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FACTORS AFFECTING OF CHILD RESTRAINTS SEATS USING

Ochepovska Anastasiia, the bachelor student
Tkachenko Iryna, assis. prof.
O. M. Beketov University of Urban Economy in Kharkiv

Abstract

Motor vehicle injuries are a leading cause of death among children worldwide, though many of these deaths are preventable. Buckling young children in age- and size-appropriate car seats, booster seats, or seat belts and also seating them in appropriate position can lead to a significant reduction of serious and fatal injuries. The key factors simultaneously influencing child passenger's sitting position and restraint use include vehicle type, driver's gender, driver's belt use, child's age, and the presence of other child or adult passenger. Furthermore, time of day and day of week also influence child passenger sitting behaviour but not their restraint use. These findings provide insight for better understanding of child transporting practices and the contributing factors influencing their sitting behaviour and restraint use. Also highlight the need for policy makers to design effective countermeasures to promote rear sitting and restraint use among child passengers.

Keywords: driving behavior, child safety, child restraint system

Introduction

Trauma is the leading cause of death and disability in pediatric patients, and it is considered an important public health problem in the world. Estimates indicate a growing trend in mortality due to road accidents in the world. It is expected that by 2030 the indicators increase by 40% if effective preventive measures are not taken. These alarming figures are due to the progressive increase of the number of circulating vehicles, growth of urban populations, lack of popular culture focused on safety, impunity, lack of effective legislation and poor condition of circulation roads. Several morphological, functional and biological characteristics inherent to childhood predispose children to car accidents as decisive factors for the discernment of the traffic conditions are still under development, and the smaller stature of children hinders the perception of their presence by the drivers. To minimize deaths and sequelae among children as car passengers, child restraint systems (CRS) or child safety seats were developed, popularly known as infant car seat, toddler car seat or simply children car seat, among others. When properly used, CRS reduce mortality by 71%; however, the risk of serious injury doubles when using the wrong model of CRS.

Road traffic crash fatality among child passengers is on the rise in Ghana (Agyeman et al., 2017). According to statistics from the National Road Traffic Crash Database at the Building and Road Research Institute, Kumasi-Ghana, a total of 141 child passengers (aged 12 years and below) were killed and another 711 were injured over the period 2014–2016 (Garces et al., 2016). It is believed that some of these young lives could have been saved if the children were appropriately restrained.

Currently, China is experiencing an extremely rapid increase in motorization. The total number of motor vehicles increased from 3.8 million in 2005 to 13.8 million in 2010. Traffic crashes are the overall leading cause of death in China. The mortality rate among children is much higher than other developed countries. Each year, about 100,000 people in China are killed in motor vehicle crashes, and children aged 1–20 years accounted for more than 12% of these deaths. Further, China currently has no law requiring the use of child restraints, although child restraints have been shown as effective measures to protect children from road traffic injuries. Child restraint use is very low in China, although the majority of drivers had positive attitudes about child restraint. These findings indicate that child restraint policies and educational approaches are urgently needed in China.

Also child passenger injuries and deaths resulting from motor vehicle collisions (MVC) remain a significant public health problem in Canada (World Health Organization, 2016; Parachute Canada, 2017). Between 2008 and 2012, there were 398 motor vehicle deaths among Canadian children aged 0–14 years, with 119 of those deaths in children aged 5–9 years (Statistics Canada, 2017). In the United States, MVCs are the leading cause of death for children under 13 years of age, resulting in 938 fatalities in 2015 (Centers for Disease Control and Prevention, 2017). Importantly, most injuries and deaths involve unrestrained or incorrectly restrained child passengers.

When used correctly, child restraint use can reduce the risk of death and serious injury in toddlers and infants. The use of child restraints has been documented to reduce infant and toddlers (aged 1–4 years) death due to road traffic crashes by 71% and 54%, respectively, whilst the risk of serious injuries among children (aged 4–7 years) also reduces by 59%. Children should be strapped in appropriate restraints based on their age, weight or height**.**

Analyzes from previous studies

An observational study and driver survey on child restraint use was conducted in the Southeast China city of Shantou in 2012. Observational sites included 22 middle schools, 31 primary schools, 24 kindergartens, and 4 hospitals. Drivers were asked about their knowledge of and attitude toward the use of child restraints. In September 2012, multivariate regression was used to evaluate the factors associated with increased child restraint use.

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In addition to restraint use, child sitting position has also been determined to have an effect on injury severity in the event of crash. For children, studies have established that sitting in the rear seat of a vehicle is about 35% safer than sitting in the front seat, in the event of a crash (Halman et al., 2002; Lardelli-Claret et al., 2006). Effective measures to protect children, therefore, include using age-appropriate restraints and being seated in the rear of the vehicle.

Problems

The transversal descriptive study which included 200 vehicle drivers who carried 0-10 year old children in the city of São Luis, MA, Brazil. The drivers' passengers' and children's features were properly identified. The children's transportation using CRS were analyzed according to the Resolution 277/8 of the Brazilian National Traffic Department.

The transportation of children was classified as inappropriate in 70.5% of the vehicles analyzed. The most common way for children transportation was free on the back seats (47%) or on the lap of passengers/ drivers (17%). The main reasons to justify the improper transportation were either not understanding the importance of CRS use (64.5%) or not having financial resources to buy the devices. The child safety seat was the most used CRS (50.8 %) among vehicles with proper child transportation system. The transportation of children was inappropriate in most of the vehicles analyzed, reflecting the need for creating awareness among automobile drivers, including education, supervision and improvement of policies for health improvement and prevention of accidents involving children transportation.

Aim and tasks

The objectives of this study were to investigate the level of awareness and usage of child car seats in Europe and other countries, identify problems that influence non-usage among the knowledgeable parents, to describe child restraint use, and parents' knowledge of and attitude toward child restraint.

Results of the main tasks solving

The variables regarding the vehicle drivers and passengers were: drivers' age and gender, safety belt use and number of passengers in the vehicle. The degree of relatedness of the driver and the child was stratified as father (biological, adoptive or step-father), mother (biological, adoptive or step-mother), uncle or aunt, grandfather or grandmother, and others (brother, taxi driver, etc.). The drivers level of education was categorized as illiterate, basic schooling (elementary school, complete or incomplete), medium schooling (high school, complete or incomplete) and higher education (college or university education, complete or incomplete).

The children's age, gender, weight and height were informed by the vehicle driver. The number of children in the vehicle and the transportation mode were evaluated according to the Contran Resolution 277/08.This regulation states that children up to one year old should be transported in infant car seat devices in the back seat facing the rear window, with a slight slope. Children aged between one and four years old must use toddlers' safety car seat. Children between four and seven years old must use booster seats fixated in the back seat with three-point safety seat belts. Children over seven years old should use seat belts. Children aged 10 years or older are allowed to travel in the front seat.

According to this regulation, child's transportation was classified as appropriate or inappropriate in each case. When children transportation was considered inappropriate, irregularities were classified as: child in the lap, loose (sitting in the car seat without any CRS), using seat belt (inappropriate use according to the child's age, weight or height) or in a child's car seat (inappropriate use according to the child's age, weight or height) or standing (children standing between

the driver and passenger seats). In cases of inadequacy, the vehicle's driver was questioned about the absence of CRS.

Table 1 shows the drivers' and passengers' characteristics of the 200 vehicles transporting children that have been approached. Most drivers were male (79.5%), and were the child's father (71%), aged between 31 and 40 years old (39%), with mid level education (58%) and were using safety belts (74%). Besides drivers and children, vehicles were carrying two other passengers (46%), who also used seat belts (52.5%).

Table 1. Sample characterization of drivers and passengers of vehicles transporting children

Variables	n	%
Drivers' gender		
Male	159	79,5
Female	41	20,5
Degree of relativeness of the driver to the child		
Father	142	71
Mother	26	13
Uncle or aunt	15	7,5
Grandparents	11	5,5
Other	6	3
Drivers' age (years old)		
18-30	69	34,5
31-40	78	39
41-50	40	20
51-60	8	4
Above 60	5	2,5
Mean ± standard deviation	35,86 (±9,34)	
Drivers' schooling		
Illiterate	1	0,5
Basic education	2	1
Medium education	116	58
Higher education	81	40,5
Driver used seat belt		
Yes	105	52,5
No	95	47,5
Passenger used seat belt		
1	29	14,5
2	92	46
3	51	25,5
4 or more	28	17
Mean ± standard deviation	2,43 (±1,02)	

Child transportation was inappropriate in 70.5% of the vehicles approached (Fig. 1).

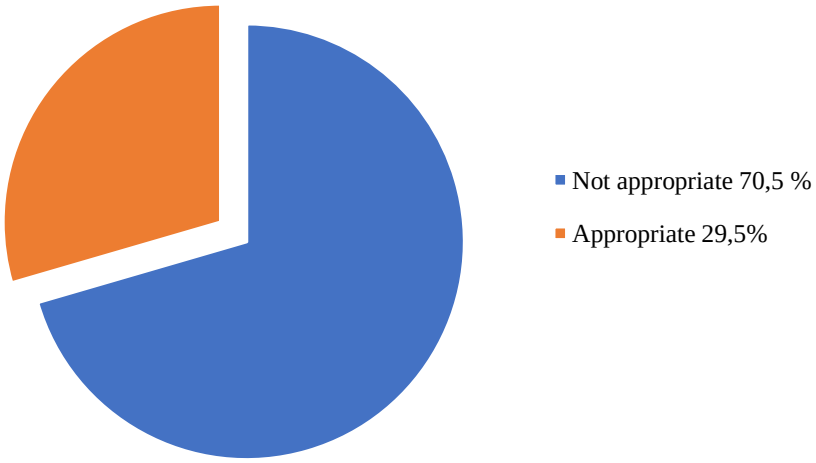

Figure 1 – Analysis of children transportation in vehicles

The 200 vehicles' drivers were carrying 293 children, corresponding to 1.46 ± 0.93 children per vehicle. Most vehicles (71.5%) were carrying only one child (71.5%) of the male gender (51.9%). Most children were aged between one and four years (47.4%) (Table 2). The children's weight and height was 15.76 ± 8.11 kg and 87.60 ± 28.30 cm, respectively.

Table 2. Sample characterization of children transported in vehicles

Variables	n	%
Number of children		
1	143	71,5
2	36	18
3	12	6
4 or more	9	4,5
Mean ± standard deviation	1,46 (±0,93)	
Gender		
Male	152	51,9
Female	141	48,1
Age (years old)		
Up to 1	55	18,8
>1 and ≤4	139	47,4
>4 and ≤7	78	26,6
>47and ≤10	21	7,2
Mean ± standard deviation	3,65 (±2,24)	

The main given reasons were “not finding important to use CRS” (64.5%) and “not have financial resources for purchasing CRS” (14.9%). Seven drivers (5%) declared they did not know about CRS or their importance (Table 3).

Table 3. Justifications for inadequacy of children’s transportation

Justifications for inadequacy	n	%
Does not consider it as important	91	64,5
Has no financial resources to buy a CRS	21	14,9
The vehicle has only two seats	9	6,4
Does not know about CRS	7	5
Child did not adapt/has accepted CRS	5	3,5
Will provide/buy a CRS	3	2,1
Owns a CRS, but does not use it due to lack of inspection	3	2,1
CRS occupy too much space inside the vehicle	2	1,4

Most children were transported in the vehicle’s back seat (88.4%) and in the central seat (35.2%). The most common children transportation way was loose in the back seat without any restraint equipment (safety belt or CRS) (47%) or in the passenger’s or driver’s lap (17.5%). Thirty-two children (10.9%) were transported on the front passenger seat and two (0.7%) in the driver’s lap, while driving the vehicle.

In this study, most vehicle drivers were the child’s father, well educated and were wearing the seat belt. However, 26% of drivers and 47.5% of passengers were not using seat belts. The lack of seat belt use by the parents can contribute to the nonuse by children and adolescents,7,14,17 pointing out the need for educational and preventive policies showing the importance of safety equipment for all vehicle occupants. Most children were loose in the back seat without any containment equipment or CRS, but 32 children were in the front passenger seat and two in the driver’s lap, despite the mandatory use of CRS and seat belt in the back seat.

Transporting children in the front passenger seat is permitted only in special situations (vehicles without rear seat, for example), while using appropriate CRS. Most drivers do not consider important to use CRS, showing a lack of appreciation and understanding by the population of the importance of such device. The use of safety belt and CRS have a major impact on hospital costs and rehabilitation. Therefore, to raise awareness on the proper use of seat belts and CRS among the population should be a commitment of all health professionals in order to reduce the number of child victims of car accidents.

The main finding of this research was low level of parental willingness to pay for child car safety seats against moderate to high perceived efficacy. The main predictor for willingness to pay was family income level. A considerable unmet need was also observed regarding CRS advice from the physician responsible for the care of the child/family. This research can also be of practical importance for health policy makers to initiate CRS insurance coverage or lending programs parallel to decisions for obligatory CRS regulations. Future research can examine the effectiveness and feasibility of methods suggested in the paper to promote CRS use in the world.

In this study, children transportation was inappropriate in most vehicles that have been approached, similar to the findings of other studies. The lack of CRS or inadequate ones can lead to serious injuries or death of children in cases of collisions, since the child is more fragile and lacks defensive attitudes or danger perception.5,14 Traffic accidents are one of the most important factors influencing the morbidity and mortality of children in the country. A study conducted in a referral trauma center in Embu and Taboão da Serra (SP, Brazil), from December 2005 to December 2006 showed that 15% of the trauma mechanisms in childhood were related to traffic accidents. In San Diego (USA), according to information obtained from the database of the Legal Medical Service between January 2000 and December 2006, car accident was the leading cause of death (40.2%) in children and adolescents, followed by asphyxia and penetrating trauma. In a retrospective study conducted in Uberlândia (MG, Brazil),123 victims of traffic accidents under the age of 15 were treated at Hospital de Clínicas from 1999 to 2003. It was found that 58.8% were not using safety devices and/or used them incorrectly at the time of the accident. These findings reinforce the need for the CRS and seat belts use for children and adolescents as one measure to reduce morbidity and mortality associated to traffic accidents.

Almost half of the participants were found to be unaware of child car safety restraints. Those who knew, most commonly expressed unavailability, time taken in child car seat installation, and absence of law as the reasons behind not using the child car seats while another common reason was their misperception about the children age group for using child car seats. Driver's education level was found to be the most significant demographic characteristic associated with the driver's awareness on child car seats as well as support towards their usage, initiation of awareness campaigns, and law implementation.

Motor vehicle crashes are a major cause of death and injury to children worldwide. Although risk of injury to child passengers can be reduced by using a child restraint, most restraints are incorrectly used. This greatly reduces the restraints' protective potential; however there is limited research on drivers of correct child restraint use. The aim of this study was to explore perceived barriers and motivators of correct child restraint use in experienced child restraint users, to inform interventions to promote correct use. Motivations and risk perceptions concerning incorrect child restraint use among high and low socioeconomic populations and culturally and linguistically diverse child restraint users. The results indicate current child restraint product information is poorly understood, particularly among those whose first language is not English. Interventions to increase correct child restraint use should address access to correct use information, capability to understand and use these, and the influence of motivation, memory and attention in the process. Despite legislation mandating child restraint use for child passengers in most high income countries (WHO, 2015), and increasing adoption of legislation globally in response to the World Health Organisation road safety campaign in 2004 traffic injuries remain a leading cause of death for children, and child passengers account for up to half of these deaths. Using age-appropriate restraints reduces the risk of death and injury.

However for optimal crash protection restraints must be used correctly, as misuse significantly increases the risk of injury during a crash. Correct use of child

restraints requires restraints to be installed and the child secured as intended by the manufacturer.

Result

This study may help to create awareness among drivers and health professionals and it serves as a quantitative data showing the seriousness of the problem, and may be useful to support educational programs on safe transportation of children, especially in the family and school context. The results also highlight the need to improve the inspection regarding CRS, enforcing the existing legislation on effective security measures for children transportation among the population. Proper child transportation with the correct use of CRS establishes safety conditions that can dramatically reduce the chances of severe traumatic injury and death in the event of collisions. Results of this study revealed very low use of child safety seats and a high proportion of the population who had never seen them, despite a majority who had positive attitudes about their use. The finding that large and low-income families are less likely to use an age appropriate restraint also indicates a need to address the economic and logistic barriers in strategies aimed at increasing best practice child restraint use.

Literature

1. Agyeman, W., Afukaar, F., Agyemang, K.O., Road Traffic Crashes in Ghana: Statistics 2016. CSIR-Building and Road Research Institute, Kumasi, 2017. Ghana.

2. Garces, A.Q., Coimbra, I.B., Silva, D.S., Transporting children in cars and the use of child safety restraint systems. Acta Ortop. Bras. 2016. 24, P. 275–278.

3. World Health Organization, World Report on Child Injury Prevention. World Health Organisation, Geneva, 2016. Switzerland.

4. Halman, S.I., Chipman, M., Parkin, P.C., Wright, J.G., Are seat belt restraints as effective in school age children as in adults? A prospective crash study. BMJ 324, 2002. P. 1123–1126.

5. Lardelli-Claret, P., Jimйnez-Moleyn, J.J., Luna-del-Castillo, Jd., Beuno-Cavanillas, A., Individual factors affecting the risk of death for rear-seated passengers in road crashes. Accid. Anal. 2006. Prev. 38, P. 563–566.

6. Elvik, R., Vaa, T., Hoye, A., Sorensen, M., The Handbook of Road Safety Measures, second ed. 2009.

7. Chen, X., et al., Parents' knowledge, attitude, and use of child restraints. Shantou. China Am J Prev Med. 2014. 46 (1), P. 85–88.

8. Аулін В.В., Гриньків А.В. Методика вибору діагностичних параметрів технічного стану транспортних засобів на основі теорії сенситивів // Науковий журнал "Технічний сервіс агропромислового, лісового та транспортного комплексів". – №5.– Харків: ХНТУСГ, 2016. – С. 109-116

9. 15. Hrynkiv A. Operational evaluation of motor oils of trucks by their thermal oxidative stability. Технологический аудит и резервы производства. - Харків : Технологічний центр, 2019. - № 3 (1). - С. 25-30.