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Factors associated with chronic respiratory disorders in the saleswomen working near Dantokpa's market highways in Cotonou, Benin

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Sales around roads, a common activity mainly carried out by women in African urban areas, expose these later to outdoor air pollution (OAP), leading to chronic respiratory diseases (CRD). This research aims at studying associated factors with CRD among these professionals. A cross-sectional, analytical study was conducted among 396 saleswomen working on the outskirts of the main track of Dantokpa's market in Cotonou. Participants were systematically recruited by convenience, in the proportion of one in two, according to the defined selection criteria and interview. A multivariate analysis was performed by the top-down procedure. The CRDs prevalence was 43.18% for chronic bronchitis (35.18%) and asthma (8.33%). The associated factors with CRD were (Adjusted OR; 95%CI): the low-quality housing (1.92; 1.18-3.13), monthly income above the minimum wage (2.48; 1.51-4.06) and the daily selling time above 9 h (3.66; 2.15-6.22). Three items of the knowledge's level about OAP were found to be protective factors, namely the recognition by saleswomen of: At least three sources of OAP (0.43; 0.26-0.72), the OAP's reality (0.25; 0.07-0.85), and their higher exposure (0.06; 0.013-0.31). The risk and protective factors identified will help implementing preventive measures, including consciousness-raising for saleswomen and targeted OAP mitigation efforts.

Keywords: Chronic respiratory disorders, associated factors, road sales, outdoor air pollution.

INTRODUCTION

Chronic respiratory disorders (CRD) are diversified diseases that affect the respiratory tract and other lung structures (WHO, 2007). They commonly include chronic bronchitis, emphysema, asthma, chronic obstructive pulmonary disease and unclassified chronic airway obstruction (Wang et al., 2007). It also includes lung

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cancer, tuberculosis, cystic fibrosis,respiratory distress syndrome and sleep apnea (WHO, 2007). These diseases raise attention regarding their prevalence, mortality and economic burden (Wang et al., 2007). CRD are responsible for 4.2 million deaths a year worldwide, nearly 80% of which occur in low or middle-income countries (WHO, 2014). They have therefore turn into a serious public health problem (Aït-Khaled et al., 2001). More than half a century ago, air pollution was already responsible for respiratory diseases, of which chronic bronchitis and asthma (Shephard, 1971) are included. Chronic bronchitis is defined by the presence of a chronic cough and sputum developing for more than 3 months each year. Asthma is a chronic inflammatory disease characterized by an episodic and reversible airway obstruction, a bronchial hyper reactivity and clinical manifestations: wheezing, cough, respiratory discomfort and chest tightness (Reddel et al., 2015). Agglomerations are characterized by marked contrasts in the levels and chemical composition of air pollutants, depending on how far or closer they are to roads with heavy traffic (Host, 2013). The health degradation of populations living near high-traffic roads is often greater than that reported for background levels (Host, 2013). Living close to a busy traffic road poses significant risks to respiratory health (Guéguen et al., 2012; Host, 2013). Indeed, road traffic is the main pollution's source in large African cities (Amegah and Jaakkola, 2014; Chen et al., 2007; Mama et al., 2013). In Cotonou, the concentration of outdoor air pollutants related to road traffic is high, especially in Dantokpa because of the high traffic intensity in this area (Mama et al., 2013). The concentration of Carbon Monoxide can reach, 214.7 mg/m^3 at Dantokpa for a national standard of 10 mg/ m^3 (over 8 h) and that of Nitrogen dioxide (NO_2) reach 470 mg/m^3 for a national standard of 150 mg/m^3 in 24 h (Mama et al., 2013). Another study carried out in 2018 in the same locality found $PM_{2.5}$ concentrations ranging to 500 mg / m^3 for a national standard of 50 mg / m^3 in 24 h (Houngbegnon et al., 2019). Many studies have shown that some people are more exposed to outdoor air pollution (OAP) than others because of their work activity (Choudhary and Tarlo, 2014; Pascal, 2009). Studies on traffic-regulating police officers (Ekpenyong et al., 2012; Obaseki et al., 2014), as well as taxi and motorcycle drivers (Fourn and Fayomi, 2006; Lawin et al., 2016) have found a high incidence of respiratory pathology. In the urban areas of African capitals, sales on the roads are a predominant activity and are mainly carried out by women (Amegah and Jaakkola, 2014). The later spend several hours each day in the vicinity of traffic; thus exposed to OAP, leading to several pathologies and CRD in particular (Amegah and Jaakkola, 2014; Ekpenyong et al., 2012; Obaseki et al., 2014). Different studies have noted that factors such as smoking, indoor air pollution, allergens, exposure to occupational risks such as dust, respiratory infections, low socioeconomic status, and poor nutritional status would favor CRD (Gbaya and Garand, 2010). CRD are responsible for 4.2 million deaths a year worldwide, nearly 80% of which occur in low or middle-income countries (WHO, 2014). Given the importance of CRD in OAP exposures (Ekpenyong et al., 2012; Fourn and Fayomi, 2006; Choudhary and Tarlo, 2014; Obaseki et al., 2014; Pascal, 2009; WHO, 2014), the need for a better characterization of the factors associated appears as necessary. This knowledge could lead to targeting health and environmental prevention actions (Pascal, 2009). The objective of this study was therefore to determine the factors associated with CRD, chronic bronchitis and asthma in particular in saleswomen working near the Dantokpa's market highways.

MATERIALS AND METHODS

The study was conducted in Cotonou, the business capital of Benin, around the main road of the Dantokpa's market, which is the largest in the country. This site was chosen on the basis of a previous study results indicating that, the concentration of outdoor air pollutants related to this road traffic (CO, NO_2) was particularly high due to the high traffic intensity (Mama et al., 2013). Data were collected from February to May 2017.

This was a cross-sectional and analytical study that questioned saleswomen recruited around the main Dantokpa market axis. The sample's size was calculated using the Schwartz formula adapted for cross-sectional studies (Hsieh et al., 1998): $N= (Z)2*p*(1-p) /d^2$. The Z confidence interval is 95% and the margin error is 5%. In case missing data were observed on this specific target, 50% was considered for p and N was 396 saleswomen. 396 volunteer saleswomen were selected. Inclusion criteria were as follows: to be between 15 and 60 years old, to carry out main activity of selling on roads at Dantokpa's market, to have been at least three years selling on the site. The main non-inclusion criterion was the existence of other potential exposure to smoke or dust such as active or passive smoking (spouse's smoking), exposure to smoke at a professional fish smoking site, residence in a locality of industrial cement mining, exposure to dust through involvement in a "street sweeper" job. As a matter of convenience, we systematically selected one out of every two saleswomen who retracted the criteria to obtain the sample size. We selected the first and left the second. The study used a validated questionnaire (Fuhrman et al., 2008) that was administered to respondents by a physician assisted by a medical assistant and a translator among the illiterate.

The study covered 4 groups of variables: Socio-demographic factors such as age, education, housing standard, fuel used for cooking; professional factors such as monthly income, professional seniority, status in the activity, number of working days per week, working time per day, duration of break during the working day and type of item sold. OAP knowledge inspired from the conceptual model of Li et al. (2016) through three declinations- its sources, its aspects, and the severity of its adverse health effects. With regard to the study's target, 6 key sources of OAP were included in the questionnaire: smoke from vehicles and motorcycles, generator smoke, industrial gases, waste burns, various odors, indoor air pollution. CRD variables were taken from the main questionnaire of the 10-year health survey on the prevalence and impact of chronic bronchitis on daily life conducted in France (Fuhrman et al., 2008). Two chronic respiratory conditions were considered: chronic bronchitis which is defined according to the WHO criteria as chronic cough and sputum occurring three months per year for at least two years; and asthma that is evoked before any paroxysmal attacks of sibilant dyspnea, repeated episodes of chest wheezing or spasmodic cough with repetitive respiratory discomfort. Dyspnea

Table 1. Chronic respiratory disorders in respondents.

		Effective	%
CRD	Chronic bronchitis	138	34.85
	Asthma	30	7.58
	Chronic bronchitis plus asthma	3	0.76
No CRD		225	56.82
Total		396	100

was assessed according to the five-stage Sadul classification (Fuhrman et al., 2008).

To search for chronic bronchitis, we asked the respondents about the frequency of coughing and sputum during the day, at night and on waking. Asthma has been sought through the notion of wheezing with respiratory discomfort. In order to facilitate reading, these two conditions (chronic bronchitis and asthma) have been grouped in this work under the name "chronic respiratory disorders" (CRD).

The questionnaire has been translated in a local language for unschooled participants. Transcription and retranscription were provided by a professional translator. There was no physical examination or laboratory test for the participants. The data was entered with Cspro 7.1 software and analyzed with Stata14. Statistical analysis of quantitative variables was presented as mean ± standard deviation, while the categorical variables were presented by their frequencies. The bivariate analysis consisted in looking for any associations between socio-demographic and professional characteristics, the level of knowledge on OAP and CRDs with the respondents. The proportions were compared by the chi-square test or by the Fisher's exact test in cases where the conditions for using the chi-square test were not met. The significance threshold was set at 0.05. To control the confounding factors, we performed a logistic regression analysis using the top-down procedure. All factors with a p-value greater than 0.20 in the bivariate analysis were introduced in the initial model. This analysis provided the adjusted odds ratio (ORa) with their 95%CI.

This study is part of the Pol Chair project which obtained the approval of the National Committee for Health Research Ethics in Benin under number N°032 of 7 October, 2016 notified by letter N° 078/MS/DC/SGM/DFR/CNERS/SA of 7 October, 2016. All participants signed an informed consent form.

RESULTS

Participants in the study were 87 women who had refused to participate during recruitment for two main reasons: the interview time would make them lose customers; and the fear (wrongly) that the inclusion in the study could be such a registration that would oblige them later to pay periodic taxes. These saleswomen did not understand the notion of confidentiality despite the explanations.

Chronic respiratory disorders prevalence

Of the respondents, 138 (34.85%) had chronic bronchitis and 30 (7.58%) had asthma. The association of the two disorders was suspected in 3 participants (0.76%), or 9.09% of asthma cases and 2.13% of chronic bronchitis cases. At least one of the two conditions was present in 171 out of 396 respondents, representing an overall prevalence of 43.18% CRD (Table 1). By integrating the three cases of association of the two diseases with the non-associated cases, there is a total of 141 (35.18%) of chronic bronchitis and 33 (8.33%) of asthma.

Associated factors with chronic respiratory disorders

Socio-demographic, professional characteristics and chronic respiratory disorders in respondents

The frequency of CRD was higher among some categories of respondents than others. These were respondents over 40 years of age (p = 0.000), respondents having more than 10 years of professional service (p = 0.000) or who had an income above the Minimum Inter-professional Guaranteed Wage (SMIG) (Offshore development, 2015) (p = 0.000). Similarly, CRDs were more common among respondents who spent more time around the sales lane; that is, those who worked more than five days per week (p = 0.003) or more than 9 h per day (p = 0.000). In addition, there is a significant difference between the fuel used in the kitchen (p = 0.001) as well as between the item sold by the saleswomen (p = 0.001) and the occurrence of CRD among these saleswomen (Table 2).

Knowledge level on outdoor air pollution and chronic respiratory disorders among respondents

According to the number of recognized sources, there was no significant difference in the presence of CRD in respondents for 0, 1 and 2 sources. In contrast, those who were not ill recognized more sources of OAP (3 or more sources) (p = 0.000). It was noted that those with CRD were more aware of the reality of OAP, poor air quality (p = 0.002). As a result, they recognized more the impact of OAP on their own health (p = 0.002) than on the health of the entire population (p = 0.001) (Table 3).

Multivariate analysis of factors associated with chronic respiratory disorders

Factors significantly associated with a high risk of CRD

Table 2. Socio-demographic and professional characteristics and chronic respiratory disorders association in respondents.

Characteristics	CRD				P
	Yes (n = 171)		No (n = 225)		
	n	%	n	%	
Ages (years)					
≤40	94	36.43	164	63.57	P<0.00001
>40	77	55.80	61	44.20	
Education					
Schooled	109	42.41	148	57.59	0,674
Unschooled	62	44.60	77	55.40	
Housing standards					
High and medium	62	34.83	116	65.17	0.002
Low	109	50.00	109	50.00	
Fuel for cooking					
Wood	03	21.43	11	78.57	
Charcoal	167	46.01	196	53.99	0.001
Household gas	01	05.26	18	94.74	
Monthly income (FCFA)					
≤ 40000	44	28.95	108	71.05	P<0.00001
> 40000	127	52.05	117	47.95	
Professional seniority (years)					
≤10	65	34.03	126	65.97	P<0.00001
>10	106	51.71	99	48.29	
Status in the profession					
Goods owner	150	43.48	195	56.52	0.150
Shop assistant	21	41.18	30	58.82	
Number of selling days per week					
≤5	20	27.40	53	72.60	0.003
>5	151	46.75	172	53.25	
Number of selling hours per day					
≤9	30	20.41	117	79.59	P<0.00001
>9	141	56.63	108	43.37	
Sold articles					
Food products	119	44.07	151	55.93	
Clothing products	41	53.25	36	46.75	0.001
Divers	11	22.45	38	77.55	

were low-standing housing (ORa 1.92; 95%CI: 1.18-3.13), monthly income above SMIG (ORa 2.48; 95%CI: 1.51-4.06) and daily selling time above 9 h (ORa 3.66; 95%CI: 2.15-6.22). Three OAP knowledge level items were found to be protective factors. These are the recognition of at least 3 sources of OAP (ORa 0.43; 95%CI: 0.26-0.72), the recognition of reality of OAP (ORa 0.25; 95%CI: 0.07-0.85) and the recognition by saleswomen of their higher exposure (ORa 0.06; 95%CI: 0.013-0.31). All other factors were not significant (Table 4).

DISCUSSION

As far as is known, this study was the first in Benin to estimate the prevalence and associated factors of CRD of chronic bronchitis and asthma-type in saleswomen in the vicinity of roads. It helped establish the profile of CRDs among these professionals. It is a prerequisite for

Table 3. Association between the level of understanding on air pollution and chronic respiratory disorders among the respondents.

Variable	CRD				
	Yes (n = 171)		No (n = 225)		
	n	%	n	%	P
Knowledge of OAP sources					
Recognition of no source					
Yes	00	00.00	05	100.00	0.058
No	171	43.73	220	56.27	
Recognition of 1 source					
Yes	171	43.73	220	56.27	0.058
No	00	00.00	05	100.00	
Recognition of 2 sources					
Yes	165	43.88	211	56.12	0.222
No	06	30.00	14	70.00	
Recognition of 3 sources					
Yes	39	25.00	117	75.00	p<0.00001
No	132	55.00	108	45.00	
Recognition of 4 sources					
Yes	11	13.10	73	86.90	p<0,00001
No	160	51.28	152	48.72	
Recognition of 5 sources					
Yes	02	03.39	57	96.61	p<0.00001
No	169	50.15	168	49.85	
Recognition of 6 sources					
Yes	01	02.50	39	97.50	p<0.00001
No	170	99.42	186	82.67	
Understanding on OAP aspects					
Reality of OAP					
Yes	170	44.16	215	55.84	0.027
No	01	09.09	10	90.91	
Air quality in Cotonou					
Bad	169	44.13	214	55.87	0.040
Good	02	15.38	11	84.62	
Higher exposure of saleswomen compare with other professionals					
Yes	170	45.21	206	54.79	P<0.00001
Non	01	05.00	19	95.00	
Recognition of OAP gravity (Health impact)					
Global health					
Yes	142	40.57	208	59.43	0.004
Non	29	63.04	17	36.96	
Personal health status					
Yes	170	45.09	207	54.91	0.001
Non	01	05.26	18	94.74	
Respiratory diseases					
Yes	156	45.88	184	54.12	0.008
No	15	26.79	41	73.21	

Table 4. Multivariate analysis for associated factors to chronic respiratory disorders.

Variable	OR	IC at 95 (%)	P
Age (years)	1.47	0.88 - 2.47	0.141
House standard	1.92	1.18 - 3.13	0.009
Fuel use for cooking	1.003	0.47 - 2.13	0.992
Monthly income (euros)	2.48	1.51 - 4.06	P<0.0001
Professional seniority (years)	1.38	0.83 - 2.28	0.217
Number of selling days per hours	1.23	0.64 - 2.36	0.539
Number of selling hours per weeks	3.66	2.15 - 6.22	P<0.0001
Sold articles	0.90	0.63 - 1.30	0.583
Recognition of at least 3 sources of OAP	0.43	0.26 - 0.72	0.001
Recognition of OAP reality	0.25	0.07 - 0.85	0.026
Sensibility to OAP	0.89	0.63 - 1.27	0.531
Recognition of a higher exposure on road axes	0.06	0.013 - 0.31	0.001
Recognition of OAP impact on respiratory diseases	0.88	0.42 - 1.83	0.726

longitudinal studies to better document the factors associated with CRD related to this type of exposure among female vendors. The realization of spirometry to the respondents would have allowed us to confront the CRD with a systematic screening of chronic obstructive pulmonary disease (COPD).

Chronic respiratory disorders prevalence

The prevalence of CRD in the study was 43.18% for chronic bronchitis (35.18%) and asthma (8.33%).

Prevalence of each CRD has been reported in Benin among other targets. A lower prevalence of chronic bronchitis of 10% was found in 2010 among women working at an artisanal fish smoking site (Agodokpessi et al., 2011). This study was led on a smaller sample size. In 2016, another study in Benin found a higher prevalence of asthma-type CRD of 14.6% among school children (Wachinou et al., 2020). Other studies have reported overall prevalence of the two CRDs. An overall prevalence of CRD of 40%, slightly lower than what was found in this work, was reported in Egypt among identical targets (Serya et al., 2019). However, a higher overall CRD prevalence of 57.9% was observed among taxi drivers in Senegal (Sylla et al., 2018). The variability of the targets and sample sizes of these different studies could explain the observed differences in the prevalence found in the literacy, in comparison to the findings of this study. Besides, this work also suspected that 0.76% of respondents had an association between the two CRD (chronic bronchitis and asthma). The presence of this overlapping disorder is consistent with the literature (Tabka et al., 2017). However, this clinical suspicion requires confirmation on the basis of standardized diagnostic criteria. This prevalence is lower than the 2.4% found in Tunisia in 2017 (Tabka et al., 2017). Further research is needed for a better characterization of subjects with this overlap. In this context, the authors suggest that a standardized definition of this syndrome should be based on markers associated with the individual therapeutic response of patients (Tabka et al., 2017).

Associated factors with chronic respiratory disorders prevalence

The study found an association between the low-standard housing and CRD occurrence. This association could suggest that the level of indoor air pollution in this type of dwelling would represent an overage factor in favor for CRD in some respondents. Commonly, this housing profile refers to the low socio-economic level widely recognized as risk factors for respiratory diseases by several authors (Makri and Stilianakis, 2008; Pascal, 2009; Peled, 2011). A strong association between daily selling time (9 h and more) and CRD has also been found. The results are consistent with the findings of other studies in India and Egypt (De et al., 2019; Serya et al., 2019). Indeed, over 80% of participants with CRD worked more than 9 h per day. This is comparable what is found in other studies (Amegah and Jaakkola, 2014; Noomnual and Shendell, 2017) but deviate from the requirements of the Labor Code in Benin (Affodjou et al., 2019). Prolonged and repetitive exposure of saleswomen to high concentrations of such pollutants at the study site (Mama et al., 2013) would promote the development of CRD. These results could suggest that the intensity of the respiratory effect would depend on the time or dose of exposure. However, the dose-response relationship is not established in the available literature (Pascal, 2009; Peled, 2011). A longitudinal study would better document this situation. This study also found an association between monthly income above SMIG and CRD. More than 4 out of 5 participants in this study with CRD and

this income level worked more than 9 h per day. This association seems to be consistent and would therefore be a consequence of the extension of working time and therefore of exposure in the respondents. The association between age and CRD, although significant in univariate analysis, no longer existed in logistic regression analysis. However, it is observed that high age is associated with an increased risk of respiratory problems in exposed individuals (Makri and Stilianakis, 2008; Pascal, 2009; Peled, 2011). In this work, 3 items of the OAP knowledge level appear to have a protective effect. This involves the recognition of at least 3 sources of pollution, the recognition of the reality of the OAP and the recognition by saleswomen of their higher exposure. Indeed, the recognition by respondents of several sources of pollution and their higher level of exposure seems like a primary factor that can induce key favorable behaviors in the prevention of risk related to exposure to OAP by saleswomen. This is consistent with the results of studies in China (Li et al., 2016) and Lebanon (Khazen et al., 2019). This critical observation suggests that early awareness of the sources and consequences of OAP among female sellers could be an effective prevention approach with a beneficial impact on health among saleswomen. Such awareness should take into account the risk factors identified in order to draw sellers attention on the benefit of reducing the number of selling hours per day as well as the number of selling days per week by diversifying income sources if possible.

Conclusion

A prevalence of 43.18% CRD among saleswomen has been noted. The associated factors were essentially the low-standing housing (recalling the low socio-economic level), monthly income above the SMIG and daily selling time above 9 h. The recognition of at least 3 sources of pollution, the recognition of the reality of the OAP, the recognition by saleswomen of their higher exposure is on the other hand a protective factor. It is important to raise the awareness of the two groups of factors (risk factors and protective factors) highlighted as well as targeted OAP mitigation efforts for these workers in resource-limited countries. These results will also serve as a basis for longitudinal studies to refine the primary prevention axes of CRD.

Limitations of the study

There are some limitations to this study. First, the study was conducted among women working in an area where traffic-related air pollution is high; however, chronic respiratory disorders cannot be attributed solely to outdoor air pollution because of other confounding factors coming into play such as exposure to indoor air pollution which was not estimated among saleswomen. Second, the somewhat small size of the sample may limit the detection of an OR from a logistic regression. Thirdly, due to the absence of an official list of saleswomen working near the main roads of the market due to the informal nature of the activity which allows free entry of saleswomen into the profession, we were unable to have a baseline list and were led to make a selection of participants for convenience. This type of choice limits the scope of the study results somewhat. However, choosing one of two salespeople who meet the criteria helped to reduce this weakness.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interest.

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REFERENCES

Affodjou D, Friedrich-Ebert-Stiftung B (2019). Le droit béninois du travail : Guide pratique à l'usage des : - chefs d'entreprise - responsables des ressources humaines - salariés, syndicats et délégués du personnel - enseignants et étudiants. http://library.fes.de/pdf-files/bueros/benin/15653.pdf

Agodokpessi G, Ade G, Ade S, Adjobimey M, Okoumassou C-X, Gninafon M (2011). Broncho- pneumopathie chronique obstructive non tabagique en milieu tropical à Cotonou. Revue de Pneumologie Tropicale 16:18-20.

Aït-Khaled N, Enarson D, Bousquet J (2001). Chronic respiratory diseases in developing countries: The burden and strategies for prevention and management. Bulletin of the World Health Organization 79:97-1979. https://doi.org/10.1590/S0042-96862001001000011

Amegah AK, Jaakkola JJK (2014). Work as a street vendor, associated traffic-related air pollution exposures and risk of adverse pregnancy outcomes in Accra, Ghana. International Journal of Hygiene and Environmental Health 217(23):354-362. https://doi.org/10.1016/j.ijheh.2013.07.010

Chen TM, Gokhale J, Shofer S, Kuschner WG (2007). Outdoor air pollution: Nitrogen dioxide, sulfur dioxide, and carbon monoxide health effects. The American Journal of the Medical Sciences 333(4): 249-256. https://doi.org/10.1097/MAJ.0b013e31803b900f

De S, Kushwah GDS, Dharwey D, Shanmugasundaram D (2019). Respiratory Morbidity of Roadside Shopkeepers Exposed to Traffic-related Air Pollution in Bhopal, India. Journal of Health and Pollution 9(21):1-6. https://doi.org/10.5696/2156-9614-9.21.190305

Ekpenyong CE, Ettebong EO, Akpan EE, Samson TK, Daniel NE (2012). Urban city transportation mode and respiratory health effect of air pollution: A cross-sectional study among transit and non-transit workers in Nigeria. BMJ Open 2(5):1-13. https://doi.org/10.1136/bmjopen-2012-001253

Fourn L, Fayomi EB (2006). Pollution atmosphérique en milieu urbain à Cotonou et à Lokossa, Bénin. Pollution atmosphérique en milieu urbain à Cotonou et à Lokossa, Bénin. Bulletin de la Société de Pathologie Exotique 99(4):264 268.

Fuhrman C, Roche N, Vergnenegre A, Chouaid C, Zureik M, Delmas MC (2008). Bronchite chronique : prévalence et impact sur la vie quotidienne. Analyse des données de l'enquête santé Insee 2002-2003. Institut de Veille Sanitaire. Consulté 14 novembre 2020, à

l'adresse/maladies-et-traumatismes/maladies-et-infections-respiratoires/bpco-et-insuffisance-respiratoire-chronique/bronchite-chronique-prevalence-et-impact-sur-la-vie-quotidienne.-analyse-des-donnees-de-l-enquete-sante-insee-2002-2003.

Gbaya AA, Garand C (2010). Les maladies respiratoires. Québec, Service de surveillance, recherche et évaluation, Direction de Santé Publique et d'Evaluation.

Guéguen F, Stille P, Lahd Geagea M, Perrone T, Chabaux F (2012). Atmospheric pollution in an urban environment by tree bark biomonitoring – Part II: Sr, Nd and Pb isotopic tracing. Chemosphere 86(6):641 647. https://doi.org/10.1016/j.chemosphere.2011.11.008

Choudhary H, Tarlo SM (2014). Airway effects of traffic-related air pollution on outdoor workers. Current Opinion in Allergy and Clinical Immunology 14(2):106-112. https://doi.org/10.1097/aci.0000000000000038

Serya H, El Hadidi S, El Bestar S (2019). Respiratory health effects among female street food vendors in mansoura city, egypt. Egyptian Journal of Occupational Medicine 43:17-32. https://doi.org/10.21608/ejom.2019.25104

Host S (2013). Exposition à la pollution atmosphérique liée au trafic routier et risques sanitaires. VertigO - la revue électronique en sciences de l'environnement, Hors-série 15, Article Hors-série 15. https://doi.org/10.4000/vertigo.12816

Houngbegnon P, Ayivi-Vinz G, Lawin H, Houessionon K, Tanimomon F, Kêdoté M, Fayomi B, Dossou-gbété S, Agueh V (2019). Exposure to PM2.5 Related to Road Traffic: Comparison between Crossroads and Outside of Crossroads at Cotonou, Benin. Open Journal of Air Pollution 8:108-117. https://doi :10.4236/ojap.2019.84006)

Hsieh FY, Bloch DA, Larsen MD (1998). A simple method of sample size calculation for linear and logistic regression. Statistics in Medicine 17(14):1623-1634. https://doi.org/10.1002/(SICI)1097-0258(19980730)17:14<1623::AID-SIM871>3.0.CO;2-S

Khaze MA, Adjizian-Gerard J, Flanquart H (2019). La perception de la pollution de l'air à Beyrouth. Territoire en mouvement Revue de géographie et aménagement. Territory in movement Journal of Geography and Planning 41 p. https://doi.org/10.4000/tem.5279

Lawin H, Agodokpessi G, Ayelo P, Kagima J, Sonoukon R, Mbatchou Ngahane BH, Awopeju O, Vollmer WM, Nemery B, Burney P, Fayomi B (2016). A cross-sectional study with an improved methodology to assess occupational air pollution exposure and respiratory health in motorcycle taxi driving. The Science of the Total Environment 550:1 5. https://doi.org/10.1016/j.scitotenv.2016.01.068

Li Z, Folmer H, Xue J (2016). Perception of Air Pollution in the Jinchuan Mining Area, China: A Structural Equation Modeling Approach. International Journal of Environmental Research and Public Health 13(7). https://doi.org/10.3390/ijerph13070735

Makri A, Stilianakis NI (2008). Vulnerability to air pollution health effects. International Journal of Hygiene and Environmental Health 211(3 4):326 336. https://doi.org/10.1016/j.ijheh.2007.06.005

Mama D, Dimon B, Aina M, Adounkpe J, Ahomadegbe M, Youssao A, Kouazounde J, Kouanda SP, Moudachirou M (2013). Transport urbain au Benin et pollution atmosphérique : Évaluation quantitative de certains polluants chimiques de Cotonou. International Journal of Biological and Chemical Sciences 7(1):377-386, 386. https://doi.org/10.4314/ijbcs.v7i1.33

Noomnual S, Shendell DG (2017). Young Adult Street Vendors and Adverse Respiratory Health Outcomes in Bangkok, Thailand. Safety and Health at Work 8(4):407, 409. https://doi.org/10.1016/j.shaw.2017.02.002

Obaseki DO, Adeniyi B, Jumbo J, Oyewo A, Irabor I, Erhabor GE (2014). Respiratory symptom, lung function and exhaled carbon monoxide among a sample of traffic workers in Lagos, Nigeria: A pilot survey. Nigerian Medical Journal 55(4):306. https://doi.org/10.4103/0300-1652.137190

Offshore Developpement (2015). Le revenu minimum au Bénin. https://www.offshore-developpement.com/le-revenu-minimum-au-b%C3%A9nin

Pascal L (2009). Effets à court terme de la pollution atmosphérique sur la mortalité. Revue Française d'Allergologie 49(6):466-476. https://doi.org/10.1016/j.reval.2009.08.005

Peled R (2011). Air pollution exposure: Who is at high risk? Atmospheric Environment, 45(10):1781-1785. https://doi.org/10.1016/j.atmosenv.2011.01.001

Reddel HK, Bateman ED, Becker A, Boulet L-P, Cruz AA, Drazen JM, Haahtela T, Hurd SS, Inoue H, de Jongste JC, Lemanske RF, Levy ML, O'Byrne PM, Paggiaro P, Pedersen SE, Pizzichini E, Soto-Quiroz M, Szefler SJ, Wong GWK, FitzGerald JM (2015). A summary of the new GINA strategy: A roadmap to asthma control. The European Respiratory Journal, 46(3):622-639. https://doi.org/10.1183/13993003.00853-2015

Shephard RD (1971). La Pollution de l'Air et la Bronchite chronique. Canadian Family Physician 17(11):137 142.

Sylla FK, Faye A, Diaw M, Fall M, Tal-Dia A (2018). Traffic Air Pollution and Respiratory Health: A Cross-Sectional Study among Bus Drivers in Dakar (Senegal). Open Journal of Epidemiology 8(1):113. https://doi.org/10.4236/ojepi.2018.81001

Tabka Z, Denguezli M, Aouichaoui C, Abbassi A, Daldoul H, Burney P (2017). Prévalence du syndrome de chevauchement BPCO/asthme en Tunisie. Revue Française d'Allergologie 57(3):271-272. https://doi.org/10.1016/j.reval.2017.02.173

Wachinou A, Agodokpessi G, Ade S, Kintossou E, Imorou N, Sagbo G (2020). Prévalence de l'asthme et facteurs associés chez les adolescents âgés de 13 à 14 ans en milieu scolaire dans deux villes du Bénin. Revue des Maladies Respiratoires Actualités 12:178. https://doi.org/10.1016/j.rmra.2019.11.399

Wang Y-C, Lin J-M, Li C-Y, Lee L-T, Guo Y-L, Sung F-C (2007). Prevalence and Risks of Chronic Airway Obstruction: A Population Cohort Study in Taiwan. CHEST 131(3):705-710. https://doi.org/10.1378/chest.06-1829

World Health Organization (WHO) (2014). Ambient (Outdoor) Air Quality and Health. Geneva, WHO.

World Health Organization (WHO) (2007). Global surveillance, prevention and control of chronic respiratory diseases: A comprehensive approach. Geneva, WHO.