

# The variability of expiration peak flow of workers employed in the washing installation (laundry) of Haji Adam Malik general hospital Medan

W Saragih<sup>1</sup>, A P Tarigan<sup>1\*</sup>, N Nainggolan<sup>1</sup> and P C Eyanoe<sup>1</sup>

<sup>1</sup>Department of Pulmonology and Respiratory Medicine, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia

\*Corresponding author: amira@usu.ac.id

**Abstract.** Laundress in hospitals is very susceptible to respiratory disorders, especially occupational asthma. To investigate the occurrence of an obstruction, the daily Expiration Peak Flow (EPF) examination was carried out to compare the EPF, before and after work. It is a descriptive study conducted in November 2016. The sample was 24 workers in Haji Adam Malik General Hospital Medan Laundry Installation, without any exclusion criteria, where all workers have been working for more than one year. Sampling was by distributing daily questionnaires and EPF examination for 14 days. From the results of EPF examinations that have been conducted, there were nine persons who were indicated to experience a decrease in lung function. Based on the most sex category, men were 5 people (55.6%), age  $\geq 40$  years were 2 people (22.2%), working duration  $\geq 10$  years were 3 people (33.3%), with the smoking habit were 5 people (55.6%), total dust  $\geq 0.2$  micron were 6 people (66.7%), total exposure of bacterium  $\geq 500$  were 3 people (33.3%), poor APD usage was 3 people (33.3%). In conclusion, there was a decrease in lung function by  $\geq 3.1\%$  found in 9 workers.

## 1. Introduction

Laundresses are not only exposed by the chemicals contained in cleaning liquids and perfumes but also organic compounds on linen/dirty fabrics such as animal furs, mites, fungi and microbes from moist environments, dust and other chemicals. If those compounds were inhaled, they can cause a pulmonary disorder such as bronchitis. Moreover, it can cause occupational asthma.

The Expiration Peak Flow Examination (EPF) is the measurement of the maximum amount of airflow that can be during the forced expiration at a certain time by using a peak flow meter or spirometry. The sensitivity and specificity of this examination were 75% and 94%, respectively. The positive results obtained in occupational asthma is when the laundress experiences a decline in the value of EPF at work.[1,2]

The variations of EPF value are strongly influenced by age, sex, race, height and smoking habit. The normal rate of EPF for adult men is 500-700 L/min while for adult women is 380-500 L/min.[3] EPF examination aims to measure objectively the airflow in the large respiratory tract.[4] It is a contrast to VEP1, that is affected by the changes in measurements of the large respiratory and medium respiratory tract.[3]

Therefore, the research was aimed to see the possible level of the decreasing in the pulmonary function of laundresses especially in health facilities in Haji Adam Malik General Hospital, Medan.



## 2. Method

This research was a descriptive study and conducted on November 2016 to the laundresses at Haji Adam Malik General Hospital Medan, where the sample was all workers (total sampling) of 24 persons, without any exclusion criteria. All the workers in this laundry installation have been working for more than one year. And all samples were willing to participate in the research by signing the inform consent.

The data were collected through interview and questionnaires distribution from Health and Safety Executive and OASQ-11 that has already been modified, physical diagnostic examination, expiratory peak examination for twice a day (before and after work) for 14 consecutive days, spirometry examination, dust and bacteria content in the room. From the examination result, the average was found to be 3.1%.

The equipment used during the research were including Vitalograph, peak flow meter (Philips) to examine the expiration peak flow, stethoscope for the physical diagnostic examination, high volume dust sampler with gravimetric and laser counting method to investigate the dust content and Plate Count Agar (PCA) to analyze the bacterial colony.

## 3. Results

Research sample were 24 workers with the characteristics of EPF variability as follows.

**Table 1.** Characteristics of the research sample.

	Parameter	PEFR Variability			
		<3.1		≥ 3.1	
		N	%	N	%
Age	<40 years	6	40.0	7	77.8
	≥ 40 years	9	60.0	2	22.2
Length of work	<10 years	8	53.3	6	66.7
	≥ 10 years	7	46.7	3	33.3
Cigarettes	Nonsmoker	11	73.3	4	44.4
	Smoker	4	26.7	5	55.6
Dust p2.5	<0.2	1	6.7	3	33.3
	≥ 0.2	14	93.3	6	66.7
Bacteria	<500	14	93.3	6	66.7
	≥ 500	1	6.7	3	33.3
APD	Good	12	80.0	6	66.7
	Not good	3	20.0	3	33.3
Gender	Man	4	26.7	5	55.6
	Women	11	73.3	4	44.4
<b>AMOUNT</b>		<b>15</b>	<b>100</b>	<b>9</b>	<b>100</b>

## 4. Discussion

Based on the observation, working environment in the washing installation (laundry) at Haji Adam Malik General Hospital Medan has many factors that can trigger the occurrence of health problems, especially for the respiratory system. It can be seen from the physical condition of the noisy laundering machine resulted from the washer and dryer; heat is from the steam produced by the washing machine, the dryer and iron, dust and germs (bacteria and fungi) are from the dirty linen and chemicals used. Overall, these affect the worker's pulmonary function.

The explanation of the relationship between the characteristics of samples with the results of pulmonary function in the laundry of Haji Adam Malik General Hospital Medan is below.

#### *4.1. The Description of Pulmonary Function Based on Gender*

According to Behavioural Risk Factor Surveillance Survey, gender does not affect the occurrence of pulmonary function declining, leading to the occurrence of asthma due to work. Many other factors cause gender to experience a pulmonary function declining. For example, job location, the different occupation will cause different exposure, smoking habit, etc. In this study, the number of “male” is more, compared to female towards the pulmonary disorder; it was the majority of male respondents are smokers. According to a World Health Organization (WHO) report, a smoker can also accelerate the decline in pulmonary function. Vandenplas and Houba stated that age and sex did not associate with decreased pulmonary function, occupations are typically employed by certain gender, so the rate of pulmonary function declining can be varied.[5] In this study, there were five men (55.6%) and four persons (44.4%) who experienced a decrease in pulmonary function  $\geq 3.1\%$ .

#### *4.2. The Description of Pulmonary Function Based on Age*

As the age is increasing, it does not mean that the risk of pulmonary disorder is increasing as well. Age is not the only factor that causes the pulmonary disorder; there are many other factors that cause the occurrence of pulmonary physiological disorders. According to Suma'mur (2009), health disorder caused by exposure from substances or allergens in the workplace may be caused by several factors such as chemical properties of the substance, port of entry, physical properties of particles and worker factors. Worker factors are including, habituation (adjustment), endurance and health status of the body. In the laundry environment, several factors can potentially cause a respiratory tract disturbance. But in this study, after conducting the examination, there were seven persons (77.8%) with age of  $<40$  years old who had their pulmonary function decreased for  $\geq 3.1\%$ , and there were two persons (22.2%) with age of  $\geq 40$  years old. The workers with age of  $<40$  years were indicated to have a decreased pulmonary function by  $\geq 3.1\%$ . It could happen due to the poor habit of workers such as smoking, sleep late, and not aware of using PPE, so it is possible to experience respiratory problems. Workers have 7 hours each day (Monday to Saturday) to be exposed to chemicals and other harmful materials so that for each worker has equal potential to have a pulmonary disorder. In conclusion, age is not the main factor that is responsible for the occurrence of pulmonary disorder of laundresses in Haji Adam Malik General Hospital Medan.

#### *4.3. The Description of Pulmonary Function Based on Work Duration*

The decreasing of pulmonary function may be affected by the long duration of exposure or work. The longer the working duration of a person who works in places containing dust/allergens, the risk of getting exposed to the work environment that will affect the health, especially respiratory disorders. Several studies have suggested that duration of work affects pulmonary function impairment, which means that the working period, the more likely the worker having pulmonary function impairment.[11] According to Suma'mur (2009), the longer the exposure time will lead to a greater risk to possess pulmonary disorders.[8]

In this study, there were ten workers who have a working period of  $\geq 10$  years but only three workers (33.3%) who experienced a decreased pulmonary function. On the other hand, there were 14 workers who have already worked for  $<10$  years and only six workers (66.7%) and more to experience a pulmonary function impairment. This is not suitable for previous research that stated, working period affects a person's pulmonary function. This might be caused by other factors such as smoking habits, poor use of PPE and work environment.

#### *4.4. The Description of Pulmonary Function Based on Smoking Habit*

Smoking can lead to the change of the respiratory tract structure and function and the pulmonary tissue. In the respiratory tract, mucosal cells are enlarging (hypertrophy) and mucus gland is multiplying in numbers (hyperplasia). In small respiratory tracts, mild inflammation occurs and causing a respiratory

tract constriction due to the increase of inflammatory cells and mucus formed. In the pulmonary tissue, there is an increased inflammatory cells and alveoli damage. Because of the changes in pulmonary anatomy, smokersexperience a change in pulmonary function and all kinds of its clinical changes. It becomes the main basis of chronic obstructive disease. Smoking habits will accelerate the decreasing pulmonary function. The decrease in forced expiratory volume per year was 28.7 mL for non-smokers, 38.4 mL for former smokers and 41.7 mL for active smokers. In this study, there were 5persons (55.6%) who have a history of smokinghabits experienced an impairment ofpulmonaryfunction. The results of this study indicated that smoking is a supportive factor of pulmonary function impairment of workers.

#### *4.5. The Description of Pulmonary Function Based on Dust Exposure*

One of the main factors that can cause pulmonarydisorder and can lead to pulmonary function impairment is dust particles. From the results of High Volume sampler with the time-balanced method, it was the total average of dust found was 0.192 mg/m<sup>3</sup> in the dirty area while the total average of dust in the clean area was found to be 0.210 mg/m<sup>3</sup>. The dust came from dirt and dust attached to the dirty linen and the room. This dust can cause respiratory tract disorders such as coughing, sneezing, and pulmonary function impairment. According to Indonesian Ministry of Health Decree No.1450/MENKES/SK/XI/2002 towards environmental health requirements, the limit of total indoor dust level is 0.15 mg/m<sup>3</sup>. According to Wiwiek Pudjiastuti [6], the smaller the size of dust particles, the more dangerous it will be for health. Because it can easily settle in the lung. The size of harmful dust particles is 0.5-5 microns. According to Alsagraf (2004), anexcessive amount of dust inhaled can cause respiratory tract disturbance and can lead to discomfort while working. In this study, there were 6workers (66.7%) who experienced a pulmonary function decreasing due to inhaling p.2.5 dust in the room, and this was accordance with previous research. These six workers worked in a clean area.[10]

#### *4.6. The Description of Pulmonary Function Based on Bacteria Counting*

The laundresseswerenot only exposed to dust but also bacteria and fungi contained in dirty linen. Bacteria and fungi can also cause respiratory infections. According to the standard quality of Indonesian Ministry of Health No. 261/MENKES/SK/II/1998, the number of germs is less than 700 colonies/m<sup>3</sup> in air. In the results of bacterial colonies examination using Colony Counter in thedirty area, there were 570 CFU/m<sup>3</sup> and while in a clean area, there were 410 CFU/m<sup>3</sup>. From the examination results, both the clean and dirty rooms were still in normal threshold values. But based on the results of the examination, there were threepersons (33.3%) who experienced a decreasing of pulmonary function that inhaled bacteria  $\geq 500$  CFU/m<sup>3</sup>. According to the data, three workersworked in a dirty room.

#### *4.7. The Description of Pulmonary Function Based on Personal Protective Equipment (PPE)*

Personal protective equipment (PPE) is the equipment used to protect workers against hazards that may interfere their health in the work environment. The use of personal protective equipment (PPE) is an effort to protect the workers in the work environment. The utilization of personal protective equipment can prevent the accumulation of pollutant particles in the lung cavity thus reducing the possibility of pulmonarydisorders. The personal protective equipment is urgently needed by workers in laundry installations, because workers are not only exposed to dust but also bacteria, fungi and detergent particles in the form of powders and liquids which, if they get exposed continuously for long periods of time, can cause respiratory problems. The personal protective equipment used by workers in laundry installation is a surgical mask. From the results of data collection, it was found that six persons (66.7%) who wore good PPE butpossessed an impairment of pulmonary function  $\geq 3.1\%$ . While there were three workers (33.3%) using PPE did not experience the decreasing of pulmonary function  $\geq 3.1\%$ . It is by with the results of previous studies that stated; there is a relationship between the use of PPE with the decreasing of pulmonary function.[7] On the other hand, the results of statistical tests that have been conducted by Kumendong [12], indicated that the worker's lung capacity

does not have a significant correlation with the use of PPE. However, an attention is needed since the use of PPE can protect workers from the exposure in the workplace.

## 5. Conclusion

Based on the results of daily EPF examination of all workers in the laundry room at Haji Adam Malik General Hospital Medan, there were 9 workers who experienced a pulmonary function decreasing for  $\geq 3.1\%$ . It was calculated from the measurement of expiratory peak flow before and after the work.

## References

- [1] Tarlo S M and Lemiere C 2014 Occupational asthma *N. Engl. J. Med.* **37** 640-9
- [2] Moore C V, *et al.* 2009 Peak expiratory flow analysis in worker exposed to detergent enzymes *Occupational Med.* **59** 418-23
- [3] Jain and Prasoon 1998 Utility of peak expiratory flow monitoring *CHEST Cardiopulmo. Crit. Care J.* **114** 861-76
- [4] Menaldi R, *et al.* 2001 *Prosedur tindakan bidang paru dan pernapasan, diagnosa dan terapi* (Jakarta: Bagian Pulmonologi FK UI) pp 34-6
- [5] Vandenplas O 2011 Occupational asthma: etiologies and risk factors *Allergy Asthma Immunol. Res.* **3** 157-67
- [6] Pudjiastuti W 2002 Debu sebagai bahan pencemar yang membahayakan kesehatan kerja Available from: <http://depkes.co.id/download/debu.pdf>
- [7] Dewi E and Widajati N 2016 Hubungan paparan debu kapur dengan status faal paru pada pekerja gamping *Indon. J. Occupational Safety Health* 61-70
- [8] Suma'mur P K 2009 Higiene perusahaan dan kesehatan kerja (HIPERKES) (Jakarta: Agung Seto)
- [9] Suma'mur P K 2013 Higiene perusahaan dan kesehatan kerja (HIPERKES) (Jakarta: Agung Seto)
- [10] Alsagaf H and Mangunegoro 2004 Nilai normal faal paru orang Indonesia pada usia sekolah dan pekerja dewasa berdasarkan rekomendasi american thoracic society (ATS) 1987: Indonesia preumobil project (Surabaya: Airlangga University Press)
- [11] Noor R A, Djajakusli R and Masyita M 2012 Faktor yang memengaruhi kejadian gangguan fungsi paru pada pekerja pengangkut semen di gudang penyimpanan semen pelabuhan malundung kota Tarakan, Kalimantan Timur *Jurnal Kesehatan Masyarakat UNHAS*
- [12] Kumendong J W M D, Rattu A M J and Kawatu A T P 2011 Hubungan antara lama paparan dengan kapasitas paru tenaga kerja industri mebel di CV. Sinar Mandiri Kota Bitung *Jurnal Kesehatan Masyarakat Universitas SamRatulangi Manado*