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Original Research Article

Children commute to schools in Bangalore urban and rural districts: travel pattern, behaviour and perceptions

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ABSTRACT

Background: Children form vulnerable road users during their regular school commute. School children safety is not taken into consideration before construction of road network. The total number of persons injured in India during 2015 near schools or colleges or educational institutions due to road traffic accidents are 13,270 in urban areas according to National Crime Records Bureau which is quite alarming. Current study is the first attempt in both rural and urban Karnataka towards understanding travel pattern, behaviour and perceptions among school children during commute to schools. The objectives of the present study were to assess travel pattern, behaviour and perception of school children in Bangalore urban and rural districts and to assess factors associated with travel pattern.
Methods: A cross sectional study was conducted using a representative sample of schools selected by simple random sampling. Data was collected using a pre-tested, semi-structured questionnaire which was analysed using SPSS version 20.
Results: Nearly 86% of school children travelled less than 5 kms to reach their schools. Nearly 39% of school children travelled alone to school. Most common mode of travel to school was by walk. Nearly 27.4% did not cross the main roads safely. Adherence to road safety behaviour was insufficient. Vehicular traffic was perceived as a major apprehension by children during school commute.
Conclusions: Commute of children to schools in both urban and rural part of Bangalore was unsafe with least adherence to safety measures, which might increase their vulnerability to road traffic injuries.

Keywords: Injury, Accident, Road traffic injuries, Travel pattern, School children, Behaviour, Perceptions

INTRODUCTION

Children use the road as pedestrians, bicyclists, motorcyclists and occupants of vehicles. Several risk factors associated with childhood increase the susceptibility of children to road traffic injury during school commute.[1] Road traffic injuries occupied 6th place in the top 10 leading causes of death in India in the year 2013 in the age group between 5 to 15 years, and in the year 2015 people injured near schools or colleges or educational institutions due to road traffic accidents were 13,270 in urban areas.[2,3]

Increasing motorization in the last two decades, lack of safety policies and environmental norms are responsible for increase in injuries and deaths due to road traffic accidents. The highest number of deaths were reported in those 25 to 34 years of age (21%), followed by 15 to 24 year old (19%).[4] Mobility of children will increase as they grow up and become independent. However, road traffic injuries (RTI's) should not be the price they and their

families have to pay with, since there are proven and effective measures to reduce the risk.[1]

No study has been done so far in Karnataka regarding travel pattern among school children during commute to school. This study aims to assess travel pattern as well as behaviour of school children during commute to school both in urban and rural districts of Bangalore and factors associated with travel pattern.

METHODS

Study setting

Study was done in Bangalore, one of the 30 districts in Karnataka, India, which has a population of over 10 million, and is divided in to Bangalore urban and rural districts. In total there were 7,159 schools in Bangalore.[5] Schools in Bangalore were distributed under three divisions by Department of Education for administrative and convenience reasons- Bangalore urban North, Bangalore urban South and Bangalore rural. Bangalore urban North and Bangalore urban South divisions represented Bangalore urban district. Bangalore rural division represented Bangalore rural district.

Study design and sample size

A cross sectional study was done for five months between 25 July 2017 to 31 December 2017, where 12 schools were selected using simple random sampling method.

Sample size was calculated by using the formula $n=4pq/d^2$, considering the prevalence of RTI's in school children during school commute in previous studies, i.e., p value is 0.17, at 95% CI and precision of 0.03.

Selection of schools

Bangalore urban North division constituted of 2,295 schools, urban South division constituted of 3322 schools and Bangalore rural division constituted of 1542 schools. Bangalore urban North was further divided into four sub-divisions (North 1, North 2, North 3, and North 4). Bangalore urban South was divided into five sub-divisions (South 1, South 2, South 3, South 4 and Anekal). Bangalore rural district was divided into four sub-divisions (Devanahalli, Doddaballapura, Hoskote and Nelamangala). From each division, one subdivision was randomly chosen using a lottery method i.e., North 1 sub-division, South 3 sub-division and Hoskote sub-divisions were randomly chosen from urban North, urban South and rural divisions respectively.

There were 133 government schools and 523 Private schools in North 1 sub-division, 160 Government schools and 629 private schools in South 3 sub-division and 285 Government schools and 94 private schools in Hoskote sub-division. From each sub-division two government and two private schools i.e., 12 schools were randomly selected by a lottery method.

Necessary permissions were obtained from the Office of Commissioner of Public Instructions, Deputy Directors of Public Instructions and Block Education Officers (BEO's) of the sub-divisions of Bangalore urban North, Bangalore urban South and Bangalore rural divisions.

Data collection method

Authorities of each selected schools were met and briefed about the purpose of study and necessary permissions were obtained to collect data from students of 6th, 7th, 8th and 9th standards. School children from 6th to 9th standard (11 to 14 years age group) were selected for the study because this is typically an age when children may be expected to travel independently.[6] Parental consent was obtained through a form sent home through students. Information regarding socio-demographic characteristics, travel pattern, travel behaviour associated with travel pattern and perceptions about safe travel was collected through a pretested, semi structured questionnaire prepared by a review of literature.[7-9] The questionnaire was translated to local language and pilot tested. Questionnaire was sent home to be filled with the help of parents after the consent and collected next day morning. Nearly 780 students were given questionnaires, among them 675 students returned the filled forms with the consent.

Ethical clearance

Ethical clearance was obtained from institutional ethical committee of Rajiv Gandhi Institute of Public Health and Centre for Disease control, Rajiv Gandhi University of Health Sciences.

Statistical analysis

Data was analysed using SPSS version 20. Descriptive variables were presented in the form of frequency and percentages. Z test and Pearson's Chi-square tests were used to test significance of the association.

RESULTS

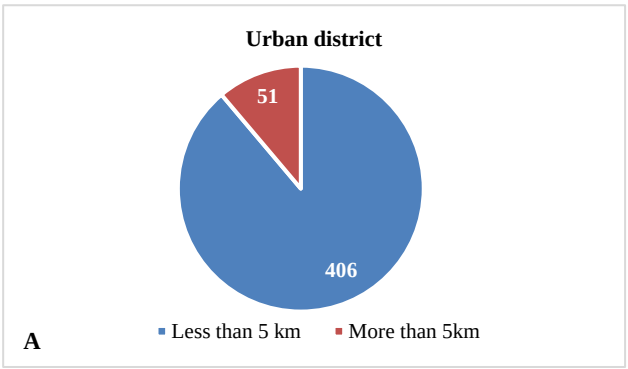
In the current study, nearly half of the children in both Bangalore urban and rural districts were studying in government schools, majority being boys (64.2%) in rural areas compared to almost equal distribution of boys (48%) and girls (51%) in urban schools. More than 80% of parents of the children were literates and were working in different occupations (Table 1).

Nearly 20% of children in rural and 11% of the children in urban district travelled more than 5 kms to reach their schools (Figure 1).

Table 1: Socio-demographic characteristics of school children.

S. no.	Socio-demographic characteristics	Number of children in districts			Z test score	P value
		Urban (n=457)	Rural (n=218)	Total (n=675)		
		N (%)	N (%)	N (%)		
1	Type of school					
	Government	224 (49)	112 (51.4)	336 (49.8)	0.573	0.568
	Private	233 (51)	106 (48.6)	339 (50.2)	0.573	0.568
2	Gender					
	Boys	221 (48.4)	140 (64.2)	361 (53.5)	3.863	<0.001**
	Girls	236 (51.6)	78 (35.8)	314 (46.5)	3.863	<0.001**
3	Fathers education					
	Illiterate	90 (19.7)	33 (15.1)	123 (18.2)	1.433	0.152
	Primary school	117 (25.6)	32 (14.7)	149 (22.1)	3.199	0.001*
	Middle school	45 (09.8)	16 (7.3)	61 (09.0)	1.062	0.289
	High school	125 (27.4)	83 (38.1)	208 (30.8)	2.820	0.004*
	Post high school	49 (10.7)	13 (06.0)	62 (09.2)	2.001	0.045*
	Graduate	18 (03.9)	29 (13.3)	47 (07.0)	4.469	<0.001**
	Profession	6 (1.3)	11 (5.0)	17 (02.5)	2.894	0.003*
	Data unavailable	7 (1.5)	1 (0.5)	8 (01.2)	1.204	0.230
4	Fathers occupation					
	Unemployed	19 (4.2)	3 (01.4)	22 (03.3)	1.903	0.057
	Unskilled worker	68 (14.9)	54 (24.8)	122 (18.1)	3.122	0.001*
	Skilled worker	258 (56.5)	89 (40.8)	347 (51.4)	3.799	<0.001**
	Profession	105 (23.0)	71 (32.6)	176 (26.1)	2.654	<0.008*
	Data unavailable	7 (1.5)	1 (0.5)	8 (1.2)	1.204	0.230

Figures in parenthesis indicate percentage; *: p<0.05, significant; **: p<0.001, highly significant.



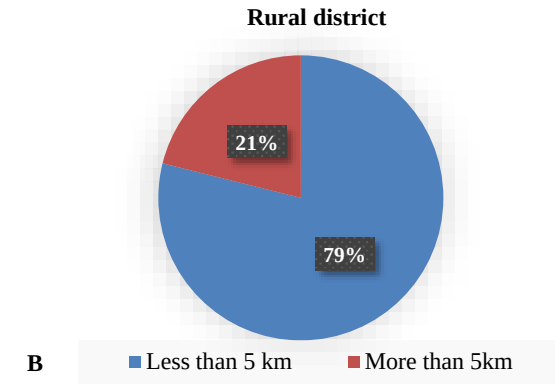


Figure 1 (A-B): Estimated distance from home to school.

Irrespective of the distance 60% of children took more than 15 minutes to reach their schools (Figure 2).

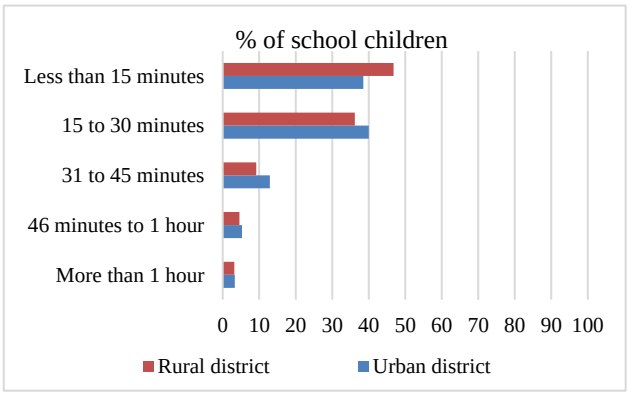


Figure 2: Distribution based on duration of home to school travel.

It was observed in the current study that 34.8% of children in Bangalore urban and 47.7% of the children in Bangalore rural districts travelled regularly to schools without accompaniment. More than 30% of school children accompanied other school mates while going back from school to home. 30% of children in urban and 50% of children in rural districts walked alone during school commute, and the difference was found statistically significant (p<0.05) (Table 2).

In Bangalore rural district, most common mode of travel to schools was by walking (49.5%) followed by bus (19.3%), cycle (13.8%) and two-wheeler (10.1%). In Bangalore urban district, walking was still the major mode (58.6%) followed by bus (23.6%) and two-wheeler (8.5%). The differences in walking and cycling to schools between Bangalore rural and urban school children was found to be statistically significant (Table 2).

Table 2: Travel pattern of school children in Bangalore urban and rural districts.

S. no.	Travel pattern	Number of children in districts			Z test score	P value
		Urban (n=457)	Rural (n=218)	Total (n=675)		
		N (%)	N (%)	N (%)		
1	Person accompanying children from home to school regularly					
	Family member	150 (32.8)	51 (23.4)	201 (29.8)	2.504	0.012*
	Other school children	148 (32.4)	63 (28.9)	211(31.3)	0.913	0.362
	Alone	159 (34.8)	104 (47.7)	263(39.0)	3.217	0.001*
2	Regular travel mode from home to school					
	Walk	268 (58.6)	108 (49.5)	376 (55.7)	2.226	0.025*
	Cycle	7 (1.5)	30 (13.8)	37 (5.5)	6.527	<0.001**
	School bus	3 (0.7)	6 (2.8)	9 (1.3)	2.219	0.026*
	Two-wheeler	39 (8.5)	22 (10.1)	61 (9.0)	0.660	0.509
	Bus	108 (23.6)	42 (19.3)	150 (22.2)	1.275	0.200
	Auto-rickshaw	30 (6.6)	10 (4.6)	40 (5.9)	1.017	0.307
	Others	2 (0.4)	0 (0)	2 (0.3)	0.978	0.327
3	Person accompanying children from school to home regularly					
	Family member	112 (24.5)	38 (17.4)	150 (22.2)	2.067	0.038*
	Other school children	199 (43.5)	70 (32.1)	269 (39.9)	2.837	0.004*
	Alone	146 (31.9)	110 (50.5)	256 (37.9)	4.635	<0.001**
4	Regular travel mode from school to home					
	Walk	290 (63.5)	114 (52.3)	404 (59.9)	2.766	0.005*
	Cycle	7 (1.5)	29 (13.3)	36 (5.3)	6.364	<0.001**
	School bus	4 (0.9)	7 (3.2)	11 (1.6)	2.241	0.025*
	Motorised two-wheeler	15 (03.3)	17 (7.8)	32 (4.7)	2.581	0.009*
	Bus	107 (23.4)	42 (19.3)	149 (22.1)	1.214	0.226
	Auto-rickshaw	31 (6.8)	9 (4.1)	40 (5.9)	1.366	0.170
	Others	3 (0.7)	0 (0)	3 (0.4)	1.366	0.170

Percentages are given in parenthesis; *:p<0.05, significant; **:p<0.001, highly significant.

Table 3: Road crossing behaviour of school children while travelling to school.

S. no.	Road crossing behaviour	Number of children in districts			Z test score	P value
		Urban (n=457)	Rural (n=218)	Total (n=675)		
		N (%)	N (%)	N (%)		
1	Crossing of main roads to reach school					
	Always	317 (69.4)	102 (46.8)	419 (62.1)	5.652	<0.001**
	Sometimes/rarely	71 (15.5)	53 (24.3)	124 (18.4)	2.753	0.006*
	Never	69 (15.1)	63 (28.9)	132 (19.6)	4.227	<0.001**
2	Person accompanying children during crossing of main roads to reach school					
	Alone	142 (36.6)	97 (62.6)	239 (43.9)	5.508	<0.001**
	With parents	52 (13.4)	17 (11.0)	69 (12.7)	0.769	0.441
	Watchman/aaya	6 (01.6)	0 (0)	6 (1.1)	1.556	0.118
	Other school children	185 (47.7)	41 (26.5)	226 (41.5)	4.532	<0.001**
	Relatives	3 (0.8)	0 (0)	3 (0.6)	1.097	0.271
3	Usage of Zebra crossing					
	Using	298 (76.6)	97 (62.6)	395 (72.6)	3.361	<0.001**
	Not using	90 (23.2)	58 (37.4)	148 (27.4)	3.361	<0.001**

Figures in parenthesis indicate percentage; *:p<0.05, significant; **:p<0.001, highly significant.
Note: Questions concerned with Serial numbers 2 and 3 in the above table were answered only by children who crossed the main roads always/sometimes/rarely.

In this study, it was observed that 69.4% of Bangalore urban and 46.8% of Bangalore rural school children always crossed main roads to reach their schools. It was observed that 36.6% of urban and 62.6% of the rural school children crossed main roads alone while commuting to schools, while 47.7% of urban and 26.5% of rural school children crossed with other school children (Table 3).

76.6% in Bangalore urban district and 62.6% in Bangalore rural districts reported that they use Zebra crossing while crossing the roads. The above differences between urban and rural were found to be statistically significant (Table 3).

It was observed that out of all the children who regularly travelled to/from school by walk, 89.8% and 79.8% of school children reported that they used footpath whenever it was present. The observed differences were found to be statistically significant (Table 4).

More than 60% reported that they used helmet while travelling in two-wheeler and nearly 20% reported of getting in or out of a moving bus (Table 4).

Absence of foot path was one of the common reasons among those who did not use foot path while walking (Figure 3).

In the current study it was observed that, 35% and 20% of the school children liked to travel to/from school by walk, in Bangalore urban and rural districts respectively. The observed differences were found to be statistically significant. Nearly 20.8% and 14.7% of the school children liked to travel to/from school by cycle in Bangalore urban and rural districts respectively (Table 5).

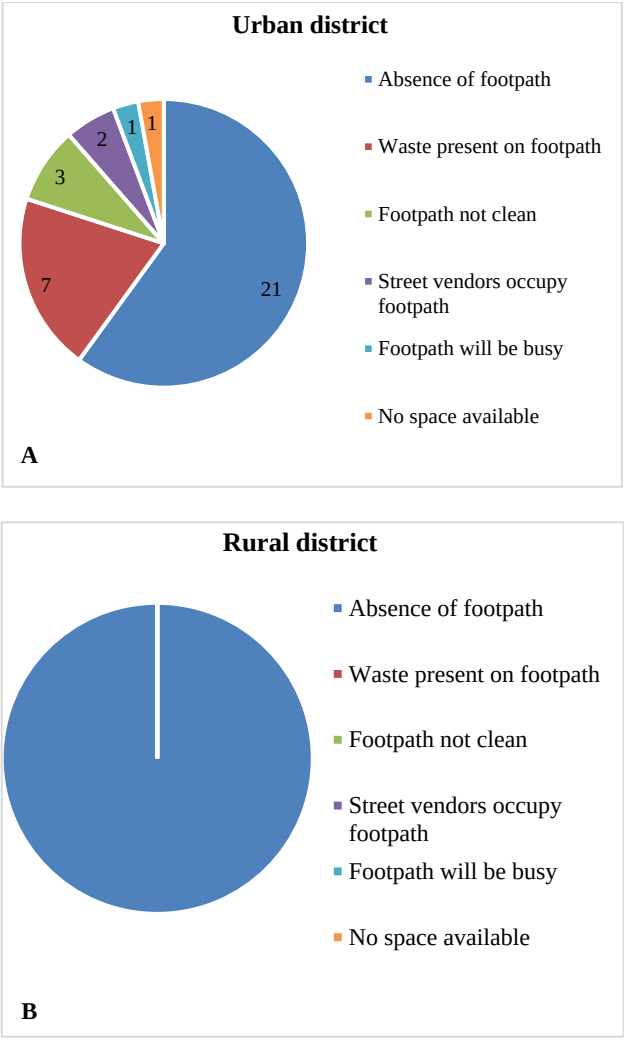


Figure 3 (A and B): Reasons for not using footpath.

Table 4: School children adherence to safety behaviour while commuting to schools.

S. no.	Adherence to safety behaviour		Number of children in districts			P value
			Urban n=457	Rural (n=218)	Total (n=675)	
			N (%)	N (%)	N (%)	
1	Use of footpath[a]	Yes	307 (89.8)	103 (79.8)	410 (87.1)	0.004*
		No	35 (10.2)	26 (20.7)	61 (13.0)	
2	Use of Helmet[b]	Yes	24 (70.6)	14 (60.9)	38 (66.7)	0.445
		No	10 (29.4)	9 (39.1)	19 (33.3)	
3	Getting in or out of a moving bus[c]	Yes	23 (20.7)	12 (27.3)	35 (22.6)	0.379
		No	88 (79.3)	32 (72.8)	120 (77.4)	

Figures in parenthesis indicate percentage. *: p<0.05, significant. Note: [a] denotes only for children who regularly travel to/from school by walk; [b] denotes only for children who regularly travel to/from school by two-wheeler; [c] denotes only for children who regularly travel to/from school by bus.

Nearly half in urban and more than 60% in rural district did not feel safe during their school commute in Bangalore urban and rural districts respectively. The observed differences were found to be statistically significant (Table 5).

Nearly 61.5% of urban and 48.6% of rural school children were worried about traffic during their school commute. The observed differences were found to be statistically significant (Table 5).

Table 5: Children's perceptions about safety while commuting to schools in Bangalore urban and rural districts.

S. no.	Perceptions	Number of children in districts			Z test score	P value
		Urban n=457	Rural n=218	Total n=675		
		N (%)	N (%)	N (%)		
1	Children's preference in travel mode to/from school					
	Walk	159 (34.8)	43 (19.7)	202 (29.9)	3.997	<0.001**
	Cycle	95 (20.8)	32 (14.7)	127 (18.8)	1.898	0.057
	School bus	37 (08.1)	30 (13.8)	67 (09.9)	2.301	0.021*
	Two-wheeler	33 (07.2)	26 (11.9)	59 (08.7)	2.024	0.043*
	Bus	65 (14.2)	21 (09.6)	86 (12.7)	1.672	0.094
	Auto-rickshaw	23 (05.0)	16 (07.3)	39 (05.8)	1.201	0.230
	Car	38 (08.3)	25 (11.5)	63 (09.3)	1.316	0.186
	Other modes	7 (1.5)	25 (11.5)	32 (4.74)	5.680	<0.001**
2	Safety perception in children during school commute					
	Very safe	228 (49.9)	25 (11.5)	253 (37.5)	9.642	<0.001**
	Fairly safe/not very safe	162 (35.5)	143 (65.6)	305 (45.2)	7.359	<0.001**
	Not at all safe	67 (14.7)	50 (22.9)	117 (17.3)	2.655	0.007*
3	Apprehensions of children towards their school commute					
	Traffic	281 (61.5)	102 (46.8)	383 (56.7)	3.604	<0.001**
	Strangers	11 (02.4)	15 (06.9)	26 (03.9)	2.824	0.004*
	Being late	55 (12.0)	55 (25.2)	110 (16.3)	4.340	<0.001
	Getting lost	2 (0.4)	4 (01.8)	6 (0.9)	1.808	0.070
	Being teased	0 (0)	8 (03.7)	8 (01.2)	4.119	<0.001**
	Nothing	108 (23.6)	34 (15.6)	142 (21.0)	2.395	0.016

Figure in parenthesis indicate percentage. *: p<0.05, significant; **: p<0.001, highly significant.

DISCUSSION

Not many studies have been done in India assessing the travel pattern, behaviour and perceptions of school children during commute to schools. This is one of the first study conducted in entire Bangalore district with a representative sample giving comparison of Bangalore rural versus Bangalore urban districts.

It was observed that 85.6% (Bangalore urban district 88.8% and Bangalore rural district 78.9%) of the school children travelled less than 5 kms to reach their schools in Bangalore. A similar study by Tetali et al in Hyderabad, India found that most children (90%) lived within 5 km of school, many (69%) lived within 2 km, and about a third (36%) lived within 1 km respectively.[10] Another study conducted by Nelson et al in Ireland found that the majority of adolescent children who walked to schools lived within 1.5 miles and cyclists within 2.5 miles to their schools respectively.[11] The study conducted by Cordovil et al in Portugal showed that about half of the school children (49%) from primary and secondary schools lived within 1 km from their schools.[12]

It was observed in the current study that more than 70% of the school children travelled regularly to schools without any family person accompanying them and nearly 30% had fellow school mates accompanying them. A study from the University of Westminster showed that only 25 per cent of primary school children now travel home alone.[13] The study conducted by Mammen et al revealed that unescorted children were more likely to live within one kilometer from their school and were significantly older in age compared to escorted children.[14] The study conducted by Cordovil et al showed that less than half of the children went to school (34%) and returned home (42%) not accompanied by an adult. Also, less than 1 of 3 travelled actively (walked/cycled) and independently to 26% and from 30% school.[12]

In this study, nearly half of the school children (58.6% and 49.5% from Bangalore urban and rural districts respectively), regularly walked to school. The study conducted by Shailaja et al concluded that walking is still a major mode of transport in developing countries.[15] A study conducted by Wen et al found that almost a third (32%) of students walked all the way to school.[16] A study by Gururaj et al found that a high proportion of travel is by walking, cycling or on two wheelers in Indian urban and rural roads.[17] The study conducted by Nelson et al concluded that one third of total children walked or cycled to school.[11] In the study by Zhu et at it was found that mode share of students who walked was 27.8% and 31.5% for the trips to and from school, respectively.[18]

In this study it was observed that 23.2% from Bangalore urban district and 37.4% from Bangalore rural district did not use Zebra crossing while crossing main roads to reach their schools. The study conducted by Selim found that around 78% of school bound children used to cross roads

2-3 times/day, recklessly, even knowing its dangerous consequences.[19] The National Center for Statistics and Analysis reported 8,000 injuries and 207 fatalities involving motor vehicles and pedestrians aged 14 years and younger in 2014.[20]

In this study it was observed that 33.3% of the school children (29.4% and 39.1% from Bangalore urban and rural districts respectively) commuting to school by Motorized two-wheeler did not use helmets. In the study conducted by Swami et al it was found that more than half (57.1%) of students were caught for not wearing helmets.[21] In the study conducted by Berg et al it was found that most children reported having worn helmets when they were younger.[22]

In this study it was observed that out of all the school children who regularly walked to/from school, 11 to 20% did not use footpath. The study conducted by Dong et al concluded that better road safety knowledge and the avoidance of walking or cycling-related risk behaviours protected children from road traffic injuries.[23]

In the present study it was found that 22.6% of the school children (20.7% and 27.3% from Bangalore urban and rural districts respectively) regularly commuting via bus used to get in or out of a moving bus. There are not many studies related to bus usage behaviour of school children in India. A study done in Pakistan by Mirza et al reported that 33% did not wait for the bus to stop; 54% stepped off in the center of the road and 84% did not look out for traffic.[6]

In this study it was observed that average 30% of the school children (34.8% and 19.7% from Bangalore urban and rural districts respectively) preferred commuting to school by walk which is more than what is found in a study conducted by Tetali.[8]

Nearly 20.8% of children in urban and 14.7% from rural districts preferred commute to school by cycle which is similar to a study done in Hyderabad but no study is available for urban and rural comparison.[8]

More than 50% in Bangalore urban district and nearly 90% in Bangalore rural district, children did not feel safe while commuting to schools, which was more compared to a study done by Tetali where 69.7% and 2.3% of the school children felt very safe and not at all safe respectively.[8]

In the present study, 61.5% of urban and 46.8% of rural school children had apprehensions regarding traffic during their school commute. In the study conducted by Tetali it was concluded that 15.3% and 44.9% of the school children worried about traffic and being late respectively.[8]

CONCLUSION

Walking was the major mode of transport among school children in both Bangalore rural and urban districts. Majority of the school children travelled unaccompanied by a family member/adult in both Bangalore urban and rural districts. Vehicular traffic was a major apprehension among children during school commute. Considerable number of school children did not adhere to safe road user behaviour during their school commute which might expose them to increased risk for road traffic injuries.

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