Association Between Exposure/Non-Exposure to the Mandatory Seat Belt Law with Regards to Compliance in Vehicle Accident Victims – A Hospital Review

EW Williams[1], M Reid[2], JLM Lindo[3], J Williams-Johnson[1], S French[1], P Singh[1], AH McDonald[1]

ABSTRACT

Objective*: Injuries sustained in motor vehicle accidents (MVAs) are a major challenge to the Jamaican healthcare system. In November 1999, Jamaica enacted legislation to make seat belt usage in motor vehicles compulsory. The effect of this policy change on seat belt usage is unclear. This study therefore sought to determine the prevalence of seat belt usage and to determine the association between exposure/non-exposure to the mandatory seat belt law and seat belt use in subjects who presented to the Accident and Emergency Department (A&E) of the University Hospital of the West Indies (UHWI) as a result of motor vehicle accidents.*

Methods: *Subjects were recruited from June to November 2003, post-seat belt law (POBL) period, and May to October 1999, pre-seat belt law (PRBL) period. Data collected included demographic variables, seat belt use and position of the occupants in the vehicle.*

Results: *Of the 277 patients who were eligible for inclusion, data were complete in 258 subjects, 87 in the PRBL period and 171 in the POBL period. The prevalence of seat belt use was 47% (PRBL) and 63% (POBL) respectively. There was no significant gender difference at each period. The odds of wearing seat belt in the rear of a motor vehicle were significantly lower than that of a driver (Table 3, OR 0.19, 95% CI 0.07, 0.48). Adjusting for age, gender and position in vehicle exposure, there was about 100% increase in the odds of seat belt use during the post seat belt law era (OR = 2.09, 95% CI 1.21, 3.61).*

Conclusion: *It is concluded from this hospital-based study that the mandatory seat belt law legislature was associated with increased seat belt use in motor vehicle accident victims. However, current data from the Road Traffic Agency indicate that there is still an alarming number of fatalities. This clearly suggests that additional public health measures are needed to address the epidemic of motor vehicle trauma in Jamaica.*

Asociación Entre Exposición/no Exposición a la Ley Obligatoria de Cinturón de Seguridad en Relación con su Cumplimiento en el Caso de Víctimas de Accidentes Vehiculares – Un Estudio Basado en Datos de Hospital

EW Williams[1], M Reid[2], JLM Lindo[3], J Williams-Johnson[1], S French[1], P Singh[1], AH McDonald[1]

RESUMEN

Objetivo: *Las heridas producidas en accidentes en vehículos motorizados (AVM) constituyen uno de los principales desafíos para el sistema de atención a la salud en Jamaica. En noviembre de 1999, Jamaica aprobó una legislación que obligada al uso del cinturón de seguridad en vehículos motorizados. El efecto de este cambio de política sobre el uso del cinturón de seguridad no está claro. Por lo tanto, este estudio busca determinar la prevalencia del uso del cinturón de seguridad y determinar la asociación entre exposición/no exposición a la ley obligatoria de cinturón de seguridad y el uso del cinturón de seguridad en sujetos que acudieron al Departamento de Accidentes y Emergencia (A&E) del Hospital Universitario de West Indies (HUWI) como resultado de un accidente vehicular.*

Métodos: *Los sujetos fueron reclutados de junio a noviembre de 2003, período posterior a la ley de cinturón de seguridad (PLCS), y de mayo a octubre de 1999, período anterior a la ley de cinturón de seguridad (ALCS) Los datos recopilados incluyeron las variables demográficas, el uso de cinturón de seguridad, y la posición de los ocupantes del vehículo.*

From: Department of Surgery, Radiology, Anaesthesia and Intensive Care[1], Tropical Medicine Research Institute[2] and Department of Community Health and Psychiatry[3], The University of the West Indies, Kingston 7, Jamaica, West Indies.

Correspondence: Dr EW Williams, Emergency Medicine Division, Department of Surgery, Radiology, Anaesthesia and Intensive Care, The University of the West Indies, Kingston 7, Jamaica, West Indies. Fax: (876) 927-2101, e-mail: verz3us@yahoo.com.

Resultados: *De los 277 pacientes que eran elegibles para ser incluidos, se completaron los datos de 258 sujetos, 87 en el período ALCS y 717 en el período PLCS. La prevalencia del uso del cinturón de seguridad fue 47% (ALCS) y 63% (PLCS) respectivamente. No hubo diferencia significativa de género en ninguno de los períodos. Las probabilidades de uso del cinturón de seguridad fueron significativamente más bajas para los ocupantes del asiento trasero que para el conductor del auto (Tabla 3, OR 0.19, 95% CI 0.07, 0.48). Ajustando por edad, género y posición en exposición vehicular, hubo un aumento de alrededor del 100% en las probabilidades de uso del cinturón de seguridad durante la era posterior a la ley del uso del cinturón de seguridad (OR = 2.09, 95% CI 1.21, 3.61).*

Conclusión: *A partir de este estudio basado en datos de hospital, se llegó a la conclusión de que la legislación de la ley del uso obligatorio del cinturón de seguridad, estuvo asociada con el aumento del uso del cinturón de seguridad en víctimas de accidentes con vehículos motorizados. Sin embargo, los datos actuales de la Agencia del Tráfico de Carreteras, indican que existe todavía un número alarmante de casos fatales. Esto sugiere a todas luces la necesidad de medidas de salud pública adicionales para abordar la epidemia de traumas por accidentes de vehículos en Jamaica.*

West Indian Med J 2007; 56 (3): 2

INTRODUCTION

Road trauma is a major public health problem in all motorized societies. Injuries sustained in motor vehicle accidents (MVAs) are a challenge to the healthcare system and an enormous societal burden. Statistically, an individual in the United States of America (USA) can expect to be involved in a MVA every 10 years and has a 33% chance of sustaining a disabling injury during a lifetime of driving (1). The overwhelming body of evidence supporting the effectiveness of motor vehicular seat belt use in reducing injuries and saving lives has motivated many countries to introduce seat belt legislation (2, 3). However, despite public educational programmes and improvements in seat belt legislation, it's use has been disappointing and road traffic accidents continue to exert an unacceptably high toll on health expenditures overall.

An observational study from the National Highway Traffic Safety Administration (USA) and self-reported data on seat belt use (1985–1993) indicated that persons most likely to be involved in traffic accidents (males, drinkers of alcohol and young drivers) were significantly less responsive to seat belt laws (4). Seat belt usage among high-risk drivers also remained limited and may require more targeted health promotion strategies for this group (5). In November 1999, the Jamaican legislature amended the Road Traffic Act to make seat belt use compulsory for drivers and front-seat passengers (6). Prior to this mandatory law, an earlier observational survey showed that 21.1% of private motor vehicle drivers and 13.5% of front seat passengers voluntarily wore seat belts in Kingston, the capital (7). Within this context, it has been reported that fatal accident rates in Jamaica are more than 10–15 times those of the USA and the United Kingdom (UK) (8). Thus, knowledge of seat belt utilization patterns is essential to estimate the level of risk to the travelling public, the potential for improvement and to provide information for health planners (7).

This study sought to determine, in a hospital based sample of subjects who presented to the Accident and Emergency (A&E) department of the UHWI as a result of motor vehicle accidents, the prevalence of seat belt usage. A secondary objective of the study was to determine the association between level of exposure to the mandatory seat belt law and the reported use of seat belt.

SUBJECTS AND METHODS

All subjects who presented to the Accident and Emergency Department of UHWI, Kingston, Jamaica, during the six-month periods, June to November 2003, post-seat belt law (POBL) period and May to October 1999 pre-seat belt law (PRBL) period, as a result motor vehicular accidents (MVAs) were eligible for the study. For the purpose of this study, a motor vehicle was defined as a motorcar or motor truck with seating capacity of less than seven persons. Exclusion criteria included bicyclists, bus passengers, pedestrians, transfers from other hospitals and subjects who reported to the A&E department later than 24 hours after the accident.

Eligible subjects recruited in the POBL period were interviewed by their attending physician with the use of a short questionnaire. Data collected included demographic variables, seat belt use and position of the occupants in the vehicle. Similar data were extracted from the patient-files of eligible subjects recruited in the PRBL period, May to October 1999. Recruitment in the PRBL period was facilitated by the A&E attendance registry.

Statistics

Values are expressed as counts or means ± standard deviation (± sd) as appropriate. For continuous outcome variables, the independent t-test was used to compare means of group. The study assessed the effect of seat belt legislation on the probability that a subject presenting to the A&E department who was involved in a MVA was wearing a seat belt at the time of an accident. An unmatched case-control analysis was employed with data collected during the POBL period being considered exposed and data collected during the PRBL period being unexposed. A case was defined as a MVA accident victim who presented to the A&E department and reported wearing a seat belt. A control was defined as a MVA accident

victim who presented to the A&E department and reported not wearing a seat belt at the time of the accident. Mantel-Haenszel methods and logistic regressions were used to control for the effects of confounding variables. Data analysis was performed using Stata statistical software version 8 (College Station, Tx). Inferential tests were considered significant with $p < 0.05$.

RESULTS

A total of 277 patients were eligible for inclusion in the study sample. One hundred participants were enrolled from May to October 1999 from the A&E registry (PRBL period). One hundred and seventy-seven patients were enrolled from June to November 2003 (POBL period). However, 13 and six subjects were excluded from data analysis because of incomplete records from the PRBL and POBL periods respectively. Thus data analysis was performed on 258 subjects, 87 in the PRBL period and 171 in the POBL period. The mean age (± sd) of subjects in the sample was 35.3 ±13.4 years with a range of 7–76 years. The mean age of subjects in the PRBL period tended to be older (mean ± sd, 37.3 ± 13.2 years; range 19–69 years) than that of those from the POBL period (34.3 ± 13.5; range 7–69 years, $p = 0.088$; Table 1). One hundred and forty-two (55%) of the sample size was male. There was no significant difference in mean age by gender (Table 1).

The prevalence of reported seat belt use in the PRBL period was 47% and the prevalence in the POBL was 63% (Table 1). Among males, the reported prevalence of seat belt use was 62% and among females it was 53%. There was no evidence that gender modified the association between exposure/non-exposure to the mandatory seat belt law and the reported use of seat belt in accident victims presenting to the A&E department UHWI (Table 2, $\chi^2 = 0.87$, df (1), $p = 0.35$). However, there was a significant association between exposure/non-exposure to the mandatory seat belt law and the use of seat belt (Table 2). Adjusting for gender, there was 93% increase in the odds of seat belt use during the POBL period (Mantel-Haenszel adjusted OR = 1.93, 95% CI 1.1, 3.2).

The majority of the MVA victims visiting the UHWI during the PRBL period were drivers (n = 87, 58%) followed by front and back-seat passengers, 34% and 8% respectively (Table 1). Similarly, in the POBL period, 58% (n = 171) of MVA victims were drivers, 35% front seat passengers and 12% back seat passengers.

The effects of variables such as age, gender and position in vehicle on the association between exposure/non-exposure to the mandatory seat belt law and the reported use of seat belt in accident victims presenting to the A&E department, UHWI, was assessed by logistic regression. The odds of wearing seat belt in the rear of a motor vehicle were significantly lower than that of a driver (Table 3, OR 0.19, 95% CI 0.07, 0.48). Adjusting for age, gender and position in vehicle exposure, there was approximately 100% increase in the odds of seat belt use during the POBL era (Table 3, OR = 2.09, 95% CI 1.21, 3.61).

Table 1: Age, gender and position in motor vehicle by exposure/non-exposure to the mandatory seat belt law and reported seat belt use in subjects

Variables	**PRBL period**			**POBL period**		
	All (n = 87)	Seat belt used (n = 41)	No seat belt used (n = 46)	All (n = 171)	Seat belt used (n =108)	No seat belt used (n = 63)
*Age (yr)	37.3 ±13.2	37.3 ± 13.5	37.3 ± 13.2	34.3 ±13.5	33.6 ±12.9	35.3 ±14.5
Gender (M: F)	48:39	23:18	25:21	94:77	65:43	29:34
Position						
Driver	50	25	25	99	71	28
Front seat	30	16	14	52	29	23
Back Seat	7	0	7	20	8	12

Values are counts. * Values are means ± sd

Table 2: Association between reported seat belt use and exposure/non-exposure to the mandatory seat belt law stratified by gender

Gender	**Odds ratio**	**95% Lower CI**	**95% Upper CI**
Male	2.44	1.12	5.30
Female	1.48	0.63	3.44
Combined	1.93	1.14	3.26

Test of homogeneity $\chi^2 = 0.87$, df =1, $p = 0.351$.
Mantel-Haenszel $\chi^2 = 6.10$, df =1, $p = 0.014$.

Table 3: Association between reported seat belt use and exposure/non-exposure to the mandatory seat belt law adjusting for age, gender and position in motor vehicle

Variable	**Odds ratio confidence limit**	**95% lower confidence limit**	**95% upper CI**
Age (yrs)	0.99	0.97	1.01
Male	1.69	0.99	2.86
Position (reference group = driver)			
Front seat	0.72	0.41	1.27
Back seat	0.19	0.07	0.48
Post-seat belt law exposure	2.04	1.21	3.51

Table 4: Motor vehicle accident fatalities in Jamaica 1994–2004 (from RTA, Kingston, Jamaica)

Year	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Total	385	367	342	372	356	295	334	361	408	391	361

DISCUSSION

The data reported here provide evidence of increased use of seat belt in the POBL period, adjusting for possible confounders of age, gender and position in motor vehicle.

Road trauma is a major public health problem with serious clinical implications. Locally, road traffic accidents account for 20% of general trauma admissions and 77% of trauma mortality in patients admitted to the UHWI (9). When compared to other leading causes of death and disability throughout the lifespan, traffic crashes are prominent during the first three decades of life. Furthermore, the single most prevalent behavioural risk factor for early death and disability is actually failure to use safety belts (3). In the POBL period, 63% of drivers used seat belt at the time of their accidents. This represented a 34% increase over the four-year period prior to implementation of seat belt legislation (1999) when only 47% of MVA victims reported seat belt legislation.

It is recognized that this study is prone to ascertainment bias, *ie* a systematic distortion in measuring the true frequency of a phenomenon because of the way in which the data were obtained. Firstly, because cases/controls were recruited from among patients presenting to hospital, the characteristics of these groups will be influenced by hospital admission rates. Therefore, if there were a difference in attendance patterns or fatality between seat belt users and non-seat belt users then this would affect the estimate of the association between seat belt use and exposure. Secondly, it is also possible that medico-legal considerations may influence the response of subjects to over-report seat belt use especially in the POBL period. From a methodological perspective, this type of measurement error is reduced in observational studies compared with questionnaire based studies (10, 11). However, the impact on our estimates is likely to be small as the prevalence of self-reported seat belt use in drivers and front-seat passengers in the PRBL period in the present study was comparable to the prevalence obtained by Crandon *et al* (7) in the PRBL period from an observational design.

The absence of a significant gender effect in this study differs from reported data (7). Additionally, the present study indicates a trend for a lower mean age of MVA victims following the legislation. Current data collected locally from the Road Traffic Agency (RTA) indicate that despite the enactment of the seat belt law in 1999, there was still an alarming number of accident fatalities in the following half-decade (Table 4). This clearly suggests that additional public health measures are needed to address the epidemic of motor vehicle trauma.

A possible confounder in the association between seat belt use and exposure to seat belt law is alcohol use. In this study, alcohol consumption in cases or controls was not measured. However, the measurement of blood alcohol levels, assessment of high risk behaviour such as marijuana use, frequency of traffic convictions, educational status and their association with seat belt use in MVA should be undertaken in the future so that appropriate interventions can be effected. In addition, the severity of the injuries could be identified and compared with belted and unbelted patients in future studies, thus highlighting the usefulness of utilizing the seat belt as a means of injury prevention.

This hospital based study concluded that the mandatory seat belt legislation was associated significantly with increased seat belt use in vehicle accident victims. Limitations of the study were the unavailability of important data such as drug intoxication which by themselves would have had an overall impact on behavioural compliance. A much larger study is warranted incorporating information from both rural and urban settings to conclude categorically that mandatory legislation of seat belt use has resulted in an overall increase in seat belt use islandwide. With the knowledge that accident fatalities are gradually increasing locally, this lifestyle change is extremely important in injury prevention. Finally, for any legislation to be fully effective, the police must strictly enforce the law.

REFERENCES

1. Campbell BJ. Safety belt injury reduction related to crash severity and front-seated position. J Trauma 1987; **27:** 733–9.
2. Rutledge R, Lalor A, Oller D. The cost of not wearing seat belts. A comparison of outcome in 3396 patients. Ann Surg 1998; **217:** 122–7.
3. Sleet DA. Motor vehicle trauma and safety belt use in the context of public health priorities. J Trauma 1987; **27:** 695–702.
4. Dee TS. Reconsidering the effects of seat belt laws and their enforcement status. Accid Anal Prev 1988; **30:** 1–10.
5. Steptoe A, Wardle J, Fuller RR, Davidsdottir S, Davou B, Justo J. Seat belt use, attitudes and changes in legislation. An international study. Am J Prev Med 2002; **23:** 254–9.
6. Road Traffic Act 1999: Laws of Jamaica. Vol 24. The Ministry of Justice. [Online] [Accessed 2005 August 16th]. Available from URL *http://law.moj.gov.jm/laws_2005//volume_xx-xxviii/VOLUME%20XXIV/Road%20Traffic%20Act//RTA%2043B.pdf.*
7. Crandon IW, Branday JM, Simeon DT, Rhoden A, Thompson H, Carpenter R. The prevalence of seat belt use in Jamaica. An observational study. West Ind Med J 1996; **45:** 31–3.
8. Sweroad Road Safety Project (1993). Government of Jamaica, Ministry of Construction. Final Report Phase I. Govt Printing Office, Kingston.
9. Crandon I W, Carpenter R, McDonald A. Admissions for trauma at the University Hospital of the West Indies. West Ind Med J 1994; **43:** 117–20.
10. Road Traffic Agency, Kingston Jamaica; Census 2005.
11. Wyatt JP, Richardson JM. The use of seat belts on British motorways. JR Soc Med 1994; **87:** 206–7.