PUBLIC HEALTH RESEARCH

Rear Seatbelt Usage in Malaysia: Findings from Roadside Observations and Surveys

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ABSTRACT

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Introduction Despite of its importance for preventing fatal and severe injuries in an event of a crash, limited studies were conducted to find out the status of seatbelt use among rear passengers in Malaysia. This study was conducted to the determine seatbelt use among rear passengers in Malaysia in conjunction with the introduction of the rear seatbelt law that took effect on 1st January 2009.

Methods Two methods were used; the roadside observations and surveys. A total of 4180 rear passengers were observed during the road side observation and 793 rear passengers were interviewed in the survey.

Results About 41.8 % (95 % CI: 38.3, 45.4) of rear passengers interviewed reported that they "Always/Often' wore safety belts, while roadside observation recorded slightly lower rate (36.2 % [95 % CI: 34.8, 37.7]). Based on the roadside observation method, male rear passengers were more likely to use rear seatbelts as compared to female rear passengers (with Odd Ratio: 1.17 (95 % CI: 1.03, 1.33)). Both methods consistently reported that rear passengers of Multipurpose Vehicle (MPV)/Sport Utility Vehicle (SUV) (survey method "always wear": 39.3 %, Odd Ratio: 2.02 [95 % CI: 1.13, 3.61], roadside observation method: 51.9 %, Odd Ratio: 2.23 [95 % CI: 1.89, 2.62]) were two times more likely to wear seatbelts as compared to rear passengers of a car.

Conclusions The two research methods indicate rear passengers in Malaysia were consistently having low seatbelt usage rate. As the rear seatbelt advocacy and enforcement programme are new in Malaysia, efforts to advocate rear seatbelt use should be strengthened. The changes in rear seatbelt usage rate need to be tracked regularly and as an alternative to roadside observation method, interview survey method could be used to measure the seatbelt usage rate and to identify the reason for not using safety belt among rear passengers.

Keywords Rear seatbelt usage - roadside observation - survey method.

INTRODUCTION

Rear seatbelt usage is proven beneficial in reducing the risk of severe injuries and fatalities among front and rear passengers[1, 2, 3]. Magnitude of effectiveness varies from study to study. Morgan[4] reported that back seat lap belts and shoulder belts were 32% (95% confident interval: 23 to 40 %) and 44% (95% confident interval: 35 to 50 %) effective in reducing fatalities compared to unrestrained back seat occupants. Elvik and Vaa[5], and Zhu[6] suggested that rear seatbelt wearing could reduce fatalities by 25 to 75 % among rear passengers.

While it was proven effective to prevent injury and death, based on the *Global status report on Road Safety: Time for Action*, only 57 % of countries require all car occupants to wear seatbelt and this figure is much higher in high-income countries (76 %) than in middle-income countries (54 %) and low-income countries (38 %)[7]. Furthermore, in many developed countries, although rear seatbelt use is required by law; the usage remains low as compared to front seatbelt usage rate[7]. The situation is even worst for developing countries, Routley[8] reported that rear seatbelt usage rate in Nanjing, China was only 0.5 %. The situation even worst as many countries do not monitor the seatbelt usage rate among rear passengers. In Malaysia, the government launched the National Advocacy Campaign to promote rear seatbelt wearing six month prior to the introduction of rear seatbelt law that took effect on 1st Jan 2009[9]. The evaluation conducted, 3 months after advocacy campaign, reported that the usage rate only increased to 2.5 % from the baseline of 1.6 % [10].

Many studies[11,12,13,14,15,16,17,18,19] used roadside observation method to measure the seatbelt usage rate as it reflected the actual practice by vehicle occupants while driving as compared to seatbelt use reported by the interview survey method[20,21,22,23]. The interview survey method typically is subjected to reporting bias that most studies try to avoid. The subjects tend to provide desirable responses to the question of seatbelt use status and therefore the estimate of usage rate may be an over estimate[23]. Routley[8] reported that seatbelt usage rates were higher than rates as reported by observation method. Although the use of roadside observation method is superior to the interview survey method, it has many weaknesses. Since, it has no interaction with the subjects; information related to individual characteristics for example age, education level, income level, ethnicity, license status and citizenship could not be collected. Critical information related to the practice of seatbelt use such as frequency of use, usage by time, distance of driving, and speed of driving are also could not be gathered. The Roadside observation method also has limited usefulness for observing vehicle occupant with heavily tinted windscreens and passengers sitting at the middle of back seat. Therefore, for reporting seatbelt usage especially among back seat passengers, the interview survey method would be more informative. As part of the broad evaluation of rear seatbelt use following the advocacy campaign, a series of roadside observation and interviews were conducted. Therefore the objective of this study was to examine the seatbelt usage rate as reported by the roadside observations and surveys**.** There was no intention to compare the findings obtained by these methods statistically.

METHODS

To avoid the influence of time factors on seatbelt usage rate, the roadside observation and the survey methods were conducted at the same month for two weeks; first and second week of February year 2009.

Roadside Observation Method

Study setting

The study was conducted in seven randomly selected states representing four different zones (Northern, Southern, Eastern and Central zones) of Peninsular Malaysia and Sabah and Sarawak zone of East Malaysia. Two districts from each state were then randomly selected as the study locations made up the total district involved to 14. Two observations site were then identified for each district made up the total observation sites to 28 sites. Criteria for site inclusion were slowing of traffic, and a safe position for viewing traffic at the closest distance.

Sample size determination

Taking a 5 % tolerable error at 95 % confidence interval, the minimum required sample size was calculated to be 384 subjects as determined by a single proportion formula based on 50 % estimated rear seatbelt usage rate. This usage rate was used as a starting point for calculations because it generated the highest number of observation required.

Field observations

The final observation unit was adult vehicle occupants. Two research assistants were stationed at each observation site during each data collection period, rotated over the sites and time periods. Depending on the traffic volume, the selection of the vehicles for observation was one in every 3 to 5 vehicles passing the observation point. To minimize measurement errors, all research assistants involved in data collection were given adequate training including field observation exercise. The survey targeted all occupants of light-duty vehicles, which included cars, light trucks, vans, multipurpose vehicles (MPV) and sport

utility vehicles (SUVs). Variables collected were gender, date and time of observation, belt use by occupant, and type of vehicle. Each observation period was for one hour, and took place during daylight hours. Vehicles with heavily tinted windscreen and taxies were excluded from the observation.

Survey Method

A self-administered questionnaire was designed for the evaluation of the effectiveness of the advocacy campaign. This report only extracted the rear seatbelt usage component. The questionnaire was developed in the national language and examined for face and content validity. Two public health experts in injury prevention and one researcher with experience in road safety research, particularly on road user behavior research, reviewed both the relevance and the content of the questionnaire.

Sample size calculation was done using EpiInfo Version 3.3.2. The expected rear seatbelt usage rate in the population was set at 40 % (based on the results reported by the observation method that was done one month prior to this survey; rear seat belt usage rate was 38.9 %), with 95 % confidence intervals, and worst acceptable rate in the population set at 44 % (10 % difference from the expected rear seatbelt wearing rate), the calculated sample size was 576. However, after considering the possibility of non respondents and incomplete questionnaire returned, the research team agreed to distribute the questionnaires to 800 subjects. A total of eight study areas were selected for the interview survey. These eight locations were selected for the survey as they overlapped with the locations for monitoring of seatbelt wearing rate by the roadside observation method. The subjects were approached by team members at different settings which included office, market place, parking lot and rest stations along the highways. Only those who ever seated as a rear passenger at least once within the last one week were recruited into the study. They were informed about the objectives of the study and were assured that information obtained would remain confidential. No name and identification card number were recorded to keep the questionnaires anonymous. Data collection was completed within two weeks (third and fourth week of February 2009).

Data analysis

Data was entered by trained officers into a database using EpiInfo statistical software. Then, data cleaning was done by a researcher before analysis using the same statistical software was performed. Descriptive analyses were performed, and 95 % CI were calculated for rear seatbelt usage rate. Chi-square analyses were also done for comparing seatbelt usage between gender and type of vehicle used. For this purpose, seatbelt use responses from interview survey method were re-coded into dichotomous variables where “Always wear” as one category and the rest of the responses were combined together.

RESULTS

Subject characteristics

Table 1 shows the summarized statistics of the survey respondents by two methods. For the interview survey method, out of 800 questionnaires handed out, 793 (99.1%) were completed. However, after data cleaning for the analysis of rear seatbelt use, only 756 were valid for analysis. Of 756 respondents, 59% were males and 41% were females. The age distributions was predominantly represented by the younger age group with overall mean (SD) age of 30 (9.7) years. The primary educated group was under represented (2.0%) as compared to secondary and tertiary educated groups which were almost equally represented in the survey. For the roadside observation method, a total of 4180 rear passengers were observed with female predominant (60 %) as compared to male (40 %). For type of vehicle, car was predominant for both methods used.

Table 1 Rear passenger characteristics based on two methods.

Variables	Survey Method n=756	Road Side Observation Method n =4180
Age Group		
17-25	44 %	Adult only
26-35	27 %	
35-45	17 %	
46-55	10	
>55	2 %	

Education Background		NA
Primary School	2 %	
Secondary School	45 %	
Tertiary Level	53 %	
Ethnicity		NA
Malay	87.1 %	
Chinese	6.3 %	
Indian	5.8 %	
Others	0.8 %	
Gender		
Male	59 %	40 %
Female	41 %	60 %
Type of Vehicle		
Car	82 %	79.4 %
MPV/SUV	9 %	18.4 %
Truck/Van (Others)	9 %	2.2 %

NA; data not available

Rear passenger seatbelt usage rate

Table 2 shows rear seatbelt usage rate reported by the surveys method. For overall seatbelt usage rate as reported by the survey method, 23.8 % (95 % CI: 20.8, 27.0) of rear passengers reported, "Always Wear" the seatbelt. Lower percentage (18 % [95 % CI: 15.4, 21.0]) was recorded for "Often Wear" response. As compare to the earlier method, the roadside observation method (Table 3) reported a higher usage rate (36.2 % [95 %CI: 34.8, 37.7). The combined responses of 'Always' and 'Often' (41.8 %) wear were close to the value reported by the roadside observation method but on the higher side with only 5.6 percentage-point difference (41.8-36.2 = 5.6 percentage points) or 15.5 % difference [(5.6/36.20 x 100 = 15.5 %]. Hence, the survey method overestimated rear seatbelt use by 15.5 % as compared to the roadside observation method.

Table 2 Self reported rear seatbelt usage rate.

Seat Belt Use	Wearing Status	Survey Method		
		n	**% (95 % CI)**	**OR (95 % CI)**
Overall	Always wear	180	23.8 (20.8, 27.0)	
	Often wear	136	18.0 (15.4, 21.0)	
	Sometime wear	226	29.9 (26.7, 33.3)	
	Rarely	99	13.1 (10.8, 15.8)	
	Never	115	15.2 (12.8, 18.0)	
	Always and often (combined)	316	41.8 (38.3, 45.4)	
Gender				
Male	Always wear	106	24.0 (20.1, 28.3)	1.05(0.70,1.51)
	Often wear	77	17.4 (14.1, 21.4)	-
	Sometime wear	133	30.1(25.9, 34.4)	-
	Rarely	57	12.9 (10.0, 16.5)	-
	Never	69	15.6 (12.4, 19.4)	-
	Always and often (combined)	183	41.4 (36.8,46.2)	-
Female	Always wear	70	23.0 (18.5, 28.3)	1
	Often wear	59	19.4 (15.2, 24.4)	-
	Sometime wear	89	29.3 (24.3, 34.8)	-
	Rarely	41	13.5 (10.0, 18.0)	-
	Never	45	14.8 (11.1, 19.4)	-

	Always and often (combined)	129	42.4 (36.8, 48.2)	-
Education				
Secondary	Always wear	102	30.3 (25.5, 35.5)	2.01(1.4,2.81)
	Often wear	67	19.9 (15.8, 24.6)	-
	Sometime wear	93	27.9 (23.0, 32.8)	-
	Rarely	41	12.2 (9.0, 16.3)	-
	Never	34	10.1 (7.2, 13.9)	-
Tertiary	Always wear	71	17.8 (14.2, 21.9)	1
	Often wear	65	16.3 (12.8, 20.3)	-
	Sometime wear	127	31.8 (27.3, 36.6)	-
	Rarely	57	14.3 (11.1, 18.2)	-
	Never	80	20.0 (16.3, 24.3)	-
Vehicle Type				
Car	Always wear	140	24.3 (20.9, 28.1)	1
	Often wear	110	19.1 (16.0, 22.6)	-
	Sometime wear	167	29.0 (25.4, 32.9)	-
	Rarely	69	12.0 (9.5, 15.0)	-
	Never	90	15.6 (12.8, 18.9)	-
	Always and often (combined)	250	43.3 (39.3, 47.6)	-
MPV/SUV	Always wear	24	39.3 (27.1, 52.7)	2.02(1.13,3.61)
	Often wear	11	18.0 (9.4, 30.0)	-
	Sometime wear	19	42.6 (19.4, 44.3)	-
	Rarely	4	6.6 (1.8, 15.9)	-
	Never	3	4.9 (1.0, 13.7)	-
	Always and often (combined)	35	57.4 (44.1, 70.0)	-
Others	Always wear	12	17.9 (9.6, 29.2)	1.47 (0.7,2.99)
	Often wear	10	14.9 (7.4, 25.7)	-
	Sometime wear	22	32.8 (21.8, 45.4)	-
	Rarely	14	20.9 (11.9, 32.6)	-
	Never	9	13.4 (6.3, 24.0)	-
	Always and often (combined)	22	32.8 (21.8, 45.4)	-

NA: Data not available

Seatbelt use by gender, the survey ('Always Wear' response) and the roadside observation method reported that the usage rate were higher among male (survey method: 24.0 % [95 % CI: 20.1, 28.3]; roadside observation method: 38.4 % [95 % CI: 36.1, 40.8], Odd Ratio: 1.17 (95 % CI: 1.03, 1.33)) as compared to female rear passengers (interview survey: 23.0 % [95 % CI :18.5, 28.3]; roadside observation: 34.8 % [95 % CI :32.9, 36.7]). The 'Always' and ' Often' wear responses, when combined reported a higher usage rate for both female and male rear passengers as compared to rates reported by the roadside observation with small difference for male (3.0 %) and female (7.6 %) respectively.

Seatbelt use by education level revealed that rear passengers with secondary education level (always wear: 30.3 % [95 % CI: 25.5, 35.5], often wear: 19.9 % [95 % CI: 15.8, 24.6]), have a higher usage rate as compared to tertiary education group (always wear: 17.8 % [95 % CI: 14.2, 21.9], often wear: 16.3 % [95 % CI: 12.8, 20.3]). Rear passengers with secondary education (Odd Ratio: 2.01(1.40, 2.81) were two times more likely to wear seatbelt as compared to tertiary education group.

Seatbelt use by type of vehicle recorded a consistent finding between the two methods where seatbelt usage rate among rear passengers of Multipurpose Vehicle (MPV)/Sport Utility Vehicle (SUV) (survey method "Always Wear": 39.3 %, Odd Ratio: 2.02 [95 % CI: 1.13, 3.61], roadside observation method: 51.9 %, Odd Ratio: 2.23 [95 % CI: 1.89, 2.62]) were two times more likely to wear seatbelt as compared to rear passengers of cars.

DISCUSSION

The results reported herein show that the seatbelt usage rate among rear passengers in Malaysia remains low. This study revealed that only 23.8 % and 18.0 % of respondents claimed to 'Always' and

'Often' wear rear seatbelt respectively. The combined 'Always' and 'Often' wore self-reported rate was 41.8 % which was higher than the usage rate reported by the roadside observation method (36.2 %). Both reported usage rates were far lower than the rates among rear passengers in the developed countries like Australia (92%), Canada (87%), France (83%), and New Zealand (87 %)[7]. The percentage-point difference for usage rate reported by the interview survey (always and often wear) as compared to the roadside observation was relatively small (5.6 %) in this study, while, Routley[8], in his study on seatbelt wearing among taxi driver in Nanjing, China recorded a bigger difference in usage rate when measured by interview method as compared to roadside observation method. He reported that for 'Always and Mostly wear', the self-reported rate was 56.4 % as compared to observed rate of 31.7 % (by roadside observation) and 20.4 % (by In-taxi observation). However, different occupant category in both studies might contribute to different level of reliability in self-reporting usage rate. Even though, it is difficult to explain, the status of the rear seatbelt law in Malaysia that was about two months when the study was conducted might had contributed to a relatively small difference in self-reported as compared to observed seatbelt usage rate in current study. The community might not feel socially guilty for not wearing seatbelt while seating at the back of a vehicle, therefore, over reporting of seatbelt use status was less likely to occur.

As always reported, one of the limitations for relying on self-reported usage rates; it tends to be on higher side due to reporting bias. This study shows that the reporting bias could be small and within acceptable range when studying seatbelt usage rate among rear passengers in Malaysia. The seatbelt usage rates "Always/Often" wear reported through survey method could provide a good estimate of seatbelt wearing as it mirror the usage rate reported by the roadside observation method as shown in our study. This is very important tool for studying seatbelt usage rate among rear passengers where the roadside observation method has difficulty to observe the middle seat passengers, passengers in vehicle with heavily tinted windscreens, and during night time.

The higher rate of rear seatbelt usage among road users with secondary level of education compared to the rate of usage among road users with tertiary level of education is perplexing. It is the assumption that, the higher the education level, the better read a person is and the more they are aware of the legal requirements in wearing rear seatbelts but the results obtain appear contrary to the assumption. Due to the limitations of this study, no definite explanation can be obtained as to why there was a difference in usage rate of rear seatbelts in regards to level of education.

As for rate of rear seatbelt usage among users based on vehicle use, the higher rate of usage among passengers of MPV/SUV can be misleading. This is because, there were more car users interviewed compared to users of MPV/SUV and users of vehicles classified in others (Trucks and Vans). The number of car passengers reporting usage rate of rear seatbelts as 'Always' and 'Often' is much higher than those of MPV/SUV passengers but as comparisons are made within each respective categories, the data might not revealed the true picture. Had there been equivalent number of MPV/SUV to car users, that were interviewed, the result obtained might be different.

CONCLUSIONS

The two research methods found rear passengers in Malaysia had consistently low seatbelt usage rate (This is in line with self-reported usage rate for "always and often wear": 41.8 %; and usage rate reported by observation method: 36.2 %). As the rear seatbelt advocacy and enforcement programme are new in Malaysia, efforts to advocate rear seatbelt use should be strengthened. These could be addressed by greater enforcement and more media campaigns to increase the public awareness level. The changes in rear seatbelt usage rate need to be tracked regularly and efforts to increase the usage rate could be revised to be more strategic. As an alternative to the roadside observation method, the survey method could be used to measure the seatbelt usage rate and to investigate factors associated with the seatbelt wearing status. Additionally, the tools to obtain data would have to be improved in order to understand more concerning the low usage rate of wearing rear seatbelts. This is to ascertain whether the non-conforming to rear seatbelt wear on part of road users are due to behaviour, to lack of knowledge or awareness or simply to failure of design.

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REFERENCES

1. Ichikawa M, Nakahara S, Wakai S. Mortality of front-seat occupants attributable to unbelted rear-seat passengers in car crashes. Lancet, 2002; 43-44.
2. Broughton J,. The actual threat posed by unrestrained rear seat car passengers. Accid Anal Prev, 2004; 36, 627-629.
3. Shimamura M, Yamazaki M, Fujiti G. Method to evaluate the effectiveness of safety belt use by the rear passengers on the injury severity of front seat passengers. Accid Anal Prev, 2005; 37, 5-17.
4. Morgan C. Effectiveness of lap/ shoulder belts in the back outboard seating position. 1999; NHTSA Report Number DOT HS 808945.
5. Elvik R, Vaa T. The handbook of road safety measures. Amsterdam, Elsevier Science. 2004.
6. Zhu M et al. Association of rear seat safety belt use with death in a traffic crash: A matched cohort study. Injury Prevention; 2007; 13; 183-185.
7. World Health Organization. Global status report on road safety; time for action. Geneva, Who Health Organization. 2009
8. Routley, Ozanne-Smith J, Li D, Hu X, Wang P, Qin Y. Pattern of seatbelt wearing in Nanjing, China. Injury Prevention; 2009; 13, 388-393.
9. Road Transport Department, Road Transport Act 1987; Rules motor vehicles (rear seatbelt), Amendment 2009.
10. Norlen M, Fadhli Y, Ilhamah, et al. Achievement of first 3-month advocacy program; rear seatbelt use; public awareness and practice. MRR 09/2008. Malaysia Institute of Road Safety Research. 2008
11. Beaton SJ, Kramer CF, Thode HC, Hariss D,. A field evaluation of the effectiveness of the Virginia Safety Law. Forensic Rep, 1988; 1, 229-236.
12. Brillhart BA, Jay HM., The impact of Texas state legislation on the use of safety belts. Rehabil Nurs, 1988; 13, 146-149.
13. Cope JG, Johnson AW, Grossnickle WF. Behaviour engineering proposals: Effects on drivers and passengers of mandatory use law for safety belts. Percept Mot Skills, 1990; 71, 291-298.
14. Preusser DF, Williams AF, Lund AK The effects of New York's seatbelt use law on teenage drivers. Accid Anal Prev, 1987;20, 245-250.
15. Reinfurt DW, Campbell BJ, Stewart JR, Stutts JC. Evaluating the Noth Carolina safety belt wearing laws. Accid Anal Prev, 1990; 22, 197-210.
16. Ulmer RG, Preusser CW, Preusser DF, Cosgrove LA. Evaluation of California's safety belt law change from secondary to primary enforcement. J Safety Res, 1995; 26, 213-220.
17. Wagenaar AC, Wiviott MB. Effects of mandating seatbelt use: a series of survey on compliance in Michigan. Public Health Res 1986; 101, 505-513.
18. Williams AF, Wells JK, Lund AK., Shoulder belt use in four states with belt use laws. Accid Anal Prev, 1987; 19, 251-260.
19. Kim S, Depue L, Spence L, Reine J. Analysis of teenage seatbelt use: From the 2007 Missouri high school seatbelt survey. Journal of Safety Research, 2009; 40,311-316.
20. Escobedo LG, Chorba TL, Remington PL, Anda RF, Sanderson L, Zaidi AA. The influences of safety belt laws on self-reported safety belt use in the United States. Accid Anal Prev, 1992; 24, 643-654.
21. Fielding JE, Knight KK, Goetzel RZ. The impact of legislation on self-reported safety belt use in working population. J Occup Med, 1992; 34, 715-717.
22. Tipton RM, Camp CC, Hsu K. Effects of mandatory seatbelt legislation on self-reported seatbelt use among male and female college students. Accid Anal Prev, 1990; 22, 543-548.
23. Perkins B.J, Helgerson S.D, Harwell T.S. Attitudes toward a primary seatbelt law among adults in a rural state with a secondary seatbelt law. Journal of Safety Research, 2009; 40, 49-52.