

## ORIGINAL ARTICLE

## A Study on the Occurrence of Injuries and Concept of Students on School Bus Safety in India

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**Abstract:** A school bus is used universally to transport school children to and from school. These are considered as the safest mode of transport in city areas in spite of poor ergonomic interior design and predominant unsafe condition. The study was performed among the students to find out their concept of safety regarding the interior design of school buses. For this study a questionnaire was developed and performed among three hundred urban students of eight different schools of Kolkata. The students were divided into three groups of equal strength: primary, middle and high. Each group had fifty male and fifty female students. From the analysis of questionnaire it was observed that all students were facing many unsafe and poor ergonomics related problems that lead to injuries while traveling in the school buses. It was further revealed that design of Indian school buses should be improved immediately.

**Key Word:** School Bus, Safety, Injury, Kolkata

### Introduction

In metropolitan cities of India school bus is one of the most predominant and important mode of transportation for students. It is normally believed that school bus is one of the safest forms of transportation today. A school bus is a large, painted vehicle that takes children to school and returns them to their homes in many countries throughout the world. They are commonly painted yellow for purposes of visibility, safety and equipped with specialized traffic warning devices. In ancient times in India, education was mostly provided through *Gurukuls*. That time no such transportation was available. Those who belonged to royal families used horse drawn carts as transport. Public education started in the mid 1600's, but pupil transportation was not provided until the late 1800's. By 1910, thirty states had pupil transportation programs in place. The first "vehicles" used to transport students were nothing more than horse-drawn carts, which were borrowed from local farmers. In the recent years, there has been a significant increase in the numbers of school going infants who are being transported in school buses [1]. In Kolkata only 95 Registered School Buses are present and these are used by 5700 students. These buses travel 4750 km per day [2]. It is commonly believed that school buses are safer than other transports. But several tragedies or problems related to the school buses have occurred, which indicates the existing unsafe condition of these buses. The safety of the general people and students both within the bus as well as those in the roads are given least priority (Gangopadhyay et al, 2005) [3].

Thousands of children are injured or killed each year in school bus accidents. A significant number of these tragic incidents are precipitated by disruptive child behavior that distracts the drivers from their difficult task [4]. In India, the conditions of the school buses are poor and the students suffer from a lot of problems while traveling in such buses (Dev et al, 2007) [5]. However no study regarding the internal design of the school bus has been recorded. In West Bengal major school bus accidents is rare but from previous study it was found that near miss cases are very high, which is a very alarming condition indicating that school buses are running in the road ignoring the safety norms. Minor and some time major accidents occur inside the buses because of poor design of school bus interiors. The present investigation is made to find out the responses of the school children regarding their problems related to school bus and the design of future school bus.

### Materials and Methods

1. *Selection of Subjects:* In this study, the experiment was performed on 300 subjects in which 100 subjects from three different groups of students (primary, middle and high school students). The groups were chosen in such a manner that they all avail school bus facilities on a regular basis. Hundred such students from each group, constituting 50 male and 50 female were chosen. To avoid selection bias, all the subjects were selected randomly from eight different schools of Kolkata.

2. *Questionnaire:* The questionnaire was developed on the objective of the study and special attention was given to include all related and relevant aspects of safety, design of the school bus and behaviours of the commuters. Questionnaire was first performed on randomly selected reference group (50) to make necessary modifications. Bus drivers and parents of school bus users are also included during the preliminary stage of questionnaire development to gather more information related to the school bus. During modification some questions were subsequently added to and rejected from pre modified questionnaire. After modification, the modified questionnaire was performed on the experimental group. To judge the reliability of respondents some questions were repeated in the modified questionnaire. The modified questionnaire consists of a series of objective type questions with affirmative and negative options of responses.

2 (a). *Injury Records and Analysis:* To minimize bias, respondents were asked 'Have you ever had an injury during travel in the school bus? When the answer was positive, the respondent was invited to provide a narrative about what happened, how and when, which was recorded as a written narrative. For detailed recording of the injury, the Nature of Injury, Part of Body Affected, Source of Injury were all taken into account.

3. *Selection of Buses:* Only one type of school bus was selected for this study. Selection of bus was made on the basis of the predominance in uses by the selected schools.

4. *Statistical Analysis:* Student t-test is done to find out the significant difference of physical parameters between the male and female students of the groups [6].

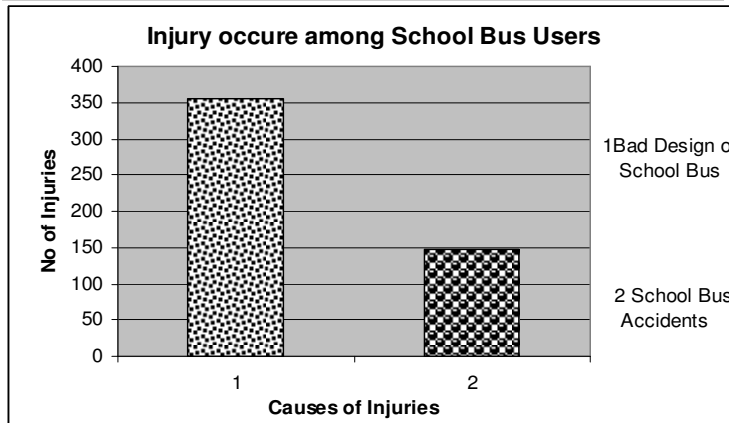
**Results and Discussion**

Table 1 represents the physical parameters of both male and female school students, which are represented as: *Primary school students: Group A, Middle school students: Group B, High school students: Group C.* The age ranges of students are between 6 to 16 years. Apart from age, there was significant difference in both weight and height between the male and the female students of respective groups.

Table 1: Physical parameters of male and female students (N=300)

Parameters		Male (n=150)		Female (n=150)		t	Remarks
		Mean	±SD	Mean	±SD		
AGE (years)	Group A	7.5	1.26	7.7	1.25	0.797	Not Significant (P>0.05)
	Group B	11.2	0.78	11.2	0.78	0.00	Not Significant (P>0.05)
	Group C	14.5	1.08	14.2	0.78	1.592	Not Significant (P 0.05)
Height (cms)	Group A	129.4	8.06	126.2	12.13	1.554	Significant (P<0.05)
	Group B	147.3	6.73	141.1	6.58	4.568	Significant (P<0.05)
	Group C	164.6	6.55	151.0	4.50	12.01	Significant (P<0.05)
Weight (kgs)	Group A	34.4	5.19	27.3	2.00	9.026	Significant (P<0.05)
	Group B	49.2	4.49	37.9	3.57	13.929	Significant (P<0.05)
	Group C	54	3.09	47.0	3.39	10.791	Significant (P<0.05)

Figure 1: Injuries occur among the school bus users due to bad design of school bus and school bus accidents



From the analysis of questionnaire, results are developed in tabular forms. From the questionnaire study, it is observed that the main reason of injuries is bad design of school buses and injuries also occur because of school bus accidents (Figure 1)

The predominant types of injury are laceration (75%), sprain & strain (69%), cut (48%) and abrasion (30%) (Figure-2). This result shows that the injuries may have resulted from the improper interior design as well as lack of maintenance of these buses. The most affected body parts are legs (90%) followed by hands (70%), chest (50%), and head (39%) (Figure3). This again highlights the unsafe behavior of the students and also the unsafe design of the school bus.

Figure 2: Different types of injuries on school bus

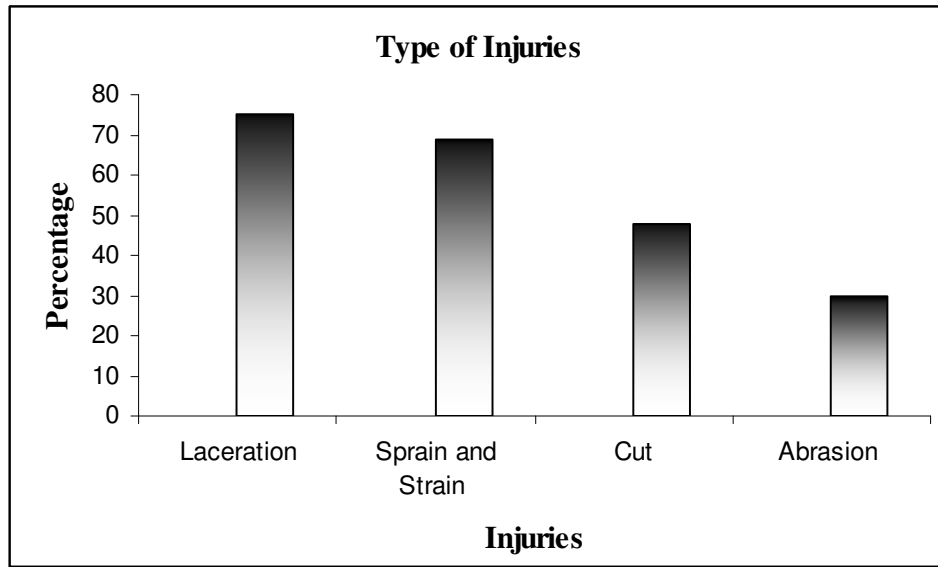
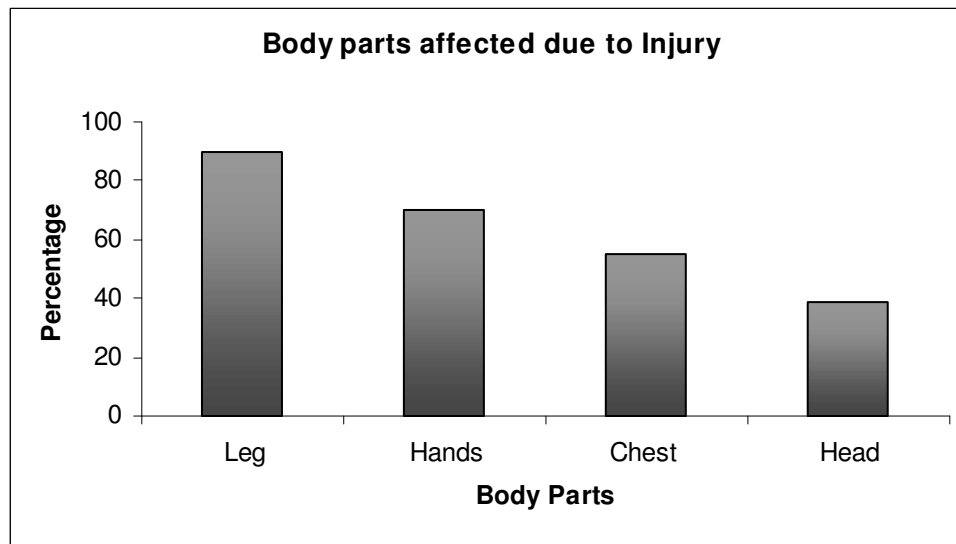


Figure 3: Region of body parts affected due to injuries (N=300)



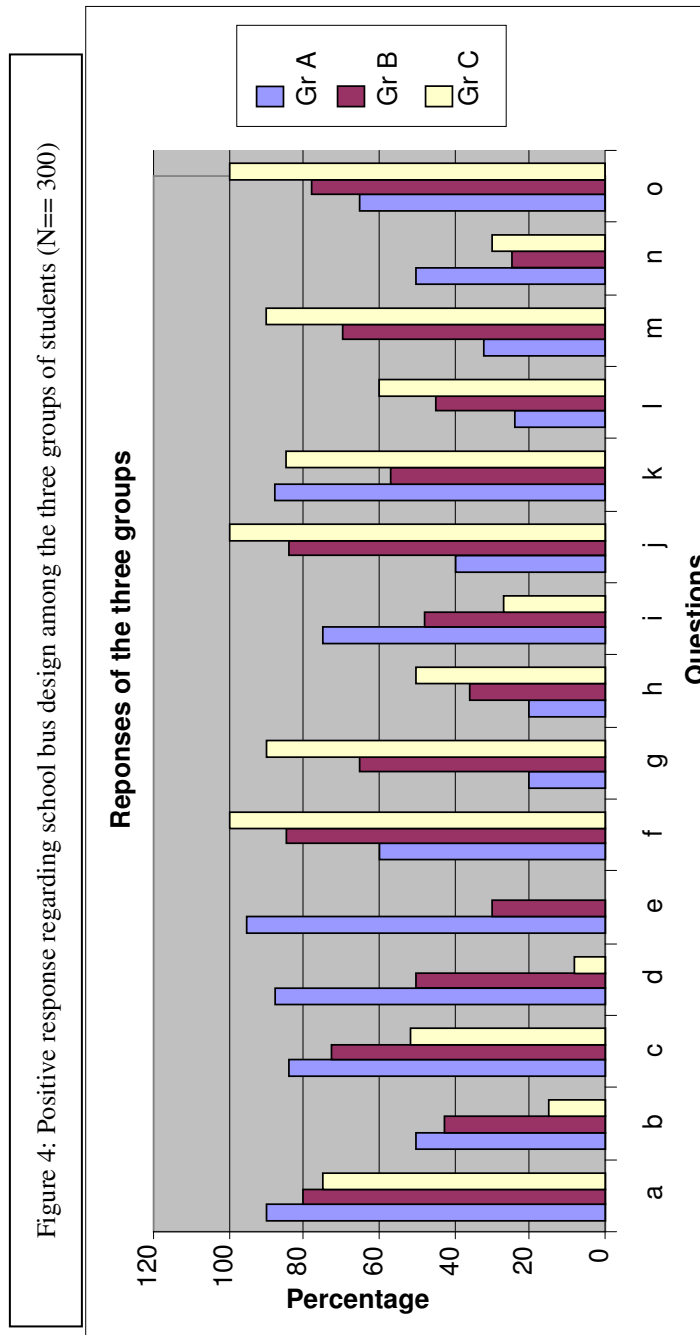


Figure 4 shows the positive responses of the school bus users regarding the school bus design. From the questionnaire analysis performed among the three groups of school students, it is found that they like school bus for their journey. They can travel in them as a group together and thus enjoy the time thoroughly. However according to maximum number of students, the seats need improvement as mostly these seats bear torn and tattered cushions.

Consequently they have a difficulty in sitting and when brakes are applied suddenly; they suffer from back injury while sitting in those seats. The seats lack proper cushioning and in most cases due to the lack of maintenance, cushions are torn to such an extent that the metal frames and wires of the seat framework are

exposed dangerously. Thus after a sudden and rapid forward movement, the inertial effect leads to back injury as they hit the seats with same momentum on return. They felt that the seats should be cushioned from top to bottom along with proper armrests for their comfort. Moreover the armrests may protect them from sudden fall on the floor of the bus.

<i>Questionnaire regarding school Bus Design (Figure 4)</i>	
a	Do you prefer existing school bus for your journey?
b	Is School bus seats comfortable for sitting?
c	Do you prefer the sitting arrangement of school bus?
d	Is the seat length sufficient to sit with comfort?
e	Is leg space sufficient or comfortable?
f	Do you require armrests along with the seats?
g	Is the height of seat sufficient?
h	Whether seat belts are required in school buses?
i	Whether position, size and number of windows are appropriate?
j	Is more than one emergency door required?
k	Do you prefer more wide walking passages in the middle?
l	Do all the buses have handlebars inside to hold?
m	Do you want any change in the existing school bus- design?
n	Do you ever had any accident?
o	Are fire extinguishers and first aid boxes required in school buses?

According to students of junior section the seat length as well as the leg space is sufficient but for the students in the middle and high schools, both these parameters are inadequate. So they want enhancement of seat length and leg space. However according to junior school students the height of the seat pan was high for them, but it was sufficient for middle and high school students. Most of them do not prefer seat belt in school buses because according to them seat belts will restrict their normal movements. It is revealed from the questionnaire that most of the students of all groups want their bus windows to be larger in size and also felt that the number of such windows should be increased. This is required because according to them the internal environment of school bus is warm and suffocating. There should be more than one emergency door in the buses to facilitate exit in times of crisis. They also felt that the passage between the two rows of seats should be enhanced so that they can move freely inside the bus. According to junior school students the height of the handles attached to the ceiling was too high for them, but this height was sufficient for middle and high school students. The junior school students have met with accidents inside the school bus. They have cut injuries due to sharp edges, exposed sharp nails; swelling of head on being struck against the ceiling handles and also suffer from chest injuries as they get hit against the back portion of the preceding seat on sudden application of brakes. Presence of first aid boxes is a necessity so that every one can use it. Fire extinguisher also must be present in all school buses and proper training should be provided to the drivers and high school students. From the above discussion it is clearly evident that a number of changes have been suggested by the groups of students for the overall improvement of the school buses. Another factor that should be taken into consideration is the behaviour of the students. In many cases huge commotion raised by them inside the bus lead to injuries amongst them. They fight, play, quarrel with others, play pranks and prefer to stand while the bus is in motion. All these are attributes of unsafe behaviour, most often terminating into injuries. Moreover the drivers suffer as well from lapse of concentration and this

	Per Day	Per Week	Per Month	Per Year
Number of near miss cases	1	4	12	100
Number of accidents	0	0	1	10

may lead to near-miss cases and some time minor accidents. The importance and relevance of the study is also quite evident from the number of near miss cases and number of accidents. Although major accidents are not

a frequent phenomenon (non-availability of official reports of minor accidents), but occurrence of near miss cases is very high. There are no official reports of near miss cases. Whatever information is available (Table 2) is derived from the responses of the students as well as the drivers. The alarming rate of near miss case is an indication of the minimal awareness regarding the safety of the school bus commuters.

### Conclusion

School bus is one of the most important and biggest modes of transport for students mainly in metropolitans as well as in small cities. At the end of the present investigation it is found that due to poor design of the school buses, students face many safety related problems. Some major changes in the existing design of the bus are required. School bus safety highly depends on drivers, bus maintenance and safe behaviors of students. School buses maintenance is poor and students always create commotion inside the buses, which show unsafe behaviors of students. School bus safety also depends on other transport. So it is also important to give training to other transportations. The school also should play some role in the entire process.

### Acknowledgement

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