

Studies of Health Effect among the Taman Wahyu II Building, Kuala Lumpur Residents at the Former Landfill

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Abstract: Former landfill at Taman Wahyu II, Malaysia produces various combinations of gases which can pose health problems among the residents. A study was conducted to determine the health effects among the residents who occupied the building at former landfill based on the symptoms of respiratory, skin, psycho neurological and cardiovascular disorders. Methods used were survey questionnaires and lung function tests using Peak Flow Meter among 61 exposed and 61 control respondents. Results showed that the majority of respondents answered 'no' for the disease's symptoms. Scores of symptoms and lung function tests among exposed and control respondents showed no significant difference between two locations although there were significant differences for the comfort level of staying at the residence. The normal level of the lung function test showed no significant differences between exposed and control respondents. This study also showed no correlation between age and health status of the respondents. Occupational factor with the symptoms of skin reddens, tiredness after working, difficulty to sleep, feeling dizzy, lack of appetite and PEF readings showed significant correlation with the range of values of $\chi^2 = 10.241$ to 20.668 , $p < 0.05$. Gender and poor appetite showed significant value and the value of $\chi^2 = 6.061$, $p < 0.05$. Staying at the resident factor showed that only symptoms of skin dryness and reading of Peak Flow Meter were significant with range value of $\chi^2 = 6.755$ to 9.921 , $p < 0.05$. Smoking factor with symptoms of shortness of breath, feeling dizzy, lack of appetite, chest pain and PEF reading were significant with range of value of $\chi^2 = 6.450$ to 31.468 , $p < 0.05$. In conclusion this study showed no difference in health status among the exposed and control respondents.

Key words: Landfill • Health Effect • Lung Function Test • Neurological Symptoms

INTRODUCTION

The increment in population growth has contributed to the accelerating volume of waste in landfills. When these landfills can no longer accept those wastes, they will be closed and redeveloped for public facilities such as parking areas and residential building. However, these landfills could produce various gases that can have deleterious effects on human health such as methane, hydrogen sulfide, carbon dioxide and carbon monoxide through microbial decomposition of waste. Consequently, all the gases can transfer from the soil surface to the house through cement's cracks, electricity circuit, and water flow system and directly from ambient air [1].

The most significant health effect of gases is on the human respiratory system because most of the gases will move up from the soil surface to pollute the surrounding

air which is inhaled by human. The common effect of landfill gases to the pulmonary system are bronchitis, chronic obstructive pulmonary disease (COPD) and asthma. In addition to these, other healths effects include dermatological, cardiovascular as well as the nervous system mainly behavioral have also been reported [2]. For example, the symptoms that will occur to a person who exposed to the landfill gas are headache, psychological problems and allergies [3]. Besides that, these gases can also cause blurred vision, muscle spasms, coma and suffocation [4]. In Malaysia, an example of former landfill that was closed and redeveloped for housing residents is PPR Taman Wahyu II Selayang, Selangor. This former landfill was closed and reclaimed more than 10 years ago. In 2004, this housing was formally occupied by residents of different races. There are three blocks in which each of them consists of 17 floors with

many amenities provided such as mosques, parking bays and waste disposal areas among others. Therefore, this study was conducted to determine the health effects due to exposure to landfill gases to the exposed residents.

MATERIALS AND METHODS

This study involved exposed respondents who were occupying the building at former landfill which is PPR Taman Wahyu II (N3.22074°E101.67005°) and respondents from PPR Taman Intan Baiduri (N3.23406°E101.65425°) as control. The chosen respondents were only from first and second floor because they are at higher risk to the released gases exposure as being nearer to the soil surface which was based on ATSDR [1], that landfill gases can move up to only about 250 feet. A total of 122 respondents including 61 exposed and 61 controlled respondents were involved in this study. The chosen respondents at the control building were also from first and second floor. The sample size was the same as the exposed respondents. Then, data collection was obtained using questionnaire method and lung function test using Peak Flow Meter and Pikonet. The questionnaire involved three sections of questions. Part A consisted of the socio-demography aspect while part B covered the environment surrounding of the respondents that will affect indoor air quality in their homes and lifestyle. The important part in this questionnaire was Part C which focused on the health symptoms that the respondents might get after occupying the building. This section involved four divisions of symptoms namely the respiratory, dermatology, psycho neurology and cardiovascular symptoms. Next, all the involved respondents were needed to take their lung function tests using Peak Flow Meter and Pikonet. The Peak Flow Meter could give the reading of Forced Expiratory Volume in One Second (FEV₁) and the Pikonet would give the reading of Forced Expiratory Volume in One Second (FEV₁) and Peak Expiratory Flow (PEF). These two readings would determine the lung volume of the respondents. Then, all the results were analyzed using statistical analysis which was Statistical Package for the Social Sciences (SPSS). The data based on the socio-demography aspect were employed using the chi square and Pearson correlation test. As far as the comparison between the exposed and control respondents were concerned, the independent t-test was used whereby the 0.05 level was considered to represent statistical significance. As for the lung function test, the results will be analyzed using their formal standard.

RESULTS

Socio-Demography of the Respondents: A total of 122 exposed and control respondents with signs and symptoms of health effects were analyzed. The descriptive data showed that 50.8% of the exposed respondents were below 25 years old and 49.2% were 25 years old and more while 44.3% of the control respondents were less than 25 years old and 55.7% were 25 years old and more. For the period of residence, the exposed and control respondents who stayed at their residence from 4 to 7 years were 49.2 and 62.3%, respectively.

The Environmental Condition and Lifestyle of Respondents: For the smoking habit, only 11.5% from exposed respondents and 4.9% from the control respondents were smokers. The comfort level at their residence showed that most of the exposed respondents answered uncomfortable stay at their residence compared to the control respondents. The reason behind this answer was mostly due to the bad odor surrounding their residence. The type of household products that mostly used was the furniture made from wood which accounted for 82% of the exposed respondents and 49.3% of the control respondents. On top of this, the usage of localized source such as printer and scanner in respondent's house consisted of 6.6% from the exposed respondents and 4.9% from the control respondents.

Signs and Symptoms of Disease among the Respondents: The four types of disease symptoms involved were the respiratory, dermatology, psycho neurology and cardiovascular system illness. Firstly, most of the respondents answered 'no' for the symptoms of respiratory system illness but the highest respiratory symptoms that exposed respondents (14.8%) answered 'yes' compared to control respondents (8.2%) was need to draw breath and stop when walking. Dermatological symptoms with highest 'yes' answer among the exposed respondents compared to control respondents were dry skin 18 and 8.2% respectively, and itchiness, 19.7% present among exposed respondents and 9.8% among control respondents. For the psycho neurological symptoms, the highest that exposed respondents (16.4%) said 'yes' compared to the control respondents (6.6%) was difficult to sleep. However, there were no big differences between symptoms of cardiovascular illness

Table 1: Lung function tests results

Lung function test	Score of lung function test (Mean \pm Std. Deviation)	
	Taman Wahyu II (Exposed respondents)	Taman Intan Baiduri (Control respondents)
Peak Flow Meter	264.92 \pm 107.914	258.20 \pm 90.985
PEF	200.51 \pm 97.710	181.84 \pm 70.665
FEV ₁	1.19 \pm 0.594	1.35 \pm 0.404

*PEF = Peak Expiratory Flow

*FEV₁ = Force Expiratory Volume in 1 second

between the exposed and control respondents. For the lung function tests results, Table 1 shows that the Peak flow meter and Piconet's readings for the exposed respondents were higher than the control respondents.

To achieve the objectives of the research, a few of socio-demographic factors were analyzed and the results showed that only a few symptoms were significant. The socio-demographic factors were age, occupation, and period of residence, gender and smoking. For the age factor, the result showed that there were no correlations between health status and age factor. However, the chi square test analysis on the respiratory illness symptoms showed that only smoking factor was significant with the shortness of breath. The dermatological illness showed a significant correlation between the occupation factors with the redness of skin. This symptom also showed a significant correlation with the period of residence. As for the psycho neurological symptoms, there were significant correlations between respondent's occupation and the symptoms experienced such as tiredness after work, difficulty to sleep, headache, appetite loss and numbness. There were also significant results between the gender, smoking habit and headache with loss of appetite. PEF reading showed that lung function tests were significantly correlated to the factors such as occupation of the respondent, period at residence and smoking habit. Meanwhile the peak flow meter reading showed a significant correlation with period at residence.

By comparing the comfort level at residences, there was a significant difference between the two locations in which the exposed respondents were not comfortable at their residences due to the bad smell factor. On the other hand, comparison of health status showed no significant difference between the exposed and controlled respondents.

DISCUSSION

The results showed that the demographic factors of respondents in part A were not materially different for the two study locations. This condition is essential to avoid

differences in external factors affecting the health of studied subjects. In addition, the majority of the respondents are Malaysians and with formal education background, so they could understand and answer the questions well. The respondents were residents of 1st and 2nd floors of the building who were the closest to the soil surface. According to ATSDR [1], landfill gas can travel up to 250 feet above the ground. Thus, the selected respondents are prone to be exposed to the landfill gases emissions.

Questionnaire was related to the environment factors and the activities of respondents which might have an impact on their health. Environmental conditions were the external factors that could distinguish the symptoms obtained by the respondents from landfill gas or caused by indoor air quality homes. Among the criteria that being questioned were types of items that were available in their homes for example the kitchen furniture, cleaning materials used and source of energy. All these criteria were important because these products can affect indoor air quality at home. According to Begum *et al.* [5], indoor air pollution can occur from cooking activity that involves combustion process in which gases such as carbon dioxide and carbon monoxide can be produced. The risk of health problems, particularly on the respiratory system can affect women who cook and children who often spend more time with their mother at home [6]. In addition, the type of detergent used can also affect the home indoor air quality. The chemicals found in the detergents can be volatile and may be a second pollutant in the volatile reaction with the reactive species [7]. According to Kwon *et al.* [8] the material in the detergent can reacts with ozone to produce formaldehyde. Exposure to low concentration level can cause irritation of the eyes, nose and upper respiratory system [9]. Exposure to formaldehyde may also occur from wood-based products [10]. Thus, the type of furniture also affects indoor air quality at home. In addition, local resources such as printers, photocopy machines and scanners can produce highly reactive materials and radicals such as ozone, nitrogen dioxide, sulfur dioxide and hydroxyl radical [11]. Subsequently, other household items and presence of

pets were also asked in part B survey questions. Pets can trigger asthmatic symptoms in susceptible individuals causing worsening symptoms in asthmatic patients. The hair, skin, saliva and urine of the pets are known allergens [12]. Besides pets, types of floor coverings such as carpets can also produce harmful allergens and exacerbate asthma [13]. Other questions found were concerned with the time spent inside and outside the home. These criteria are important as to determine whether the symptoms obtained by the respondents were through exposure to landfill gases, or caused by other external factors. The data obtained showed little difference between the exposed and control respondents. Activities for the chosen residential respondents and their living standards were not much different.

Respondent health symptoms descriptive data generally indicated that many respondents did not have symptoms as proposed in the questions related to health that may be suffered by the respondent if there were effects of landfill gas emissions in their homes. The majority of respondents answered 'no' for the symptoms of the disease. Therefore, this situation affected symptoms association analysis results with the tested factors.

The health of respondents may be influenced by various factors such as gender, age, culture and educational background. Socio-economic status factors also influenced the physical health of a person. Individuals of low socioeconomic status have higher mortality rates compared to those with high socioeconomic status [14]. According to Shmueli [15], the gender differences also affect the health of a person where he believed men are healthier than women. In this study, the socio-demographic factors discussed were age, gender, occupation, duration of stay in residential buildings and lifestyle.

Age: Correlation tests were made and the data obtained were not significant. It indicated no correlation between age and health status of respondents. In this study the health of the respondents were viewed as the scores of all symptoms and lung function tests results. However, according to Anuar *et al.* [16], age is a major factor in the test of Neurobehavioral Core Test Battery (NCTB), developed by an expert panel convened by the World Health Organization (WHO) and according to Watsford *et al.* [17], the increase in age may reduce the functional capacity of the human respiratory system. Thus, aging affects a number of health symptoms among the respondents.

However, the difference in age showed no significant correlation with symptoms. This result might be due to the confusion towards the reply of the questionnaire. For breathing tests, age was not significant which might be due to technical error whereby the respondents did not blow correctly to reach the normal level of the respiratory tests. In addition, the limitations factors might include lack of cooperation from the residents as well as the reasons for these technical problems that occurred. This is in line with Mandal [18] who reported that blowing breath test Peak Flow Meter should be repeated at three to five times or until the maximum reading is obtained. However, in this study the readings were taken only three times due to limitation factors. Therefore, this situation affected the age correlation of test results.

Gender: Loss of appetite showed a significant correlation with the gender factor. According to Shmueli [15], gender differences affect the health of a person but in this study, only lack of appetite indicated a significant relationship. This situation might also be attributed to factors from limitations as discussed above. Based on chi square test, the majority of man answered 'yes' for the symptoms of poor appetite.

Stay at Residence: Only the symptom of skin dryness under the skin disease symptoms showed a significant relationship with the stay at residence. For breathing tests, the Peak Flow Meter reading and PEF showed a significant relationship with this socio-demographic factor. According to Kang *et al.* [19], the duration of exposure affect the severity of the acquired disease symptoms. In chi square tests for symptoms of skin dryness, the majority who answered 'yes' were the respondents who lived more than 8 years in the residence. Similarly, the breathing test was significant with a stay at home whereby, chi square test also showed that the majority who stayed longer in the residence would get of low and medium readings for breath test. Thus, the stay at residence affected some respiratory symptoms.

Occupation: There were several symptoms that indicated a significant relationship between job factors and symptoms of skin reddening, tiredness after working, difficulty of sleep, dizziness and poor appetite. There were four categories of employment in the questionnaire: industry or factory, office, business and others. Housewives and students were grouped under the other category. From chi square tests, symptoms of skin reddening occurred among respondents who worked in

industry or factory. Thus, there is a possibility that the type of work influenced the respondents for having these symptoms. For respiratory tests, only PEF reading indicated a significant relationship with occupation.

Smoking: Smoking showed a significant relationship with the symptoms seen among the respondents. This is supported by Spencer and William [20] who reported that smoking can affect human health, especially respiratory and cardiovascular systems. In addition, smoking also affects mental, emotional and psychological health [21]. Smoking can increase blood pressure, heart rate and blood vessel defense which can result in reduced oxygen content [22]. In this study, the symptoms that showed a significant correlation with smoking were shortness of breath, dizziness, poor appetite and chest pain. For breathing tests, the readings showed no significant correlation with the smoking factor.

Comparison between Exposed and Control Respondents:

In this study, 36.1% of exposed respondents were not comfortable living in their house. The factors that affected their discomfort were the unpleasant smell of their environment which comprised 19.1%. This probably happened because their residential environment was involved in dumping activities despite the landfill being closed for more than 10 years.

Despite differences in the respondents' comfort level which showed significant differences, comparison of the respondent's health status showed no significant differences between exposed and control respondents. Compared Criteria were scores of symptoms, readings and the normality of the respiratory tests. This showed that the former landfill is still safe for occupancy by the respondents.

In conclusion, the health status of exposed respondents showed no difference compared to the control respondents. This suggests that the former landfill is safely occupied by the respondents. In addition, the socio-demography factors also showed that there were no correlations with the health status among the respondents.

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