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Rear-seat seatbelt use in urban Southeast Asia: results from Bandung and Bangkok

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ABSTRACT

Road traffic injuries (RTIs) remain a leading cause of morbidity and mortality in Southeast Asia. We aim to estimate the prevalence and predictors of rear seatbelt use, a key behavioural risk factor for RTI, in Bandung and Bangkok, two cities in Southeast Asia. Roadside observational studies were conducted to provide a representative picture of the prevalence in each city. From eight rounds of observations (July 2015 to April 2019), 39,479 and 7,207 rear-seat passengers were observed in Bandung and Bangkok. Across all rounds, 4.2% of rear-seat passengers used seatbelts in Bandung, compared to 8.4% in Bangkok. In both cities, males and adults, as compared to females and adolescents (aged 12-17 years), had higher odds of rear seatbelt use, as did passengers with a restrained driver. Findings highlight the need for rear seatbelt laws in Bandung and improved enforcement of existing rear seatbelt laws in Bangkok.

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rear seats;
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Background

Road traffic injuries (RTIs) remain a leading cause of death globally with 1.35 million people dying annually (World Health Organization, 2018b). Non-fatal RTIs also pose a significant burden worldwide with 82.5 million disability-adjusted life years lost in 2016 (World Health Organization, 2018a). In response to the burden of RTIs, the United Nations proclaimed the Decade of Action for Road Safety from 2011-2020, which aimed to reduce the forecasted level of global road fatalities by saving an estimated 5 million lives within the period (World Health Organization, 2013). RTIs also disproportionately affect low- and middle-income countries (LMICs) (World Health Organization, 2018b). While mortality from RTIs in LMICs is on an upward trajectory, it is on a declining trend in high-income countries (HICs) (Bachani et al., 2017b). This can be attributed to the implementation of road safety programs including those focusing on improving road-user behaviour (Bachani et al., 2017b; García-Altés et al., 2013). As we entered the year 2021, it is essential to examine the progress of key RTI behavioural risk factors in Southeast Asia, the world region with one of the highest numbers of RTI fatalities (World Health Organization, 2018b).

Seatbelt usage is a key behavioural risk factor for RTI (World Health Organization, 2018b). Seatbelt use has been found to reduce injury severity and the risk of fatality for users by 40% to 65% in a crash (World Health Organization, 2004). Rear-seat passenger seatbelt use has benefits not only for safety of the rear-seat passengers themselves, but also for front-seat passengers and drivers (Bose et al., 2013; Ichikawa et al., 2002; Mayrose et al., 2005; Shimamura et al., 2005). The risk of fatal injury to a restrained driver has been shown to increase between 75% to 137% with the presence of an unrestrained rear-seat passenger (Bose et al., 2013; Mayrose et al., 2005), and is nearly 500% for restrained front-seat passenger (Ichikawa et al., 2002).

While many national seatbelt laws and enforcement policies give significant attention to driver and front-seat passenger seatbelt use, these laws are often not directed towards or enforced as often on rear-seat passengers, especially in LMICs (World Health Organization, 2018b). Even in HICs, seatbelt use is low among rear-seat passengers, compared to drivers and front-seat passengers (Sauber-Schatz et al., 2016; Trowbridge & Kent, 2009). One major challenge to addressing this key behavioural risk factor in LMICs, which bear a disproportionate burden of RTIs, is the lack of consistent and valid data to drive efforts related to implementation of seatbelt law on rear-seat passenger.

Previous literature examining factors associated with seatbelt use either aggregates rear-seat and front-seat passengers or presents seatbelt use data by combining together drivers, front-seat, and rear-seat passengers (Han, 2017; Lerner et al., 2001). However, since rear seatbelt use has historically been lower, it is important to understand what factors are

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associated with rear seatbelt use such that targeted interventions can be planned. Limited studies have specifically looked at seatbelt use among rear-seat passengers and its associated factors. Three studies that have examined rear seatbelt use in Southeast Asia were conducted in a single country and based on self-report (Mohamed et al., 2011; Ng et al., 2013; Wong, 2016).

The Bloomberg Philanthropies Initiative for Global Road Safety (BIGRS) aims to strengthen road safety legislation at the national level and implement evidence-based road safety interventions in partnership with local governments (Hyder et al., 2012). So far, two cycles of the initiative have been implemented (Bloomberg Philanthropies, n.d.; Hyder et al., 2013). In the second cycle, spanning over 2015 to 2019, Bandung, Indonesia and Bangkok, Thailand were selected for the initiative (Table 1 shows country characteristics and related road safety indicators). While both Indonesia and Thailand have national seatbelt law that applies to driver and front-seat passengers, only recently Thailand passed national rear seatbelt law in April 2017 (Order of National Council for Peace & Order, 2017). Additionally, average occupancy rates for passenger cars in Bandung and Bangkok were 1.98 and 2.1, respectively (Heidt et al., 2019; Kijmanawat et al., 2016).

As part of the evaluation of the initiative, the Johns Hopkins Bloomberg School of Public Health International Injury Research Unit conducted multi-site serial cross-sectional observational studies in each city. Previously, our group examined speeding as a key RTI behavioural risk factor in urban Southeast Asia using results from these studies (Bachani et al., 2017a). In this paper, we extend on this work and conduct secondary data analysis of the BIGRS project. Two primary aims of this study were to report the prevalence of rear seatbelt use, along withfactors associated with its use in Bandung and Bangkok. To the best of our knowledge, this is the first paper that provides a city-wide comparison on rear seatbelt use in two selected Southeast Asian cities.

Methods

Data collection

Eight rounds of observations were conducted in Bandung and Bangkok between July 2015 and April 2019 (Table 2 shows data collection period and number of observations in both cities). Details on data collection methodology have been described before (Adetunji et al., 2020; Bachani et al., 2017a; Li et al., 2018). Briefly, observation sites (traffic lights at intersections) were randomly chosen using a random number generator from a list of eligible observation sites identified in collaboration with local partners. Observation site selection was done to ensure a representative sample of the local traffic within each city. In Bandung, 10 sites were randomly sampled from 39 eligible observation sites, with four of these sites in peri-urban and the rest in urban areas. In Bangkok, six out of 46 eligible observation sites were randomly selected, with all sites in urban areas. The selected observation sites remained the same across all the rounds.

The data collection team at each site was trained to conduct observations using a standardized protocol and data collection tool. Through the trainings, the data collection team participated in guided field practice prior to each observation round. Weeklong refresher trainings were conducted before each round. Each observation site was staffed by two data collectors; one for observing and other for recording data. The observer maintained a view of the stationary vehicle and its occupants and reported data to the recorder. Data collection team attempt to collect observation from all vehicles at observation sites. Each round of observations consisted of randomly selected full days, including both weekdays and weekends. On each selected day, data was collected in five 90-minute time slots, in the early morning, mid-morning, early afternoon, late afternoon and evening. On Fridays in Bandung, the exact times of data collection were shifted up to an hour earlier or later to accommodate Muslim religious services during the afternoon. The observer and recorder captured seatbelt use, position of occupants within the vehicle, estimated sex and age of occupants; vehicle type and ownership; road type; visible presence of law enforcement; and the date, time period, and location of the observation. For each vehicle, data was collected for up to five occupants; driver, front passenger, and a maximum of three rear-seat passengers.

Variable definitions

The outcome of interest, rear seatbelt use, was categorized as a binary variable. To recognize the passage of national rear seatbelt law in Thailand in April 2017 (Order of National Council for Peace & Order, 2017), the observation round variable in Bangkok was dichotomized into first

Table 1. Data reported to World Health Organization by country, 2018 (World Health Organization, 2018b).

Country	Indonesia	Thailand
Population (2016)	261,115,456	68,863,512
Registered vehicles*	49,173	54,220
Road traffic deaths*	11.98	31.58
National Seatbelt Law applies to:		
Drivers	Yes	Yes
Front Passengers	Yes	Yes
Rear Passengers	No	Yes
National child restrain law	No	No
Seatbelt wearing (%)	69% All occupants	58% Drivers, 40% Front seats
Perceived level of enforcement**	8	6

*Per 100,000 population.
**Countries self-rated their level of seatbelt law enforcement out of 10.

Table 2. Data collection schedule and number of observations in Bandung and Bangkok.

	Bandung			Bangkok		
Round	Data Collection Period	Vehicles Observed	Rear-seat Passengers Observed	Data Collection Period	Vehicles Observed	Rear-seat Passengers Observed
1	November 2015	23,603	7,123	July 2015	26,820	2,397
2	March 2016	28,607	5,277	January - March 2016	31,140	1,237
3	July - August 2016	27,447	2,705	August - September 2016	44,427	732
4	March - April 2017	32,670	6,728	February - March 2017	33,854	1,131
5	August 2017	36,785	4,681	July - September 2017	38,840	386
6	February 2018	37,007	5,422	February - March 2018	18,947	130
7	July 2018	26,635	4,212	July - September 2018	20,216	851
8	March 2019	34,251	3,331	March – April 2019	23,714	343

– fourth round (before the law was passed) and fifth - eight round (after the law was passed). Estimated sex was captured as either male or female. Similar with a previous BIGRS study on seatbelt wearing rate (Li et al., 2018), estimated age of adolescent or adult passengers was categorized into 12 to 17 years, 18 to 24 years, 25 to 59 years, and above 59 years. This category did not include those below the age of 12 as those individuals should be wearing a child restraint instead of seatbelt.

Vehicle type was classified as a sedan, pickup/light truck, truck, bus, minibus/van, or sport utility vehicle (SUV). In the first two rounds, vehicle type classifications also included taxis; however, this was dropped in later rounds as the observation is already captured in vehicle ownership variable. Vehicle ownership was categorized into private, commercial, government, taxi, or tourist.

Data collection team also recorded their observation on visible police presence, camera enforcement, both, or neither at the observation sites. Road types were classified as arterial, collector/distributor, or local roads in Bandung, and arterial or collector/distributor roads in Bangkok (US Department of Transportation Federal Highway Administration, 2013). Akin to previous BIGRS study on seatbelt (Li et al., 2018), the five observation times were categorized as morning (06:30 hr to 11:59 hr) or afternoon (12:00 hr to 19:00 hr).

Data analysis

Descriptive analysis was performed using rear-seat passengers as the unit of analysis. Rear-seat passenger demographics (estimated sex and age) and seatbelt use, road safety behaviour of other vehicle occupants (driver and front passenger seatbelt use), and vehicle factors (vehicle type and ownership) were captured at the individual level. Round of observation and environmental factors (presence of law enforcement, road type, road location, day of observation, and time of observation) were collected for each 90-minute observation period.

Descriptive statistics were presented as frequencies and percentages by city. Comparisons across groups utilized Pearson $\chi 2$ tests (Fisher's exact test used when any cell $n < 5$). Multivariable logistic regression analysis was used to explore the association between rear seatbelt use and independent variables including observation round, rear-seat passenger demographics, road safety behaviour of other vehicle occupants, vehicle factors, and environmental factors. For Bangkok, road location was not included in logistic regression as all observations were conducted in urban areas. All tests were two-tailed and considered significant at $p < 0.05$, and missing data were handled as listwise deletions. Data analysis was performed using Stata (Version 15, StataCorp, College Station, TX).

Ethical approval

Ethical approval was received from the Institutional Review Board at Johns Hopkins Bloomberg School of Public Health, and the ethical review boards of the local collaborating institutions: Universitas Padjadjaran in Bandung and ThaiRoads Foundation in Bangkok. Since this study was a secondary analysis with the whole project deemed to be non-human subjects research, the study received an exemption from the Institutional Review Board.

Results

Descriptive analysis

During eight rounds of observations across the two cities, 484,963 vehicles were observed; 247,005 (50.9%) in Bandung and 237,958 (49.1%) in Bangkok. Between the two cities, a total of 46,686 rear-seat passengers were observed; 39,479 (84.6%) in Bandung and 7,207 (15.4%) in Bangkok. Overall, rear seatbelt use was 4.2% ($n = 1,653$) in Bandung and 8.4% ($n = 603$) in Bangkok. Figure 1 shows the trend in rear seatbelt use among rear-seat passengers observed in each city across rounds.

Table 3 provides comparison of characteristics of observed restrained and unrestrained rear-seat passengers. Compared to rear-seat passengers who did not wear a seatbelt, those who wore seatbelts tended to be male (Bandung: 37.8% vs 60.2%, Bangkok: 38.4% vs. 52.4%; $p < 0.001$) and between age 25 to 59 years (Bandung: 68.3% vs 85.8%, Bangkok: 74.6% vs. 86.3%; $p < 0.001$). In Bandung, compared to rear-seat passengers who did not wear a seatbelt, restrained rear-seat passengers tended to be observed with restrained drivers (69.2% vs. 92.1%; $p < 0.001$). In Bangkok, compared to rear-seat passengers who did not wear a seatbelt, restrained rear-seat passengers tended to be observed with restrained front-seat passengers (61.5% vs. 73.8%; $p < 0.001$) but unrestrained drivers (13.2% vs. 20.5%; $p < 0.001$).

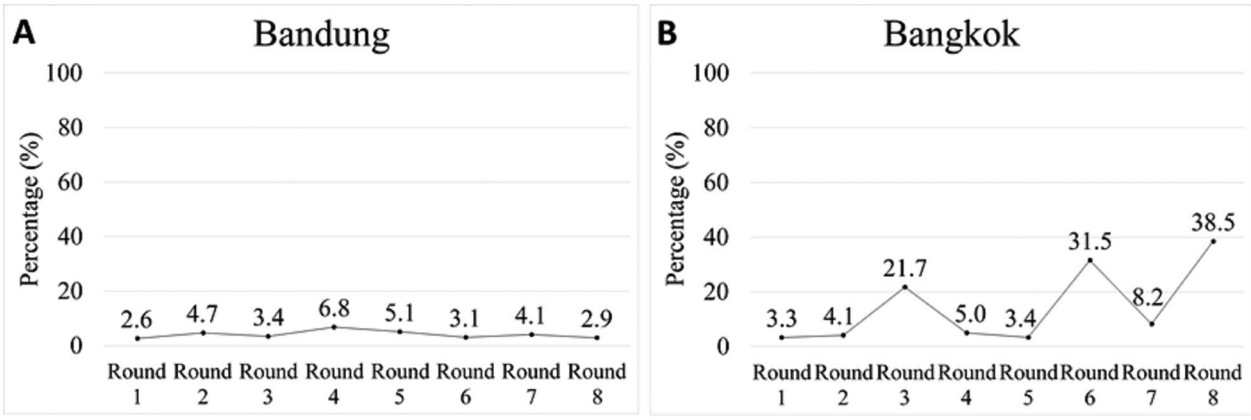

Figure 1. Prevalence of seatbelt use among rear-seat passengers observed in (A) Bandung and (B) Bangkok.

Unrestrained rear-seat passengers were observed mostly in a minibus/van (58.0%) in Bandung and in a sedan (63.6%) in Bangkok. In term of vehicle ownership, the most common vehicles observed with restrained rear-seat passengers in both cities were private vehicles (Bandung: 85.1%, Bangkok: 55.6%).

While in Bangkok, there was no law enforcement present at the time of the observations (99.8%), in Bandung, some form of law enforcement activity was present (police [12.1%], camera [26.7%], and combination of both [22.5%]) where restrained passengers were observed. Both restrained and unrestrained rear-seat passengers were most commonly observed on arterial roads in Bandung (restrained: 46.4%, unrestrained: 46.6%) and on collector/distributor road in Bangkok (restrained: 64.2%, unrestrained: 66.4%). In Bandung, most restrained rear-seat passengers were observed in the afternoon (57.2%) and on weekdays (67.1%). Similarly, most restrained rear-seat passengers were observed in the afternoon (57.6%) and on weekdays (70.0%) in Bangkok.

Multivariable analysis

Table 4 presents the factors associated with rear seatbelt use in Bandung and Bangkok. Several demographics characteristics were significantly associated with seatbelt use in Bandung and Bangkok, with some similarities and differences between the two cities. Among rear-seat passengers, males had higher odds of wearing seatbelts as compared to females in both cities (Bandung: adjusted odds ratio [aOR] = 1.96, 95% confidence interval [CI]: 1.70-2.26; Bangkok: aOR = 1.47, 95% CI: 1.09-1.99). In Bandung, rear-seat passengers ages 18-24 years, 25-59 years, and above 59 years had higher odds of wearing seatbelts as compared to those aged 12-17 years (18-24 years: aOR = 1.74, 95% CI: 1.23-2.45; 25-59 years: aOR = 3.31, 95% CI: 2.46-4.48; above 59 years: aOR = 1.88, 95% CI: 1.09-3.22). In Bangkok, rear-seat passengers aged 18-24 years and 25-59 years had significantly higher odds of wearing seatbelts than those aged 12-17 years (18-24 years: aOR = 5.12, 95% CI: 2.05-12.78; 25-59 years: aOR = 6.67, 95% CI: 2.94-15.13).

The odds for seatbelt use were higher among rear-seat passengers when the driver was also observed to be wearing seatbelt (Bandung: aOR = 3.74, 95% CI: 2.96-4.73; Bangkok aOR = 3.09, 95% CI: 1.53-6.25). However, when a front-seat passenger was also present and wearing a seatbelt, the odds for rear-seatbelt use were lower in Bandung (aOR = 0.58, 95% CI: 0.50-0.66), while the opposite was the case in Bangkok (aOR = 5.46, 95% CI: 3.42-8.72).

In Bandung, compared to sedan occupants, the odds of rear seatbelt use were higher for light truck occupants (aOR = 2.02, 95% CI: 1.62-2.51) and truck occupants (aOR = 2.77, 95% CI: 2.12-3.62), but lower for minibus/van occupants (aOR = 0.56, 95% CI: 0.47-0.67) and SUV occupants (aOR = 0.63, 95% CI: 0.50-0.81). In Bangkok, a similar pattern was observed among minibus/van occupants (aOR = 3.00, 95% CI: 1.12-8.06) and SUV occupants (aOR = 1.73, 95% CI: 1.13-2.64). Compared to private vehicles, taxi and tourist vehicles had lower odds for rear seatbelt use in Bandung (taxi: aOR = 0.33, 95% CI: 0.23-0.47; tourist: aOR = 0.22, 95% CI: 0.06-0.71).

No significant association was noted between rear seatbelt use and environmental factors in Bandung. In Bangkok, compared to rear-seat passenger observed in arterial road, the odds of seatbelt use were lower among rear-seat passengers observed in distributor/collector road (aOR = 0.70, 95% CI: 0.53-0.94). Compared to rear-seat passenger observed on weekend, the odds of seatbelt use were higher among rear-seat passengers observed on weekdays in Bangkok (aOR = 1.83, 95% CI: 1.34-2.50).

Discussion

Prevalence rear seatbelt use

This study presents the prevalence of rear seatbelt use in Bandung and Bangkok, two of the most populous cities in Southeast Asia (United Nations et al., 2016). Rear seatbelt use was observed to be low in Bangkok and even lower in Bandung. This finding is similar to what was reported in Shanghai, China (5%) (Li et al., 2018), and consistent with findings from other LMICs (for example: 2% in Ecuador and 10% in Serbia) (World Health Organization, 2018b). In contrast, reported seatbelt among rear-seat passengers is much higher for HICs (for example: 89% in Canada and

Table 3. Characteristics of rear-seat passengers in Bandung and Bangkok (n = 46,686).*

	Bandung (n = 39,479)			Bangkok (n = 7,207)		
	Rear seatbelt use n (%)	No rear seatbelt use n (%)	p value	Rear seatbelt use n (%)	No rear seatbelt use n (%)	p value
Overall	1,653 (4.2)	37,826 (95.8)	–	603 (8.4)	6,604 (91.6)	–
Rear-seat passenger demographics						
Estimated sex						
Female	656 (39.8)	23,213 (62.2)	<0.001	236 (47.6)	3,933 (61.6)	<0.001
Male	990 (60.2)	14,090 (37.8)		260 (52.4)	2,452 (38.4)	
Estimated age (in years)						
12-17	52 (3.3)	3,745 (11.6)	<0.001	10 (2.1)	339 (5.6)	<0.001
18-24	145 (9.1)	5,520 (17.1)		43 (9.2)	888 (14.6)	
25-59	1,367 (85.8)	22,014 (68.3)		405 (86.3)	4,545 (74.6)	
above 59	30 (1.9)	968 (3.0)		11 (2.4)	321 (5.3)	
Road safety behaviour of other vehicle occupants[a]						
Driver seatbelt use						
Yes	1,522 (92.1)	26,165 (69.2)	<0.001	478 (79.5)	5,724 (86.8)	<0.001
No	131 (7.9)	11,629 (30.8)		123 (20.5)	867 (13.2)	
Front-seat passenger seatbelt use						
Yes	710 (54.7)	15,240 (52.7)	0.164	299 (73.8)	1,856 (61.5)	<0.001
No	589 (45.3)	13,686 (47.3)		106 (26.2)	1,161 (38.5)	
Vehicle factors						
Vehicle type						
Sedan	276 (17.0)	5,691 (16.6)	<0.001	254 (45.2)	2,898 (63.6)	<0.001
Light Truck	352 (21.7)	1,879 (5.5)		94 (16.7)	679 (14.9)	
Truck	167 (10.3)	620 (1.8)		130 (23.1)	363 (8.0)	
Bus	14 (0.8)	1,107 (3.2)		20 (3.6)	46 (1.0)	
Minibus/van	583 (35.9)	19,919 (58.0)		10 (1.8)	103 (2.3)	
SUV	233 (14.3)	5,118 (14.9)		54 (9.6)	468 (10.3)	
Vehicle ownership						
Private	1,407 (85.1)	25,696 (67.9)	<0.001	334 (55.6)	2,743 (41.6)	<0.001
Commercial	108 (6.5)	745 (2.0)		135 (22.5)	491 (7.4)	
Government	31 (1.9)	498 (1.3)		8 (1.3)	65 (1.0)	
Taxi	103 (6.2)	10,415 (27.5)		124 (20.6)	3,290 (49.9)	
Tourist	4 (0.2)	469 (1.2)		0 (0.0)	2 (0.1)	
Environmental factors						
Law enforcement						
None	640 (38.7)	14,220 (37.6)	0.661	602 (99.8)	6,600 (99.9)	0.354
Police	200 (12.1)	4,417 (11.7)		1 (0.2)	4 (0.1)	
Camera	441 (26.7)	10,316 (27.3)		0 (0.0)	0 (0.0)	
Both police and camera	372 (22.5)	8,873 (23.5)		0 (0.0)	0 (0.0)	
Road location						
Urban	1,150 (69.6)	27,592 (72.9)	0.003	603 (100)	6,604 (100)	–
Peri-urban	503 (30.4)	10,234 (27.1)		-[b]	-[b]	
Road type						
Arterial road	767 (46.4)	17,629 (46.6)	0.190	216 (35.8)	2,220 (33.6)	0.273
Collector/ distributor road	653 (39.5)	15,420 (40.8)		387 (64.2)	4,384 (66.4)	
Local road	233 (14.1)	4,777 (12.6)		-[c]	-[c]	
Day of observation						
Weekend	544 (32.9)	14,726 (38.9)	<0.001	181 (30.0)	2,406 (36.4)	0.002
Weekday	1,109 (67.1)	23,100 (61.1)		422 (70.0)	4,198 (63.6)	
Time of observation						
Morning	708 (42.8)	15,221 (40.2)	0.036	256 (42.4)	2,549 (38.6)	0.063
Afternoon	945 (57.2)	22,605 (59.8)		347 (57.6)	4,055 (61.4)	

p values are from Pearson χ^2 tests for categorical variables where all cells n ≥ 5; Fisher's exact test for categorical variables where any cell n < 5. Discrepancies in totals are due to some missing demographic and risk factor information.

*Column percentage.

[a]This is the proportion of rear-seat passengers in a vehicle where the driver or front occupant used a seatbelt. Within a vehicle, there may be several rear-seat passengers; the safety behaviour of a driver or front-seat passenger is applied to all rear-seat passengers within the vehicle.

[b]All road location in Bangkok were urban.

[c]Observation sites in Bangkok were either arterial road or collector/distributor road.

96% in Australia) (World Health Organization, 2018b). This contrast between HICs and LMICs may, in part, be due to the lack of legislation mandating the use of seatbelts among rear seat passengers. The most recent Global Status Report on Road Safety indicates that 105 (out of 161) countries in the world have adequate legislation in place mandating the use of seatbelts by all vehicle occupants, yet only 7% of countries with seatbelt laws meeting best practice are low-income countries (World Health Organization, 2018b). Both Indonesia and Thailand have a national seatbelt law, although the law applies to rear-seat passengers only in Thailand (World Health Organization, 2018b). The self-reported enforcement of the law at the national level is highly rated in Indonesia at 8 out of 10, compared to 6 out of 10 in Thailand (World Health Organization, 2018b), indicating that a change in policy rather than additional

Table 4. Multivariable logistic regression results of rear seatbelt use in Bandung and Bangkok.

	Bandung		Bangkok	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Round				
1	Ref	Ref	Ref	Ref
2	**1.81 (1.49-2.20)**	1.26 (0.99-1.62)		
3	**1.30 (1.01-1.68)**	0.72 (0.53-1.00)		
4	**2.70 (2.27-3.21)**	**1.87 (1.47-2.39)**		
5	**1.99 (1.63-2.41)**	1.13 (0.87-1.46)	**2.61 (2.20-3.10)**	**5.78 (4.32-7.74)**
6	1.17 (0.95-1.45)	**0.52 (0.39-0.69)**		
7	**1.57 (1.27-1.94)**	0.88 (0.67-1.16)		
8	1.10 (0.86-1.41)	0.97 (0.71-1.33)		
Rear-seat passengers' demographics				
Estimated sex				
Female	Ref	Ref	Ref	Ref
Male	**2.49 (2.25-2.75)**	**1.96 (1.70-2.26)**	**1.76 (1.47-2.12)**	**1.47 (1.09-1.99)**
Estimated age (years old)				
12–17	Ref	Ref	Ref	Ref
18–24	**1.89 (1.37-2.60)**	**1.74 (1.23-2.45)**	1.64 (0.81-3.30)	**5.12 (2.05-12.78)**
25-59	**4.47 (3.38-5.91)**	**3.31 (2.46-4.48)**	**3.02 (1.60-5.71)**	**6.67 (2.94-15.13)**
above 59	**2.23 (1.42-3.52)**	**1.88 (1.09-3.22)**	1.16 (0.49-2.77)	2.00 (0.59-6.80)
Road safety behaviour of other vehicle occupants				
Driver seatbelt use				
No	Ref	Ref	Ref	Ref
Yes	**5.16 (4.31-6.18)**	**3.74 (2.96-4.73)**	**0.59 (0.48-0.73)**	**3.09 (1.53-6.25)**
Front passenger seatbelt use				
No	Ref	Ref	Ref	Ref
Yes	1.08 (0.97-1.21)	**0.58 (0.50-0.66)**	**1.76 (1.40-2.23)**	**5.46 (3.42-8.72)**
Vehicle factors				
Vehicle type				
Sedan	Ref	Ref	Ref	Ref
Light Truck	**3.86 (3.27-4.56)**	**2.02 (1.62-2.51)**	**1.58 (1.22-2.03)**	1.02 (0.71-1.47)
Truck	**5.55 (4.50-6.85)**	**2.77 (2.12-3.62)**	**4.09 (3.22-5.18)**	1.51 (0.65-3.51)
Bus	**0.26 (0.15-0.45)**	0.59 (0.28-1.22)	**4.96 (2.89-8.51)**	-[a]
Minibus/van	**0.60 (0.52-0.70)**	**0.56 (0.47-0.67)**	1.11 (0.57-2.14)	**3.00 (1.12-8.06)**
SUV	0.94 (0.78-1.12)	**0.63 (0.50-0.81)**	1.31 (0.97-1.79)	**1.73 (1.13-2.64)**
Vehicle ownership				
Private	Ref	Ref	Ref	Ref
Commercial	**2.65 (2.15-3.26)**	0.92 (0.72-1.18)	**2.26 (1.81-2.82)**	1.19 (0.65-2.20)
Government	1.14 (0.79-1.64)	0.69 (0.43-1.11)	1.01 (0.48-2.12)	0.42 (0.05-3.42)
Taxi	**0.18 (0.15-0.22)**	**0.33 (0.23-0.47)**	**0.31 (0.25-0.38)**	0.74 (0.42-1.32)
Tourist	**0.15 (0.06-0.42)**	**0.22 (0.06-0.71)**	-[a]	-[a]
Environmental factors				
Law enforcement				
None	Ref	Ref	Ref	Ref
Police	1.01 (0.85-1.18)	0.86 (0.69-1.07)	2.74 (0.30-24.56)	3.08 (0.24-38.29)
Camera	0.95 (0.84-1.07)	1.09 (0.89-1.33)	-[b]	-[b]
Police and camera	0.93 (0.82-1.06)	1.00 (0.81-1.23)	-[b]	-[b]
Road type				
Arterial road	Ref	Ref	Ref	Ref
Collector/ distributor road	0.97 (0.87-1.08)	0.91 (0.76-1.09)	0.91 (0.76-1.08)	**0.70 (0.53-0.94)**
Local road	1.12 (0.96-1.30)	1.18 (0.93-1.49)	-[c]	-[c]
Road location				
Urban	Ref	Ref	-[d]	-[d]
Peri-urban	0.85 (0.76-0.94)	0.96 (0.78-1.19)	-[d]	-[d]
Day of observation				
Weekend	Ref	Ref	Ref	Ref
Weekday	**1.30 (1.17-1.44)**	1.06 (0.93-1.20)	**1.34 (1.11-1.60)**	**1.83 (1.34-2.50)**
Time of observation				
Morning	Ref	Ref	Ref	Ref
Afternoon	**0.90 (0.81-0.99)**	1.01 (0.89-1.14)	0.85 (0.72-1.01)	0.87 (0.66-1.18)

[a]Missing due to regression conducted with listwise deletion method.
[b]No observation for camera or police and camera was recorded in Bangkok.
[c]Observation sites in Bangkok were either arterial road or collector/distributor road.
[d]Road location was not included in the regression as all road location in Bangkok were urban.

enforcement may be needed to increase rear passenger seatbelt use.

Another issue that may be contributing to low seatbelt usage among rear seat passengers may be the availability of seatbelts. The vehicle fleet in both these countries and many LMICs is often made up of older vehicles imported from HICs. Many Indonesian vehicles are not equipped with rear seatbelts (Global Investment Center USA, 2015) with the cost of installing rear seatbelts left to users, potentially presenting a barrier to rear passenger seatbelt use. There is an urgent need to address the policy gap in Indonesia by extending national seatbelt law to include rear-seat passengers and vehicle standards mandating the presence of rear seatbelt. As the risk of fatal injury to

restrained driver and front-seat passenger are increased with the presence of unrestrained rear-seat passengers (Bose et al., 2013; Ichikawa et al., 2002; Mayrose et al., 2005), this would enhance the safety of all vehicle occupants.

Factors associated with rear seatbelt use

Seatbelt use among male rear-seat passengers was found to be higher compared to their female counterparts in both cities. In contrast to our finding, multiple studies looking at general seatbelt use (all passengers – front- and rear-seat) have found that male passengers are less likely to use seatbelts (Babio & Daponte-Codina, 2006; Han, 2017; Lerner et al., 2001). It is important to note that these studies either did not distinguish between front- and rear-seat passengers or relied on self-reported surveys. One study from Malaysia reported higher seatbelt use among female rear-seat passengers (Ng et al., 2013). However, several other studies, mainly from the United States, have reported no statistically significant difference between male and female seatbelt use (Bhat et al., 2015; Pickrell, 2014). Study from Ho Chi Minh City, Vietnam mirrored our findings and posited that this difference may be explained due to females being more likely than males to be passengers (Adetunji et al., 2020), thus females in rear seats may be more likely to be occupied with children, or holding children in the lap, as compared to male rear seat passengers. Therefore, these mixed findings may be indicative of the roles of local context, societal norms, and enforcement activities (Boakye et al., 2019; Jans, 2015; Litt et al., 2014), and highlight the need for further qualitative studies to gain deeper insight on the drivers for seatbelt use in Indonesia and Thailand.

Age is also a factor associated with rear seatbelt use in the two cities. Passengers aged 12 to 17 years are less likely to use seatbelts in comparison to their older counterparts. This is mostly consistent with previous studies which found that younger rear-seat passengers are less likely to wear seatbelts (Lerner et al., 2001; Li et al., 2018; Ng et al., 2013). While our observational study did not assess knowledge, attitudes, and perceptions around seatbelt use, another study from Malaysia reported that self-consciousness and perception of getting caught by law enforcement are key factors in increasing seatbelt use (Mohamed et al., 2011).

In our study, the safety behaviours of other passengers in the vehicle (driver or front-seat passengers) had a significant impact on whether rear-seat passengers used seatbelts: rear-seat passengers had around three times the odds of wearing a seatbelt if the driver was wearing one in both the cities. This confirms findings from previous studies (Han, 2017; Vecino-Ortiz et al., 2014), and aligns with theories of behaviour change, which indicate that individuals' behaviours are influenced by those around them (Jans, 2015; Weston & Hellier, 2018). Yet, in Bandung, rear-seat passenger has lower odds to use seatbelt if front-seat passenger used seatbelt. This may signify an interplay between seatbelt use and local sociocultural context (Hayden, 1989; Rakauskas et al., 2009), which warrants further investigation.

While a variety of vehicle types are noted to influence the odds of rear seatbelt use in Bandung, it appeared to be less influential in Bangkok. The difference seen between Bandung and Bangkok could be explained lack of rear seatbelts in certain types of Indonesian vehicles (Global Investment Center USA, 2015) and the difference in rear seatbelt law between the two countries. Compared to sedans, rear-seat passengers in light trucks and trucks had higher odds of using seatbelt in both Bandung and Bangkok, though this was only significant in Bandung. This finding contrasts with a study from Shanghai, where passengers in light trucks and trucks were less likely to wear seatbelts compared to those in sedans (Li et al., 2018). It is important to note that the study in Shanghai aggregated both front-seat and rear-seat passenger together, so there is a possibility that the odds for front-seat passenger masked the odds for rear-seat passenger in wearing seatbelt.

In addition to enactment of seatbelt legislation, visible and widespread enforcement is necessary to improve seatbelt use rate. A previous study from Malaysia showed that perception of being caught by law enforcement was associated with rear seatbelt use (Ng et al., 2013). In Indonesia, the national seatbelt law only applies to the driver and front-seat passengers. In Thailand, the rear seatbelt law was implemented in April 2017 with primary enforcement; vehicle where rear-seat passenger failed to use seatbelt will be pulled and received fines up to 500 Baht (~15 USD) (Order of National Council for Peace & Order, 2017). Previous meta-analysis has reported that primary enforced seatbelt laws are likely to be more effective than secondary enforced laws (a citation for lack of seatbelt use only if the vehicle has been stopped for some other reason) (Rivara et al., 1999). Indeed, two of the highest percentage of rear seatbelt use in Bangkok were observed during round six and eight after the law was enacted. This highlights not only the importance of policy changes, but also the missed opportunities to enforce the rear seatbelt law at both the national and sub-national levels in Thailand.

Strengths and limitations

The design of this study had several strengths. The multi-round cross-sectional design, using a standardized study protocol, enables the observation of trends and cross-city comparisons, while providing a large sample size. Additionally, the roadside observation method, which has been used in road safety studies extensively, allows observation of road safety behavioural risk factors in real life situations; is able to capture a large and representative sample at a reasonable cost; and has greater validity than self-reported surveys or interviews that are subjected to response bias (Li et al., 2018). Response bias have been noted to be more pronounced in low seatbelt use countries (Özkan et al., 2012).

However, this design also had several limitations related to measurement or data collection. First, there are several factors associated with seatbelt use published in previous studies that we were not able to collect, such as level of

education, race/ethnicity, marital status, and level of income (Bhat et al., 2015; Lerner et al., 2001; Ng et al., 2013). Second, direct observation was limited in some cases due to the presence of tinted car windows which prevented the observer to capture the observation. Third, both sex and age of rear-seat passenger were estimated based on the judgment of the observer. Lastly, our observation covered from 06:30 hr to 19:00 hr rather than 24-hours, preventing our observation of whether rear-seat passengers might have different restraint use from 19:00 hr to 06:30 hr.

Conclusion

Rear seatbelt use was low in Bangkok and even lower in Bandung. To improve road safety for all vehicle passengers, policy changes to rear seatbelt laws and mandate the presence of rear seatbelt as vehicle standards, followed by enforcement, are needed in Indonesia, while increasing the presence of law enforcement in Bangkok may serve to increase the prevalence of proper restraint use. Gender, age, and the behaviour of other occupants were key predictors of rear seatbelt use. Evidence gathered in this study could serve to guide policymakers in designing and implement appropriate intervention for these cities.

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