belt use patterns in Delhi, India, and the implications for effectiveness of traffic safety interventions.

Methods In September 2014 we conducted roadside traffic surveys at 17 locations and observed 3,251 MTWs and 3,200 cars. All surveys were done between 0700 and 1900 hours. The following data were recorded: Number and sex of passengers by their location in the vehicle, seatbelt use by car occupants and helmet use by MTW occupants. The data are analysed for estimating the effectiveness helmet and seatbelt laws and the outcome in terms of lives saved.

Results <u>MTW use patterns</u>: Total MTW: 3251; Passengers per MTW: 1.3; Children per 100 MTW: 3; Overall helmet wearing rate: 88%; Driver helmet wearing rate: 96%; Pillion helmet wearing rate: 70%.

<u>Car use patterns</u>: Total Cars: 3,200; Passengers per car: 2.0; Overall belt use 60.3%; Driver belt use: 91.5%; Front seat passenger belt use: 76%, Rear seat passenger belt use: 6%.

<u>Fatality rate estimates per billion vehicle-km in Indian cities</u>: Delhi: Car-3.8, MTW – 16.5; Average for 5 other Indian metropolitan cities where helmet laws are not enforced and seat belt law enforcement is weak: Car – 12.5, MTW – 37.7.

Conclusions Helmet wearing rates for MTW riders exceeds 88% in Delhi where the law is enforced as compared to less than 20% in other Indian cities where the law is not enforced. Between the years 1999 and 2014 helmet use by women passengers was insignificant, but increased to more than 70% immediately after the mandatory law was reintroduced. Belt use by front seat car passengers in Delhi is 76%. This shows that publicity campaigns do not result in high belt and helmet use, but enforcement of mandatory laws has a very strong effect on compliance.

Fatality rates per billion vehicle km in Delhi for cars are 30% of those in other cities and for MTW 44%. The lower rates in Delhi are probably partly due to enforcement of helmet and seatbelt use laws.

| 663 | REGULATIONS AND ENFORCEMENT IN OFF-HIGHWAY VEHICLE PARKS IS ASSOCIATED WITH SAFER RIDING BEHAVIOURS |

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Background Previous studies showed that Iowa all-terrain vehicle (ATV) crash victims from off-highway vehicle (OHV) parks practiced safer riding behaviours than off-road crash victims outside the parks. The objective of this study was to determine the effect of regulations and enforcement on the prevalence of safety behaviours among Iowa OHV park users.

Methods From May to September of 2014, motion-activated cameras captured photos of users at the entrances of Iowa's eight OHV parks. Riders were coded by vehicle type, estimated age, sex, and safety behaviours. Descriptive and multivariable logistic regression analyses were performed.

Results A total of 6,718 vehicles and 9,083 riders were analysed. Among OHV park users, 44% were on ATVs, 51% on dirt bikes and 5% on side-by-sides (SxSs). Helmet use was 94% overall. Just 6% of single-rider ATVs and 0.8% of dirt bikes had passengers. While only 11% of park users on ATVs were <16 years

old, 59% of the child operators were driving adult sized ATVs. Of those riding SxSs, 64% were not using their restraints. As compared to young adult (16–39 years) ATV riders, children were ~6 times more likely to wear a helmet and adults 40–60 years old were half as likely. When officers were patrolling the parks, there was a 3.6-fold higher likelihood of helmet use and a 40% lower likelihood of passengers on dirt bikes and ATVs.

Conclusions Regulated safety behaviours (helmet use and riding without passengers) were highly common among OHV park users. However, unregulated behaviours (SxS restraint use and children driving youth-sized ATVs only) had lower compliance. Moreover, regulated safety behaviours were significantly increased when the parks were patrolled. This study shows that a combination of regulation and enforcement is effective in ensuring safety behaviour compliance in OHV parks. Similar efforts outside parks could have a substantial effect on decreasing off-road vehicle-related deaths and injuries.

| 664 | A NEEDS ASSESSMENT OF OPPORTUNITIES FOR SAFE BICYCLING IN AN URBAN AREA |

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Background Bicycling has been proposed as a potential intervention to reduce sedentary lifestyles, decrease air pollution, and promote active transportation. This study sought to assess the knowledge, attitudes, and behaviours towards bicycling in an urban area, explore the dominant safety concerns for bicyclists, and understand equity issues.

Methods A sequential mixed-methods design was used for this study. Data were first collected from an online survey administered from mid-February 2014 through April 1, 2014. Quantitative data guided the focus of key informant interviews with a purposive sample of policymakers and advocates, and a focus group of neighbourhood residents. A literature and document review supplemented the quantitative and qualitative data. Data analysis involved identifying key themes across all data. Findings were disseminated to City leaders.

Results The online survey was completed by 1,437 City residents (62% were regular riders). Nearly three-quarters of the respondents did not feel safe riding in the City. The leading safety concerns were motorists, lack of room to ride, uneven road surfaces, and the potential for crime. Only 37% of respondents said that the bicycling community was representative of the City in terms of gender, race, and age. Qualitative data identified youth and Latin Americans as populations who use bicycles as their primary mode of transportation. Key informants emphasised the safety risks, and acknowledged that the City suffers from inadequate infrastructure for cyclists. Respondents also highlighted significant inequities in neighbourhoods where investments in infrastructure have been made.

Conclusions People who ride regularly and those who are non-riders, but are interested in riding more, reported feeling unsafe. Efforts to improve safe cycling should enhance enforcement of traffic laws targeting motorists and bicyclists and improve bicycling infrastructure throughout the City.

665 STATISTICAL MODELLING FOR CROSSING BEHAVIOUR OF PEDESTRIANS ON URBAN ROAD: CASE STUDY DELHI, INDIA

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Background A significant number of pedestrians are willing to take risk while crossing the road at all type of crosswalks. The paper explored the utility of binary probabilistic modelling and its performance measures to analyse the pedestrians' unsafe crossing behaviour exhibited by different types of pedestrians and their associated risk at different traffic and road environments.

Methods Binary Logistic regression models were fitted to determine the probability of road crossing by a pedestrian with a set of predictor variables. To quantify the risk to pedestrian, adequate gap size to cross the road at the crosswalks was determined. Thereafter, binary Logistic regression models were fitted to determine the probability of crossing by a pedestrian with the gap size less than the adequate gap size for crossing.

Results Findings reveal that crossing behaviour of pedestrian significantly varies at different crossing locations. At signalised intersections and a free left turn crosswalk, no other predictor parameter, except the gap size parameter, is contributing to determine pedestrians' crossing behaviour, whereas at non-signalised crosswalks (at the foot of flyover and grade-separators and non-signalised crosswalk near bus-stop), their individual and traffic characteristics also contribute to determine their unsafe road crossing behaviour. At all types of crosswalks, almost all the pedestrians (who cross the road in an unsafe condition) cross with the gap size less than the adequate gap size.

Conclusions The results of the study are the basic inputs to understand the road crossing behaviour of pedestrian and their associated risk needed to design well structured and safe transport system. The results highlight human behaviour and risk taking owing to road geometry and traffic operations. Free left-turns, flyovers or grade separators are often introduced to reduce traffic congestion. However, the study shows the negative impact of these types of constructions on the pedestrians.

666 HUMAN COST OF "MOTORCYCLE MASS TRANSIT": REPORT OF 9,000 FATALITIES FROM URBAN ROAD INJURY SURVEILLANCE IN A DEVELOPING COUNTRY

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Background Many of the burgeoning megacities in developing countries have witnessed poorly planned urban sprawls. The absence of a coherent mass public transport system encourages the acquisition of inexpensive motorcycles for commuting and this has distorted the traffic mix. In Karachi the proportion of motorcycles on the road has risen from 34% of registered vehicles to 55% over the past decade. We have sought to assess the impact of this on road use fatalities by analysis of data captured by ongoing road traffic injury surveillance based in 5 city hospitals.

Methods The recorded road-use deaths were those dying within 30 days of being admitted to hospital and included cases brought dead to the EDs or the mortuaries of the hospitals. The case information included gender, age, number of vehicles involved in the crash, road-user type (motorcycle rider or pillion rider), helmet use and injury scoring.

Results During 8 years, 2007–2014, motorcycle occupants accounted for 3901 of the 9192 fatalities and over the study period these increased from 36% to 53% of the recorded road deaths (p < 0.001). 69% of them were aged 35 years or less. Though most motorcycle collisions resulting in death involved heavy commercial vehicles, 185 fatalities resulted from motorcycle to motorcycle collisions. Of the 3253 pedestrian fatalities recorded, a motorcycle had struck 19% of them. Of the 2179 instances where a cause could be ascribed to the motorcycle fatality, over speeding was reported in over 50% and the top 6 roads for motorcyclist fatalities were signal-free corridors.

Conclusions An escalating socio-economic tragedy is being played out in the urban centres of many developing countries by the juxtaposition of poor public transport and availability of inexpensive motorcycles. Our study suggests that while the implementation of mass transit schemes are awaited, strategies that segregate traffic and reduce speeds should be prioritised along with strict enforcement of helmet laws.

667 MOTORCYCLE ONE-WHEELING: A FATAL VENTURE IN PAKISTAN

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Background Motorcycle one-wheeling (MOW) is one of the burgeoning factors in motorcycle crashes in Pakistan. Young One-wheelers (YOW) perform dangerous stunts such as riding motorcycle while laying flat, lifting front-wheel and their backs facing motorcycle handles. Consequently, they put themselves and others at risk. A newspaper reported that over 200 YOW died and around 1,300 other road users were injured or killed in MOW crashes during 2011–2013. Current research is the first in Pakistan that presents the most recent epidemiology of MOW crashes.

Methods Retrospective analysis was conducted on crash data for last two years collected by Rescue 1122 (an emergency service in Pakistan) from 37 major cities of Province Punjab.

Results Rescue 1122 attended 389 MOW crashes during the study period. Of them, maximum MOW crashes were reported in Kasur (n = 88), followed by Lahore (n = 69) and Rawalpindi (n = 41). In all 351 injuries and 16 fatalities were reported among YOW. Of the 351 injuries, about 70% were critical (head, spinal & fractures). All 16 fatalities were aged between 16 and 25 years. Most (19%) were aged 21 years, followed by 13% amongst aged 18, 19 and 22 years respectively. None of fatalities/ injured YOW were wearing helmet. Most MOW crashes were reported on Pakistan Independence Day (14 August) and Chand