A Study on Accident Characteristics of Child Occupants by Passenger Car and Motorcycle in Changsha

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Abstract: The study aimed to investigate the characteristics of child occupant accidents by passenger car and motorcycle. The accident data of 0-15 years old child occupants in road traffic were selected from Changsha Traffic Police Accident Database (CTPAD) from 2001 to 2006. A statistics analysis was carried out in terms of the accident type, vehicle type, accident scenarios, age and gender of casualties, injury region and injury severity. The results indicated that the small passenger cars accounted for 75.0% of the passenger car accidents, the three-wheel motorcycles for 73.6% of the motorcycle accidents. The side impact is the most frequently occurred in the passenger car and motorcycle accidents, 45.0% of passenger car accidents and 49.1% of motorcycle accidents. The head and extremities injuries have high frequency in passenger car and motorcycle accidents. It is necessary to pay more attention to the child occupant injuries on road traffic in China.

Keywords: Accident characteristics, Statistic analysis, Child occupant, Passenger car, Motorcycle

1 Introduction

Children represent the vulnerable group in road traffic. According to the international statistic data for traffic safety, at least one and over was child in every ten people dying of traffic accidents [1]. Motor vehicle accidents caused the major injuries and deaths of children in Europe and USA. More than 1000 children up to 16 years old were killed in road traffic accidents in Europe in 2004[2]. In USA, around 1,946 children up to 14 years old were killed and 234,000 children were injured in road traffic accidents in 2005[3]. In 2005, 6,082 children up to 15 years old were killed and 27,850 children were injured in road traffic accidents[4] in China.

Traffic accident is the key factor to the death of children up to 14 years old in USA, and most of the death took place inside the automobiles[3] [5]. As for China, according to the incomplete statistic from traffic administration authority, child passenger takes minimum 10% in traffic deaths and injuries[6]. As Chinese families possess car speedily, children will have more and more chance to taking car while go out. In addition, motorcycle takes the important role in traffic as well, therefore, child occupant takes pretty amount in motorcycle passengers. Child passengers are more weak comparing with adult passengers, therefore, they will suffer even more serious injuries while traffic accident take place. The research of child occupant protection has been started earlier in foreign countries, particular laws and regulations for child occupant restraint system have been issued and applied in Europe, USA , Japan and many other countries at present time, consequently, the child occupants were effectively protected by the restraint system in motor accidents. The research of child occupation protection has been commenced in China, the officially technical codes, regulations and complete test availability are not available for the time being, which resulting in the further shortage of statistic data, injuries analysis and protection to child occupant. Therefore, the study on Accident Characteristics of Child Occupants will contribute realistically in improving the safety of child occupants in China.

2 Materials and Methods

2.1 Data Source

All the data for this study are from the record of CTPAD（Changsha Traffic Police Accident Database）dated 1 January 2001 to 31 December 2006. 21,688 traffic accidents took place during this period and 48,766 people were involved, including 1,162 children up to 15 years old. 16,292 cases with injuries took place and 22,475 casualties were involved, including 1,128 children up to 15 years old. 5,595 occupants involved including 368 children up to 15 years old. 5,439 occupants were injured including 360 children up to 15 years old.

The definition of specimen for this study is as follows:

Age of Children: Up to 15 years old.

Type of vehicle: Large Passenger Car, Middle Passenger Car, Small Passenger Car and Mini Passenger Car.

Type of motorcycle: Three-wheel motorcycle, two-wheel motorcycle and light motorcycle.

Injury Severity: Child occupant accidents including slight injury, serious injury and death.

Accident Place: Changsha City including Furong District, Tianxin District, Yuelu District, Kaifu District, Yuhua District, Freeway Around the City, Changsha County, Wangcheng County, Ningxiang County and Liuyang City.

The data for study were selected by the above mentioned specimen, 60 accidents are related to child by passenger car involving 71 casualties with average 8.1 years of old, and 106 accidents are related to child by motorcycle involving 113 casualties with average 9.4 years of old.

2.2 Statistics Analysis

By means of the statistics analysis, the accident type, vehicle type, accident scenarios, age and gender of casualties, injury region and injury severity in above mentioned 60 passenger car accidents and 106 motorcycle accidents were concluded and deduced by quantity and characteristics.

3 Results

Injury severity distribution in 60 child occupant accidents by passenger car is indicated in Table 1, injury severity distribution in 106 child occupant accidents by motorcycle is indicated in Table 2.

Table 1 Injury severity distribution in 60 child occupant accidents by passenger car

Injury severity / Accident	Slight	Serious	Dead	Total
Number	47	5	8	60
%	78.3	8.3	13.3	100.0

Table 2 Injury severity distribution in 106 child occupant accidents by motorcycle

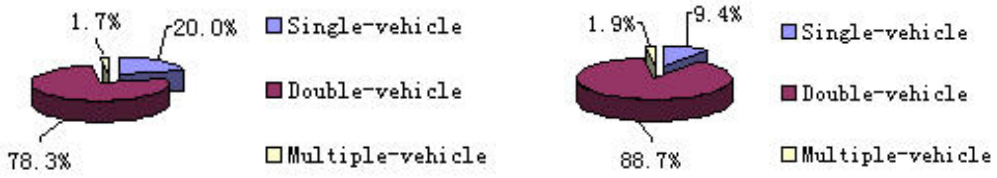
Injury severity / Accident	Slight	Serious	Dead	Total
Number	83	12	11	106
%	78.3	11.3	10.4	100.0

“Dead” means one or more children died in the accident, “Serious” means one or more children seriously injured in the accident, “Slight” means one or more children slightly injured in the accident. Among the 60 child occupant accidents by passenger car in table 1, 47 accidents are “Slight” accounting for 78.3% of the total accidents, 5 accidents are “Serious” for 8.3% of total accidents, 8 accidents are “dead” for 13.3% of total accidents. Among the 106 child occupant accidents by

motorcycle in table 2, 83 accidents are “Slight” accounting for 78.3% of the total accidents, 12 accidents are “Serious” for 11.3% of total accidents, 11 accidents are “dead” for 10.4% of total accidents. Either in the passenger car accidents or in the motorcycle accidents, “Dead” is exceeds 10% of total accidents.

3.1 Type of Accidents

As indicated in Figure 1, most of the accidents are of double-vehicle type. In figure 1a for child occupant accidents by passenger car, double-vehicle accidents account for 78.3% of the total accidents, single-vehicle accidents for 20.0% and multiple-vehicle for merely 1.7%. In figure 1b for child occupant accidents by motorcycle, double-vehicle accidents account for 88.7% of the total accidents, single-vehicle accidents for 9.4% and multiple-vehicle for merely 1.9%.

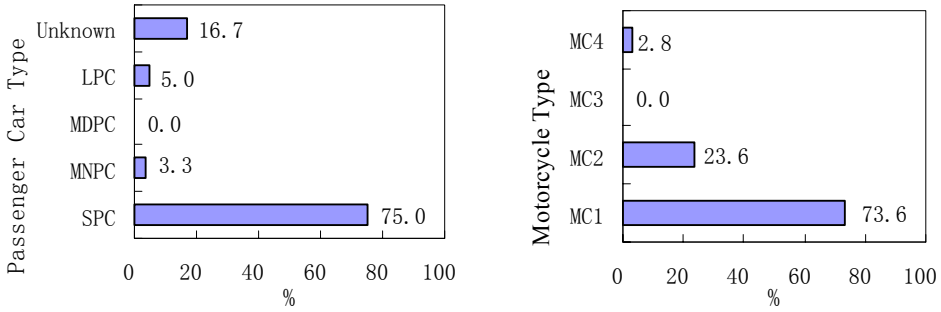


a) Child occupant accidents by passenger car　　b）Child occupant accidents by motorcycle

Figure 1　Type of child occupant accident distribution

3.2 Vehicle types

Vehicle types distribution for accidents is showed in Figure 2. In figure 2a for child occupant accidents by passenger car, the vehicle type of 16.7% of the accidents could not be identified, small passenger car accidents account for the most ratio to 75.0%, and no identified middle passenger car accident is found. In figure 2b for child occupant accidents by motorcycle, the vehicle type of 2.8% of the accidents could not be identified, thee-wheel motorcycle accidents account for 73.6% of total accidents, two-wheel motorcycle accidents account for 23.6% and no identified light motorcycle accident is found.



a) Child occupant accidents by passenger car

SPC: small passenger car

MNPC: mini passenger car

MDPC: middle passenger car

LPC: large passenger car

b）Child occupant accidents by motorcycle

MC1: thee-wheel motorcycle

MC2:two-wheel motorcycle

MC3:light motorcycle

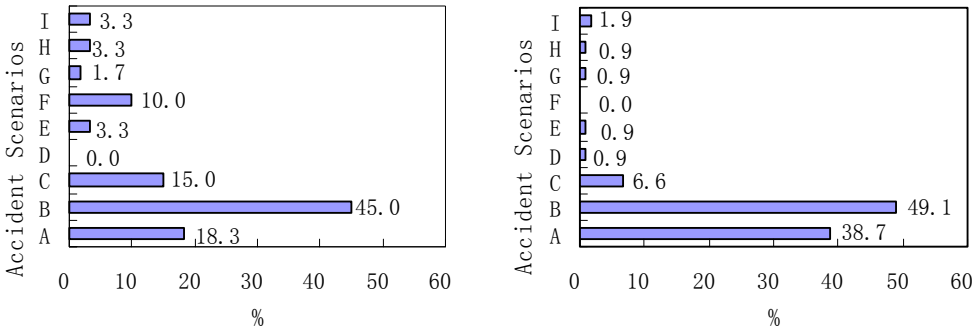
MC4: Unknow

Figure 2　Vehicle types distribution in child occupant accidents

3.3 Accident scenarios

In figure 3, it is obviously indicated that the side impact accounts for the most ratio and frontal

impact accounts for the second position, either in passenger car accidents or in motorcycle accidents. In figure 3a for child occupant accidents by passenger car, the side impact accounts for 45.0% of the total accidents and frontal impact accounts for 18.3%. In figure 3b for child occupant accidents by motorcycle, the side impact accounts for 49.1% of the total accidents and frontal impact accounts for 38.7%.



a) Child occupant accidents by passenger car b）Child occupant accidents by motorcycle

Figure 3 Child occupant accident scenarios distribution, A: Frontal impact, B: Side impact, C: Rear impact, D: Cocurrent scratching, E: Rolling, F: Roll over, G: Drop, H: Bumping unmovable things, I: Others.

3.4 Injury severity

Injury severity distribution for 71 casualties of child occupants by passenger car is indicated in Table 3. 55 children slightly injured account for 77.5% of total casualties, 7 children seriously injured account for 9.9% and 9 children killed account for 12.7%. Injury severity distribution for 113 casualties of child occupants by motorcycle is indicated in Table 4. 89 children slightly injured account for 78.8% of total casualties, 12 children seriously injured account for 10.6% and 12 children killed account for 10.6%. Comparing Table 3 with Table 4, the ratio of death exceeds 10% either in the passenger car accidents or motorcycle accidents.

Table 3 Injury severity distribution in 71 casualties by passenger car

Injury severity / Casualties	Slight	Serious	Dead	Total
Number	55	7	9	71
%	77.5	9.9	12.7	100.0

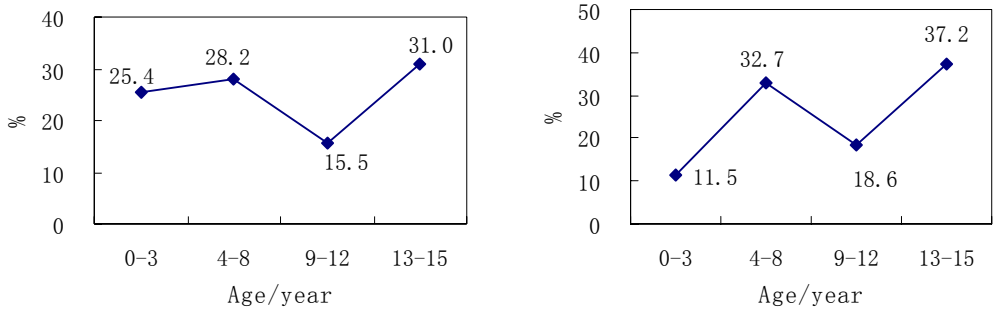
Table 4 Injury severity distribution in 113 casualties by motorcycle

Injury severity / Casualties	Slight	Serious	Dead	Total
Number	89	12	12	113
%	78.8	10.6	10.6	100.0

3.5 Age of casualties

The restraint system should be suitable for specific age distribution due to the variety growth degree of children from 0 to 15 years old. The children of the age up to 15 years old have been divided in to 4 groups for restraint systems: 0-3 years old, 4-8 years old, 9-12 years old and 13-15 years old. The age distribution of casualties is indicated in Figure 4. In Figure 4a for 71 child casualties by passenger car, the group of 13-15 years old accounts for the maximum ratio 31.0% of total casualties,

secondly the group of 4-8 years old accounts for 28.2% and the group of 0-3 years old accounts for 25.4%, the group of 9-12 years old accounts for the minimum ratio 15.5%. In Figure 4b for 113 child casualties by motorcycle, the group of 13-15 years old accounts for the maximum ratio 37.2% of total casualties, secondly the group of 4-8 years old accounts for 32.7% and the group of 9-12 years old accounts for 18.6%, the group of 0-3 years old accounts for the minimum ratio 11.5%. Both the age distributions of casualties by passenger car and by motorcycle have the similar "N" trends.



a) 71 casualties by passenger car b) 113 casualties by motorcycle

Figure 4 Age distribution of child casualties

3.6 Gender of casualties

Gender distribution of child casualties by passenger car is indicated in Table 5, boys account for 52.1% and girls account for 47.9%, boys and girls account for almost the same ratio of 1.09: 1. Gender distribution of child casualties by motorcycle is indicated in Table 6, boys are higher than those of girls, boys account for 60.2% and girls account for 39.8%, boys and girls account for the ratio of 3:2.

Table 5 Gender distribution of casualties by passenger car

Casualties / Gender	Number	%
Male	37	52.1
Female	34	47.9
Total	71	100.0

Table 6 Gender distribution of casualties by motorcycle

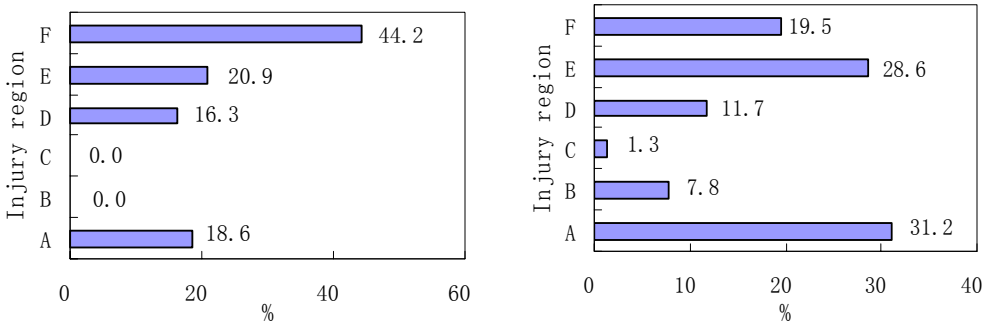
Casualties / Gender	Number	%
Male	68	60.2
Female	45	39.8
Total	113	100.0

For the 71 child casualties by passenger car, 43 children are registered with injury region and 28 children registered without injury region. For the 113 child casualties by motorcycle , 77 children are registered with injury region and 36 children registered without injury region. The injury region distribution of child causalities is indicated in Figure 5. In Figure 5a for child casualties by passenger car with registered injury region, lower extremity injuries account for the maximum ratio with 20.9%, head injuries account for 18.6% and upper extremity injuries account for 16.3%, no record for injuries of abdomen, lumbar, chest and back. The situation is different in child casualties by motorcycle in Figure 5b, head injuries account for the maximum ratio with 31.2%, lower extremity injuries account for the ratio 28.6%, in addition, certain records for injuries of abdomen, lumbar, chest and back also are found.

Table 7 "Registered injury region vs. injury severity distribution of casualties by passenger car" indicated that, head injuries caused 66.7% cases of death accounting for the maximum ratio of death. As for the serious injuries cases, upper extremity injuries account for the ratio of 40.4%, head injuries

account for the ratio of 20%. For the slight injuries cases, lower extremity injuries account for the maximum ratio of 28.1%. No case of death was caused by upper extremity injuries and lower extremity injuries.

Table 8 "Registered injury region vs. injury severity distribution of casualties by passenger motorcycle" indicated that, all the 7 cases of death were caused by head injuries. As for the serious injuries cases, heads injuries account for the maximum ratio of 66.7%, lower extremity injuries for the ratio of 33.3%. For the slight injuries cases, lower extremity injuries account for the maximum ratio of 31.3%, head injuries for the ratio of 20.3%.



a) Casualties by passenger car b）Casualties by motorcycle

Figure 5 Registered injury region distribution of casualties, A: Head, B: Chest and back, C: Abdomen and lumbar, D: Upper extremity, E: Lower extremity, F: Other.

Table 7 Registered injury region vs. injury severity distribution of casualties by passenger car

Injury severity / Injury region	Slight		Serious		Dead		Total	
	Number	%	Number	%	Number	%	Number	%
Head	3	9.4	1	20.0	4	66.7	8	18.6
Chest and back	0	0.0	0	0.0	0	0.0	0	0.0
Abdomen and lumbar	0	0.0	0	0.0	0	0.0	0	0.0
Upper extremity	5	15.6	2	40.0	0	0.0	7	16.3
Lower extremity	9	28.1	0	0.0	0	0.0	9	20.9
Other	15	46.9	2	40.0	2	33.3	19	44.2
Total	32	100.0	5	100.0	6	100.0	43	100.0

Table 8 Registered injury region vs. injury severity distribution of casualties by motorcycle

Injury severity / Injury region	Slight		Serious		Dead		Total	
	Number	%	Number	%	Number	%	Number	%
Head	13	20.3	4	66.7	7	100.0	24	31.2
Chest and back	6	9.4	0	0.0	0	0.0	6	7.8
Abdomen and lumbar	1	1.6	0	0.0	0	0.0	1	1.3
Upper extremity	9	14.1	0	0.0	0	0.0	9	11.7
Lower extremity	20	31.3	2	33.3	0	0.0	22	28.6
Other	15	23.4	0	0.0	0	0.0	15	19.5
Total	64	100.0	6	100.0	7	100.0	77	100.0

3.8 Injury region in different age groups

Injury region distribution in different age groups of child occupants by passenger car is indicated

in Table 9. For the group of 0-3 years old, 11 children were recorded with injury region and 7 children without record of injury region. For the group of 4-8 years old, 13 children were recorded with injury region and 7 children without record of injury region. For the group of 9-12 years old, 5 children were recorded with injury region and 6 children without record of injury region. For the group of 13-15 years old, 14 children were recorded with injury region and 8 children without record of injury region. Injury region distribution in different age groups of child occupants by motorcycle is indicated in Table 10. For the group of 0-3 years old, 10 children were recorded with injury region and 3 children without record of injury region. For the group of 4-8 years old, 28 children were recorded with injury region and 9 children without record of injury region. For the group of 9-12 years old, 16 children were recorded with injury region and 5 children without record of injury region. For the group of 13-15 years old, 23 children were recorded with injury region and 19 children without record of injury region.

Table 9 Casualties registered injury region distribution in different age groups children by passenger car

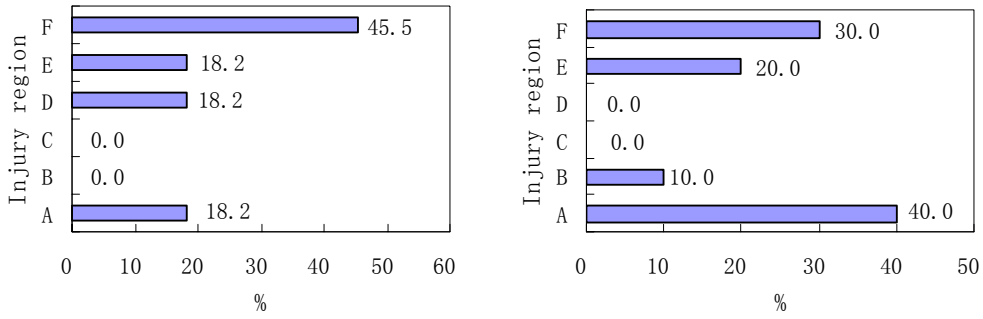
Age	Number of casualties	
	Registered injury region	No registered injury region
0-3	11	7
4-8	13	7
9-12	5	6
13-15	14	8
Total	43	28

Table 10 Casualties registered injury region distribution in different age group children by motorcycle

Age	Number of casualties	
	Registered injury region	No registered injury region
0-3	10	3
4-8	28	9
9-12	16	5
13-15	23	19
Total	77	36

3.8.1 Group of 0-3 years old

Registered injury region distribution of 0-3 years old is indicated in Figure 6. Figure 6a indicated the casualties by passenger car. For the group of 0-3 years old, head injuries and upper/lower extremity injuries account for the maximum ratio of 18.2% separately. The casualties by motorcycle indicated in Figure 6b are different from that by passenger car. For the group of 0-3 years old, head injuries account for the maximum ratio of 40%, lower extremity injuries account for the ratio of 20%. In addition, chest and back injuries also account for certain ratio (10%).

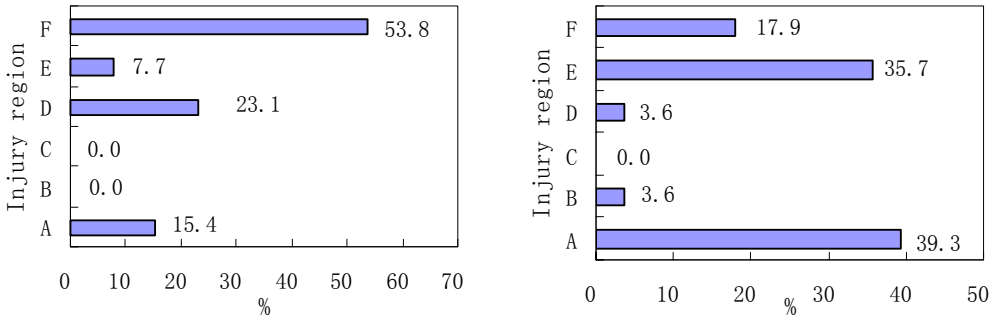


a) Casualties by passenger car b）Casualties by motorcycle

Figure 6 Registered injury region distribution of 0-3 years old casualties

3.8.2 Group of 4-8 years old

As indicated in Figure 7a, for the group of 4-8 years old child occupants by car, upper extremity injuries account for the maximum ratio 23.1% of total casualties, head injuries account for the ratio of 15.4%. The situation is the same for the group of 4-8 years old child occupants by motorcycle indicated in Figure 7b, head injuries account for the maximum ratio 39.3% of total casualties, and lower extremity injuries account for the ratio of 35.7%.

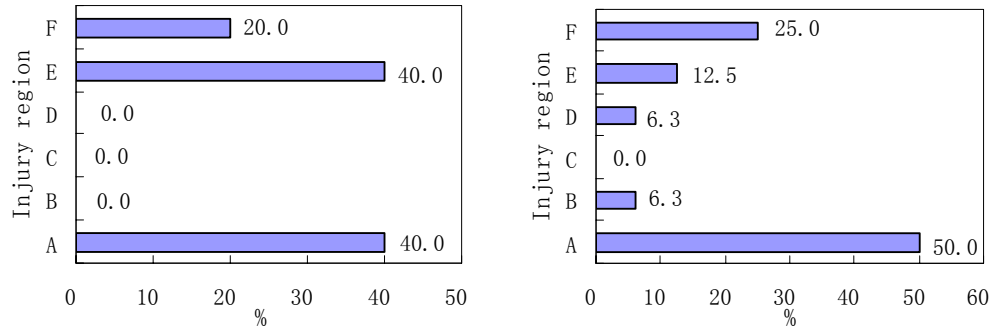


a) Casualties by passenger car b）Casualties by motorcycle

Figure 7 Registered injury region distribution of 4-8 years old casualties

3.8.3 Group of 9-12 years old

As indicated in Figure 8a, for the group of 9-12 years old child occupants by passenger car, head and lower extremity injuries account for the maximum ration 40.0% of total casualties separately. For the group of 9-12 years old child occupants by motorcycle indicated in Figure 8b, head injuries account for the maximum ratio 50.1% of total casualties, lower extremity injuries account for the ratio of 12.5%.

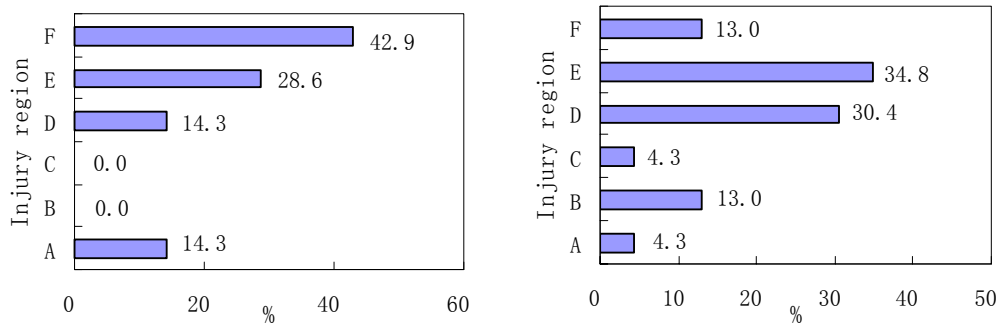


a) Casualties by passenger car b）Casualties by motorcycle

Figure 8 Registered injury region distribution of 9-12 years old casualties

3.8.4 Group of 13-15 years old

As indicated in Figure 9a, for the group of 13-15 years old child occupants by passenger car, lower extremity injuries account for the maximum ration 28.6% of total casualties, head and upper extremity injuries account for the ratio of 14.3% separately. For the group of 13-15 years old child occupants by motorcycle indicated in Figure 9b, lower extremity injuries account for the maximum ratio 34.8% of total casualties, upper extremity injuries for the ratio of 30.4%.



a) Casualties by passenger car　　b）Casualties by motorcycle

Figure 9　Registered injury region distribution of 13-15 years old casualties

4　Analysis and Discussion

Children safety is the issue focused by worldwide. Road traffic accidents caused the most death cases not only in Europe and USA and other developed countries but also in China and other developing countries.

The analysis for child occupant accidents by passenger car and motorcycle in Changsha shows that the double-vehicle accident is the main type of accident, side impact account for the maximum ratio in the accident scenarios followed by the frontal impact due to the multiple grade crossing style in Changsha. The small passenger car accident and three-wheel motorcycle accident are the main type of vehicle. Motorcycle accidents mostly took place in suburbs of Changsha city, especially for three-wheel motorcycle accidents, 75% took place in suburbs, for the two-wheel motorcycle accident, 59% took place in suburbs area.

Regarding the child occupants by passenger car, boys and girls account for almost the same ratio by casualties, and the casualties took place mostly in the age group of 0-3 years old, 4-8years old and 13-15 years old. Regarding the child occupant by motorcycle, boy casualties and girl casualties is in the ratio 3:2, and the casualties took place mostly in the age group of 4-8years old and 13-15 years old. According to the results of this study, the injury risk of boy is higher than that of girls. The injury risk of the age group 9-12 years old is relative low and the reason need to be studied further.

In view of the injury region distribution of child occupants by passenger car, most children were injured in lower extremity, head and upper extremity, however, the situation is variable from different age of groups. For the age group of 0-3 years old, the injuries took place mostly in head, upper extremity and lower extremity, for the age group of 4-8 years old, the injuries took place mostly in upper extremity and head, for the age group of 9-12 years old, the injuries took place mostly in head and lower extremity, for the age group of 13-15 years old, the injuries took place mostly in lower extremity, head and upper extremity. In view of the injury region distribution of child occupants by motorcycle, most children were injured in head and lower extremity, and the situation is also variable from different age of groups: For the age group of 0-3 years old and 4-8 years old, the injuries took place mostly in head and lower extremity, for the age group of 9-12 years old, the injuries took place mostly in head, for the age group of 13-15 years old, the injuries took place mostly in lower extremity and upper extremity. It is also observed that the multi-region injuries took place to child occupants, the ratio is 26% by passenger car and 17% by motorcycle. Either the child occupants by passenger car or child occupants by motorcycle, the children up to 12 years olds suffered more multi-region injuries comparing with the age group 13-15 years old, however, the multi-region injuries mainly consists of slight injuries. The growth degree, style and habits by car of different age groups probably cause the different accident characteristics.

During the study of the specimen, certain results are zero, for instance, the quantity of middle passenger car and light motorcycle, the injury region of abdomen, lumbar, chest and back for child occupants by passenger car, this might be due to the data limits of specimen, in another words, it shows that few of children take the middle passenger car and light motorcycle and few abdomen injuries, lumbar injuries, chest injuries and back injuries happened to the child occupants by passenger car.

It is noticed during the study that the children almost do not use any restrain systems while go out by passenger car in Changsha. The protection effect of CRS (Child Restraint System) has not been correctly realized in Changsha even in China. The overwhelming majority of parents did not set the special safety seat for child, usually the child was hold by parent or sit in the front seat in the car. Child sit in the rear seat could reduce the risk of injuries and deaths[7-13]. National Highway Traffic Safety Administration (NHTSA) recommended that the child up to 13 years old should sit in the rear seat by car no matter what kind of restrain system used. CRS is always suggested to be the best protection provision for child weight less than 36 kg (around 12 years old) in abroad [14-16]. By means of analyzing the children by car in Arizona, Florida, Mississippi, Missouri, Pennsylvania and Washington D.C, Lawrence E. Decina etc. found that 62.3% of the children use CRS by car, 25.9% of the children use adult seat safety belt, 11.8% of the children don't use any restrain systems. According to the statistics on weight of children, 97.1% of children with the weight less than 9 kg, 86.4% of children with the weight 9-18 kg, 41.7% of children with the weight 18-27 kg and 10.9% of children with the weight 27-36 kg use CRS by car [17] .

Infant and toddler safety seats are designed to absorb the most impact loads or disperse the impact loads to the strongest regions of the children body[18]. Booster seats are designed to increase the sit height of children to improve the configuration of the seat belt through the children resulting the better compatibility for children and seat belt. Booster seats provide the transit from child safety seat to seat belt[19,20]. While the CRS is correctly used, the risk of death of infant (up to 1 years old) could be reduced 71%, the risk of death of toddler (1-4 years old) could be reduced 54%[21]. By means of analyzing the Database from Volvo, Isaksson-Hellman etc. found, compared with the children with no any restrain systems, MAIS2+ injuries could be reduced 77% while using booster seat, and the MAIS2+ injuries could be reduced 59% while using adult seat belt. In addition, the rearward restrain system provides the lowest risk of injury followed by booster and adult seat belt. The children with no any restrain systems take the highest injury risk [22]. In USA, more than 50% of the deaths of children caused by traffic accident in 2003 were due to the lack of the restrain system[23]. Therefore, to reduce the injury risks of children in road traffic accident in China, the using of CRS should be increased by means of propagation, education and legislation etc.

While riding and sitting on the two-wheel motorcycle, the rider and passenger must wear helmet, taking the child younger than 12 years old on the back seat of two-wheel motorcycle and side three wheel motorcycle are not allowed. People by light motorcycle are not allowed[24] [25]。However, according to the statistic results, more than 77% of child occupants by two-wheel motorcycle and 51% by three-wheel motorcycle are younger than 12 years old, and most of the children did not wear helmet while taking the two-wheel motorcycle. As the safety device is not available on motorcycle itself, wearing helmet could reduces 37% of the fatal risk of rider[26]. To reduce the accidents and injuries of child passengers by motorcycle, the monitoring of motorcycle riding should be enhanced, the safety conscious should be increased. Meanwhile, as the motorcycle accidents took place mostly and mainly at the suburbs district, it is necessary to enhance the propagation of the traffic safety and lift the conscious of obeying the law for motorcycle rider especially for three-wheel motorcycle at suburbs district.

Furthermore, it is found that most of the accidents by passenger car and motorcycle were caused by the action of breaking rules and regulations of drivers, therefore, enhancing the conception of traffic regulations and lifting the traffic safety consciousness would be helpful to reduce the happen of traffic accidents.

This study only represents part of the accident characteristics for child occupants by passenger car and motorcycle in Changsha other than that of all the China. As the data take its source from traffic police database, the record of casualties is not embodied. To deeply analyze the causes of injuries of child occupants, the detailed records form hospital should be collected.

5 Conclusions

(1) Double-vehicle accident is the main type of child occupants accidents by passenger car and motorcycle, it accounts for 78.3% of the child occupant accidents by passenger car and 88.7% of that by motorcycle.

(2) Small passenger car is the main type of vehicle for child occupant accidents by passenger car, and three-wheel motorcycle is the main type of vehicle for child occupant accidents by motorcycle, both account for over 73% of total accidents separately.

(3) Side impact accounts for the most ratio followed by frontal impact to child occupant accidents both by passenger car and by motorcycle. For child occupant accidents by passenger car, side impact and frontal impact account for 63.3 % of total accidents, for child occupant accidents by motorcycle, side impact and frontal impact account for 87.8 % of total accidents. Therefore, side impact and front impact protection should be considered in priority in the safety research field of child occupant by passenger car and motorcycle.

(4) Casualties of child occupants by passenger car mainly concentrated in the age group of 0-3 years old, 4-8 years old and 13-15 years old. Casualties of child occupants by motorcycle mainly concentrated in the age group of 4-8 years old and 13-15 years old.

(5) Lower extremity, head and upper extremity are the main injury regions of child occupants by passenger car. Considering the high fatal ratio of head injury, the protection of head of child occupants by passenger car should be in priority.

(6) Head and Lower extremity are the main injury regions of child occupants by motorcycle, and considering the high fatal ratio of d head injury, the protection of head of child occupants by motorcycle should be also in priority.

Casualties of child occupants in road traffic accidents have been becoming an important subject in the field of traffic safety research in China.

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