

ORIGINAL ARTICLES

Respiratory symptoms and some related factors in waste collection workers at 2 branches in Hanoi, 2017

Vu Thai Son^{1*}, Tran Thi Thu Thuy¹, Nguyen Thuy Quynh¹

ABSTRACT

Objectives: Describe the current situation of respiratory symptoms in waste collection workers at 2 branches in Hanoi and some related factors, 2017

Methods: The cross-sectional study was implemented in the first 6 months of 2017. The study was performed on 796 waste collection workers at 2 branches of Hanoi Urban Environment Company Limited. The study used the American Thoracic Society and the Division of Lung Disease-1978 adult (ATS - DLD - 78a) questionnaire to collect and assess workers' respiratory symptoms.

Results: Common respiratory symptoms in waste collection workers were: Cough (27.8%), phlegm (18.3%) and wheezing (15.2%). 10.8% of workers have at least one chronic respiratory symptom; 4.6% and 5.4% of workers had wheezing both day and night and wheezing to the point of difficulty breathing. The proportion of reporting respiratory symptoms in workers over 45 years old was 1.93 times that of workers younger than 45 years.

Conclusions: Workers exposed to occupational hazards had a higher prevalence proportion of chronic respiratory symptoms than those who were not exposed. However, a significant association between exposure to occupational harmful factor and chronic respiratory symptoms has not been established.

Keywords: respiratory symptoms, worker, waste collection.

INTRODUCTION

In the period 2011-2015, along with the process of urbanization, the amount of domestic waste generated in Hanoi is 5,515 tons per day and predict up to 7,000-8,000 tons per day in 2019 (1). Waste collection workers (WCW) are those who directly perform the collection and treatment of domestic waste, industrial waste and other types of waste under any conditions. Almost the waste collection process in developed countries has been mechanized, but in developing countries, including Vietnam,

it is still done manually with rudimentary equipment (shovels, brooms, trolleys, etc.) (2). Manually and non-mechanized work makes workers directly exposed to hazardous substances, such as: hot, cold, dust, toxic chemicals, toxic fumes, etc.) (3-5). Frequent exposure to adverse factors makes workers more susceptible to respiratory diseases. In addition, the equipment of personal protective equipment is still limited; Workers are not equipped with specialized masks and only use ordinary cloth masks. This increases the workers' exposure to dust, infectious



* Corresponding author: Vu Thai Son

Email: vts@huph.edu.vn

¹ Hanoi University of Public Health

Submitted: 23 February, 2021

Revised version received: 25 June, 2021

Published: 15 July, 2021

microorganisms and toxic chemicals in the working environment; increases the risk of disease.

Workers working in environmental sanitation have a higher incidence of respiratory diseases than other industry groups (6). Common respiratory diseases in WCW include: chronic obstructive bronchitis, allergic bronchopneumonia, and some cases of limited lung diseases (7). In Jaithli H's research at Calcutta (8), the incidence of respiratory diseases among waste collection workers was 71%, while the comparison group was only 34%. 25% WCW suffer from respiratory diseases in the study by Hala Samir Abou-AlWafa in Spain, which is much higher than the service workers group (12.2%) (9). Respiratory symptoms are also one of the most common symptoms in WCW, ranging from 11.7% to 31.7% (10-12). Common symptoms are cough, sputum, shortness of breath, etc. Research by Halim Issever and associates in Turkey, in 2011, found that 14.2% of workers had a prolonged cough, 11.7% of workers felt shortness of breath (10). The study in India, of similar results, found that 31.7% WCW found shortness of breath (11). Another study by Thayyil Jayakrishnan found that 21% of workers had respiratory symptoms (12). The incidence of respiratory symptoms in WCW is also higher than that of workers working in other fields. Research on street garbage workers in Nigeria and Bangkok, Thailand shows a marked decline in all lung function values (13,14). The evaluation of respiratory symptoms helps to detect respiratory diseases early in WCW, thereby taking appropriate interventions to limit the health consequences for workers. However, due to the work characteristics of WCW, clinical evaluation of respiratory symptoms or respiratory function exploration is not

always easy and convenient. In order to improve the effectiveness of the diagnosis of respiratory diseases and the identification of clinical symptoms, the study applied the ATS questionnaire of the American Thoracic Society to perform a review of respiratory symptoms in WCW. At the same time, there are very few studies in Vietnam on the situation of respiratory symptoms and related factors in WCW. In order to propose interventions to contribute to the protection and improvement of WCW's health, the research is implemented with the aim of: 1) Describing the situation of respiratory symptoms in WCW of Hanoi and 2) Identifying a number of factors associated with respiratory symptoms in WCW.

SUBJECTS AND METHODS

Study design

Analytical cross-section research

Location and time of study

Location: 02 branches of Hanoi Urban Environment Company (Ba Dinh, Hai Ba Trung)

Study period: Data on respiratory symptom characteristics collected from January to June 2017.

Subjects of study

Urban environmental workers with labor contracts, directly doing waste collection work; work at least 1 year before the time of the study.

Sample size, choose a template

Sample size is calculated according to a formula that estimates a ratio:

$$n = Z_{(1-\alpha/2)}^2 \frac{p(1-p)}{d^2}$$

n: minimum sample size collected at 1 branch

$Z_{(1-\alpha/2)}$: Reliability, 2-way inspection at the meaningful level $\alpha=0.05$; $Z_{1-\alpha/2} = 1.96$.

p: Percentage of waste collection workers with health problems related to working conditions. Estimated take $p = 0.5$

d: Desired accuracy ($d= 0.05$)

Instead, the calculation formula is $n = 385$. It is estimated that about 5% of the voting subjects/ votes are invalid, the sample size to be collected at a branch is 398. So the total size of the study samples for 2 branches is 796 workers.

Sample selection method: select all workers directly working in waste collection work to meet the selection criteria at 02 branches of Hanoi Urban Environment One Member Limited Liability Company.

Data collection method

Data collection tool: The study used the American Thoracic Society and the Division of Lung Disease-1978 adult questionnaire to interview workers about respiratory symptoms. The ATS – DLD – 78a tool set is standardized and emphasizes a clinical history in the evaluation of respiratory symptoms. The questionnaire consists of sections evaluating respiratory symptoms: cough, chronic cough, sputum, chronic sputum, frequent wheezing, chronic wheezing, shortness of breath when running fast or walking uphill slightly and having to walk slower than those of the same age because of shortness of breath or having to stop to breathe. Questions related to colds and diseases of the same chest (feeling chest pain and / or shortness of breath) and chest pain caused by cold (feelings of chest pain

and / or occasional shortness of breath when cold), Questions consisting of only 2 answers are yes and no; assessment period within 3 months, 1 year before the interview time.

Study variables: The variables of the study consist of 2 parts: 1) General information of WCW - independent variables and 2) Information about the appearance of acute and chronic respiratory symptoms - dependent variables. General information of workers includes the contents of age, sex, education level, marital status, number of existing children and seniority in the profession. Acute respiratory symptoms: cough (cough symptoms appear within 1 year prior to the interview), sputum (sputum appears within 1 year prior to the interview), wheezing (there is a when breathing within 1 year before the interview), shortness of breath (appears when walking fast or walking on a low slope, when walking at a normal speed), severe shortness of breath (insular self-dressing, walking), there are colds and chest diseases (a cold affects the chest area, an injury affects the chest area). Chronic respiratory conditions include: chronic cough (coughing 3 months in a row within 1 year prior to the interview), chronic sputum (with sputum appearing for 3 consecutive months within 1 year before the interview), breathing chronic wheezing (there is a squeak when breathing for 3 consecutive months within 1 year before the interview), chronic pulmonary obstruction (signs of pulmonary obstruction appear for 3 consecutive months within 1 year before the interview) (3).

Data analysis: The test sheets are cleaned before being entered using Epi Data 3.1 software and processed with SPSS 22 software. Descriptive statistical analyses are used to describe the actual state of respiratory symptoms. Analytical statistics were used

to evaluate the association between chronic respiratory symptoms and related factors. The degree of association is accredited through Chi-squared test, odds ratio and CI95%. Accordingly, the study sample was divided into 2 groups: The group had at least 1 symptomatic of chronic respiratory disease and the group did not have symptoms of chronic respiratory disease.

Study ethics

The study complies with the regulations on research ethics and was passed by the Ethics Council of the University of Public Health under Decision No. 002/2017/YTCC-HD3 of January 16, 2017.

RESULTS

Table 1. General information about the subject of study

Characteristics	Group	Number (N=796)	Proportion (%)
Ages	< 30	57	7.2
	30 - 39	416	52.3
	40 – 49	279	35.0
	≥ 50	44	5.5
Sex	Male	123	15.5
	Female	673	84.5
Education	Elementary	3	0.5
	Secondary school	181	22.7
	High school	587	73.7
	Higher education	25	3.1
Marital status	Unmarried	13	1.6
	Living with a spouse	731	91.8
	Divorce/Separation/Widow	52	6.6
Number of existing children	No children yet	27	3.4
	Childless under 5 years old	427	53.6
	Have 1-2 children under 5 years old	323	40.6
	Have > 2 children under 5 years old	19	2.4
Seniority in the profession	≤ 10 years	464	58.3
	> 10 years	332	41.7

Out of 796 subjects, 52.3% of the workers were aged 30-39 years old. 35% of workers were aged 40-49, 7.2% were under the age of 30 and only 5.5% were over 50 years of age. 84.5%

of the employees were female; male workers accounted for only 15.5%. Only 3.1% of the workers who participated in the study had a higher education; the majority of workers

completed high school (73.7%). 91.8% of workers now live with their spouses and 1.6% of workers who participated in the study were unmarried. Workers without children under 5 years old accounted 53.6%; only 1.8%

of the study participants had more than 2 children under 5 years of age. Seniority in the profession: 41.7% of employees have more than 10 years of working seniority.

Table 2. Respiratory symptoms of subjects studied for 1 year according to ATS

Symptoms	Characteristics	Number (N=796)	Proportion (%)
Cough	Total cases of cough	221	27.8
	Cough more than 4 days/week	78	9.8
	When wake up, early in the morning	91	11.4
	At night	144	18.1
Phlegm	Total cases of phlegm	146	18.3
	Phlegm more than 4 days/week	70	8.8
	When wake up, early in the morning	92	11.6
	At night	56	7.0
Wheezing	Total cases of wheezing	121	15.2
	Cold	63	7.9
	When you don't have a cold	14	1.8
	Day and night	37	4.6
	Wheezing to the point of difficulty breathing	43	5.4
Shortness of breath	When walking fast on a plane or walking up a low slope	67	8.4
	When walking at a speed that suits you	52	6.5
	Can't go out on your own, get dressed	11	1.4
Colds and chest diseases	Does a cold affect the chest area	68	8.5
	Injuries affecting the chest area	12	1.5

The results showed that 9.8% of workers had symptoms of coughing more than 4 days a week and 18.1% of workers had a cough at night. With sputum symptoms, 8.8% of workers have more sputum symptoms than 4 days/week and 7% show symptoms of sputum at night. 15.2% of

workers had wheezing symptoms; 11.1% of workers wheezed when they caught a cold. 1.4% of the study participants had difficulty breathing to the point of not being able to go out on their own and 8.5% of participants had a cold that affected the chest area.

Table 3. The percentage of workers with chronic respiratory symptom

Chronic respiratory symptoms	Number (N=796)	Proportion (%)
There's no sign.	710	89,2
Have at least 1 symptom of chronic respiratory disease	86	10,8
Have 1 chronic respiratory symptom	56	7,0
There are 2 chronic respiratory symptoms	23	2,9
There ≥ 3 chronic respiratory symptoms	7	0,9

Table 3 shows that there are 86 employees with at least 01 sign of chronic respiratory disease (accounting for 10.8%). 7% of workers have 1 symptom of chronic respiratory disease, 2.9% have 2 symptoms of chronic respiratory disease and 0.9% have 3 or more symptoms.

Table 4. Some chronic respiratory symptoms in WCW

Chronic respiratory symptoms	Number (N=796)	Proportion (%)
Chronic cough (minimum 3 months in the past 1 year)	17	2,1
Chronic phlegm (continuously lasting more than 3 months for the past 1 year)	13	1,6
Chronic wheezing	37	4,6
Wheezing to the point of difficulty breathing	43	5,4

4.6% of workers often wheezed day and night and 5.4% had ever wheezed to the point of shortness of breath. The percentage of workers showing signs of persistent cough lasting more than 3 months is 2.1% and 1.6% of sputum workers last more than 3 months in the past 1 year.

Table 5. Relationship between personal characteristics and at least one chronic respiratory disease symptom of WCW

Characteristics	Group	Have at least 1 symptom of chronic respiratory disease		
		Have symptom	Non-symptom	OR (CI 95%)
Ages	> 45 years old	17.9	82.1	1.9 (1.1 – 3.8)
	≤ 45 years old	10.2	89.8	
Sex	Male	9.8	90.2	0.9 (0.5 – 1.7)
	Female	11.0	89.0	

Education	From secondary school or below	6.5	93.5	0.5 (0.3 – 1.0)
	High school or higher	12.1	87.9	
Marital status	Living with a spouse	10.7	89.3	0.9 (0.4 – 1.9)
	Live alone	12.3	87.7	
Children under 5 years old	Child < 5 years old	9.6	90.4	0.8 (0.5 – 1.3)
	Childless < 5 years old	11.7	88.3	
Seniority in the profession	> 10 years	10.5	89.5	0.9 (0.6 – 1.5)
	≤ 10 years	11.0	89	

Table 5 results show that workers over the age of 45 have an incidence of at least 1 symptom of chronic respiratory illness (17.9%) higher than the under 45 years old (10.2%); the difference is statistically significant (OR = 1.93 CI95% (1.09 – 3.77)). Workers with an education of secondary school or lower have a symptomatic proportion

of chronic respiratory illness (6.5%) lower than the group with high school education or higher education (12.1%). There are no statistically significant differences in symptoms of chronic respiratory disease between gender groups, marital status, number of children under 5 years of age and seniority.

Table 6. Relationship between health factors and at least one chronic respiratory symptom according to ATS of waste collection workers

Characteristics	Group	Have at least one chronic respiratory symptom		
		Have symptom	Non-symptom	OR (CI 95%)
Exposure to heat	Exposure	10.8	89.2	1.2 (0.2 – 9.6)
	Non-exposure	9.1	90.9	
Exposure to cold	Exposure	11.0	89	0.9 (0.8 – 0.9)
	Non-exposure	12.5	87.5	
Exposure to dampness	Exposure	10.9	89.1	1.1 (0.4 – 3.2)
	Non-exposure	9.5	90.5	
Smog exposure	Exposure	13.3	86.7	0.8 (0.2 – 3.5)
	Non-exposure	9.1	90.9	
Chemical/toxic gas/stench exposure	Exposure	11.4	88.6	1.7 (0.8 – 3.5)
	Non-exposure	7.2	92.8	
Exposure to microorganisms	Exposure	11.4	88.6	0.9 (0.8 – 0.9)
	Non-exposure	10.8	89.2	

The results showed that workers exposed to hazardous had a higher incidence of chronic respiratory symptoms than workers who were not exposed to harmful factors: Cold exposure to 11% of exposed workers had symptoms while no workers in the contact group had symptoms. 10.9% of workers exposed to wetness had symptoms compared to 9.5% in the non-contact group. Exposure to smog: 13.3% of workers in the exposed group had chronic respiratory symptoms compared to 9.1% in the non-contact group. At least 1 symptom of chronic respiratory disease was recorded in 11.4% of workers exposed to chemicals; in the non-contact group only 7.2%. And 11.4% of subjects were in the group exposed to symptomatic microorganisms; while no workers in the contact group showed symptoms. However, a statistically significant link between hazardous and chronic respiratory symptoms has not been identified.

DISCUSSION

Of the 796 subjects involved in the study, 30-49 year old accounted for 87.3% and the majority of workers were female (87.6%) and have high school education (73.7%). This result of the study is consistent with research by Nguyen Van Bang et al (2007) in Hai Ba Trung district on the same subject. The number of employees working for more than 10 years accounted for 41.7%; 57% of workers do not have children under 5 years of age. This proportion is higher than that of Nguyen Van Bang et al (2007), with 40% of workers having more than 10 years of seniority and 55.8% of workers having children under 5 years old (18).

Research shows that 7% of workers have strep throat and only 2% of workers have

bronchitis. This result is lower than the study results of Luigi Vimercati et al. In Italy, in 2016, with 17.4% of workers suffering from sore throats and 19% of workers with bronchitis (18). Cough symptoms in WCW accounted for 27.8%, higher than the study of Thayyil Jayakrishnan (India) (12), over 313 urban solid waste collectors accounted for 25%. However, this proportion is lower than the study of Nonhlanhla Tlotleng (South Africa) in 2019 (19), 46.8% of waste collection workers reported cough symptoms. When compared to other professions, the proportion of cough in WCW is higher than that of office workers (18.1% versus 7.1%); or when compared with those who sell vegetables (54.9% versus 12.9%) (18). The symptom of workers with sputum accounted for 18.3%, this proportion was lower than the result of Prisca S, 39.2% of workers collecting waste showed symptoms of sputum (18). 8.4% of participants in the study had symptoms of dyspnea, this result was lower than the result of Halim Issever (2011), when up to 11.7% of workers reported symptoms difficulty breathing (10). According to Mariammal (2012) in India, the percentage of workers having difficulty breathing was high, 31.7%; the risk of developing dyspnea symptoms among workers in urban environments was also 2.1 times higher than that of construction workers (11). Our study found that 15.2% of workers had wheezing, 7.9% wheezing with a cold, 4.6% wheezing during day and night and 5, 4% of workers wheezed to the point of difficulty breathing. This result is lower than the result of Prisca S (18), which studied on 102 waste collection workers, the proportion of workers wheezing accounted for 32.4% of subjects participating in the study. There are 8.5% of workers with a cold that affects the chest area. In our study, the proportion of WCW with continuous cough

that lasted for more than 3 months in 1 year and sputum continuously lasting more than 3 months in 1 year accounted for 2.1% and 1.6%. This result is lower than research in Turkey (14.2%) (14) and research in India (5.9%) (11). Respiratory symptoms on workers in high urban environments can be caused by workers working outdoors, directly affected by unfavorable climatic conditions, and frequently exposed to dust and toxic chemicals, pathogenic microorganisms.

Research has shown that there is a relationship between age and chronic respiratory symptoms in urban environmental workers. Workers over 45 years of age have a higher risk of developing at least one chronic respiratory symptom than those under 45 years old (OR = 1.93; 95% CI (1.09 - 3.77)). This result is similar to the study of author Zuskin E et al (1996) in Croatia, the group of elderly workers with a higher proportion of chronic respiratory symptoms compared to the young worker group ($p < 0.05$) (20). Workers exposed to harmful factors had a higher incidence of chronic respiratory symptoms than workers who were not exposed. 11% of workers exposed to the cold had respiratory symptoms while none of the workers had symptoms in the control group. Similarly, in the group exposed to humidity, dust, chemicals, and microorganisms, the proportion of workers with chronic respiratory symptoms was: 10.9%, 13.3%, 11, 4% and 11.4%. These proportions in the control group are 9.5%, 9.1%, 7.2% and 0%, respectively. A study in Spain, 1998, showed that too high or too low the heat factor increases the risk of respiratory symptoms, specifically: a 2-fold increased risk of shortness of breath (OR = 1.72; CI95% = 1.52 - 2.31) and increased risk of cough 3 times (OR = 2.93; 95% CI (2.24 - 3.33)) (14).

CONCLUSIONS

The study showed the actual characteristics of the workers' respiratory symptoms: Cough (27.8%); cough more than 4 days / week (9.8%); sputum (18.3%); sputum production more than 4 days / week (8.8%); wheezing (15.2%); difficulty breathing (8.4%), cold affects the chest area (8.5%). There are 10.8% of workers have at least 1 chronic respiratory symptom, specifically: Cough persists for more than 3 months / year (2.1%); Sputum continuously lasted for more than 3 months / year (1.6%); wheezing both day and night (4.6%); Wheezing to the point of difficulty breathing (5.4%).

Research has identified a number of factors influencing respiratory symptoms in WCW. Workers over 45 years old had a higher risk of developing respiratory symptoms than workers less than 45 years old (OR = 1.93; 95% CI (1.09 - 3.77)). Workers exposed to the harmful factors had a higher proportion of respiratory symptoms than the non-exposed group: cold exposure (11% versus 0%); smoke and dust (13.3% compared to 9.1%); chemicals (11.4% versus 7.2%) and with microorganisms (11.4% versus 0%). However, research has not determined an association between exposure to harmful factors and respiratory symptoms in WCW.

REFERENCES

1. Hong Khanh (2016). *Situation and solutions for domestic solid waste management in Hanoi*. Environmental Magazine No. 9/2016.
2. Doan Tuyet Nhung (1995). *Research on working conditions of female urban sanitation workers. Recommendations and solutions, 1995*
3. Emily P. Brigham, Lyn M. Steffen, Stephanie J. London, Danielle Boyce, Gregory B. Diette, Nadia N. Hansel, Jessica Rice, Meredith C. McCormack. (2018). *Diet Pattern and Respiratory Morbidity in the Atherosclerosis*

- Risk in Communities Study*. Annals of the American Thoracic Society 15:6, 675-682.
4. Yanhong Gong et al (2013). *Occupational Safety and Health Status of Sanitation Workers in Urban Areas: A Pilot Study from Wuhan, China*. International Journal of Occupational Safety and Ergonomics. 2013; 19 (3): 435-442.
5. Marco JMH et al (1998). *Pushing and pulling in relation to musculoskeletal disorders: a review of risk factors*. Ergonomics. 1998; 41(6): 757-781
6. Wouters IM, Hilhorst SK, Kleppe P, Doekes G, Douwes J, Peretz C, Heederik D (2002). *Upper airways inflammation and respiratory symptoms in domestic waste collectors*. Occup Environ Med. 2002 Feb; 59(2):106-12.
7. Matheson MC, Benke G, Raven J, SIM MR, Kromhout H, Vermeulen R, Johns DP, Walters EH, Abramson MJ (2005). *Biological dust exposure in the workplace is a risk factor for chronic obstructive pulmonary disease*. Thorax. 2005 Aug; 60(8):645-51.
8. Jaithli H. Health Problems (1996). *A Rapid Assessment Survey of the Health and Environmental Impacts of Solid Waste Recycling*. Calcutta: Centre for Study in Man and Environment, pg.36-42
9. Hala Samir Abou-ElWafa, Sohair Fouad El-Bestar, Abdel-Hady ElGilany, Ehab El-Sayed Awad El-Toraby (2011), *Respiratory disorders among municipal solid waste collectors in Mansoura, Egypt*.
10. Halim Issever (2011), *Respiratory functions of the people working in solid waste storage centres in Istanbul*, Nobel Medicine, 7(1), pg.29-36
11. T. Mariammal, A. Amutha Jaisheeba and R. Sornara (2012), *Work related respiratory symptoms and pulmonary function tests observed among construction and sanitary workers of Thoothukudi*, International Journal of PharmTech Research, 4(3), pg.1266-1273
12. Thayyil Jayakrishnan, Mathummal Cherumanalil Jeeja, Rao Bhaskar (2013), *Occupational health problems of municipal solid waste management workers in India*, Int J Env Health, 2(1), pg.42
13. Nku CO, Peters EJ, Eshiet AI, Oku O, Osim EE (2005), *Lung function, oxygen saturation and symptoms among street sweepers in Calabar-Nigeria*, Nigerian Journal of Physiological Sciences, 20(2), pg.79-84.
14. Somsiri Decharat (2017). *Prevalence of Adverse Health Effects among Municipal Solid Waste Workers, Southern Thailand*. Int J Occup Hyg. 9(4):186-191.
15. Sandra Cointreau (2006), *Occupational and Environmental Health Issues of Solid Waste Management. Special Emphasis on Middle-And Lower-Income Countries*. Urban papers, Washington D.C: World Bank Group, Urban Sector Board, accessed: 05/04/2016
16. Luigi Vimercati, Antonio Baldassarre, I, Maria Franca Gatti, Luigi De Maria, Antonio Caputi, Angelica A. Dirodi, Francesco Cuccaro, and Raffaello Maria Bellino (2016). *Respiratory Health in Waste Collection and Disposal Workers*. Int. J. Environ. Res. Public Health 2016, 13, 631; doi:10.3390/ijerph13070631.
17. Nguyen Van Bang et al (2017). *The symptomatic connection of chronic respiratory disease with some characteristics of urban environmental workers in Hai Ba Trung district, Hanoi*.
18. Prisca Stambuli (2012), *Occupational respiratory health systems and associated factors among street sweepers in Ilala municipality*, Master of Public Health Dissertation Muhimbili University of Health and Allied Sciences
19. Tlotleng N, Kootbodien T, Wilson K, Made F, Mathee A, Ntlebi V, Kgalamono S, Mokone M, Du Preez K, Naicker N (2019). *Prevalence of Respiratory Health Symptoms among Landfill Waste Recyclers in the City of Johannesburg, South Africa*. Int J Environ Res Public Health. 2019 Nov 4;16(21):4277. doi: 10.3390/ijerph16214277. PMID: 31689929; PMCID: PMC6862197.
20. Zuskin E, Mustajbegovic J, Schachter EN, Kern J, Pavicic D, Budak A (1996). *Airway function and respiratory symptoms in sanitation workers*. J Occup Environ Med 1996;38:522–527