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Assessing the Fatigue Related Psychological Risk Factors among Oil and Gas Tankers Drivers in Malaysia

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ABSTRACT

The oil and gas sector plays a vital role in the economic development of Malaysia. The transportation of oil and gas product is a sensitive issue because a minor negligence of a tanker truck driver can cause a serious accident of heavy loss and fatality. To address this issue, the study of oil and gas truck drivers' Fatigue is very important because most of the transportation activities depend on them. Further, the psychological risk factors (personality traits, behaviors and work stress) have a high impact on drivers' fatigue. The annual report has been taken from Malaysian Institute of Road Safety Research. The report has identified the fatalities rate among heavy vehicle drivers. Several fatal crashes' results show the high fatalities rate in Malaysia. The concepts of mental fatigue, physical fatigue, task-related fatigue and socioeconomic impacts of drivers' fatigue are discussed in this study. In conclusion, the proposed methodology and future recommendations are presented.

Keywords: Psychological Risk Factors, Drivers Fatigue, Tanker Drivers
JEL Classification: R41

1. INTRODUCTION

This study aims to explore the psychological factors related to heavy vehicles drivers fatigue working in oil and gas sector of Malaysia. The existing literature is identifying the possibility of psychological factors such as work stress, driving behaviors and personality traits as indicators of driver fatigue. These reviews try to seek critical discussion on research design used by different researchers and draw a conclusion based on those finding and results. This paper is organized in the following order; the first section dealt with the fatigue introduction. Mental and physical fatigue is discussed in next two sections. The fatigue impact on the socioeconomic condition of drivers and their' performance are presented in five and six sections of this study respectively. The review of literature is followed by the psychological factors' section. The section nine described the methodologies of fatigue studies and proposed a model. This study concludes with some future recommendations. This study critically assessed methodologies of previous studies. Most of the articles were taken from accident analysis and prevention's journal.

However, the psychological factors need to be explored among heavy vehicle's drivers in oil and gas sector of Malaysia. This fatigue resulted in accidents and cause fatalities on roads as well at a workplace. The shift of work causes disturbance, anxiety and fatigue at a workplace (Lal and Craig, 2001). So, what are the psychological risk factors that impact of heavy vehicle's tanker drivers' fatigue? The main objective of this research is to identify the psychological risk factors (personality traits, driving behaviors and work stress) that impact on heavy vehicle's drivers' fatigue. Fatigue has markedly reduced the efficiency and cause general boredom among workers on duty (Åhsberg, 1998). The fatigue is oppositions to continue task performance, and it's become the cause of reduction human efficiency (Brown, 1997). Furthermore, the fatigue can be mainly divided into two groups. This classification of fatigue lies into physically and mental categories. These two types

need to be defined with the perspectives of heavy-duty drivers in Malaysia.

1.1. Mental Fatigue

A feeling of weariness might not be unhappy if one is allowed to be rested, but it could be disturbing an individual if the individual cannot be relaxed (Grandjean, 1988). At any moment, a person is in a specific state of sleep and state of alarm. The state ranges are between deep sleep, drowsy weary, light sleep, awake, resting, relaxed, alert, stimulated and state of alarm. Such type of symptoms of mental fatigue among heavy vehicle tanker's driver's impact on the driving performance of drivers (Sung et al., 2005). The high level of psychological distress in employees of full-time working seems to be high as compared to the part-time employees. The symptoms of mental health such as difficulties with attention, motivation, concentration and decision-making cause to the mental fatigue of drivers. These mental workloads related to the neurophysiological measurement. Every driver needs attention and cognitive efforts from the operators' brain (Borghini et al., 2014). The mental workload is near to the mental fatigue.

1.2. Physical Fatigue

The reduction of performance of a muscle after due to stress is called physical fatigue. It is characterized by reducing the power of muscle and their movement. The impaired muscular fatigue increased the chance of accidents (Grandjean, 1988). The driver must take the rest before driving. The rest before the driving reduced the physical fatigue. The hard physical work before driving can be increasing the risk of accidents among drivers and experiencing the physical fatigue during the driving (Strand and Rodahl, 1986). Most of the cargo drivers involved such a type of risk before performing the work. There is another study conducted on physical fatigue of seat interface pressure among drivers (Balasubramanian and Jagannath, 2014). The chemical tankers' drivers tend to be stressed by a prolonged journey as traveled long distance in chemicals supplies process. The psychological factors need to be investigated as a way of mitigating fatigue.

1.3. Fatigue and Drivers Performance

The fatigue is a major contributor of drivers' errors. The fatigue occurs when the physiological activities increased and influenced the performance of drivers (Nilsson et al., 1997). On the flip side, the physiological activities are diminishing during the daytime of driving. There are many other's factors that affect the performance of heavy vehicle drivers. One of them is continued driving without taking any rest. The indicators of driving performance influence on commercial driver's performance such as speed perception, depth perception number of incorrect action judgments, attention allocation value choice reaction time and number of correct light reactions (Wang and Pei, 2014). These indicators help to determine the performance of drivers. The task-related (TR) fatigue effects of highway driving activities. Moreover, such activities observed with a different environment such as morning, afternoon and at night (Gastaldi et al., 2014).

1.4. Socioeconomic Impacts of Drivers' Fatigue

The salary of drivers considered less as compared to the others' employees in the organization. There would be a reduction of income of drivers due to unavailability of a trip in Malaysia. The 50% of income loss is faced by drivers if no trip during this period of time. This reduction of income compels the drivers to find a part-time job other than an actual job. It's quite difficult to find out a good job. Most of the time, drivers are performing odd jobs at night while continuing driving at daytime (Mohamed et al., 2012). Therefore, drivers cannot sleep enough and this may cause vehicle accidents.

1.5. Drivers Fatigue and Psychological Factors

Three types of psychological factors will be applied to assess the drivers fatigue such as personality traits, driving behaviors and work stress. The personality traits related with the drivers of heavy vehicles and driver's performance. The aged employees are less addicted of drugs and more concentrated as compared to the young drivers (Adrian et al., 2011). The personality traits influence of driving fatigue. The multidimensional measure of fatigue such as visual fatigue, muscular fatigue, and boredom and malaise states associated with the personality of drivers (Matthews and Desmond, 1998). The driving-related stress generated from personal and environment factors that caused of drivers stressed (Ge et al., 2014a). Most of the drivers feeling fatigued are a common experience, and it depends upon the driving behaviors. The more complicated task performed by the drivers such as driving on curved roads on various environments related to the driver cognition and behaviors (Liu and Wu, 2009). The driver comes with the curvatures of a road but sometimes on a straight road the vehicle performance tends to deteriorate. There are all different perspectives of assessing the fatigue among heavy vehicle's tankers drivers. The psychological factors need more attention to assessing the fatigue and fatalities rate of heavy vehicle's drivers working in oil and gas sector.

1.6. Related Work

It can be true that fatigue is the second name of problems among the heavy-duty drivers, commercials' drivers and professional drivers working with different organizations and industries. The driver of heavy road's transport industries facing problems such as hours of works and perceptions of fatigue (Arnold et al., 1997). There are certain distinctions between the companies, and drivers fatigue and different approaches to handling fatigue. If fail to handle the fatigue it can create others problems such as vehicle fires and vehicle collision. There is a strong association between vehicle, collision, vehicle fires and driver's risk factor that affecting crashes on highways (Bunn et al., 2012). The fatigue is a risk factor between the Sleepiness and reduced vigilance among professional drivers. The accident report shows the professional drivers are more involved with Sleepiness as compared to the general population drivers (Carter et al., 2003). The reason of these phenomena is that the professional drivers performed more duty as compared to the drivers among the public. The ratio of fatigue is higher in commercial drivers because of shift work and overtime duty.

The fatigue-related risk is a serious safety hazard at a workplace. The fatigue-related risks' factors can be reduced by using the error management system. There have been used strategies by various authors to reduce the fatigue among drivers as well at a workplace.

A system of error management introduced for risk reduction the individuals can be work while fatigued (Dawson et al., 2012). The fatigue proofing strategies are adopted and avoiding risk behaviors. In this way, the fatigued-related error will be detected and try to avoid the accident and injury. The numbers of the accident among the light vehicle and heavy have been calculated in many studies. The studies show that the heavy vehicles drivers fatigue are caused accidents and injuries as compared to the light vehicles' drivers (Friswell and Williamson, 2013). The light vehicles' drivers remain within the premises of the cities, and the heavy vehicles' drivers need to shift the goods one place to another place. Sometimes drivers traveled on a rural area and an unsafe road that might be riskier and being fatigued among heavy vehicle drivers (Salva et al., 2014). The sleep deprivation and fatigue recognized as safety issues in transportation industries. This sleep deprivation causes the accidents among heavy drivers. The drivers need to be sleep 6.28 h per night according to the occupational health and safety regulations in the United States (Hanowski et al., 2007). The sleepiness behavior is diverse in a different vehicle like The drivers' behaviors toward the automated vehicle control is fluctuated in different situations and changes the behaviors of drivers due to visual attentions (Jamson et al., 2013). The heavy vehicles' drivers having the insurance policy feel less fatigue as compared to the non-insurance vehicle drivers (Mooren et al., 2014).

1.7. The Methodology of Fatigue Studies

This paper shows that the psychological risk factors are a key threat for driver's health and safety hazards in oil and gas sector of Malaysia. These risk hazard's impact on drivers fatigued that resulted in fatal crashes. Several methodologies have been applied in drivers' fatigue. Most of the time, vehicle's crashes lead to the drivers' injuries. The same type of the study has been conducted in Taiwan and developed a non-parametric classification regression tree (CART) model to establish the empirical relationship between driver/vehicle characteristics and injury severity outcomes, environmental characteristics, accident variables and highway geometric variables (Chang and Chien, 2013). In CART model, authors used determinants of injury such as seatbelt exercise drinking-driving, vehicle type, contributing circumstance, collision type, and a number of vehicles involved in the accident, accident location and driver/vehicle action.

The rate of injuries can be seen among heavy vehicles such as road train and B-doubles due to the size of vehicles. The study has been emphasized on the heavy vehicles drivers and train drivers fatigue road rail level crossing (Davey et al., 2008). The heavy vehicle accidents and fatigue have been estimated using different methods in different countries. The methods of a heavy vehicle are not the standardized, and the crashes of heavy vehicle-related fatigue vary from one situation to another. As a study has been conducted in New Zealand (Vashitz et al., 2008). A questionnaire and official accident's report acquired for the data collection and results interpretations of fatigue-related accidents. The comparison of sleep and sleepiness of drivers has been measured by excessively sleepy, never/rarely get enough sleep, never/rarely wake refreshed and observed apnea average neck size (Gander et al., 2006). The drivers' fatigue can be estimated by using multimodal fatigue measures. These measures are oxygen saturation level, surface electromyography, electroencephalography (EEG), blood pressure, seat interface pressure and heart rate (Jagannath and Balasubramanian, 2014). However, the psychological risk factors need attention to avoid heavy vehicle driver fatigue. The Figure 1 presented a proposed model for this study. This proposed model of fatigue related psychological risk factors are supported by state trait theory.

1.8. State Trait Theory

The founder of this theory is Spielberg's, who presented this theory in 1929 and that is related to the psychology of individuals and personality traits with the perspectives of driver behavior (Huang and Ford, 2012). The drivers are going to be stressed due to day to day driving. The aberrant behavior leads to vehicle crashes and fatalities. The driver's state-trait theory has been applied on driver's anger and risky behavior that caused fatigue (Deffenbacher et al., 2001). This theory has been correlated with the driver's anger and crash-related conditions, such as loss of concentration and loss of vehicular control. The loss of concentration due to driver stress reaction (Öz et al., 2010). The loss of vehicular control is because of a driver's aggression whilst driving. The stress impact on dangerous driving behavior causes fatal crashes among vehicle drivers (Ge et al., 2014b). The driver's anger depends on the situation whilst driving. The driver's anger with Malaysian drivers presented some factors of aggressive driving behavior, such as rudeness, traffic obstructions, hostile gestures, slow driving, illegal driving and police presence (Sullman et al., 2014).

1.9. Holistic Overview with Malaysian Perspectives

The holistic overview describes fatal crashes and fatalities from 1997 to 2013 in Malaysia. According to the report of the Malaysian Institute of Road Safety (MIROS), the road crashes were increasing with the passage of time. The fatigue-related fatal road crashes in Malaysia were caused by heavy vehicle drivers (Mohamed et al., 2012). This study put emphasis on the work-related fatigue among heavy vehicle drivers.

The Figure 2 describes fatal crashes and fatalities from 1997 to 2013 in Malaysia. This is general road accident data retrieved online November 2015. According to a survey, the number of road fatalities and fatal crashes between light and heavy vehicles

Figure 1: Proposed model

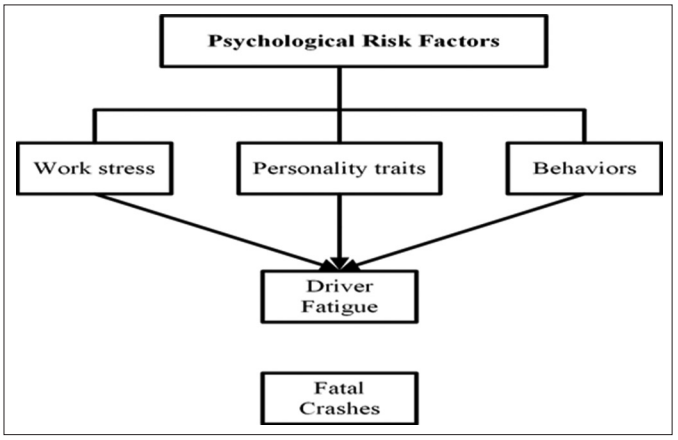
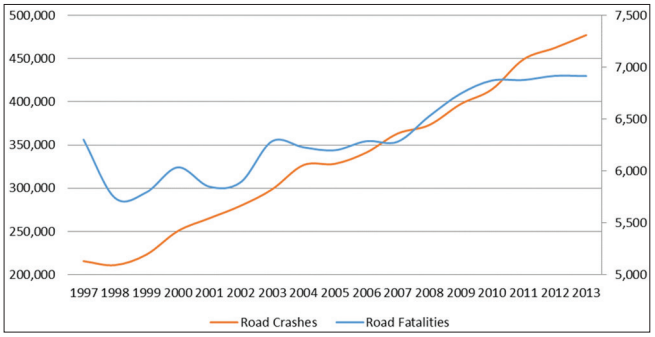


Figure 2: Holistic view with Malaysian perspective



reached an alarming stage in Malaysia. The holistic overview described fatal crashes and fatalities from 1997 to 2013 in Malaysia. According to the report of MIROS, the road crash is increasing with the passage of time. The fatigue-related fatal crashes caused by road fatalities among heavy vehicle drivers in Malaysia (Mohamed et al., 2012). This study emphasizes the fatigue related psychological risk factors among tanker's drivers in Malaysia.

2. CONCLUSION AND FUTURE DIRECTIONS

This paper examining the psychological risks' factors that contribute towards accidents among heavy vehicle's tanker drivers. Fatigue is potentially dangerous for the transportation industry. Therefore, fatigue-related risk factors need to be counter and prevented from vehicle's crashes. In this paper, the psychological risk factors contributed immensely towards the drivers' fatigue. Some of the studies developed the algorithm to better describe the drivers fatigue and sleepiness that cause traffic accidents. The EEG-based fatigue algorithm called the fatigue countermeasure algorithm (Lal et al., 2003). Some of the research identified the casual relationship between the sleep-related form of driver's fatigue and TR fatigue among drivers (May and Baldwin, 2009).

The future research on driver's fatigues, and accidents should be improved with the methodological limitations. The Manchester driving behaviors questionnaire will be used for data collection. The heavy vehicle tankers drivers will be the participants of this study. The non-intrusive fatigue detection system has been developed assuming driver's characteristics and video analysis of drivers (Azim et al., 2014). The new fatigue detection system can be developed based on the survey. Furthermore, the driver safety training needed to decrease driver fatigue.

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