyagae: <https://orcid.org/0000-0001-9051-3835>  
Baemedi Letsholo: <https://orcid.org/0000-0003-0878-0104>  
Bontle Mbongwe: <https://orcid.org/0000-0002-3839-1225>  
Roy Tapera: <https://orcid.org/0000-0002-7242-8650>

#### **REFERENCES**

1. Le Thi H. Health Impacts of Traffic-related Air Pollution: Cause-effect Relationships and Mitigating Measures. In: Ha-Minh C, Dao DV, Benboudjema F, Derrible S, Huynh DVK, Tang AM, editors. CIGOS 2019, Innovation for Sustainable Infrastructure. Singapore: Springer Singapore; 2020. p. 1031-36.
2. Salvi A, Salim S. Neurobehavioral Consequences of Traffic-Related Air Pollution. *Front Neurosci.* 2019;13:1232.
3. Al-Naimi N, Balakrishnan P, Goktepe I. Measurement and modelling of nitrogen dioxide (NO<sub>2</sub>) emissions: a marker for traffic-related air pollution in Doha, Qatar. *Annals of GIS.* 2015;21(3):249-59.
4. Noomnuan S, Shendell DG. Young Adult Street Vendors and Adverse Respiratory Health Outcomes in Bangkok, Thailand. *Saf Health Work.* 2017;8(4):407-09.
5. Health Effects Institute. Traffic-related air pollution: a critical review of the literature on emissions, exposure, and health effects. Special Report 17. Boston: Health Effects Institute; 2010.
6. Noomnuan S, Shendell DG. Risk of adult street vendor exposure to traffic-related air pollution in Bangkok, Thailand. *Hum and Ecol Risk Assess.* 2017;23(2):340-49.
7. Laumbach RJ, Kipen HM. Respiratory health effects of air pollution: update on biomass smoke and traffic pollution. *J Allergy Clin Immunol.* 2012;129(1):3-11; quiz 12-3.
8. Andersen ZJ, Hvidberg M, Jensen SS, Ketzel M, Loft S, Sørensen M, et al. Chronic obstructive pulmonary disease and long-term exposure to traffic-related air pollution: a cohort study. *Am J Respir Crit Care Med.* 2011;183(4):455-61.
9. Pope CA, 3rd, Burnett RT, Thun MJ, Calle EE, Krewski D, Ito K, et al. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *Jama.* 2002;287(9):1132-41.
10. Modig L, Torén K, Janson C, Jarvholm B, Forsberg B. Vehicle exhaust outside the home and onset of asthma among adults. *Eur Respir J.* 2009;33(6):1261-67.
11. Hegseth MN, Oftedal BM, Höper AC, et al. Self-reported traffic-related air pollution and respiratory symptoms among adults in an area with modest levels of traffic. *PLoS One.* 2019;14(12):e0226221.
12. Heinrich J, Topp R, Gehring U, Thefeld W. Traffic at residential address, respiratory health, and atopy in adults: the National German Health Survey 1998. *Environ Res.* 2005 98(2):240-9.

13. Kan H, Heiss G, Rose KM, Whitsel E, Lurmann F, London SJ. Traffic exposure and lung function in adults: the Atherosclerosis Risk in Communities study. *Thorax*. 2007;62(10):873-9.
14. Cesaroni G, Badaloni C, Porta D, Forastiere F, Perucci CA. Comparison between various indices of exposure to traffic-related air pollution and their impact on respiratory health in adults. *Occup Environ Med*. 2008;65(10):683-90.
15. Kongtip P, Thongsuk W, Yoosook W, Chantanakul S, Singhaniyom S. Health Effects of Air Pollution on Street Vendors: A Comparative Study in Bangkok. *Thai J Toxicol*. 2008;23(1):5.
16. Yi APJ, Sumedha, Ramalingam V. Prevalence of Respiratory Symptoms and Associated Risk Factors among Street Food Vendors in Klang Valley, Malaysia. *J Exp Biol Agric*. 2022;10(3):533-38.
17. Amegah AK, Dakuu G, Mudu P, Jaakkola JJK. Particulate matter pollution at traffic hotspots of Accra, Ghana: levels, exposure experiences of street traders, and associated respiratory and cardiovascular symptoms. *J Expo Sci Environ Epidemiol*. 2022;32(2):333-42.
18. Barthwal V, Jain S, Babuta A, Jamir C, Sharma AK, Mohan A. Health impact assessment of Delhi's outdoor workers exposed to air pollution and extreme weather events: an integrated epidemiology approach. *Environ Sci Pollut Res*. 2022;29(29):44746-58.
19. Nazurah bt Abdul Wahid NN, Balalla NBP, Koh D. Respiratory Symptoms of Vendors in an Open-Air Hawker Center in Brunei Darussalam. *Front Public Health* 2014;2:167
20. Sepadi MM, Nkosi V. Health Risk Assessment of Informal Food Vendors: A Comparative Study in Johannesburg, South Africa. *Int J Environ Res Public Health*. 2023;20(3):2736.
21. De S, Kushwah GDS, Dharwey D, Shanmugasundaram D. Respiratory Morbidity of Roadside Shopkeepers Exposed to Traffic-related Air Pollution in Bhopal, India. *J Health Pollut*. 2019;9(21):190305.
22. Sepadi MM, Nkosi V. Environmental and Occupational Health Exposures and Outcomes of Informal Street Food Vendors in South Africa: A Quasi-Systematic Review. *Int J Environ Res Public Health*. 2022;19(3):1348.
23. Amegah AK, Jaakkola JJK. Work as a street vendor, associated traffic-related air pollution exposures and risk of adverse pregnancy outcomes in Accra, Ghana. *Int J Hyg Environ*. 2014;217(2):354-62.
24. Erick P, Sethatho M, Tumoyagae T, Letsholo B, Tapera R, Mbongwe B. Self-reported neck and back pain among supermarket cashiers in Gaborone, Botswana. *Int J Occup Saf Ergon*. 2022:1-9.
25. Statistics Botswana. Quarterly multi-topic survey (QMTS). Gaborone: Statistics Botswana; 2021.
26. Maharjan A, Adhikari S, Ahmad R, et al. Air pollution exposure and its impacts on everyday life and livelihoods of vulnerable urban populations in South Asia. *Environ Res Commun* 2022;4(7):071002.
27. Wiston M. Status of Air Pollution in Botswana and Significance to Air Quality and Human Health. *J Health Pollut* 2017;7(15):8-17.
28. Statistics Botswana. Transport and Infrastructure Statistics Report 2020. Gaborone: Statistics Botswana; 2021.
29. Mogobe SS. Exploring livelihood strategies employed by women street food vendors in Gaborone, Botswana. Cape Town: University of the Western Cape; 2020.
30. Nani GV. A synthesis of changing patterns in the demographic profiles of urban street vendors in Botswana, South Africa and Zimbabwe. *Probl Perspect Manag*. 2016;14(3):549 - 55.
31. Serya H, El Hadidy S, El Bestar S. Respiratory health effects among female street food vendors in Mansoura City, Egypt. *Egypt J Occup Med*. 2019;43(1):17-32.
32. Françoise E, Massongo M, Adrien A, Thérèse A, Jacques Z, Siegfried E, et al. Prevalence of respiratory events at non-ambulating street sellers in the city of Douala, Cameroon. *J Med Res*. 2020;6:87-90.
33. Bano R, Khayyam U. Industrial air pollution and self-reported respiratory and irritant health effects on adjacent residents: a case study of Islamabad Industrial Estate (IEI). *Air Qual Atmos*. 2021;14(10):1709-22.
34. Wahid NbANN, Balalla NBP, Koh D. Respiratory Symptoms of Vendors in an Open-Air Hawker Center in Brunei Darussalam. *Front Public Health*. 2014;2.
35. Sepadi MM, Nkosi V. Working conditions and respiratory health of informal food vendors; in Johannesburg, South Africa: a cross-sectional pilot study. *PAMJ - One Health*. 2022;8(8).
36. Vimercati L. Traffic related air pollution and respiratory morbidity. *Lung India*. 2011;28(4):238.
37. Amaran NA, Zainal Abidin E, Rasdi I. Respiratory Health Symptoms and Lung Function among Road-side Hawkers in Serdang and Its Association with Traffic-Related Exposures. *Iran J Public Health*. 2016;45(Supple 1):77-84.
38. Simet SM, Sisson JH. Alcohol's Effects on Lung Health and Immunity. *Alcohol Res*. 2015;37(2):199-208.
39. Sisson JH. Alcohol and airways function in health and disease. *Alcohol*. 2007;41(5):293-307.

**Table 1:** Demographic characteristics of street vendors

Characteristics	Males (n=113)	Females (n=279)	Total (n=392)	P-value
	(n, %)	(n, %)	(n, %)	
<b>Age (years)</b>				<b>0.001</b>
≤30	44 (38.9)	30 (10.8)	74 (18.9)	
31-40	30 (26.5)	42 (15.1)	72 (18.4)	
41-50	26 (23.0)	27 (9.7)	53 (13.5)	
51-60	13 (11.5)	124 (44.4)	137 (34.9)	
>60	0 (0.0)	56 (20.1)	56 (14.3)	
Total	113 (100)	279 (100)	392 (100)	
<b>Level of education</b>				<b>0.001</b>
No formal education	0 (0.0)	13 (4.7)	13 (3.3)	
PSLE	0 (0.0)	33 (11.8)	33 (8.4)	
JCE	31 (27.4)	117 (41.9)	148 (37.8)	
BGCSE	82 (72.6)	100 (35.8)	182 (46.4)	
Other (professional certificate & diploma)	0 (0.0)	16 (5.7)	16 (4.1)	
<b>Marital status</b>				<b>0.001</b>
Single	96 (85.0)	110 (39.4)	206 (52.6)	
Married	12 (10.6)	122 (43.7)	134 (34.2)	
Other (separated/ divorced/ widowed)	5 (4.4)	47 (16.8)	52 (13.3)	
<b>Experience as a street vendor (years)</b>				<b>0.001</b>
≤5	89 (78.8)	76 (27.2)	165 (42.1)	
6-10	23 (20.4)	121 (43.4)	144 (36.7)	
>10	1 (0.9)	82 (29.4)	83 (21.2)	
<b>Vending hours/day</b>				<b>0.001</b>
<8	12 (10.6)	74 (26.5)	86 (21.9)	
8	24 (21.2)	85 (30.5)	109 (27.8)	
>8	77 (68.1)	120 (43.0)	179 (50.3)	
<b>Vending days/week</b>				
5	84 (74.3)	120 (43.0)	204 (52.0)	
>5	29 (25.7)	159 (57.0)	188 (48.0)	
<b>Tobacco smoking</b>				<b>0.001</b>
Smokers	39 (34.5)	37 (13.3)	76 (19.4)	
Ex-smokers	11 (9.7)	17 (6.1)	28 (7.1)	
Never smoked	63 (55.8)	225 (80.6)	288 (73.5)	
<b>Alcohol consumption</b>				0.13
Currently drinks	71 (62.8)	152 (54.5)	223 (56.9)	
Never used alcohol	42 (37.2)	127 (45.5)	169 (43.1)	
<b>Physical exercise</b>				<b>0.01</b>
No	103 (91.2)	271 (97.1)	374 (95.4)	
Yes	10 (8.8)	8 (2.9)	18 (4.6)	

PSLE – Primary School Leaving Examination, JCE – Junior Certificate Education, BGCSE – Botswana Government Certificate for Secondary Education, Bold data are statistically significant ( $p < 0.05$ ).

**Table 2:** Prevalence of self-reported respiratory symptoms and other health symptoms among street vendors in Gaborone, Botswana

Variable	Frequency (N)	Proportion (%)
<b>Upper respiratory symptoms</b>		
Sore throat	55	14.0
Nasal congestion	109	27.8
Laryngeal irritation	48	12.2
<b>Lower respiratory symptoms</b>		
Shortness of breath	71	18.1
Chest tightness	185	47.2
Phlegm	38	8.9
Wheezes	109	27.8
Coughing	349	89.0
Sputum	71	18.1
<b>Other health symptoms</b>		
Bronchial asthma	31	7.9
Headache	245	62.5
Eye irritation	183	46.7
Dizziness	228	58.2
Allergic sinusitis	145	37.0

**Table 4:** Prevalence of other self-reported symptoms in relation to behavioural and work-related factors

Characteristics	Bronchial asthma	Headache	Eye irritation	Dizziness	Allergic sinusitis
<b>Gender</b>					
Male	0 (0.0)	62 (54.9)	35 (31.0)	48 (42.5)	15 (13.3)
Female	31 (11.1)	183 (65.6)	148 (53.0)	180 (64.5)	130 (46.6)
Total	31 (7.9)	245 (62.5)	183 (46.7)	228 (58.2)	145 (37.0)
p-value	<b>&lt;0.001</b>	<b>0.047</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Age (years)</b>					
≤30	0 (0.0)	52 (70.3)	0 (0.0)	18 (24.3)	11 (14.9)
31-40	0 (0.0)	56 (77.8)	8 (11.1)	39 (54.2)	12 (16.7)
41-50	0 (0.0)	21 (39.6)	35 (66.0)	23 (43.4)	7 (13.2)
51-60	23 (16.8)	90 (65.7)	84 (61.3)	122 (89.1)	77 (56.2)
>60	8 (14.3)	26 (46.4)	56 (100)	26 (46.4)	38 (67.9)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Level of education</b>					
PSLE & Lower	2 (4.3)	20 (43.5)	39 (84.8)	20 (43.5)	35 (76.1)
JCE	29 (19.6)	113 (76.4)	102 (68.9)	115 (77.7)	55 (37.2)
BGCSE	0 (0.0)	97 (53.3)	39 (21.4)	90 (49.5)	53 (29.1)
Other (professional certificate & diploma)	0 (0.0)	15 (93.8)	3 (18.8)	3 (18.8)	2 (12.5)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Marital status</b>					
Single	0 (0.0)	125 (60.7)	39 (18.9)	100 (48.5)	50 (24.3)
Married	0 (0.0)	79 (59.0)	99 (73.9)	82 (61.2)	55 (41.0)
Other (separated/ divorced/ widowed)	31 (59.6)	41 (78.8)	45 (86.5)	46 (88.5)	40 (76.9)
p-value	<b>&lt;0.001</b>	<b>0.031</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Experience as a street vendor (years)</b>					



≤5	0 (0.0)	111 (67.3)	33 (20.0)	54 (32.7)	19 (11.5)
6-10	21 (14.6)	90 (62.5)	73 (50.7)	124 (86.1)	77 (53.5)
>10	10 (12.0)	44 (53.0)	77 (92.8)	50 (60.2)	49 (59.0)
p-value	<0.001	0.091	<0.001	<0.001	<0.001
<b>Vending hours/day</b>					
<8	23 (26.7)	56 (65.1)	30 (34.9)	53 (61.6)	49 (57.0)
8	0 (0.0)	44 (40.0)	46 (42.2)	64 (58.7)	73 (67.0)
>8	8 (4.1)	145 (73.6)	107 (54.3)	111 (56.3)	23 (11.7)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.006</b>	0.703	<b>&lt;0.001</b>
<b>Vending days/week</b>					
5	22 (10.8)	146 (71.6)	80 (39.2)	124 (60.8)	64 (31.4)
>5	9 (4.8)	99 (52.7)	103 (54.8)	104 (55.3)	81 (43.1)
p-value	<b>0.028</b>	<b>&lt;0.001</b>	<b>0.002</b>	0.273	<b>0.016</b>
<b>Tobacco smoking</b>					
Non-smokers	31 (10.8)	151 (52.4)	163 (56.6)	187 (64.9)	129 (44.8)
Ex-smokers	0 (0.0)	28 (100)	11 (39.3)	28 (100)	8 (28.6)
Current smokers	0 (0.0)	66 (86.8)	9 (11.8)	13 (17.1)	8 (10.5)
p-value	<b>0.002</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Alcohol consumption</b>					
Never used alcohol	31 (18.3)	146 (65.5)	93 (41.7)	142 (84.0)	85 (50.3)
Currently drinks	0 (0.0)	99 (58.6)	90 (53.3)	86 (38.6)	60 (26.9)
p-value	<b>&lt;0.001</b>	0.163	<b>0.023</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Physical exercise</b>					
No	31 (8.3)	245 (65.5)	183 (48.9)	224 (59.9)	141 (37.7)
Yes	0 (0.0)	0 (0.0)	0 (0.0)	4 (22.2)	4 (22.2)
p-value	0.203	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.002</b>	0.184

PSLE – Primary School Leaving Examination, JCE – Junior Certificate Education, BGCSE – Botswana Government Certificate for Secondary Education, Bold data are statistically significant ( $p < 0.05$ ).

**Table 5:** Risk Factors for self-reported respiratory symptoms and other health symptoms

Body region	Significant risk factors <sup>a</sup>	Adjusted odds ratio	95% Confidence Interval	p-value
<b>Upper respiratory symptoms</b>				
<b>Sore throat</b>				
Age (years)	≤ 50	1		
	>50	12.25	3.347-44.82	<b>&lt;0.001</b>
Marital status	Single	1		
	Married	0.443	0.075-0.788	<b>0.018</b>
	Other (divorced/widowed)	0.880	0.233-3.325	0.851
Level of education	JCE and lower	1		
	BGCSE and higher	17.378	6.350-47.559	<b>&lt;0.001</b>
Experience as a street vendor (years)	≤ 5	1		
	>5	9.207	2.449-34.620	<b>0.001</b>
<b>Nasal congestion</b>				
Marital status	Single	1		
	Married	2.324	0.757-7.136	0.141
	Others (Divorced/widowed)	5.838	1.634-20.855	<b>0.007</b>
Level of education	JCE and lower	1		
	BGCSE and higher	0.088	0.035-0.220	<b>&lt;0.001</b>
Experience as a street vendor (years)	≤ 5	1		

	>5	5.838	1.255-16.211	<b>0.003</b>
Vending days per week	5	1		
	>5	2.876	1.320-6.269	<b>0.008</b>
Smoking	Never smoked	1		
	Current smoker	4.344	1.282-14.720	<b>0.018</b>
<b>Laryngeal Irritation</b>				
Level of education	JCE and lower	1		
	BGCSE and higher	17.650	4.963-62.771	<b>&lt;0.001</b>
Marital status	Single	1		
	Married	0.44	0.004-0.455	<b>0.009</b>
	Others Divorced/widowed)	0.122	0.012-1.256	0.077
<b>Lower respiratory symptoms</b>				
<b>Shortness of breath</b>				
Level of education	JCE and lower	1		
	BGCSE and higher	0.124	0.023-0.659	<b>0.014</b>
Alcohol consumption	Never drank alcohol	1		
	Currently drinks alcohol	3.702	1.288-10.645	<b>0.015</b>
<b>Chest tightness</b>				
Gender	Male	1		
	Females	0.385	0.203-0.733	<b>0.004</b>
Marital status	Single	1		
	Married	3.151	1.392-7.132	<b>0.006</b>
	Others(Divorced/Widowed)	5.822	2.117-16.010	<b>&lt;0.001</b>
Tobacco smoking	Never smoked	1		
	Quit smoking	3.597	1.225-10.561	<b>0.020</b>
	Currently smoker	0.751	0.348-1.617	0.464
Physical exercise	Yes	1		
	No	0.133	0.031-0.0570	<b>0.007</b>
<b>Wheezes</b>				
Gender	Male	1		
	Female	3.124	1.243-7.853	<b>0.015</b>
Age (years)	≤ 50	1		
	>50	4.000	1.445-11.074	<b>0.008</b>
Level of education	JCE and lower	1		
	BGCSE and higher	0.395	0.187-0.834	<b>0.015</b>
Marital Status	Single	1		
	Married	0.876	0.343-2.232	0.781
	Others(widowed/divorced)	3.607	1.319-9.868	<b>0.012</b>
<b>Coughing</b>				
Gender	Male	1		
	Female	0.056	0.015-0.203	<b>&lt;0.001</b>
<b>Sputum</b>				
Level of education	JCE and lower	1		
	BGCSE and higher	0.124	0.023-0.659	<b>0.014</b>
Alcohol Consumption	No	1		
	Yes	3.454	1.233-9.448	<b>0.015</b>
<b>Other health symptoms</b>				
<b>Headache</b>				
Gender	Male	1		

	Female	4.609	2.015-10.540	<b>&lt;0.001</b>
Level of education	JCE and lower	1		
	BGCSE and higher	0.125	0.51-0.305	<b>&lt;0.001</b>
Marital Status	Single	1		
	Married			
	Others(widowed, divorced)	5.413	1.648-17.774	<b>0.005</b>
Tobacco Smoking	Never smoked	1		
	Currently Smoker	11.936	4.671-30.498	<b>&lt;0.001</b>
<b>Eye irritation</b>				
Gender	Male	1		
	Female	4.609	2.015-10.540	<b>&lt;0.001</b>
Level of education	JCE and lower	1		
	BGCSE and higher	0.232	0.116-0.466	<b>&lt;0.001</b>
Marital Status	Single	1		
	Married	6.121	2.497-15.005	<b>&lt;0.001</b>
	Others(divorced, widowed)	9.942	3.317-29.797	<b>&lt;0.001</b>
<b>Dizziness</b>				
Marital Status	Single	1		
	Married	0.304	0.095-0.967	<b>0.044</b>
	Others(divorced, widowed)			
Physical Exercise	No	1		
	Yes	0.73	0.15-0.352	<b>0.001</b>
<b>Allergic sinusitis</b>				
Age (years)	≤50	1		
	>50	4.190	1.649-10.646	<b>0.003</b>
Marital Status	Single	1		
	Married	0.247	0.089-0.685	<b>0.007</b>
	Others(divorced, widowed)	1.166	0.378-3.596	0.789
Experience as a street vendor (years)	≤5	1		
	>5	6.301	2.577-15.405	<b>&lt;0.001</b>

JCE – Junior Certificate Education, BGCSE – Botswana Government Certificate for Secondary Education

Bold data are statistically significant ( $p < 0.05$ ).

**Table 3:** Prevalence of self-reported respiratory symptoms in relation to different factors

Characteristics	Upper respiratory symptoms			Lower respiratory symptoms					
	Sore throat N (%)	Nasal congestion N (%)	Laryngeal irritation N (%)	Shortness of breath N (%)	Chest tightness N (%)	Phlegm N (%)	Wheezes N (%)	Coughing N (%)	Sputum N (%)
<b>Gender</b>									
Male	3 (2.7)	6 (5.3)	0 (0.0)	0 (0.0)	52 (46.0)	0 (0.0)	10 (8.8)	99 (87.6)	0 (0.0)
Female	52 (18.6)	103 (36.9)	48 (17.2)	71 (25.4)	133 (47.7)	35 (12.5)	99 (35.5)	250 (89.6)	71 (25.4)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.767	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.567	<b>&lt;0.001</b>
<b>Age (years)</b>									
≤30	0 (0.0)	2 (2.7)	0 (0.0)	0 (0.0)	15 (20.3)	0 (0.0)	0 (0.0)	57 (77.0)	0 (0.0)
31-40	2 (2.8)	10 (13.9)	0 (0.0)	0 (0.0)	20 (27.8)	0 (0.0)	8 (11.1)	54 (75.0)	0 (0.0)
41-50	6 (11.3)	4 (7.5)	3 (5.7)	0 (0.0)	33 (62.3)	4 (7.5)	9 (17.0)	45 (84.9)	0 (0.0)
51-60	47 (34.3)	55 (40.1)	45 (32.8)	33 (24.1)	63 (46.0)	23 (16.8)	49 (35.8)	137 (34.9)	33 (24.1)
>60	0 (0.0)	38 (67.9)	0 (0.0)	38 (67.9)	54 (96.4)	8 (14.3)	43 (76.8)	56 (14.3)	38 (67.9)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Level of education</b>									
PSLE & Lower	2 (4.3)	35 (76.1)	2 (4.3)	28 (60.9)	46 (100)	2 (4.3)	32 (69.6)	46 (100)	28 (60.9)
JCE	15 (10.1)	63 (42.6)	13 (8.8)	41 (27.7)	72 (48.6)	29 (19.6)	55 (37.2)	139 (93.9)	41 (27.7)
BGCSE	36 (19.8)	9 (4.9)	33 (18.1)	1 (0.5)	63 (34.1)	4 (2.2)	20 (11.0)	159 (87.4)	1 (0.5)
Other (professional certificate & diploma)	2 (12.5)	2 (12.5)	0 (0.0)	1 (1.4)	4 (25.0)	0 (0.0)	2 (12.5)	5 (31.3)	1 (6.3)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.006</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Marital status</b>									
Single	27 (13.1)	16 (7.8)	23 (11.2)	0 (0.0)	70 (34.0)	4 (1.9)	24 (11.7)	171 (83.0)	0 (0.0)
Married	14 (10.4)	58 (43.3)	12 (9.0)	37 (27.6)	73 (54.5)	0 (0.0)	48 (35.8)	126 (94.0)	37 (27.6)
Other (separated/divorced/ widowed)	14 (26.9)	35 (67.3)	13 (25.0)	34 (65.4)	42 (80.8)	31 (59.6)	37 (71.2)	52 (100)	34 (65.4)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.009</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Experience as a street vendor (years)</b>									
≤5	5 (3.0)	8 (4.8)	0 (0.0)	0 (0.0)	57 (34.5)	0 (0.0)	15 (9.1)	126 (76.4)	0 (0.0)
6-10	36 (25.0)	52 (36.1)	34 (23.6)	28 (19.4)	66 (45.8)	25 (71.4)	45 (31.3)	140 (97.2)	28 (19.4)

>10	14 (16.9)	49 (59.0)	14 (16.9)	43 (51.8)	62 (74.7)	10 (28.6)	49 (59.0)	83 (100)	43 (51.8)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Vending hours/day</b>									
<8	15 (17.4)	44 (51.2)	13 (15.1)	25 (29.1)	46 (53.5)	27 (31.4)	33 (38.4)	82 (95.3)	25 (29.1)
8	29 (26.6)	31 (28.4)	27 (24.8)	31 (28.4)	61 (56.0)	0 (0.0)	46 (42.2)	95 (87.2)	31 (28.4)
>8	11 (5.6)	34 (17.3)	8 (4.1)	15 (7.6)	78 (39.6)	8 (4.1)	30 (15.2)	172 (87.3)	15 (7.6)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.010</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.105	<b>&lt;0.001</b>
<b>Vending days/week</b>									
5	10 (4.9)	44 (21.6)	8 (3.9)	25 (12.3)	115 (56.4)	29 (12.7)	62 (30.4)	172 (84.3)	25 (12.3)
>5	45 (23.9)	65 (34.6)	40 (21.3)	46 (24.5)	70 (37.2)	9 (4.8)	47 (25.0)	177 (94.1)	46 (24.5)
p-value	<b>&lt;0.001</b>	<b>0.004</b>	<b>&lt;0.001</b>	<b>0.002</b>	<b>&lt;0.001</b>	<b>0.006</b>	0.234	<b>0.002</b>	<b>0.002</b>
<b>Tobacco smoking</b>									
Non-smokers	53 (18.4)	95 (33.0)	48 (16.7)	71 (24.7)	148 (51.4)	35 (12.2)	99 (34.4)	274 (95.1)	71 (24.7)
Ex-smokers	0 (0.0)	10 (35.7)	0 (0.0)	0 (0.0)	20 (71.4)	0 (0.0)	10 (35.7)	28 (100)	0 (0.0)
Current smokers	2 (2.6)	4 (5.3)	0 (0.0)	0 (0.0)	17 (22.4)	0 (0.0)	0 (0.0)	47 (61.8)	0 (0.0)
p-value	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
<b>Alcohol consumption</b>									
Never used alcohol	48 (28.4)	54 (32.0)	43 (25.4)	32 (18.9)	106 (62.7)	35 (20.7)	65 (38.5)	159 (94.1)	32 (18.9)
Currently drinks	7 (3.1)	55 (24.7)	5 (2.2)	39 (17.5)	79 (35.4)	0 (0.0)	44 (19.7)	190 (85.2)	39 (17.5)
p-value	<b>&lt;0.001</b>	<b>0.111</b>	<b>&lt;0.001</b>	0.713	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.005</b>	0.713
<b>Physical exercise</b>									
No	55 (14.7)	105 (28.1)	48 (12.8)	71 (19.0)	181 (48.4)	31 (8.3)	105 (28.1)	345 (92.2)	71 (18.1)
Yes	0 (0.0)	4 (22.2)	0 (0.0)	0 (0.0)	4 (22.2)	4 (22.2)	18 (22.2)	4 (22.2)	0 (0.0)
p-value	0.079	0.588	0.105	<b>0.041</b>	<b>0.030</b>	<b>0.043</b>	0.588	<b>&lt;0.001</b>	<b>0.041</b>

PSLE – Primary School Leaving Examination, JCE – Junior Certificate Education, BGCSE – Botswana Government Certificate for Secondary Education

Bold data are statistically significant ( $p < 0.05$ ).