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Research paper



Work-Related Symptom and Injuries Among Vehicle Maintenance Worker: an Overview

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Abstract

Vehicle Maintenance workers involve a task that is performed infrequently and exceptional conditions mainly to inspect, maintain and repair. The overview looks at past research on vehicle maintenance worker associate injuries and symptoms that influence their health and work. The purpose of this paper is to illustrate the issues, gather information and statistics on type of injuries, illness or symptoms arise from maintenance vehicle work to provide an effective way of understanding its nature of work. Methods search of the scientific database and the internet using the following keyword; 'Vehicle maintenance worker', 'mechanic workers', with injuries, incident and disease. Further point out other risk factors that influence work-related symptom and injuries, the program suggested, ergonomic implementation as a further approach to solving the rising issues with regards to maintenance vehicle sector. This paper administers a good understanding of car maintenance and its work task. By this knowledge, more flexible approach and efficient prevention can be done as a platform in tackling down work-related disease and injuries.

Keywords: *Mechanic worker, musculoskeletal disorder, accident, incident, Occupational health and safety*

1. Introduction

Vehicle maintenance worker or mechanic nowadays faced more challenging scope of work due to over-engineered new cars with different types that require at least 5 hours of labor to swap alternator, which not include trying to figure out the problem that makes the vehicle broke down. Good innovation is certainly a positive thing, where the issues of maintenance are one of the possible bothering things among vehicle owner, as not everyone equips with vehicle have the maintenance knowledge. This situation in vehicle maintenance sectors is unstable yet there is no framework to overcome such position, which are unexplored thoroughly. Safety and health are the main concern towards worker in any area of work. Maintenance vehicle worker is more likely to be injured and developed disease in the workplace due to its nature of work handling with a different type of tools and equipment, try to work in limited space of the vehicle, facing awkward position in long hours. The important health and safety issues in vehicle maintenance workers are injuries involving sprain, cuts, bruises, confusions and more. Such a contact with object, equipment and tools, slip and trip because of source of the floor surface as well as exposure to chemicals, vehicle exhaust and asbestos. Automotive repair and maintenance workshop is mostly doing small business. General vehicle workshop, which is small is different with large and branch service centre, since it may not have safety and health professionals approach, yet with disease problem awareness facing by the workers, this small workshop can reduce injury and illness risks by obtaining safety and health information and adopting the recommended practices. Main concern disease being talk by past researcher is musculoskeletal disorder (MSDs), which can limit the daily activity and decrease the performance of work as well as disturbing body movement function. That is not enough, as high compensation for those workers that have the disease can give a lot of impact towards the organization financially. Towards sustainable business, taking care of the safety and health of the workers become one of the responsibility, while at the same time, increasing the profit can be done as well. As we look through the area of vehicle maintenance workers, several factors can be identified which is, the nature of this worker works in an awkward position in several hours, handling force and load of equipment and tools, which result in their health and safety. A few studies concerning musculoskeletal disease among vehicle maintenance worker have been published. In a study on automotive maintenance mechanics, [1], they did not state any ergonomic tools that assessed the workers working posture. Since little have established facts about the vehicle maintenance worker regarding their health and safety, this paper aims to gather available reference published regarding the vehicle maintenance workers and address the upcoming issues.

2. Methodology

All article regarding vehicle maintenance workers were compiled from google scholar, research gate and government article statistic. The selection is by the keyword of vehicle maintenance worker, mechanic worker, garage worker associated with injuries, accident and incident, disease and safety and health. Secondary search performed through the retrieved article and journal reference. Address on the issues facing by workers in this area, solution regarding the objective, the method used, and suggestion program highlight.

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3. Result

From the retrieved article in Table 1, prevalence among vehicle maintenance worker are high more than 70%. The symptoms developed from the neck, shoulder, upper back, low back, elbows, wrist/hand, hips, knee, ankles/feet, finger and head. The injuries for vehicle maintenance workers reported are more than 60%, which mostly from cuts. Type of injuries address are cuts, burns, piercing, sprains, bruises, superficial wounds, bone fractures, concussion and internal injuries. Source of the injuries mostly come from contact with object, substance, exposure and body motion that try to suit the task. The matter on the posture while working which considered as awkward and strenuous, which is kneeling, bending, flexing, reaching, squatting, and reaching are most common working posture for this type of job may contribute to the development of the musculoskeletal disease. Other factors that can contribute to injuries and diseases address are mostly on the ergonomic side, which is lack of understanding, what is ergonomic, how ergonomic work with a worker in the workspace. The heavy physical load can contribute to a muscle problem and will get worst with unnatural working posture and with hours of working in the same position. Figure 1 illustrates as a big picture of the risk factors related to the development of diseases as reclaimed by the retrieved paper. There are different terms used by different researcher to address the factors, in classification to the group.

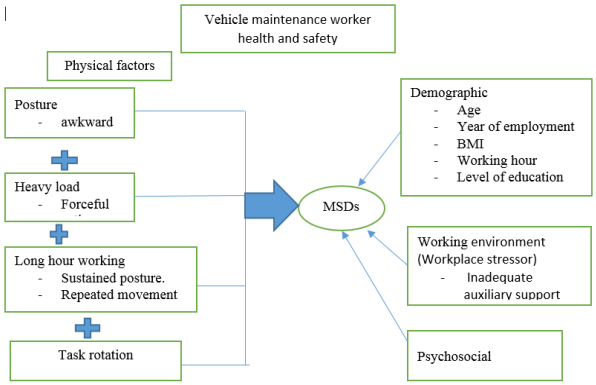


Fig 1: Risk factors associated with development of musculoskeletal disease

3.1 Musculoskeletal Disorder

Figure 2, represent percentage graph from the past researcher highlight on the highest part of the body with musculoskeletal disease. Musculoskeletal disease term can be seen varied, with different term used and explanation for each body part. Most of the researcher report on back problem as the most problem faced by the maintenance vehicle workers. With all the reported collected, it is assure that the workers that work in vehicle maintenance sector, exposed in developing musculoskeletal disease.

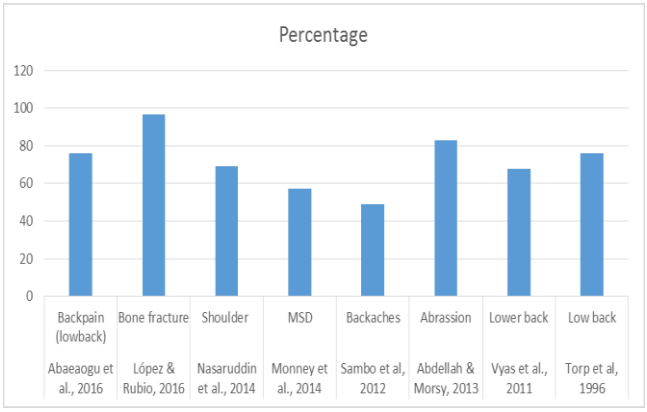


Fig 2: Musculoskeletal disorder percentage amongst past researchers

3.2 Ergonomic Knowledge

Ergonomic are included in safety and health topic, where it is one of the process designing product and system that will fit the workers. This ergonomic will explore more about workers abilities and limitations to improve system and work environment. Throughout the years, from the past researcher in this paper discussed the term intervention, educate, prevention, strategies, safer work practice and training. All this terms, are suggestion in order to tackling down the problem faced in work place. But most of the researcher did not elaborate more on the suggested preventive program which will help more people understand with this type of problem, this kind of approach are more suitable. And throughout the years too, this MSDs problem still become a high percentage, without a proper solution since from [9] reported 96% workers been trouble with pain to [3] with 84.7% suffered from MSDs, and [1] reported 76.02% having trouble with back pain. [6] , talk about a training that played a major factor for this worker in developing injuries and illness at work place, but without proper elaborate either the kind of training is for maintenance work or it is a training for safety and health of the worker in work place. With ergonomic there is come auxiliary support for the worker, the invention of hand tools or work rotation system in order to help the worker in ease their pain and eliminate injury that involve manual handling or direct contact toward the object.

3.3. Working posture

All the researcher aware about the worker working posture which categories in awkward posture for example kneeling, bending, twisting, reaching and more, but the harm level that associate with the developing of injuries, illness and injury had not been explore more. The nature of vehicle maintenance posture which considered their body as an instrument for the work, can be a new entering topic to explore, how bad is can be considered a bad posture and it is matter to correct a bad posture?

Table 1: Article retrieved addresses the issues and result by past researcher regarding vehicle maintenance workers

Author (s)	objective	issues	Method	Findings
[1] Abaraogu et al., 2016	To investigate the prevalence, pattern and severity of back pain among automotive maintenance mechanics, as well as the personal and job variables associated with or predicting occurrence of back pain	Work-related back pain is high among automotive maintenance mechanics. Workstation policy and legislation on the reduction of risks. Health literacy and ergonomic education programs in this occupational group are imperative	Using a cross-sectional design, information about self-reported back pain and the associated variables were collected among 684 randomly recruited automotive mechanics (Nigerian).	Prevalence of back pain was 76.02%; with the majority experiencing low back pain. 63.3% workers reported they limited their activity due to the back pain. Older workers (>50 years), daily work lasting ≥5 hours duration, no more than primary education, being normal weight, frequent use of kneeling and sustained postures, and lack of knowledge of ergonomic postures were associated with increased prevalence of back pain. Lack of job autonomy, inadequate task clarity, heavy physical workload, manual

				material handling, strenuous posture, noisy environment, vibrations, work schedule and inadequate auxiliary support were also associated with increased prevalence of back pain among the mechanics.
[2] López & Rubio 2016	To analyse the effects of the factors associated with different types of injury (superficial wounds, dislocations and sprains, bone fractures, concussion and internal injuries, burns scalding and freezing) caused by occupational accidents in automotive repair workshops.	Small company with five or fewer workers is at risk of suffering three of the five types of injuries. The smaller the company, the greater the exposure to physical and chemical agents, lies in the difficulty in controlling different risks due to the limited material and human resources of such companies. The responsible of the company has to handle different issues at the same time, health and safety not priority. In addition, many owners of small company consider occupational safety as the responsibility of the worker. Regulation and demand become a financial burden.	Study of a sample consisting of 89,954 industry accidents reported from 2003 to 2008. Odds ratios were calculated with a 95% confidence interval.	Health and safety strategies and accident prevention measures should be individualized and adapted to the type of worker most likely to be injured in each type of accident. Occupational health and safety training courses designed according to worker profile and improving the participation of the workers in small firms creating regional or roving safety representatives would improve working conditions.
[3] Nasaruddin et al., 2014	To determine the association between risk factors and the prevalence of musculoskeletal disorder (MSDs) among auto repair mechanics.	Mechanics are likely to exposed to variety of ergonomic hazards and risk factors. Ergonomic awareness between employer and employee with training and information sharing needed to reduce the MSD.	191 mechanics 8 auto repairs in Klang Valley Stratified sampling Standardized Nordic Questionnaire (9 different part of body) RULA, Vibration measurement. Vibration measurement of hand power tool. Questionnaire on job content. Force exertion used. Direct logistic regression to assess the impact of risk factors.	87.4% suffered MSD Logistic regression analysis; factor that associated with symptoms: - RULA (7.933.95% CI 4.637-13.573) - Forceful exertion (3.173,95% CI 1.194-8.432) The magnitude of vibration power tools exceed action level 2.5m/s2 with (mean=3.99+S.E. 0.071) Significant of the study $p<0.05$.
[4] Monney et al., 2014	To assess the extent of work-related injuries and illnesses, access to first aid, use personal protective equipment, fire safety measure and hand hygiene practices among vehicle repair artisans	Vehicle repair workers need to be educated about the dangers associated with their work and the best practices to be adopted to forestall these risks. There is the need to rather incorporate basic occupational health and safety practices into the informal job training sessions of these artisans during their apprenticeship in order to instil in them the need to protect themselves at the workplace. Excessive noise levels and prolonged inhalation of contaminated air (isocyanates in spray paints and dust) in the area. Self-medication among the artisans poses grave health effects. Apart from abusing the medicines, this practice is	100 vehicles repairs artisans 28 autos mechanics 20 electricians 26 welders 18 sprayers 8 interior design Semi-structure questionnaire Extensive field observation Key informant interviews Analysed with Minitab v16	2/3 (64%) of the artisans have sustained work-related injuries mostly resulting from cuts and burns. Respondents' marital status (P = 0.014) and the type of work (P = 0.037) were found to be significantly associated with the incidence of physical injury, in contrast to their level of education (P = 0.874) and work experience (P = 0.203). Seventy-eight percent of the artisans' lack training in fire safety and besides, basic firefighting equipment is non-existent in the workshops visited. Self-medication after injury (55%; N= 64) and ignorance in first aid administration (92%) are common among the artisans. Furthermore, due to the physical exertions required by their work, most artisans (N = 57) experience musculoskeletal disorders. Use of PPE (27%) and proper hand hygiene practices (28%; N = 98) are generally ignored by the artisans posing possible health risks

		also known to contribute to the development of antibiotic resistance.		
[5] Abdellah RF & Morsy KM, 2013	To determine the prevalence of occupational injuries. To examine the factors associated with occupational injuries among young automobile repair.	Child labour problem. Develop policies to prevent occupational injuries. Promote safer work practice. Lack basic safety standard criteria such as proper ventilation and PPE Concern on child labour.	Cross-sectional study, Egypt 12-18 years old, 60 (at least one-year experience). Systematic random sample technique. Questionnaire on demographic data and occupational history include injury	68.3% reported injuries A significant association between the occurrence of injury with age, years of education, smoking, duration of employment $p<0.05$
[6] Sambo et al., 2012	This study is aimed to identify the determinants of occupational health hazards among roadside automobile mechanics in Zaria and to determine the level of their knowledge and practice on the use of personal protective equipment.	Training type, duration of training, years of experience and level of awareness of protective device are the major determinants of occupational hazards among roadside automobile mechanics in Zaria. Also, there was a high level of awareness but the low usage of the protective device among respondents. There is a need for emphasis on health education through programs promoting workplace safety among automobile workers There is a gap between awareness and usage of PPE as only 14% of the respondents make use of protective devices regularly while 49% use them occasionally and 37% do not use at all.	This is a cross-sectional descriptive study to identify the pattern of occupational health hazard, knowledge and practice of safety measures amongst roadside automobile mechanics in Zaria using interviewer-administered questionnaire (200 respondent).	Full-time mechanics constituted 82%. 44.5% were involved in general vehicle repairs, 26.5% were motor engine mechanics, 15% were auto electricians and 9% were welders. The commonest injuries were burns (86%), bruises (64.5%), crushed digits (62%) and cuts (59%). Forty-nine percent (49%) had experienced low backaches, 15% had joint pains, and 7% had hernia. Eighty-two percent (82%) were aware of protective devices. The commonest known safety devices were overalls (85%), boots (82.5%) and rubber gloves (80%) while the least known type of safety device was earmuff (25.5%) and barrier cream (3.5%). More than 3/4 (77.5%) were trained via apprenticeship and only 28% trained for more than 6 years. Majority (77.5%) worked 6–11 hours daily.
[7] Vyas et al., 2011	To examine the occupational injury patterns. To identify work stressor associated with injury.	Workers employed as automobile garage worker are low-wage workers. The high rate of cuts, burns and bruise contrary to American day labourers report (falls, burns, lacerations and crush) Young and inexperienced at high risk of injury. Workers that worked long hours have developed fatigue, stress and drowsiness. Suggestion Health education programs and measure directed towards prevention for the occupational disease will help. India characteristics of automobile repair workshop Unorganized sector, congested, having restricted work area, poor illumination, high noise levels (80-90 dB)-situated on road-side and extreme environmental condition-high temperatures and humidity. Circumstances may differ by region and by the employer.	Male workers 153 (India) Ergonomic checklist. Questionnaire on general health and psychosocial issues. The relative risk factors and correlation statistics to identify work stressor (expose to UV and thermal radiation, hot noisy environment, present of dust, fumes, oils, grease and other chemicals) associated with occupational injury.	63% report injuries Cuts were the chief injuries reported Poor work environment, machinery and tool characteristics. Suffering from poor health.

		Injury obtains by self-report rather than by medical or administrative records. Combination of personal protective equipment with effective worker safety training.		
[8] Smith 2007	Reported data on occupational injuries, illness, and fatalities to automotive service technicians and mechanics.	147 mechanics was killed on the job. Vehicle component become more complex and computerized. 290k mechanic certified ASE. Assault and violent acts are the leading cause of workplace fatalities.	Data reported from 2003-2005.	15,680 nonfatal injuries and illness Source of illness or injury is objects, substance, exposure, or bodily motion that directly produced or inflicted the disabling condition. Vehicle 19.5% Parts and material 27.3% Machinery 7.7% Tools, instrument and equipment 23.0% Event or exposure Overexertion 3390 Fall on the same level 1160 Exposure to harmful substance 550 Transportation accidents 570 Others 3040 Struck by object 3450 Struck against object 1770 Caught in object equipment 880 Others contact with object 870
[9] Torp et al., 1996	To identify a symptom of musculoskeletal (MSS) and working environment among car mechanics.	Due to the cross-sectional design of this study it is difficult to say the working environment is an important cause of the symptoms or only symptom-aggravating. The mechanic has assumed strenuous working posture even though the mechanics regard the garages as well-equipped. The strenuous working posture must be reduced to a minimum by changing the traditional manner of repairing cars and organizing the work in such a way that the car mechanics can avoid working too long or too often in these postures.	103 car mechanics 12 different garages Cross-sectional study Standard Nordic Questionnaire	96% car mechanic trouble with MSS Low back 76% Neck 62% Head 55% Shoulder 52% Knee 47% Mechanic between ages of 30-40 reported significantly more shoulder symptoms Back and shoulder symptoms restrain worker work more. Mechanic most common working posture may contribute to the development of back and shoulder symptoms.

4. Discussion

There are only two researchers using the approach of ergonomic tool assessment in assisting the address problem with vehicle maintenance workers. The methods used were Rapid Upper Limb Assessment (RULA) and ergonomic checklist. Most of the researcher used Nordic questionnaire to assess the prevalence of the problem. The prevention program can be summarized as identify and evaluate the risk or hazard in the workplace, as well as adopt an effective way to controls or eliminate and safe work practice. Safety and health issues should be both responsible for employee and employer, regarding the awareness and not seen it as a financial burden. Until now, musculoskeletal disease is still not solved, either the approach is not effective or constraint in term of cost. Before adopting or seeking a change to tackle the problem, first we need to be aware of how much the workers understand about the disease and injuries, how it becomes a burden to an organization. Second, how good is the root cause or the risk factors found, since exposure measure has improved over the years, most of the researcher did not address medical report from the organization, rather depends on self-report from the workers. This has become a culture in automotive service by most of the developed country, medical seeking as self-responsible, a lot of sick leave record stating as absent leave mostly on personal issues, without addressing any real health problem. Technical measure of muscle activity had not been mentioned as an option to measure how severe the problem, mostly on musculoskeletal disease. How much load or force that the vehicle maintenance task or activities gave impact to human muscle, and how much this load can damage human muscle, can be tackled using this kind of approach. It is still possible in identifying risk factors without having the knowledge of muscle activity using epidemiological approach, acquiring a relationship between jobs content information will increase the intervention effect on likelihood to develop MSDs.

Third how effective are the recommended intervention, as refer by [3], where the collected data happen to be in auto repair centres equip with auxiliary support resulted in high prevalence of MSDs in workers compared to [1], which the study conducted in Nigeria, mostly the vehicle workshop lack the auxiliary support, resulting in high prevalence of back pain. Posture can be a big question mark in this type of research, especially in vehicle maintenance sector, since the posture that claims to be awkward, are most common for the worker, and is posture correction matter? That is why intervention program that being introduced are important, either it can reduce MSDs in workplace, since there is limitation of research in this area. Mostly, intervention programs are made by office worker. It is recommended that health and safety strate-

gy together with prevention measure should be categorized and adopted to the type of work. And lastly, how well, the organization improve the outcomes for MSDs. In this type of question, we need to look from the basic, which recognition of exercise, there is no mention from the past researcher regarding this type of approach. Proper rest can become one of the factors, which not many past researchers discussed, while resting or before the beginning of the work, exercise does give an impact to human muscle. Concerning the meaning of injuries and disease, how this will affect worker's work life, permanently or temporary.

5. Conclusion

As conclusion, understanding the type of work, worker's opinion regarding the problem they are facing while assessing the risk problem is important. From literature concerning regarding work-related problem supports an assumption working environment in garage or service centre is one of the factor that contributes to this problem among vehicle maintenance workers. Further research on activity muscle should be conducted, to show a different engineering approach regarding the MSDs problem compares to a medical approach. This two-type application approach will result in a better solution in tackling down the musculoskeletal disease.

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