

## OCCUPATIONAL HEALTH RISK AMONG VEHICLE MAINTENANCE WORKERS: PILOT STUDY IN MALAYSIA

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### ABSTRACT

The nature of work for vehicle maintenance worker lies mostly on awkward working posture and the use of non- ergonomic tools as well as environmental factors related. Primary headaches take most 90% of all the headache forms. This highly occurrence disease categorized as high risk in this type of working age-population and give significant impact in Malaysia. The aim of this paper is to provide useful information regarding workers suffering headache to the occupational management in workplace. The data was collected using questionnaire. This disease carries economic cost calculating loss of working days due to major headache and eventually loss in labor productivity. In an occupational setting for vehicle maintenance workers circumstances are known to cause the on-set of attacks who by the nature of work, working in not ergonomic posture. Others factor such as chemical exposure in workplace can make the headache worst. The study was conduct at 20 automotive workshop and involve 150 participants. The result shown that 80% of the workers suffer headache in workplace. Work stress related with psychosocial problem shown that there was direct relationship between factor of duration of work and work assignments ( $p < 0.05$ ).

**Keywords:** *Vehicle maintenance, occupational disease, headache, awkward posture*

### 1. INTRODUCTION

The nature working posture, working with hand for the workers can be categorized as awkward and this worker also need to solve problems. There are several work activities while maintenance the vehicle, where the worker needs to fit the features of each type of vehicle categories. In Malaysia, statistically each year there is 2.5 % increment regarding the worker in this sector [1]. Even though emerging technology such as industrial robotic and artificial intelligence are advancing and helping the maintenance workers, some activities still comfortably done manual by the workers. As an economic related, in Malaysia most of the vehicle garage exist are not fully automatic. Maintenance, service, and repair involving fixing things and understanding how machines work and depend on skills and abilities. The prevalence of health symptom among vehicle maintenance workers points at 40.7% dizziness [2], from a study that determine the worker urinary toluene level. Most of the time this worker work standing on the hard floor and repair underneath the vehicle for prolonged period with spine and arm flexed forward or above shoulder level.

Repetitive movement, from work or activity is another factor to be on looked after. There are several injury terms used to describe risk repetition movements that cause muscle pain: recurrent stretch/stress/ pressure injuries and risk of trauma. This repetitive movement can cause temporary or permanent damage that gives impact on high treatment cost. Repetitive movement are close related to operational time, refer from [2], the pain can be form by adding the repetitive movement from one task at one time to complete, as the heal time are not enough result in fatigue and tension of the muscle. Several chemical exposures contain toxic can be identify from heavy metals, lubricants and oil from vehicle parts, asbestos from brake repair, as well as car exhaust. Most of the automotive workshop visited in this study did not fully implement effective control measure in the workplace regarding this chemical exposure. Study from previous researcher [3] shows that

there is significant different effect from the worker blood pressure and hematological parameters. More clinical study needs to be conducted to show the chemical exposure can cause severe headache.

## 2. LITERATURE REVIEW

A vehicle maintenance worker is defined as a skilled worker who use or repair machines or tools (Oxford Dictionary, 2019). This professional so called as vehicle maintenance workers or workers automotive maintenance. The fact that a vehicle has approx. 30,000 parts from each part to small screws [4] require workers to be more careful in doing their jobs. With this assignment, vehicle maintenance workers spend a lot of their work in the condition unnatural or awkward body position, static and working in space which is limited. Among the examples is when the employee needs to examine the vehicle engine to be repaired. This task involves washing car bearing balls, gaskets, piston rings, etc. that require high precision in work. There is no room for error because it involves human safety in driving, and most job positions in this assignment are labeled as awkward.

This awkward position will cause pain in the limbs especially the back, neck, shoulder area of the worker. Standing position or this variety of sitting will increase the risk of pain during maintaining the vehicle, and then the constant pain will cause the formation of discomfort, injury, and symptoms, beginning of the risk of Musculoskeletal disorder. Some studies conducted by researchers on vehicle maintenance workers have paid attention to limb pain, especially the back, neck, and shoulders [5-; 6; 7,8]. When they are changing position from standing to sitting or lying down, the problem on back, neck and shoulders become more prominent. Maintenance workers spend a lot of time in the workshop for eight hours in Malaysia [9], while for managed workshops by private and medium-sized organizations, their working hours are irregular and more than eight hours according to work requirements [8;10]. During maintenance, the worker's arm is used a lot to reach to narrow space. This situation causes the position of the arm to change to reach flexibility. As a result, this position puts more pressure on the back muscles. The effect of the pain experienced leads to less productivity satisfaction that can be tracked through absenteeism and part-time work nor errors during maintenance. This fact is supported by [11], who have stated that 80% of industrial accidents are caused by human actions themselves [12; 13].

The issue that can be identified from most of the past researchers does not emphasize the selection of employees based on health status especially those involving an accident. Employee related problems vehicle maintenance with work has been certified by most researchers and Musculoskeletal disorder become an issue that is always highlighted by researchers because high financial costs. However, there's limited study that address regarding headache for this group of workers.

Table 1.0: Summary of past researcher on MSDs risk for vehicle maintenance worker

Author	Years	Result / issues
Aboraogu et al.	2016	76.02% back pain among workers 63.3% had to limit daily activities due to pain back. Workers >50 years old Working hours $\geq$ 5 hours Normal weight Primary school education Routine position; kneeling and position static. Lack of work autonomy, tasks which is unclear, workload the big one, handling manual, work position pressure, noisy surroundings, vibration, Work schedule that is not managed and not enough extra support.
Nassaruddin et al.	2014	87.4% maintenance workers suffering from musculoskeletal disease No relationship matters between MSDs and factor risk of working overtime. Related factors work such as body position and excessive pressure force.
Ataro, Z. et al.	2018	There were significant differences in blood pressure and hematological parameters between garage workers and the control group. Therefore,

		appropriate, and effective safety measures need to be taken by the workers to prevent possible chemical exposure during routine tasks.
Bawaskar, H. S et al.	2020	Occupation exposure to lead containing fuel, paints, and garage workers blood levels of lead is significant.
Decharat, S.	2021	The prevalence of skin effects (60.71%); respiratory tract irritation (49.29%); nausea (46.43%); and dizziness (40.71%) was remarkable in the automotive garage workers

There are several factors related to POR listed by the Organization World Health cited in 2016.

- i- Physical, organizational, work, and social factors in the workplace
- ii- Physical aspects and social life outside the workplace, including physical activities (sports, doing homework), and economic (incentives and values culture).
- iii- Individual physical and psychological characteristics (such as age, gender, mass index body, personal habits like smoking, and maybe some genetic aspects determine the tendency).

In conclusion, the complexity of the problem becomes increasingly critical due to all the factors listed interact differently from time to time currently based on certain circumstances. Research is needed to explain the all the relationship in between.

### 3. RESEARCH METHODOLOGY

#### The Study designs

A comparative cross-sectional study was carried out among vehicle maintenance workers around Selangor.

#### *Subjects*

Study subject comprised of 150 workers; age range from 18-55.

#### *Inclusion and exclusion criteria*

Workers directly involved in the maintenance vehicle, for at least 1 year were included

Workers with an injury causing cracking bones, fractures, protruding joints, ten-dons, torn ligaments, and muscles as well as limb amputation were excluded in this study

#### *Sampling*

##### Selection of garage

A preliminary assessment was conducted to establish the number of garages that include three different type of vehicle categories, which is, cars, multi-purpose vehicle and bus.

#### *Data collection*

After obtain approval ethical (UKM PPI/111/8/JEP-2016-200) to conduct the study, demographic and occupational data were collected using structure questionnaire and workers were interviewed. The questionnaire includes several sub sections which is demographics data (age, weight, height, etc.), work activity (work duration, rest time), worker disease history, working posture and worker health level and Nordic human body assessment.

#### *Data processing and analysis*

All data were clean, enter to Statistical Analysis Software (SPSS) latest version. Descriptive summaries were present in terms of means, SD, and proportions de-pending on the variables. T-test were used to analyses statistically significant of different amongst selective parameters. Multiple linear regression used to analyze association between dependent variable (headache) with job-related parameters as independent variable.



Figure 1: Worker during maintenance vehicle task

While assessing the posture and movement of the worker during vehicle maintenance activities as Figure 1, interviewing session were done to gain an understanding of the tasks and demands during the task cycles. All the possible awkward posture during vehicle maintenance task had identified to consider the ergonomic risk at the workplace. Ergonomic risk assessment from the awkward posture were assessed by Rapid Upper Limb Assessment and Rapid Entire Body Assessment form. The occurrence of unfavored health symptoms among the worker was also observed.

#### 4.0 RESULT AND DISCUSSION

##### General characteristic

All the workers were males, age from 18-55 years and 88% have work more than one year. Most of the worker (52.7%) need to work overtime refers Table 1, which reflect to health issues [14]. The workers who work overtime tend to be in higher risk of incident at workplace [15]. Majority work time for the workshop is 8 hours per day, according to [8], longer working hour more than 6 hours tend to have back pain (76%). Each workshop is equipped with personal protective equipment (PPE) but were poorly followed during maintenance work. Most of the worker did not have chronic disease such as high blood pressure (0.7%) but majority write down headache (80%) is the major pain other than body assessment from Nordic question. Demographic data, from the following Table 1 gives a summary of all 150 workers. Prevalence of self-report health symptoms in the preceding 6 months shown in Table 1.

This paper focus on the headache factor as 121 workers complaining about it, while when addressing more detail regarding the level of headache such as dizziness and persistence headache, the worker tends to take time to answer and mostly answer seldomly facing the situation. Due to the nature of their work, which exposed to the chemical hazard such as vehicle spray paint, they tend to face headache when not using Protective Personal Equipment. Some worker addressing after having a headache, their focus and concentration to their work is poor. Half of the worker mention that, checking the vehicle problem and seeking the answer to the problem, tend to make the worker having headache. Smoking cigarettes in the work area were statistically significantly associated with the prevalence of unfavorable health symptoms mainly with headache.

Table 1. Data distribution 150 workers of vehicle maintenance.

Variables	n	%
Years working		
5 years	132	88%
Working hours (8)	<b>133</b>	88.7%
Over time	<b>74</b>	49.3%
Headache	<b>121</b>	80.6%
Dizziness	<b>50</b>	33.33%
Persistent Headache	<b>35</b>	23.33%
Poor concentration	<b>13</b>	8.66%
Smoking	121	80.0%

#### Ergonomic risk at workplace

Several ergonomic risk factors listed for this study to identify the nature of work for vehicle maintenance. The goal is to reduce the risk of a work-related musculoskeletal disorder by eliminating worker exposure to hazard as well as to improve worker discomfort. Table 2 listed five factor that related to posture and another nine factors involve workload and environmental. For example, each body position can cause discomfort and fatigue if maintained for a long period of time. Standing, for example, is a natural body posture, and does not pose a danger. However, work for a long time in standing position can cause sore feet, general muscle fatigue, and soreness back.

Analysis of determinant coefficient result to determine the amount of change in the dependent variable explained by the enabler independent variables (psychosocial, position and headache). The value of the coefficient of determination shows the square root of  $R = 0.099$ , this shows that only 10 percent of the total dependent variable is explained by the independent variable cluster. In conclusion, the independent variable in this study is a factor that can influence the dependent variable.

Table 2: Ergonomic risk at workplace (vehicle garage)

Factor	n	Frequency (min)
Turning the body / head	125	3.61
Bend	144	3.73
Squatting	<b>136</b>	3.62
Reaching	<b>138</b>	3.59
Flexing	<b>147</b>	3.68
Weight (lifting)	<b>150</b>	3.15
Push the load	<b>149</b>	2.51
Pulling the load	<b>147</b>	2.53
Expose to hot temperature	<b>104</b>	3.01
Expose to cold temperature	<b>11</b>	1.93
Repetitive work	<b>136</b>	3.58
Work in static position for a period (10 minute each activity)	<b>139</b>	3.61
Work in confine space	<b>16</b>	2.71
Using nonadjustable chair	78	3.31

## 5.0 CONCLUSION AND RECOMMENDATION

The aim of the paper with pilot study is to address the headache pain that arise from the vehicle maintenance workers and provide this information to occupational physicians on the management. The identification seeking or solving problem work activity and chemical exposure, contribute to the worker sudden headache. Additional, headache is common complaint after workplace, statistically limited literature covered regarding headache and vehicle maintenance worker. From interview, the worker who constantly expose to the chemical as his own routine for the week involving changing brake and lubricant oil, the occurrence of headache is higher.

Majority of vehicle maintenance workers is aware of the chemical exposure, with or without PPE during work, but more negligence of the hazardous effect towards their health. To minimize chemical exposure at workplace, the workshop needs to adopt suitable ventilation system and suitable breadth of the workshop refer to each maintenance activity. The employer should publish stricter used of PPE and visual procedure regarding the maintenance activity of changing lubricant oil and brake asbestos. Future work should address on clinical side of chemical exposure quantity versus maintenance time for each activity. The associations of unfavorable health symptoms such as dizziness and persistence headache with the period hours worked per day were supported by Wong et al. [16], disclose that the potential long weekly working hours and country of origin were shown to adversely affect the occupational health of workers.

## REFERENCES

- [1] Jabatan Perangkaan Malaysia (DOSM, 2020) Laporan Tahunan. [https://www.dosm.gov.my/v1/index.php?r=column/cone&menu\\_id=QUJRUm4xMHdLZ0xaeDcvRDNYbUISUT09](https://www.dosm.gov.my/v1/index.php?r=column/cone&menu_id=QUJRUm4xMHdLZ0xaeDcvRDNYbUISUT09)
- [2] Decharat, S. (2021). Urinary toluene levels and adverse health symptoms among auto-motive garage workers, Nakhon Si Thammarat province, Thailand. *Environmental Analysis, Health and Toxicology*, 36(3.)
- [3] Ataro, Z., Geremew, A., & Urgessa, F. (2018). Occupational health risk of working in garages: comparative study on blood pressure and hematological parameters between garage workers and Haramaya University community, Harar, eastern Ethiopia. *Risk management and healthcare policy*, 11, 35..
- [4] Vannini, P. (Ed.). (2016). *The cultures of alternative mobilities: routes less travelled*. Routledge.
- [5] Nogueira, H. C., Diniz, A. C. P., Barbieri, D. F., Padula, R. S., Carregaro, R. L., & de Oliveira, A. B. (2012). Musculoskeletal disorders and psychosocial risk factors among workers of the aircraft maintenance industry. *Work*, 41(Supplement 1), 4801-4807.
- [6] Pollard, J., Heberger, J., & Dempsey, P. G. (2014). Maintenance and repair injuries in US mining. *Journal of Quality in Maintenance Engineering*.
- [7] Singh, S., Kumar, R., & Kumar, U. (2015). Applying human factor analysis tools to a railway brake and wheel maintenance facility. *Journal of Quality in Maintenance Engineering*.
- [8] Abaraogu, U. O., Ezema, C. I., Igwe, S. E., Egwuonwu, A. V., & Okafor, U. C. (2016). Work-related back discomfort and associated factors among automotive maintenance mechanics in Eastern Nigeria: a cross sectional study. *Work*, 53(4), 813-823..
- [9] Nasaruddin, A. F. A., Tamrin, S. B. M., & Karuppiyah, K. (2014). The prevalence of musculoskeletal disorder and the association with risk factors among auto repair mechanics in Klang Valley, Malaysia. *Iranian Journal of Public Health*, 43(Supple 3), 34-41.
- [10] Sambo, M. N., Idris, S. H., & Shamang, A. (2012). Determinants of occupational health hazards among roadside automobile mechanics in Zaria, North Western Nigeria. *Borno Medical Journal*, 9(1), 5-9.

- [11] Sayers, B. A. (1988). Human factors and decision making: their influence on safety and reliability..
- [12] García-Herrero, S., Mariscal, M. A., García-Rodríguez, J., & Ritzel, D. O. (2012). Working conditions, psychological/physical symptoms and occupational accidents. Bayesian network models. *Safety science*, 50(9), 1760-1774..
- [13] Murad, M. S., O'Brien, L., Farnworth, L., & Chien, C. W. (2013). Health status of people with work-related musculoskeletal disorders in return to work programs: a Malaysian study. *Occupational therapy in health care*, 27(3), 238-255. Decharat, S. (2021). Urinary toluene levels and adverse health symptoms among automotive garage workers, Nakhon Si Thammarat province, Thailand. *Environmental Analysis, Health and Toxicology*, 36(3).
- [14] Kim, Y. M., & Cho, S. I. (2017). Work–Life Imbalance and Musculoskeletal Disorders among South Korean Workers. *International journal of environmental research and public health*, 14(11), 1331.
- [15] Lee, D. W., Hong, Y. C., Min, K. B., Kim, T. S., Kim, M. S., & Kang, M. Y. (2016). The effect of long working hours on 10-year risk of coronary heart disease and stroke in the Korean population: the Korea National Health and Nutrition Examination Survey (KNHANES), 2007 to 2013. *Annals of occupational and environmental medicine*, 28(1), p.64.
- [16] Wong, K., Chan, A. H., & Ngan, S. C. (2019). The effect of long working hours and overtime on occupational health: a meta-analysis of evidence from 1998 to 2018. *International journal of environmental research and public health*, 16(12), 2102.
- [17] Bawaskar, H. S., & Bawaskar, P. H. (2020). Blood lead level among fuel station workers, Ganesh idol painters, persons with routine daily application lead containing black pigment to eyes and Garage workers. *Journal of Family Medicine and Primary Care*, 9(3), 1376
- [18] Ataro, Z., Geremew, A., & Urgessa, F. (2018). Occupational health risk of working in garages: comparative study on blood pressure and hematological parameters between garage workers and Haramaya University community, Harar, eastern Ethiopia. *Risk management and healthcare policy*, 11, 35.