Observations of Road Safety Behaviours and Practices of Motorcycle Rickshaw Drivers in Lahore, Pakistan

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Abstract

Motorcycle Rickshaws (MRs) are an informal paratransit mode in Pakistan. They are locally manufactured and very popular but there are concerns about their crash involvement and overall safety. The first study of the current PhD program revealed that rickshaws (both MRs and auto-rickshaws) were involved in 51,992 road crashes attended by emergency ambulances in Punjab province, Pakistan between 2011-2013. This study aims to examine the road safety behaviours and practices of Motorcycle Rickshaw Drivers (MRDs) that may be contributing to these crashes. MRDs were observed at 12 major signalised intersections in Lahore. Vehicle characteristics and driver behaviours were recorded using a paper-based survey between 9am-7pm for a full week in May 2015. Of the 500 MRDs observed, about 23.4% appeared to be younger than the minimum driver licensing age of 18 years. More than half (52.6%) of the MRDs entered on the red light and 17.4% crossed when the signal was turning from yellow to green or red. MR traffic conflicts were observed in 62.8% of cases and one crash and 15 near-miss crashes were witnessed. Additionally, about half of MRs were overloaded, no MRD wore a helmet, and 3.8% were using a mobile phone while driving. This study provides the first scientific evidence to substantiate public concerns regarding the safety of MRs. It demonstrates that about a quarter of MRDs are underage, almost half of MRs are overloaded and more than half disobey traffic signals. This research could inform authorities to manage MR related transport and road safety issues.

Introduction

Road traffic crashes and injuries are a major public health concern globally. Every year about 1.24 million fatalities and 20 to 50 million injuries occur due to road traffic crashes (WHO, 2015). The burden of road crashes and injuries is disproportionately distributed among the developed and developing world. Low-income and middle-income countries (LMICs) share 91.5% of global fatalities, despite having only 47.9% of the total registered vehicles (Bowman, Fitzharris, & Bingham, 2013, WHO, 2015).

Pakistan has the fifth largest number of road fatalities in the world (around 40,000 fatalities per year) (Kayani, Fleiter, & King 2014; WHO, 2009) and it has been estimated that over two million road traffic injuries occur in the country every year (Ahmed, 2007; Bhatti & Ahmed, 2014). Despite the increasing number of road crashes, road safety is not recognized as an important public health issue in Pakistan; instead it is considered an insignificant issue for which the transport sector or police department are responsible (Batool, Carsten & Jopson, 2011; Ghaffar, Hyder, & Masud, 2004). There is an absence of road safety policy at national and provincial levels and no planning exists for non-motorized and vulnerable road users (Batool et al., 2011; Hyder, Ghaffar, Sugerman, Masood, & Ali, 2006; Imran, 2009). Traffic laws (e.g. helmet wearing, seat belt, speeding etc.) exist but law enforcement is weak or absent, so compliance is very low in most parts of Pakistan (Hyder, Ghaffar, & Masood, 2000; Batool et al., 2011; Hashmi, Tahir, Akbar, Naseer, Rashid, & Zia, 2012; Klair & Arfan,

2014; Tahir, Naseer, Khan, Macassa, & Hashmi, 2012; Tahir, Macassa, Akbar, & Naseer, 2013). The public transport sector is largely dominated by the private sector, as government has failed to provide adequate infrastructure and quality transport services for the rapidly growing population (Imran, 2009; Masood, Khan, & Naqvi, 2011; Muhammad, 2013).

Various innovative modes of transport have become widespread in Pakistan to fill the gaps in public transport availability, including Motorcycle Rickshaws (MRs). MRs are 100cc motorcycle-driven three-wheeler vehicles (Figure 1) where the rear wheel of the motorcycle has been removed and a two-wheeled open-sided cart is attached to it. The cart has a nominal seating capacity of six passengers. MRs differ from conventional Auto-rickshaws (ARs) in several ways: ARs have an enclosed cabin and passenger tray (Figure 2) and a seating capacity of two to three passengers. ARs are a regulated paratransit mode in Pakistan, while MRs are an unregulated informal paratransit mode.

Figures 1 -2: Motorcycle Rickshaw and Auto-rickshaw in Pakistan (Source: Author)

Figure 1: Motorcycle Rickshaw

Figure 2: Auto-rickshaw

There is a scarcity of research on MRs in Pakistan, with most of the available information being found in newspaper articles regarding their proliferation and safety. Two newspaper articles (The Express Tribune, 2013a,b) claim that there are around 50,000-70,000 MRs in Lahore, over 100,000 in Karachi and they operate in cities, towns and villages across the country. One of major reasons for the large growth of MRs is their informal status and unregulated operation. The government has not yet regulated MRDs, so anyone with a motorcycle licence can become an MRD (many drive unlicensed), there are no route permits nor any vehicle fitness certification. Therefore, MR driving provides an easy entry to the job market for unskilled and unemployed people (The Express Tribune, 2012, 2013a; Khawaja, 2011; Siddiqui, 2014; Sarfraz & Hussain, 2010; Sargodha News, 2014; The Nation, 2012).

MRs are also cheaper than ARs, costing about AUD$1000-1200 (The Express Tribune, 2012) and in Lahore second-hand MR bodies are also easily available (AUD$200-400) that can be fitted to any 100cc motorcycle by a local welder. Currently, there are 46 MR body manufacturing companies and 22 motorcycle companies operating in Lahore (General Manager Planning - Lahore Transport Company, personal communication, May 15, 2015). The government has not formulated any engineering standards for MR manufacturers, so many variations in MR designs exist across Pakistan. Newspaper articles have expressed concern that these modifications may compromise the safety of MRs (The Express Tribune, 2011, 2012, 2013a).

Various newspaper articles and blog posts have also expressed concerns that MRDs are involved in speeding, overtaking, overloading, unlicensed and underage driving (Figures 3-5), setting up of illegal terminals and endangering the safety of pedestrians and other road users (The Express Tribune, 2011, 2012, 2013a; Khawaja, 2011, Siddiqui, 2014; Sarfraz & Hussain, 2010; Sargodha News, 2014; The Nation, 2012).

Figures 3-5: Overloading and underage MRDs in Lahore (Source: Author)

Figure 3: MR Overloading

Figure 4: Underage MRD

Figure 5: Underage MRD

Tahir et al. (2012) examined the epidemiology of road crashes attended by Rescue 1122 (an emergency ambulance and rescue service in Pakistan) in Lahore city during 2005–2010. The study revealed that rickshaws (MRs and ARs are not separately recorded) were involved in 22,488 road crashes, which comprised 18% of crashes attended by Rescue 1122 in Lahore. More recently, as part of his PhD program, the first author updated and extended this research in an unpublished report using Rescue 1122 crash data for 2011-2013. Rickshaws (both MRs and ARs) were involved in 51,992 road crashes in Punjab province in this period, with 15,735 of these occurring in Lahore. In order to better understand the high apparent involvement of these vehicles in crashes, this study examines the road safety behaviours and practices of MRDs that contribute to crashes.

Method

MRDs were observed at 30 approaches to 12 major signalised intersections in different areas of Lahore city, which is the second largest city in Pakistan, with a population of over 9 million (Ghaffar, 2015). Site selection criteria included: intersection and approaches with functional traffic signals; intersections with large numbers of MRs operating; observers' safety and convenience; and MR crash prone locations or proximity to crash locations (identified from Rescue 1122 data). The final selection was made following extensive inspection of possible sites by the first author. All 30 approaches to the 12 study intersections were located on major roads, and ranged from three to five lanes in width.

Two paper survey forms were developed to collect the data. The first form recorded site details and was completed once per site per session. A separate vehicle observation and MRD driving behaviours form was completed for each MRD. Observations were recorded for a full week (Monday to Sunday) in May 2015 between 9am and 7pm. The weather was clear, sunny and hot during the survey week. The piloting of the survey was conducted to inform its final structure and resulted in adding items regarding the number of signalized approaches and traffic lanes to the site details form, and new categories covering four items

(goods carried, traffic lane use, colour of light when MR entered the intersection and movement prior to violation) to the vehicle and driver behaviours form.

The focus of the observation was on MRDs who were at the front of the traffic queue or at the rear, since these drivers were predominantly involved in traffic and road safety violations. MRs are officially motorcycles and therefore they are required by law to travel in the left lane along with other motorcycles and non-motorized vehicles. Observations were recorded in half-an-hour blocks (30 minutes on each approach) and after finishing one approach, the next approach was observed. MRD age and condition of MRs were judged from physical appearance, based on the experience of the first author. In Pakistan, all motorized vehicles must display registration plates on the front and rear. Whether at least one registration plate was visible was recorded for each MR. All data collection (piloting and full-scale survey) was carried out by the first author. The data from the paper survey forms were entered into Excel spreadsheets and then coded and analysed in SPSS version 22. Frequencies and percentages were calculated for all variables. To examine the association between different categorical variables cross-tabulation was performed by using Pearson's Chi-Square test (χ^2) with a significance level set at $p<0.05$. The results of the cross-tabulations and Chi-Square tests are presented below along with specific tables.

Results

In total 50 MRDs were observed in the pilot phase and 500 in the full-scale survey. Only the results of the full survey are presented below under three sub-headings covering temporal/location, vehicle, driver and driving behaviour characteristics.

Temporal/location characteristics

The largest number of MRDs (*n*=94) was observed at Grand Trunk (GT) Road near University of Engineering and Technology (UET), Lahore followed by Gadi Shahu Chowk ("chowk" means "intersection" in Urdu) (*n*=60), and Akbar Chowk and Boharwarwala Chowk (*n*=46) each. These approaches were located on major roads, having three to five lanes (i.e. GT Road). The highest number of observations by day was recorded on Monday (*n*=94), while the highest by time period was 225 for 9am to11am (Table 1).

Table 1: Temporal/location characteristics

No	Location	No of MRD observed	%		Day & Time	No of MRD observed	%
1	**GT Road, UET**	94	18.8		**Monday**	94	18.8
2	**Gadi Shahu Chowk**	60	12		**Tuesday**	80	16.0
3	**Akbar Chowk**	46	9.2		**Wednesday**	80	16.0
4	**Boharwala Chowk**	46	9.2		**Thursday**	60	12.0
5	**Yateem Khana Chowk**	40	8		**Friday**	72	14.4
6	**Kadak Nala**	36	7.2		**Saturday**	52	10.4
7	**Samanabad Chowk**	34	6.8		**Sunday**	62	12.4
8	**Railway Station**	32	6.4		**Total**	500	100
9	**New Campus**	32	6.4		**09:00am-11:00am**	225	45.0
10	**MAO College Chowk**	30	6		**11:01am-01:00pm**	146	29.2
11	**Scheme More**	30	6		**01:01pm-03:00pm**	12	2.4
12	**Moon Market**	20	4		**03.01pm-05:00pm**	80	16.0
	Total	500	100		**05.01pm-07:00pm**	37	7.4
					Total	500	100

During the survey process, a traffic warden was controlling traffic at four locations (Moon Market, MAO College, Samanabad and New Campus) and was absent at two locations (Kadak Nala and Akbar Chowk). At five other locations (Gadhi Shahu, Yateem Khana, GT Road, Boharwala Chowk and Scheme More) a traffic warden was present but was not controlling the traffic. At two locations (Railway Station and New Campus), a traffic warden arrived at some time during the observation period.

Vehicle Characteristics

Most MRs were in moderate (46.2%) or poor (45%) physical condition and only 8.8% were in good condition. All of the observed MRs had open chains; most (98.6%) had a motorcycle registration plate displayed on the front or back of the vehicle, 1.2% did not have any registration plate displayed and one appeared to have a fake number plate (Table 2).

Table 2: Vehicle characteristics

MR condition	**N**	**%**		**MR overloading**	**N**	**%**
Poor	225	45.0		***1-6***	247	49.4
Moderate	231	46.2		***7-10***	230	46.0
Good	44	8.8		***11-15***	23	4.6
Total	500	100		**Total**	500	100
Number plate display	**N**	**%**		**Type of passenger**	**N**	**%**
Yes	493	98.6		***Adults***	2734	86.2
No	6	1.2		***School- age children***	293	9.2
Other	1	.2		***Pre-school children***	145	4.6
Total	500	100		**Total**	3172	100

Most MRs (61.4%) were carrying only passengers, while (35.6%) were carrying some goods as well as passengers and (1.2%) carried a substantial amount of goods as well as passengers. About half (50.6%) of the MRs were carrying more than the nominal capacity of six passengers: 22.6% were carrying seven passengers, 13.8% had eight passengers, 13.2% had nine to twelve passengers and 1% were carrying 13 to 15 passengers. In total around 3,172 passengers were travelling on observed MRs (n=500), including 2,734 adults (86.2%), 293 school-age children (9.2%) and 145 pre-school children (4.6%) (Table 2). Chi-square tests were performed to determine the association between time of day and MR overloading. The results were not statistically significant [$\chi 2$ (1) = .728, p =.393]. Similarly, no significant difference was found between MR condition and number of passengers carried/MR overloading [$\chi 2$ (2) = .366, p =.833].

MRD Characteristics

Among the MRDs observed, 15.6% were possibly and 7.8% were judged to be clearly under the licensing age of 18 years. Almost a third (30.4%) of the MRDs appeared to be aged 31-40 years, and less than 2% of them were judged to be aged over 50 years (Table 3). There was a significant difference in the prevalence of underage MRDs across the various locations [$\chi 2$ (11) = 25.467, p <0.008]. Most underage MRDs (21.4%) were operating on GT Road, compared to (14.5%) in Township area and (11.1%) on Multan Road. Only 1% of under-aged MRDs were observed at Samanabad Chowk. Similarly, MRD aged ≥18 years were also more prevalent (18%) on GT Road compared to other areas (Gardi Shahu 11.7%, Boharwala Chowk 11%, Samanabad Chowk 8.6% etc.)

Table 3: MRD age groups in Lahore

Age group (year)	N	%
Possibly under 18	78	15.6
Clearly under 18	39	7.8
18-30	121	24.2
31-40	152	30.4
41-50	101	20.2
51-60	4	.8
Over 60	5	1.0
Total	500	100

MRD Driving Behaviours

The Table 4 below presents the driving behaviours of MRDs. It shows that only about 30% of MRs entered the intersection when the traffic signal was green. More than half (52.6%) of the MRDs entered the intersection when the traffic signal was red, and 17.4% entered when the signal was turning from yellow to green or red. Similarly, most MRDs (62%) found leaving before the light turned green (the 210 MRDs recorded as passing when the light was red or yellow turning to red) leaving too early or leaving after light turned red), so MR traffic conflicts[1] were observed in 62.8% of cases.

MR traffic conflicts most commonly involved motorized vehicles such as motorcycles 98 (19.6%), MRs 50 (10%), cars 12 (2.4%), van and AR 11 (2.2% each), truck 4(.8%) and multiple motorized vehicles 15 (3%). Likewise, conflicts were also observed with pedestrians 82 (16.4%) and non-motorized vehicles such as animal carts 11 (2.2%) and bicycles 3(.6%). One MR hit the rear of a van but there was no injury and only the van was damaged. The near miss collisions observed involved motorized vehicles (*n*=15) and pedestrians (*n*=5) that included adults, school children and female road users.

Table 4: MRD driving behaviours

Light colour when MR enters	N	%		Conflict observed	N	%
Red (violation)	263	52.6		***No***	185	37.0
Green (legal)	149	29.8		***Motorized vehicle***	180	36.0
Yellow turning Red (usually legal)	47	9.4		***Pedestrian***	82	16.4
Yellow turning Green (violation)	40	8.0		***Multiple motorized***	20	4.0
Unable to observe	1	0.2		***Pedestrian & Motorized***	19	3.8
Total	500	100		***Non-motorized***	10	2.0
				Motorized & non-motorized	2	0.4
Movement prior to violation				***Pedestrian & non-motorized***	1	0.2
No violation	189	37.8		***Unable to observe***	1	0.2
Fail to stop, enter on Red/late on Yellow	178	35.6		**Total**	50	10
Stationary, then enter before Green	132	26.4				
Total	500	100				

[1] A traffic conflict is a situation where two or more vehicles or a pedestrian approach each other in such a way that a crash may occur unless one of them applies an emergency manoeuvre [e.g. apply brakes, reducing speed, changing direction etc.] (Gledec, M. 1996)

Most MRDs (71.6%) were travelling in the middle traffic lane, while 18% were using the right lane and only 10.2% were in the left lane. No MRD was wearing a motorcycle helmet. In terms of other behaviours, 3.8% were using a mobile phone and less than 1% were smoking while driving.

Chi-square tests were performed to determine the association between MR conflicts and light colour, the results were statically significant [$\chi 2$ (3) = 85.70, p <0.001]. The majority of MR conflicts with motorized, non-motorized vehicles and pedestrians (77%, 80% and 73.5% respectively) were observed at Red signals compared to Green (23%, 20% and 26.5% respectively).

Discussion

MRs are only registered as motorcycles and not as a specific vehicle type, so their exact number is unknown to authorities, however from the findings of previous studies and literature review (mainly newspaper articles), it appears that presently MRs are the largest informal paratransit mode in Pakistan. Most MRs observed in Lahore in the current study were not in good physical conditions, their repair and maintenance often seemed to be compromised. This may be a consequence of their low earning capacity (due to saturation of MRs on all routes) and lack of ownership by drivers as many MRDs do not own their vehicles and are working on daily wages. Modifications in design and compromised repair and maintenance conditions increase the likelihood of crashes.

About 23.4% of observed MRDs appeared to be younger than the minimum driver licensing age of 18 years in Pakistan. Given that police enforcement is higher in Lahore than elsewhere in Punjab, this could be predictive of an even worse situation in the smaller cities, towns and villages of Punjab, where minimal or no police enforcement exists. Data analysis shows that there was a significant difference in the prevalence of underage MRDs across the various locations [$\chi 2$ (11) = 25.467, p <0.008]. Most underage MRDs (21.4%) were operating on GT Road, compared to (14.5%) in Township area and (11.1%) on Multan Road. These areas are characterised by high population density, poor levels of formal public transit, low socioeconomic status and low police enforcement, which could account for this figure. However, since 18.8% of MRDs in this study were observed on GT Road, the prevalence of underage MRDs does not represent a very large over-representation.

In addition to underage and unlicensed driving, MRDs do not have route permits and fixed routes, so they set up illegal terminals and encroach upon roads, footpaths and markets with a consequent contribution to traffic congestion, road crashes, air and noise pollution, and compromising the safety of pedestrians and other road users.

Most MRDs observed committed traffic violations such as entering on the red light or on yellow before the light had turned green, which in turn causes traffic conflicts and increases the likelihood of crashes. There is mixed traffic in Lahore, so MR traffic conflicts were observed with almost all kinds of motorized and non-motorized vehicles and other road-users (i.e. pedestrians). A reason cited for MR traffic conflicts is their frequent traffic-lane changing and overtaking, since they overtake anywhere and will even stop in the middle of the road to pick up passengers. It is worth noting that most MRDs were travelling in middle or right (high speed) lanes whereas they are required to travel in the left lane. Similarly, a few MRDs were using handheld mobile phones and smoking while driving, with these behaviours likely to increase the likelihood of crashes.

No MRDs wore helmets, although technically they are supposed to do so, because MRs are classed as motorcycles, and MRDs as motorcyclists have to wear helmets. However, AR riders do not have to wear a helmet, and the lack of any clear rules or guidelines for MR operation in Pakistan makes the classification of MRs, and hence the helmet requirement for MRDs, ambiguous. On the other hands, helmet wearing rates are very low even among motorcyclists, as is well-documented in previous studies in Pakistan (Ahmed, 2007; Hashmi et al., 2012; Hyder, Ghaffar, & Masood, 2000; Tahir et al., 2012, 2013).

Many MRs were overloaded, and this was frequently seen in those areas where there are minimal or no other public transport modes available. Overloading was also commonly observed in morning peak hours and on weekends. MR overloading could be attributed to economic pressure, as MRDs do not earn much and their incomes are decreasing, because of increasing MR numbers on almost all routes in Lahore. Another major reason for overloading is to meet passenger's needs; this is quite common in underprivileged areas, where family size is usually large and they cannot afford any other transport mode (e.g. taxi, AR, van etc.), so they prefer to travel together by MR, because it is cheaper (15-20 Rupees/trip/person) than other modes and offers some flexibility to accommodate extra passengers.

An important reason behind frequent violations of road safety and traffic rules by MRDs is weak or absent law enforcement. It was observed during the survey process that although traffic police were present at most of the locations, they were not controlling the traffic. Most of them were standing in a concealed spot or on corners to catch drivers (mainly motorcyclists) in order to fine them, and it appears that traffic management, deterrence or road safety awareness does not seem to be a priority. Some MRs did not have a motorcycle registration plate or were displaying a fake plate, yet they were not approached by police.

Although MRs were introduced in Pakistan (from Lahore) under the "President Employment Scheme" in 2001 (The Express Tribune, 2012), they still have only an informal status and are operating without any regulation. They are contributing to the road toll and endangering the safety of pedestrians and other road users. The haphazard growth and unregulated operation of MRs indicates the government's indifference towards the public transport sector in Pakistan. A few sporadic efforts have recently been made (introduction of a bus rapid transit system in Lahore and another between Rawalpindi and Islamabad), but overall there is a severe shortage of quality public transport facilities in Pakistan.

Road crashes and injuries have serious socioeconomic impacts on the individuals as well as on the national health care system and the economy. Existing transport infrastructure and facilities do not meet the needs of the rapidly growing population in Pakistan. Therefore, people are forced to use private transport and unsafe transport modes such as MRs. Increasing use of private transport modes and mushrooming of unregulated transport modes are resulting in high motorization rates, traffic congestion and road crashes. There is a need for government attention to improve public transport and road safety in Pakistan. An important element of this improvement is to devise an appropriate road safety and transport policy for MRs, so that the burden of road crashes involving these vehicles will be reduced.

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