**Association of road traffic injuries with independent mobility of adolescents in a megacity of lower middle income country**

**or**

**Independent mobility increases road injury risks in adolescents in low income, urban settings**

**Background** Road traffic injuries are the number one cause of mortality for adolescents aged 10 to 19 years old. The objective of our study was to assess the association of independent mobility of adolescents with road traffic injury in low middle-income setting

**Methods** This was a cross sectional survey of 73 schools that were selected through stratified random sampling to include both the private and the government run schools conducted between September and December 2014 in Karachi, Pakistan. We approached students in grades 6-10 from selected schools and obtained parental consent and adolescents’s assent. Each student in selected classroom was asked to fill a written questionnaire.

**Results** There were 1288 adolescents surveyed, out of which 59% belonged to private schools. The mean age of school adolescents surveyed was 14 years (SD 2). There were 771 (60%) girls.

In the final multivariable logistic regression model; older adolescents (13-14 years old aOR = 1.7; 95% CI = 1.1,2.5 and 15-20 years old aOR = 1.6; 95% CI = 1.1,2.5), boys (aOR = 1.5; 95% CI = 1.1,2.0), adolescents who were allowed to cross main roads alone (aOr =1.3; 95% CI = 1.0,1.8), adolescents who did any activity outside home on last weekend alone (aOR=2.2; 95% CI = 1.2, 3.9) and adolescents who visited friends alone (or with same age adolescents) on last weekend (aOR=1.6; 95% CI = 1.2, 2.1) were more likely to get injured.

**Conclusions** In the absence of safe road environment in Karachi, independent mobility of adolescents is associated with road traffic injuries.

**Keywords** Adolescents, Independent mobility, road traffic injury, low income country

Background

Adolescents are not achieving the optimal level of daily physical activity despite its known physical, mental and social benefits (marzi). Screen time has replaced the active time of adolescents and they have increasing levels of obesity. Physical activity strengthens the bones and muscles, prevention from obesity and several other non-communicable diseases that tend to occur in later ages such as hypertension, diabetes, respiratory, cardio-neurovascular diseases and cancers. Physical activity also provides opportunity to socialize with peers to maintain good mental health.

Daily structured or unstructured physical activity for adolescents is not easily manageable in today’s hectic lifestyle for various reasons. Active travel which is walking and cycling for school could be a potential opportunity of incorporating physical activity into adolescents’ daily schedule. Besides the individual health benefits, active travel has population level environmental benefits for example, decrease vehicular emission and noise pollution.

The freedom of adolescents to move freely in the environment without being accompanied by an adult is known as child‘s independent mobility and it has positive impact on physical activity as well as on psychological, social, cognitive and spatial development of a child. The permission to adolescents to travel places alone on foot and to use “mechanised vehicles” such as bikes or public transport is called ‘parental licenses’ (Hillman).

However walking and cycling have decreased over a period of time as reported in many developed countries because of many reasons (linde, hosking). Short distances are covered by travelling on cars or any other motorized vehicles. There is a lack of safe environment both social and physical. Neighbors are unfamiliar to each other. There is unavailability of nearby parks and playgrounds. The streets have become motor centric.

There are concerns about adolescents’s safety (Johansson). Cases of child and adolescent abuse are also reported in many countries. Adolescents are vulnerable to road traffic injuries because of their developing physical and cognitive skills along with their risky behaviors. There is higher road traffic fatalities among pedestrians, cyclists and motorcyclists in middle and low income countries. The built environment is less developed according to needs of pedestrians, cyclists and motorcyclists in such countries.

Daily independent mobility of adolescents for schools is window of opportunity to meet recommended physical activity (alphort). It may also be a precursor to future fitness and health but it is perceived as risky by parents. The work on independent mobility with respect to injury among adolescents or adolescents is really scarce. Previous literature was primarily on pedestrian safety related to school trips. Whether independent mobility of adolescents is associated with road traffic injuries is not well established particularly in low middle-income setting. There is only one study found from Auckland that showed adult accompaniment was associated with reduced pedestrian injury risk. The objective of this study is to determine an association of adolescents’ independent mobility with road traffic injury in low middle-income setting.

Methods

This was a cross-sectional study on school adolescents in grades 6 to 10 from September till December in 2014. The study was conducted in both public and private sector schools of Karachi, Pakistan. Altogether 73 schools participated in the study, out of which 25 were public schools and 33 were private schools. The schools were selected with the ratio of (n=59, 60%) private and n=41, 40%) public.

Outcome: Any road traffic injury that resulted in any first aid or consultation in healthcare setting ever

Exposures: Parental licensing to independent mobility of adolescents was asked by whether they were allowed to cross main road, travel to and from school alone, travelling in bus, cycling, travelling in night versus day time and activities alone on the weekend. The responses were either yes or no.

Sample size: The sample size for the study population was 1,270 school adolescents. Since there was no past information on school adolescents’ mobility patterns in Pakistan, it was estimated that at least 50% students may be active commuters in the study population with 95% confidence level and a bound on error of ± 5%. The sample size required after multiplying with design effect of 3 and inflating the sample size by 10% to account for non-responders was approximately n=1267. The randomly selected list was generated twice due to refusal of some schools.

The study questionnaire for school adolescents was available in Urdu and English. The questionnaires had multiple choice questions. Some questions had five category likert scale. The questionnaire for school adolescents had questions pertaining to their modes of transport to and from school, accompanied them, whether they had suffered or witnessed any road traffic injury (RTI) in the past, and their general activities. The study questionnaires were first pilot tested to see their effectiveness, acceptability, and clarity for study participants, and modifications were made accordingly before launching the main data collection process.

For the public sector schools, permission was obtained in writing from the Executive District Office – Education (EDO - Education) for Karachi District to approach the schools. The EDO provided list of all public schools of Karachi which were registered with the authorities. For private schools, list was obtained from director private school association Karachi Pakistan. Both lists included the location addresses, and phone numbers of contact persons at the schools. Schools for the study were randomly selected from the said list. These schools were first approached through the given phone numbers and email addresses, but because the official lists of schools were not updated, many times contact with schools could not be made. To overcome the issue, two data collectors were dispatched to locate each school in person prior to data collection.

At each public and private sector school approached, permission to conduct the study was obtained from the principal of the school. In their first visit to each school, research assistants explained the study to the management and then to a class of students from the school. Each class and section (if there were multiple sections of a grade in a school) was randomly selected through paper chits to avoid any selection bias. In each class, a parental permission letter giving details of the study (in either Urdu or English language, as advised by the school administration) was distributed to each student. A week’s time was given for students to get the letters signed by their parents or guardians. It was ascertained that a weekend fell in between before the research assistants’ second school visit, so as to allow for adequate time for parents to read the permission letters. Only those students who had assented to participate and whose parents had given them permission to enroll in the study were included for data collection. For students’ assent, oral script was used. For data collection, research assistants were trained about administering the questionnaires. Each question in the data collection tool was explained to school adolescents by research assistants to ensure clarity in comprehension. The questionnaires took approximately 25 minutes to be filled by a class of students.

Statistical analysis

Results

Interviews of 1288 adolescents included in the study. The average age of adolescents was 14 years with girls in majority (60%). Overall 25% adolescents reported road traffic injuries. More boys reported road traffic injuries compared to girls (54% vs.46%). Adolescents who walked to school (69%) reported more injuries than any other mode. Adolescents who walked alone had more injuries than if accompanied with parents (40% vs. 7%). Adolescents who believed that their parents always trust them when they are on their own in road traffic reported more injuries (49%) compared to who believed their parents trust them sometimes (36%) or never (15%). Adolescents who reported parents licensing to cross main roads alone reported more injuries compared to who were not allowed (53% vs. 47%).

In the final multivariable logistic regression model; older adolescents (13-14 years old aOR = 1.7; 95% CI = 1.1,2.5 and 15-20 years old aOR = 1.6; 95% CI = 1.1,2.5), boys (aOR = 1.5; 95% CI = 1.1,2.0), adolescents who were allowed to cross main roads alone (aOr =1.3; 95% CI = 1.0,1.8), adolescents who did any activity outside home on last weekend alone (aOR=2.2; 95% CI = 1.2, 3.9) and when they accompany both adult and peers (aOR=2.0; 95% CI = 1.1, 3.6), adolescents who visited friends alone (or with peers) on last weekend (aOR=1.6; 95% CI = 1.2, 2.1) were more likely to get injured. Adolescents when accompanied with adults on activities outside home was not associated with injury. Similarly, adolescents accompany adults in their visits to friends was not associated with injury neither.

Discussion

This study shows association of independent mobility of adolescents with road traffic injuries. The three variables that were significant are crossing main road, any activity on last weekend outside home, visited friend’s home last weekend.

These results show leisure time trips/activities independently by adolescents or along with peers are associated with injuries. Our study did not find any association of injury with adolescents who accompanied adults in their trips in contrast to a previous study which showed protective effect of adult accompaniment (Roberts). The main difference between two studies is the built environment.

Despite these built environment, active school transportation (walking/cycling) did not appear to be associated with injuries. This might be due to ability of children to accustom to regular trips in same routes of short distances. Our data shows 42% of adolescents who use active transportation (walk or cycle) reach to school within 5 minutes. While 92% reach in less than 15 minutes. Previous study also confirmed that there is less risk of injury while commuting to school among adolescents 5 -17 years (schofield). However study in India showed those cycling and walking have greater risk of injury. (Tetali)

This is understandable that leisure time activities with peers provoke many risky behaviors. Previous studies have shown that children and adolescents with unsafe road safety behaviours have

Peers with similar behaviours. Lack of knowledge of road safety is also associated with having higher risky behaviours.

Adolescent till age 18 are in brain development process. The understanding of adolescent’s higher risk taking may depend on the biological development of the brain, where the brain matures both cognitively and emotionally from childhood into full adulthood (Moe).

Study finding also showed adolescents who were allowed to cross main roads are associated with injuries. This is consistent to previous findings that number of streets crossed by children and adolescents is associated with injuries (machperson). High volume roads are also linked with injuries in children and adolescents (Roberts). Karachi is deprived of safe road environment. It lacks amenities for pedestrians and cyclists. Motorcycles are used as family vehicles without safety measures. Pedestrians cross roads unsystematically on their judgment of empty road. There are no Zebra crossings or pedestrians signals.

Boys had more share of injuries and this is not a surprise finding particularly in setting of Karachi. Previous study in India, setting similar to Karachi, showed boys had more road trips than girls

(dandona) as well as more injuries in school trips (tetali). In a typical social context, boys are supposed to take care of household chores outside home while girls are involved in household chores inside home (marzi). Boys get parents licensing for physical activity much more compared to girls. Boys show less risk perception than girls in general as well as in roads (Cordellieri, Granie et al.).. Therefore, this gender difference on risk perception could explain increase risky behaviors and the frequency of road causalities among boys.

Limitations

There are limitations in this study. First of all, it is the association and not the temporality between injury and independent mobility due to cross sectional design. Moreover, there was a definite time period for measurement of independent mobility variables such as did you visit a friend on weekend that just passed but injury that happened ever in life was gathered.

Secondly, the sample size calculation was based on type of mobility with the assumption that 50% of adolescents walk to school. The sample size was not calculated on the basis of independent mobility or injury which might need more sample size.

Third limitation is related to validity of self-reports from adolescents which might be not very accurate in few pieces of information but this is the best possible practical method that we used and so did previous studies. Fourth, details on injury was not gathered with respect to mode of transport which could further help to assess the situation.

Conclusion

In the absence of safe road environment, adolescents in Karachi while commuting independently or along with peers are associated with road injuries. These results have repercussions not for adolescents now but future adults and generations to come. It is important for urban planners, environmentalists and public health practitioners to prioritize safe road environment and the needs of active transporters to promote walking and cycling. Walking and cycling are important to decrease level of sedentary lifestyles and improve quality of life.

Table 1: Demographics of adolescents from schools selected in study

(n=1288\*)

|  |  |
| --- | --- |
| Variables | n (%) |
| Gender  Boys  Girls | 517(40)  771 (60) |
| Age  9-12 years  13-14 years  15-20 years  Mean (SD) | 238 (19)  516 (40)  527 (41)  14.1 (1.8) |
| Type of schools  Private  Public | 764(59)  524(41) |
| Grade  6  7  8  9  10 | 267 (20.7)  259 (20.1)  204 (15.8)  349 (27.1)  209 (16.2) |
| Road traffic injury occurred to adolescents ever  Yes  No | 322 (25)  966 (75) |

\*There are missing values in some variables

Table 2: Univariate association of road traffic injury with socio-demographic and road mobility factors among adolescents (n= 1288\*)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Involved in road traffic injury | | Odds ratio | 95% CIs |
| Yes  n (%) | No  n (%) |
| Age  9-12 years  13-14 years  15-20 years | 41(13)  137(43)  142(44) | 197(21)  379(39)  385(40) | -  1.7  1.8 | -  1.2,2.6  1.2,2.6 |
| Gender  Boys  Girls | 174(54)  148(46) | 343(36)  623(65) | 2.1  - | 1.7,2.8  - |
| Type of school  Private  Public | 200(62)  122(38) | 564(58)  402(42) | -  0.9 | -  0.7,1.1 |
| Mode of transport to school on the day of survey  Walk  2 or 3 wheelers  4 wheelers | 221(69)  47(15)  54(17) | 711(74)  122(13)  133(14) | -  1.2  1.3 | -  0.9,1.8  0.9,1.9 |
| Travelled on his/her own  Yes  No | 129(40)  192(60) | 374(39)  589(61) | 1.1  - | 0.8,1.4  - |
| Travelled with parents to school  Yes  No | 22(7)  299(93) | 75(8)  889(92) | 0.9  - | 0.5,1.4  - |
| Time to school (minutes)  Less than 15  16-30  More than 30 | 267(83)  25(8)  29(9) | 853(89)  68(7)  43(5) | 0.5  0.5  - | 0.3,0.8  0.3,1.1  - |
| Parents trust when on his/her own in traffic  Never  Sometimes  Always | 46(15)  115(36)  157(49) | 175(18)  358(37)  428(45) | 0.7  0.9  - | 0.5,1.0  0.7,1.2  - |
| Allowed to cross main roads alone  Yes  No | 169(53)  151(47) | 387(40)  577(60) | 1.7  - | 1.3,2.2  - |
| Have a bicycle  Yes  No | 93(29)  223(71) | 192(21)  745(80) | 1.6  - | 1.2,2.2  - |
| Allowed to cycle on main roads  Yes  No | 42(13)  271(87) | 65(7)  867(93) | 2.1  - | 1.4,3.1  - |
| Allowed to ride alone to different places  Yes  No | 59(66)  31(34) | 97(52)  90(48) | 1.8  - | 1.1,3.0  - |
| Allowed to go on public buses  Yes  No | 86(27)  232(73) | 153(16)  802(84) | 1.9  - | 1.4,2.6  - |
| Visited a friend home  Yes, alone  Yes, with an adult  No | 134(42)  16(5)  170(53) | 246(26)  47(5)  670(69) | 2.1  1.3  - | 1.6,2.8  0.7, 2.4  - |
| Activities on last weekend  Yes, alone or with peers  Yes, with adults  Yes, with adults and peers  No | 148(46)  36(11)  120(37)  18(6) | 323(33)  206(21)  314(33)  123(13) | 3.1  1.2  2.6  - | 1.8, 5.3  0.7, 2.1  1.5, 4.5  - |
| Safe in local neighborhood  Yes  No | 218(70)  92(30) | 624(67)  309(33) | -  0.9 | -  0.6,1.1 |
| Allowed to travel alone or with friend’s other than for school  Yes  No | 226(73)  83(27) | 560(61)  362(39) | 1.8  - | 1.3,2.3  - |

Table 3: Multivariable logistic regression of factors associated with road traffic

injury among adolescents (n=1288)

|  |  |  |
| --- | --- | --- |
| Variables | Odds ratio | 95% CIs |
| Age in years  9-12 years  13-14 years  15-20 years | -  1.7  1.6 | -  1.1,2.5  1.1,2.4 |
| Gender  Boys  Girls | 1.5  - | 1.1,2.0  - |
| Allowed to cross main road alone  Yes  No | 1.3  - | 1.0,1.8  - |
| Any activity outside home on last weekend  No  Yes, alone or with someone of same age group  Yes, with parents or adults  Yes, mix (both with adult or alone/ same age group) | -  2.2  1.3  2.0 | -  1.2, 3.9  0.7, 2.4  1.1, 3.6 |
| Visited friend’s home on last weekend  No  Alone or with someone of same age  With adult | -  1.5  1.4 | -  1.1, 2.0  0.7, 2.6 |

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