



Risk Factors for Near Miss Incident among Long Distance Bus Drivers in Malaysia

*Nik Nor Ronaidi NIK MAHDI¹, Norsa'adah BACHOK², Norlen MOHAMED³, and *Mohd Nazri SHAFEI²*

1. State Health Department, Wisma Persekutuan, Jalan Sultan Ismail, Terengganu, Malaysia
2. School of Medical Sciences, Universiti Sains Malaysia, Kota Bharu, Kelantan, Malaysia
3. Malaysian Institute of Road Safety Research, Taman Kajang Sentral, Kajang, Selangor, Malaysia

*Corresponding Author: Email: drnazri@usm.my

(Received 20 July 2014; accepted 09 Sep 2014)

Abstract

Background: Road traffic accident is a worldwide public health issue that has its highest impact on low and middle income countries including Malaysia. Many previous studies concerned on the causality of the actual accidents and little attention were given to near miss incidents. Hence, the current study was designed to determine the prevalence and associated factors for near miss incident among long distance bus drivers in Malaysia.

Methods: A cross sectional study was conducted among 517 long distance bus drivers. Data were collected using interview-guided translated and validated Pittsburgh Sleep Quality Index and Manchester Driver Behaviour questionnaire. Multiple logistic regression analysis was performed to determine the significant factors for near miss incident among long distance bus drivers in Malaysia.

Results: The prevalence of near miss incident among long distance bus drivers was 37.5% (95% CI: 33.5, 41.8). The significant associated factors for near miss incident were younger age group (OR_{adj}: 1.99; 95% CI: 1.32, 3.01), longer distance travelled per day (OR_{adj}: 2.34; 95% CI: 1.52, 3.60), sleep disturbances (OR_{adj}: 1.74; 95% CI: 1.19, 2.54) and errors in driving behaviour (OR_{adj}: 1.31; 95% CI: 1.23, 1.39).

Conclusion: Self-reported near miss incidents were relatively high among long distance bus drivers in Malaysia. This issue should be taken seriously and preventive action should consider the significant human factors such as younger age group, errors in driving behaviours, sleep disturbances as well as occupational factors like distance travelled per day.

Keywords: Road traffic accident, Near miss, Bus drivers, Malaysia

Introduction

Road traffic accident, a worldwide public health issue which has its highest impact on low and middle income countries including Malaysia can be seen as part of an iceberg above the sea surface. Beneath the surface there are countless of near misses which are largely unreported. As reported by the World Health Organization in March 2013, 91% of the world's fatalities on the roads occur in low and middle income countries even though these countries only have about half

of the world's vehicles (1). Malaysia has been reported to have the highest fatality risk in the world and the death toll on Malaysian roads is relatively high when compared to other countries (2, 3).

Many previous studies have found that younger drivers tend to have higher accident rate compared to the elders (4-6). Among the factors to explain the risk for road accident among younger drivers is their experience in driving. Furthermore, younger drivers' risky behaviors are also influ-

enced by their psychological development at their stage of life.

A study in Tehran showed that lower socioeconomic level was significantly associated with increased road traffic accident rate and it remain unchanged even after adjustment for other demographic factors including education, marital status, gender and age (7). Educational level, which is one of the important aspects in socioeconomic status, may play a major role in increasing the risk for road traffic accident and injury.

Good quality of sleep plays a major role in maintaining health, stimulating growth and development, repairing muscles and tissues as well as boosting the immune system. The amount of sleep each person needs depends on many factors, including age. The amount of sleep a person needs also increases if he has been deprived of sleep in previous days. Getting too little sleep creates a "sleep debt" which eventually, the body will demand that the debt be repaid (8). Sleepy drivers have long been acknowledged to constitute a potential safety hazard, and several research studies have addressed various aspects of the problem.

Most of the previous studies concern more in the causality of the actual accidents with serious injuries and little attention were given to the near miss incident despite their likely relationship with actual accidents. Near miss incidents provide a good opportunity for transport companies to determine that the problem exists and to intervene before an actual accident occurs.

The aims of this study were to determine the prevalence of near miss and its associated factors (human and occupational factors) among long distance bus drivers in Malaysia.

Methods

Study Design and Subjects

A cross sectional study was conducted among long distance bus drivers from several commercial bus operators in Malaysia from March 2012 to March 2013. A full time bus driver aged of at least 21 years old with average driving distance of at least 160 kilometers per day was included in the study. On the other hand, those known to have

psychiatric illness, on anti-psychotic or anti-depressant drugs, physically disabled and taking antihistamine drugs regularly were excluded from the study.

Sample size was calculated based on the prevalence of near miss incident among long distance bus drivers using a single proportion formula. Using the rate of near miss among drivers as 18.3% (9) and precision set at 5%, the calculated sample size was 230. After considering a cluster effect of transport companies in this study as well as 20% non-response rate, the required sample size was 552. In view of limited subjects, a non-probability sampling was applied in which all 517 volunteered respondents who fulfilled the study criteria were included in this study.

In this study, near miss incident is defined as an unplanned sequence of events that could have caused injury or property damage if conditions were different or is allowed to progress. It is classified into four categories which are skidding (to slide sideways on the road), loss of traction (loss of grip), loss of control (nearly loss of control of the vehicle such as at a sharp corner) and braking or swerving (when driver had to brake suddenly and or swerve for example because another vehicle or pedestrian had enter their space) (10).

Research Tools

A proforma containing information on respondent's sociodemographic data (age, marital status, highest education and monthly income) as well as occupational information such as estimated average working hours per day, estimated distance traveled per day and duration of working experiences as bus drivers was used. Physical examination findings such as weight, height and visual acuity were also recorded. We also applied a translated and validated Pittsburgh Sleep Quality Index (PSQI) to assess respondent's sleep quality and patterns of their sleeps. In general, a high PSQI score indicate a poor sleep. The Global PSQI score were then categorized into good (score of ≤ 5) and poor (score of > 5).

Another tool that we used was a translated and validated Manchester Driver Behavior (MDB) questionnaire to determine aberrant driving behav-

ior. The questionnaire measures the respondent's driving behavior in three aspect (errors, lapses and violations). The higher the score meant the more frequent the respondent involves in aberrant driving behaviors.

Statistical analysis

Data entry and analyses were performed using SPSS version 21.0. Data were checked, explored and cleaned. Socio-demographic and occupational characteristics were summarized using mean (SD) or frequency (%). Both univariable and multivariable analyses were performed to determine the risk factors for near miss incident among the respondents. For univariable analysis, simple logistic regression was used as a screening in selection of variables for further steps in multivariable analysis. The variables tested were: age group, body mass index, marital status, educational level, number of households, working hours per day, distance travelled per day, monthly household income, working duration, duration of sleep, sleep disturbances, sleep latency, sleep efficiency, lapses, errors, violations, risk taking behaviors and vision. Variables with P-value of less than 0.25 were selected for multivariable analysis. All selected independent variables were analyzed using forward stepwise likelihood ratio (LR), backward stepwise likeli-

hood ratio (LR) and then manually using enter variable selection method to obtain a preliminary model.

Multicollinearity problem and all possible two-way interactions were checked. Then, preliminary final model was obtained. Fitness of model was tested by Hosmer-Lemeshow goodness-of-fit test. The classification table and receiver operator characteristic (ROC) curve were also used to determine the fitness of the model. The results were presented in adjusted odds ratio with 95% CI and P-value. P-value of less than 0.05 was considered as statistically significant.

Results

A total of 517 bus drivers in East Coast Malaysia aged from 22 to 69 years had consented and participated in the study. All of the respondents were male and most of them were Malay ethnicity (97.9%). The mean (SD) duration of working as a bus driver was 12.6 years (SD 8.01 years) with a mean (SD) distance travelled of 409.54 km (SD 143.71 km) daily. Their mean (SD) working duration was 7.9 hours (SD 2.95 hours) daily. Table 1 shows the socio-demographic characteristics of the respondents.

Table 1: Sociodemographic characteristics of 517 respondents

Characteristics	Mean (SD)	Frequency (%)
Age group		
21 to 45 years		253 (48.9)
> 45 years		264 (51.1)
Marital status		
Married		457 (88.4)
Single / divorcee / widower		60 (11.6)
Education level		
Secondary school and higher		377 (72.9)
Up to primary school		140 (27.1)
Number of households	4.8 (2.06)	
Monthly household income (RM)	2189.3 (903.62)	
Working hours per day		
≤ 8 hours		337 (65.2)
> 8 hours		180 (34.8)
Working experience		
≥ 10 years		305 (59.0)
< 10 years		212 (41.0)

Table 2: Types of near miss incidents reported by the respondents (n = 194)

Types of near miss incidents	n (%)	95% CI
Skidding	18 (9.3)	6.0, 14.2
Losing traction or grip	9 (4.6)	2.5, 8.6
Near loss of control	10 (5.2)	2.8, 9.2
Swerving or braking due to other vehicle (or pedestrian)	138 (71.1)	64.4, 77.1
Swerving or braking due to crossing animals	19 (9.8)	6.4, 14.8

Table 3: Associated factors of near miss incident among respondents by univariable and multiple logistic regression model (n = 517)

Variables	Crude OR ^a (95% CI)	P – value ^a	Adjusted OR ^b (95% CI)	P – value ^b
Age group:				
> 45 years	1.00	-	1.00	-
21 to 45 years	1.71 (1.19, 2.44)	0.004	1.99 (1.32, 3.01)	0.001
Distance traveled:				
≤ 400 km/day	1.00	-	1.00	-
> 400 km/day	1.44 (1.00, 2.06)	0.049	2.34 (1.52, 3.60)	< 0.001
Sleep disturbances	1.89 (1.36, 2.62)	<0.001	1.74 (1.19, 2.54)	0.004
Errors	1.27 (1.20, 1.34)	<0.001	1.31 (1.23, 1.39)	< 0.001
^a simple logistic regression; ^b multiple logistic regression				
Hosmer-Lemeshow test P-value = 0.898; Area under Receiver Operating Characteristics curve = 0.73.				

There were 194 (37.5%, 95% CI: 33.5, 41.8) of the respondents reported to have experienced at least one near miss incident while driving in the past year. Most of the incidents (59.8%) occurred at night, while 51.0% occurred during weekend. Among the different types of near miss incidents reported, swerve or brake due to other vehicle (or pedestrian) was the most frequently occurred. Table 2 shows the distribution of type of near miss incidents reported.

After considering sociodemographic variables (such as age, marital status, highest education and monthly income) and occupational information (such as estimated average working hours per day, estimated distance traveled per day and duration of working experiences as bus drivers) as well as their body mass index, visual acuity and sleep disturbance (using PSQI) as well as driving behavior (using MDB) in the multiple logistic regression, only age group, distance travelled in a day, sleep disturbance and driving errors were significantly associated with near miss among 517 respondents (Table 3).

Discussions

More than a quarter of long distance bus drivers in Malaysia had experienced at least one near miss incident in a year. The high prevalence of near miss incident really needs attention and urgent actions before it become a serious mass to the country. Since near miss and actual accident may share a similar causality (11), the accidents can be studied and actions to eliminate causes can be taken before it even started. On top of that, near miss study is a cheaper learning tool than learning from an actual injury or accident (12).

In term of time of occurrence, it seems that weekend does not give much effect to the occurrence of near miss incidents since there is no different in the occurrence of both events between weekdays and weekends. This is in line with the finding of 439 road accidents investigated by Malaysian Institute of Road Safety Research (MIROS) from 2007 to 2010 where they have found that there was no consistent pattern in the day of occurrence and

weekend showed no significant effect to accident frequencies compared to weekdays (13).

MIROS also reported that from 2007 to 2008, the majority of road accidents occurred during wee hours. However, the pattern differs in 2009, when road accidents occurred more frequently in the morning, mainly the time when the road is busy with people travelling to their workplace (13). Sixty per cent of near miss incident reported to be occurred at night shows that there are extra risks of night driving, especially during wee hours as factors related to fatigue and poor visibilities are remarkably high during that time frame (13).

Majority of near miss incidents reported by the respondents was swerving or braking due to other vehicle or pedestrian. These findings may suggest that human factors play an important role in near miss incidents, either due to the drivers' fault, the third party's fault or both. In addition, in this study we found that being a younger driver is a predictor for near miss incident. This is comparable with many previous studies, which showed that younger drivers often precede other age groups in the number of accidents involved (4, 14, 15). It can be explained by their immaturity and youth-related risky behaviors such as recklessness, speeding and drink driving (14, 16).

Other socioeconomic status such as educational level, number of households, monthly household income and monthly salary were not significant as predictors for near miss incident in the current study. These findings were in contrast from the previous studies (7, 17, 18). This finding could be explained by the majority of the respondents were from acceptable level of socio-economic status as most of them earn decent monthly income (above the national poverty line income).

Another significant predictor for near miss incidents is aberrant driving behaviour (drivers' error). This is already expected since human behaviour is the main cause for road accidents worldwide including Malaysia (19). Drivers' error which is defined as dangerous mistake and slips caused by misinterpretation of the situation has long been a focus of road safety research and with no doubt it is among the most common aberrant driving behaviour reported to be associated with accident

risk (20-22). This includes both failures of observation and misjudgements of the driver (23). In other words, errors are based on perceptual, attentional or judgmental processes (24). Thus, optimum sensory and cognitive abilities are required for attention, reception and evaluation of the incoming stimuli while driving. Impairments in any of these abilities may end up in errors.

Lapses (also known as attentional lapses, silly errors or slips) are mistakes due to driver's inattention as a result of either distraction, cognitive failure, or both (25, 26) are not significant predictor for near miss incident. In contrast, few studies have successfully reported significant associations between lapses and road traffic accidents involvement (20, 21). As lapses are related with inattention and cognitive failure, older drivers seems to be the most susceptible group of drivers.

Another important predictor for near miss incident found in the current study is sleep disturbance. Driver's fatigue or sleepiness as an important contributor for road traffic accident has been well established in many other studies in the literature (27-29). There is a long list of possible causes for sleep disturbances among drivers but the most frequently discussed in the literature is sleep disordered breathing, which is a group of disorders characterized by abnormalities of respiratory pattern (pauses in breathing) or the quantity of ventilation during sleep. The most common type of such disorder is known as obstructive sleep apnea, which is characterized, by the repetitive collapse or partial collapse of the pharyngeal airway during sleep and the need to arouse to resume ventilation. Sleep is thus disrupted because of recurrent sleep arousal in association with intermittent hypoxia and hypercapnia which will further influence their driving performance.

Considering road traffic accident may be related with the exposure to the risk itself, we studied the distance traveled per day in the analysis. This is to control the exposure of the driver and to determine whether it has a direct relationship with the risk for near miss incident. In this study, we found that those who drive more than 400 km per day are at risk to involve in a near miss incident. This could be explained by the more the person drives,

the higher the frequency of unexpected traffic events, which create a risk for near miss incidents. As the current study used a non-probability sampling method in which all available qualified and consented respondents were included in the study in view of a very limited availability of the sample, the extent to which the respondents of this study represent the entire long distance bus drivers in Malaysia is unknown. Another limitation of this study was the reliance on self-reported data. Employees often believe that there is at least a remote possibility that their employer could gain access to their responses. Although the respondents were reassured that the results would be confidential, the possibility of reporting bias would still be high because the drivers might feel that a poor result would affect their career. As a result, respondents might have responded in a way to portray themselves as good drivers.

In addition, recall bias may also occurred in the current study that caused difficulties to the respondents, especially to the elderly respondents to recall prior events, exposures, or experiences. Furthermore, an accident can even be a traumatic event to a person that one would like to forget it. Thus, the presence of these biases may have underestimated the rate, which influenced the accuracy and threaten the validity of the findings.

Conclusion

Self-reported near miss incidents were relatively high among long distance bus drivers in Malaysia. Younger age group, longer distance travelled in a day, sleep disturbances and errors behavior are the risk factors for near miss incidents. These significant risk factors need to be taken seriously to ensure safe driving. A well-designed and managed near miss program is one of the best proactive prevention systems since it empowers employees and enables observation and resolution of issues with up to date information in a timely manner. Bus companies will greatly benefit from a good near miss management system, which can be considered as a proactive preventive scheme in road safety. The companies can adopt the existing near miss management program or they can develop

their own program. The program should continuously utilize the information provided by the reported near miss incidents. It should be based on an analytical approach and employ a systematic procedure from identification to resolution of potential problems.

Ethical issues

This study was approved by The Research Ethics Committee (Human) of Universiti Sains Malaysia (USM) on February 6, 2012 {USM/KK/PPP/JEPeM [245.4.(4.10)]}. An authorization has been granted from commercial bus companies to conduct this study. A written consent was also obtained from the management and selected respondents. Confidentiality was well kept throughout the study by using anonymous technique so that only researchers were able to access personal details of the respondents.

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

The authors are most grateful to all respondents of the study who provided us with their valuable responses and to the commercial bus companies for their assistance and cooperation. The authors would also like to express their gratitude to Professor Daniel J. Buysse for his consent to use the PSQI questionnaire. The authors declare that there is no conflict of interest.

References

1. World Health Organization (2013). Road traffic injuries. Available from: <http://www.who.int/mediacentre/factsheets/fs358/en/>
2. Jacobs G, Aeron-Thomas A, Astrop A, Britain G (2000). *Estimating global road fatalities*. Transport Research Laboratory: Great Britain.
3. Kareem A (2003). Review of global menace of road accidents with special reference to

- Malaysia-a social perspective. *Malays J Med Sci*, 10(2): 31 - 9.
4. Bant D, Bhatija G, Bendigeri N, Kaul V (2010). A brief medico-socio-demographic profile of non-fatal road traffic accident cases admitted to Karnataka Institute of Medical Sciences. *Schol Res J*, 1(1): 32 - 6.
 5. Bener A, Burgut HR, Sidahmed H, AlBuz R, Sanya R, Khan WA (2009). Road Traffic Injuries and Risk Factors. *J Health Promot*. 7(2): 92 - 101.
 6. Kuchewar SV, Meshram RD, Gadge SJ (2012). Demographic Study and Medico-legal Aspect of Fatal Road Traffic Accident in Aurangabad. *J Life Sci*, 4(1):7 - 10.
 7. Sehat M, Naieni KH, Asadi-Lari M, Foroushani AR, Malek-Afzali H (2012). Socioeconomic Status and Incidence of Traffic Accidents in Metropolitan Tehran: A Population-based Study. *Int J Prev Med*, 3(3): 181- 90.
 8. National Institute of Neurological Disorders and Stroke (2010). Brain Basics: Understanding Sleep. Available from: http://www.masterdocs.com/fact_sheet_files/pdf/sleep_disorders.pdf
 9. Powell NB, Schechtman KB, Riley RW, Guilleminault C, Chiang RP-Y, Weaver EM (2006). Sleepy Driver Near-Misses May Predict Accident Risks. *Sleep*, 30(3):331 - 42.
 10. Hardy E (2009). A Study of Motorcyclists in Northern Ireland, Southern Ireland and Great Britain. Available from: <http://www.msgrgroup.org/forums/mtt/images/NearMissStudyandMotorcycles2009.pdf>
 11. Marsh P, Kendrick D (2000). Near miss and minor injury information: can it be used to plan and evaluate injury prevention programmes? *Accid Anal Prev*, 32(3):345 - 54.
 12. Intelix Technologies Inc. From Near-Miss to At-Risk: How Untracked Data Costs Lives and Kills Profit. Available from: <http://www.intelix.com/download/documentation/77170c7b03854b93bc21f46accbef6.pdf>
 13. Abidin ANSZ, Faudzi SAM, Lamin F, Manap ARA (2012). *MIROS Crash Investigation and Reconstruction: Annual Statistical Report 2007–2010*. Malaysian Institute of Road Safety Research: Kuala Lumpur.
 14. Freeman J, Scott-Parker B, Wong I, Haworth N (2012). Vulnerable road user groups: a review of younger drivers, motorcyclists and older drivers. *Vulnerable Groups & Inclusion*, 3. DOI: 10.3402/vgi.v3i0.14889.
 15. United States Census Bureau (2013). The 2012 Statistical Abstract. Available from: <http://www.census.gov/prod/2011pubs/12statab/trans.pdf>
 16. World Health Organization (2007). *Youth and Road Safety*. WHO: Geneva.
 17. Whitlock G, Norton R, Clark T, Pledger M, Jackson R, MacMahon S (2003). Motor vehicle driver injury and socioeconomic status: a cohort study with prospective and retrospective driver injuries. *Epidemiol Community Health*, 57(7): 512 - 6.
 18. Torre GL, Beek EV, Quaranta G, Mannocci A, Ricciardi W (2007). Determinants of within-country variation in traffic accident mortality in Italy: a geographical analysis. *Int J Health Geogr*, 6(49). doi:10.1186/1476-072X-6-49.
 19. Khiang NW, Ponniah S (2003). OSH profile in the transport sector in particular commuting hazard. Available from: http://www.mtuc.org.my/osh_profile_transport.htm
 20. Bener A, Al Maadid MG, Özkan T, Al-Bast DA, Diyab KN, Lajunen T (2008). The impact of four-wheel drive on risky driver behaviours and road traffic accidents. *Transportation Research Part F: Traffic Psychology and Behaviour*. 11(5): 324 - 33.
 21. Bener A, Özkan T, Lajunen T (2008). The Driver Behaviour Questionnaire in Arab Gulf countries: Qatar and United Arab Emirates. *Accid Anal Prev*, 40(4):1411-7.
 22. Curry AE, Hafetz J, Kallan MJ, Winston FK, Durbin DR. (2011). Prevalence of teen driver errors leading to serious motor vehicle crashes. *Accid Anal Prev*, 43(4): 1285 - 90.
 23. Parker D, Stradling SG (2001). *Influencing Driver Attitudes and Behaviour*. Department of The Environment, Transport and The Regions: London, United Kingdom.
 24. Parker D (2004). *The Psychology of Aggressive Driving*. United Nations: Geneva.
 25. Roca J, Lupiáñez J, López-Ramón M-F, Castro C (2013). Are drivers' attentional lapses associated with the functioning of the neurocognitive attentional networks and with cognitive failure in everyday life? *Transportation Research Part F: Traffic Psychology and Behaviour*. 17: 98 - 113.

26. Wickens CM, Toplak ME, Wiesenthal DL (2008). Cognitive failures as predictors of driving errors, lapses, and violations. *Accid Anal Prev*, 40(3): 1223 - 33.
27. Kee S, Tamrin SBM, Goh Y (2010). Driving fatigue and performance among occupational drivers in simulated prolonged driving. *Glob J Health Sci*, 2(1): 167- 77.
28. Philip P, Sagaspe P, Moore N, Taillard J, Charles A, Guilleminault C, Bioulac B (2005). Fatigue, sleep restriction and driving performance. *Accid Anal Prev*, 37(3): 473 - 8.
29. Vennelle M, Engleman HM, Douglas NJ (2010). Sleepiness and sleep-related accidents in commercial bus drivers. *Sleep and Breathing*, 14(1): 39-42.