Role of Drowsy Driving in Traffic Accidents: A Questionnaire Survey of Thai Commercial Bus/Truck Drivers

Manoon Leechawengwongs MD*, Evelyn Leechawengwongs MD**,
Chakrit Sukying MD*, Umaporn Udomsubpayakul MS***

** Vichaiyut Hospital, ** Samutprakarn Hospital*
**** Research Unit, Faculty of Medicine, Ramathibodi Hospital, Mahidol University*

Objective: *The authors assessed the relationship between traffic accidents and drowsiness.*
Material and Method: *A self-answered questionnaire survey of 4331 commercial bus/truck drivers was done.*
Result: *Sixty-nine percent of the drivers reported accidents and one third of these accidents was attributable to drowsiness. Drowsy driving and microsleeps were experienced by 75% and 28% of drivers respectively. Forty-five percent of drivers had excessive daytime sleepiness based on the Epworth Sleepiness Scale (ESS score $\geq$ 11). This excessive daytime sleepiness was strongly associated with feeling drowsy, microsleeps, and accidents. The major causes of drowsiness were sleep deprivation (90%), medications that caused sleepiness (78%), drinking alcohol the previous night (23%), and chronic loud snoring with or without obesity (17%). 61% of drivers worked longer than 12 hours with no days off. The feeling of drowsiness at the wheel was also closely related to long hours of driving (> 4 hours). Countermeasures that drivers used to keep them awake were talking to someone, drinking coffee or caffeinated-energy drinks, chewing snacks or gum and pulling over to have a nap.*
Conclusion: *There is a strong relationship between accidents and drowsiness in commercial bus/truck drivers. The main cause of drowsiness was sleep deprivation. The authors hope that this information will help the public authority develop a policy to reduce the traffic accidents attributable to drowsy driving in commercial bus/truck drivers.*

Keywords: *Drowsy driving, Traffic accidents, Bus/truck drivers*

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In Thailand, traffic accidents are a public heath crisis. According to Asian Development Bank, road accidents in Thailand in 2003 killed 13,116 persons and injured 1,529,034 persons. The accidents caused about US $ 3 billion in economic losses or 2.1% of Thailand's annual gross domestic product[1]. The accident data are very poor and incomplete. The real causes of accidents are still under study. However, Thai officials blamed drunk driving, speeding and reckless driving as the primary culprits. For many years, police reported statistics have grossly underestimated the magnitude of the problem of drowsy driving. Drowsy driving was always listed at the bottom of all causes of accidents. In 2002, drowsy driving accounted for only 0.5% (448/84,078) of all crashes in Thailand[2]. The purpose of the present study was to understand better the role of drowsy driving as one of the major causes of road accidents in Thai commercial bus/truck drivers.

Correspondence to : Leechawengwongs M, Department of Medicine, Vichaiyut Hospital, 71/3 Setsiri Rd, Phyathai, Bangkok 10400, Thailand. Phone: 0-2618-6200, Fax: 0-2278-1017, E-mail: manoonlee@yahoo.com

Material and Method

The sample consisted of 4331 commercial bus/truck drivers. Self-answered questionnaires were distributed and completed forms were returned from 2914 (67.2%) Bangkok Metropolitan Transit Authority bus drivers and its allied private bus companies drivers, 737 (17%) Transport Company limited bus drivers, 303 (7%) minibus drivers, 160 (3.7%) tour bus drivers, and 217 (4%) delivery truck drivers. The questionnaire included background and general driving characteristics, incidence of sleepiness/falling asleep at the wheel,

traffic accidents and accidents attributable to sleepiness in the last 6 months, causes of drowsiness and countermeasures drivers used frequently to keep themselves awake. In addition, the Epworth Sleepiness Scale was used to determine the level of excessive daytime sleepiness.

Statistical analysis

Descriptive statistics such as number, percentage, mean ± SD, and range were used in describing the subject characteristics. The statistical association between the variables was assessed by means of Chi-square test. Age and driving time was assessed by trend analysis. For all analyses, p-value < 0.05 was considered statistically significant.

Results

Four thousand three hundred and thirty one commercial drivers completed the self-answered questionnaire. The demographic characteristics are described in Table 1. The mean age of the subjects was 40.7 ± 8.1 (20-72) years. Most of the drivers were male (98.2%) and have been commercial drivers for 5-10 years (30.9%). Sixty-four percent of drivers drove in Bangkok while 22% drove outside of Bangkok.

Among the 4331 commercial drivers, 75% reported driving while feeling drowsy in the last 6 months. The feeling of sleepiness varied with the number of hours after continuous driving. After 1 hour, 2 hours, 3 hours, 4 hours and more than 4 hours the percentage of drivers that had sleepiness were 10.5,

Table 1. Age, sex, type of commercial vehicles, years and route of driving (n = 4331)

Characteristics	Number (%)
- Age (years) mean ± SD	40.7 ± 8.1 (20-72)
- Range (n = 4184)	
20-29	340 (8.1)
30-39	1523 (36.4)
40-49	1631 (39.0)
50-59	641 (15.3)
≥ 60	49 (1.1)
- Sex : Male	4252 (98.2)
- Type of vehicles :	
Bangkok Metropolitan Transit Authority bus drivers and its allied private bus companies drivers	3217 (74.3)
Transport Company limited bus drivers	737 (17.0)
Tour bus drivers	160 (3.7)
Delivery truck drivers	217 (5.0)
- Years of commercially driving, Mean ± SD	
< 5	910 (22.0)
5-10	1276 (30.9)
11-15	890 (21.5)
16-20	531 (12.8)
> 20	526 (12.7)
- Route of driving :	
in Bangkok	2740 (63.6)
outside of Bangkok	951 (22.1)
both in and out of Bangkok	617 (14.3)

Table 2. Incidence of drowsiness while driving in the last 6 months and time of feeling drowsy after driving a number of hours (n = 4331)

	n (%)
Feeling drowsy while driving	3254 (75.1)
Feeling drowsy after driving	
1 hour	10.5%
2 hours	10.2%
3 hours	11.8%
4 hours	12.5%
> 4 hours	55.1%

Table 3. Incidence of falling asleep at the wheel in the last 6 months (n = 2854)

	n (%)
Feeling asleep at the wheel	818 (28.7)
1-3 times	522 (18.3)
4-6 times	111 (3.9)
7-9 times	73 (2.6)
≥ 10 times	69 (2.4)
not specified	43 (1.5)

Table 4. Incidence of accidents in the last 6 months and accidents attributed to drowsiness (n = 4132)

	n (%)
Report accidents while driving	2835 (68.6)
Accidents attributed to drowsiness	944 (22.9)

10.2, 11.8, 12.5, and 55.1 respectively (Table 2). Twenty-eight percent reported that they had, at some time, fallen asleep at the wheel while driving. Most drivers reported that it had occurred 1-3 times (18.3%). However, 69 drivers (2.4%) reported the occurrence more than 10 times (Table 3). Up to 69% reported traffic accidents and 33% of those drivers attributed their accidents to sleepiness (Table 4).

As for the causes of sleepiness in the last 6 months, 90% were due to inadequate sleep, 78% were due to illnesses and taking medications that caused sleepiness, 23% were due to drinking alcohol the previous night, and 17% were due to chronic loud snoring with or without obesity (Table 5).

The major causes of inadequate sleep were due to working long hours (> 12 hours) without days off (61%), and working multiple shifts (13%). Watching television and attending parties late at night only accounted for 7% and 4% respectively (Table 6). Medications taken that increased sleepiness were mostly for common colds (75%) and allergies (8.7%) (Table 7).

The countermeasures drivers used to keep themselves awake included drinking coffee (50%), drinking caffeinated-energy drinks (42%), chewing snacks or gum (29%), talking to someone (27%) and pulling over to take a nap (11%) (Table 8). However, the effectiveness of these countermeasures were pulling over to take a nap (71%), talking to someone (63%), drinking coffee (53%), chewing (48%) and drinking caffeinated-energy drinks (44%) (Table 9).

The Epworth Sleepiness Scale (ESS) was used to evaluate the drivers. A score of $\geq$ 11 is consistent with excessive daytime sleepiness. A normal ESS score is 5.9 ± 2.2[3]. In the present survey, 45.6% of commercial drivers had excessive daytime sleepiness. (ESS score $\geq$ 11) (Table 10). Drivers with an ESS score > 11 were more likely to feel drowsy while driving than drivers with an ESS score 1-10 (OR 1.7, 95%CI 1.47-1.98) (Table 11).

Table 5. Causes of drowsiness in the last 6 months (n = 3245)

	n (%)
Inadequate sleep	2918 (89.9)
Medications	2519 (77.6)
Alcohol the previous night	757 (23.3)
Chronic loud snoring with or without obesity	546 (16.8)

Table 6. Causes of inadequate sleep (n = 2918)

	n (%)
Working long hours (>12 hours) without days off	1779 (61.0)
Working multiple shifts	384 (13.2)
Watching TV	215 (7.4)
Attending parties late at night	119 (4.1)

Table 7. Medications that increased sleepiness (n = 2519)

	n (%)
Cold preparations	1869 (75.0)
Anti-allergic medicine	218 (8.7)
Anti-anxiety medicine	136 (5.4)
Cough medicine	135 (5.4)
Sleeping pill	15 (0.6)
Anti-depressant medicine	7 (0.3)

Table 8. Countermeasures drivers used frequently to keep themselves awake

	n (%)
Drinking coffee	1457/2920 (49.9)
Drinking caffeinated-energy drinks	1204/2852 (42.2)
Chewing snacks or gum	838/2874 (29.2)
Talking to someone	784/2909 (27.0)
Pulling over to take a nap	288/2596 (11)

Table 9. Effectiveness of these countermeasures to keep them awake

	n (%)
Pulling over to take a nap	1070/1504 (71.1)
Talking to someone	1260/1993 (63.2)
Drinking coffee	1208/2295 (52.6)
Chewing snacks or gum	929/1922 (48.3)
Drinking caffeinated-energy drinks	989/2225 (44.4)

Table 10. Epworth Sleepiness Scale (n = 4029)

Scores of Epworth Sleepiness scale	n (%)
< 11	2191 (54.4)
$\geq$ 11	1838 (45.6)

They were also more likely to fall asleep at the wheel (OR 1.92, 95%CI 1.62-2.27) and were more likely to have accidents while driving (OR 1.68, 95%CI 1.41-2.00) (Table 12, 13). In conclusion, drivers with an ESS score ≥ 11 were significantly more likely to feel drowsy, fall asleep and have accidents while driving compared to drivers with an ESS score 1-10 (p-value < 0.001).

Discussion

Road safety experts in developed countries have only recently recognized the potential significance of drowsy driving as a major cause of traffic accidents[4,5]. Thai officials are not yet aware of the magnitude of the problem of drowsy driving because there is no simple test to quantify the level of sleepiness at the crash sites. Unless the police officers are trained to investigate the causes in depth and systematically, many accidents attributable to drowsy driving will be under reported.

The authors embarked on the study to assess the extent of commercial bus/truck drivers' experience with drowsy driving, its association with road accidents, what drivers do to combat drowsiness and the level of excessive daytime sleepiness. Seventy-five percent and twenty-eight percent of the commercial drivers felt sleepy and have fallen asleep at the wheel respectively in the last 6 months. This statistic is very similar to the result of the survey done in the USA[6]. Sixty-nine percent of drivers reported accidents and one third of the accidents were attributable to drowsiness. These drivers used mainly coffee and caffeinated-energy drinks to combat the sleepiness. Forty-five percent of drivers were classified as having excessive daytime sleepiness based on the Epworth Sleepiness Scale (ESS score ≥ 11). Those with ESS score ≥ 11 were significantly associated with feeling drowsy, having fallen asleep at the wheel and accidents while driving. The major cause of sleepiness was sleep deprivation (90%) taking medicine that caused sedation (78%), drinking alcohol the previous night (23%), and chronic loud snoring with or without obesity (17%).

Sixty-one percent of drivers worked longer than 12 hours with no days off. The reason why commercial drivers had to work long hours was the low salary ($50/month). Their main income came from a share of the passenger's fare or the distance driven. In order to earn a decent income commercial drivers had to drive long hours with no days off (> 80 hours/week). In

Table 11. Relationship between Epworth Sleepiness Scale (ESS) scores and drowsiness while driving

ESS score	Feeling drowsy while driving, n (%)	Odds ratio (OR)	95% confidence interval (CI)
< 11	1577/2191 (72.0)	1.00	
≥ 11	1496/1838 (81.4)	1.70	1.47-1.98*
			p-value < 0.001

Table 12. Relationship between Epworth Sleepiness Scale (ESS) scores and falling asleep at the wheel

ESS score	Falling asleep at the wheel, n (%)	OR	95%CI
< 11	321/1412 (22.7)	1.00	
≥ 11	465/1288 (36.1)	1.92	1.62-2.27*
			p-value < 0.001

Table 13. Relationship between Epworth Sleepiness Scale (ESS) scores and traffic accidents attributed to drowsiness

ESS score	Accidents attributed to drowsiness, n (%)	OR	95%CI
< 11	387/1059 (36.5)	1.00	
≥ 11	509/1034 (49.2)	1.68	1.41-2.00*
			p-value < 0.001

Thailand, there is no law prohibiting commercial drivers working over a number of hours/day and days/week as in developed countries. There is only one regulation stating that commercial drivers can drive continuously for no more than 4 hours. A minimum of 30 minutes rest is required before they can continue driving for another 4 hours. For every bus trip exceeding 500 kilometers the law specifies that there must be two bus drivers taking turns driving. The penalty fine is only $125 but little monitoring and enforcement is done by the police.

Both alcohol and drowsiness can impair the various elements of performance that are essential to safe driving including slower reaction time, reduced vigilance (delayed responding, longer periods of non-response to stimuli) and deficits in the speed and accuracy with which information is processed[4,7]. The authors are certain that there are more drowsy drivers than drunk drivers on the roads. However, drowsiness is not as apparent and well recognized as alcohol to be the cause of traffic accidents in Thai society.

Employers, union, transportation employees, and all Thai drivers should be educated about the importance of sleep, the effect of sleep deprivation, sedative medications, and sleep disorders. They need to be informed about effective measures they can take to reduce sleepiness. Helpful behaviors to avoid sleepiness include getting sufficient sleep, not drinking even small amounts of alcohol when sleep is inadequate and limiting driving between midnight and 6 a.m[7]. The most effective way to manage sleepiness while driving is to pull off into a safe area away from traffic, consume caffeine equivalent to one or two cups of coffee and then take a brief nap (15-20 minutes)[8]

In summary, drowsy driving is one of the major causes of traffic accidents in Thailand as in developing countries. The authors hope they have provided enough information and data for the public authority to address this problem and consider developing the national policy to reduce the traffic accidents attributable to drowsy driving in commercial bus/truck drivers.

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การศึกษาความสัมพันธ์ของการเกิดอุบัติเหตุและความง่วงในพนักงานขับรถโดยสาร/รถบรรทุก โดยใช้แบบสอบถาม

มนูญ ลีเชวงวงศ์, เอวริน ลีเชวงวงศ์, จักรกฤษณ์ สุขยิ่ง, อุมาพร อุดมทรัพยากุล

คณะผู้วิจัยได้ทำการศึกษาถึงความสัมพันธ์ของการเกิดอุบัติเหตุ และความง่วงในพนักงานขับรถโดยสาร/รถบรรทุก โดยใช้แบบสอบถามจำนวนทั้งสิ้น 4,331 คน พบความสัมพันธ์ระหว่างการเกิดอุบัติเหตุและความง่วงดังนี้ ร้อยละ 69 ของพนักงานขับรถเคยเกิดอุบัติเหตุขณะขับรถ และในจำนวนนี้หนึ่งในสามเป็นผลมาจากความง่วง โดยอุบัติการณ์ของการง่วงนอนขณะขับรถสูงถึงร้อยละ 75 และอุบัติการณ์ของการหลับในในขณะขับรถมีสูงถึงร้อยละ 28 และในกลุ่มพนักงานขับรถนี้ จำนวนผู้ที่มีความง่วงง่ายผิดปกติในช่วงกลางวันมีสูงถึงร้อยละ 45 และความง่วงง่ายผิดปกตินี้สัมพันธ์กับการง่วงนอนและหลับในในขณะขับรถ ซึ่งส่งผลให้เกิดอุบัติเหตุตามมา สาเหตุสำคัญที่ทำให้เกิดความง่วงในพนักงานขับรถเหล่านี้ คือ การอดนอน หรือนอนไม่พอ (ร้อยละ 90) ยาที่รับประทานสำหรับการเจ็บป่วย โดยเฉพาะยาแก้หวัด (ร้อยละ 78) การดื่มแอลกอฮอล์ในคืนก่อนปฏิบัติหน้าที่ ขับรถ (ร้อยละ 23) และนอนกรนดังเรื้อรัง (ร้อยละ 17) โดยร้อยละ 61 ทำงานมากกว่า 12 ชั่วโมงต่อวัน โดยไม่มีวันหยุด นอกจากนี้ระยะเวลาในการขับรถที่นานยังเป็นอีกสาเหตุหนึ่งของความง่วงโดยเฉพาะอย่างยิ่งระยะเวลาในการขับรถที่นานกว่า 4 ชั่วโมงขึ้นไป สำหรับวิธีแก้ง่วงที่ช่วยคลายความง่วงได้ผลในกลุ่มคนเหล่านี้คือ การชวน ผู้อื่นคุย การดื่มกาแฟ เครื่องดื่มที่มีคาเฟอีน การขบเคี้ยวของกินเล่น และการจอดรถงีบหลับก่อนขับต่อไป

โดยสรุปแล้ว การศึกษานี้พบความสัมพันธ์ระหว่างการเกิดอุบัติเหตุกับความง่วงในพนักงานขับรถโดยสาร/บรรทุก สาเหตุที่สำคัญของความง่วงคือ การนอนไม่เพียงพอ คณะผู้ศึกษามีความหวังว่าข้อมูลที่ได้ จากการศึกษาในครั้งนี้สามารถนำไปใช้เป็นประโยชน์ในการวางแผนเพื่อลดอุบัติเหตุที่เกิดจากความง่วงในพนักงานขับรถโดยสาร/บรรทุก