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# Child safety restraint use among children attending day care centers

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## ABSTRACT

**OBJECTIVE:** To estimate the prevalence of child safety restraint use and factors associated.

**METHODS:** Observational cross-sectional study using a stratified sampling conducted in the city of Maringá, Southern Brazil, between March and May 2007. Each day care center was visited at one day only. The outcome was use of child safety restraints by children under four. Vehicles (N=301) driving children under four were approached and information was collected using semi-structured questionnaires. Variables regarding child and adult seat distribution, use of safety restraints by occupants and driver's gender were analyzed. Data analyses included Fisher's exact test, Mantel-Haenszel chi-square test, and logistic regression.

**RESULTS:** Of the drivers approached, 51.8% were using seat belts (60.4% among women, 44.9% among men). Among children, 36.1% were using child safety seats, 45.4% were unrestrained during traveling, 16.0% were seated on an adult lap, and 2.7% were using seat belts. The logistic regression showed the following factors affecting child safety restraint use: child age under 15 months (OR = 3.76); seat belt use by the driver (OR = 2.45); and children from socio-occupational condition with higher income and education (OR = 1.37).

**CONCLUSIONS:** Child safety restraint use was associated to child age, seat belt use by the driver, and socio-occupational condition of day care centers. The finding of low rates of child safety restraint use poses a challenge to preventive medicine in Brazil, requiring attention and action to promote its widespread use.

**DESCRIPTORS:** Child. Accidents, Traffic, prevention & control. Seat Belts, utilization. Protective Devices. Cross-Sectional Studies.

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## INTRODUCTION

Traffic accidents has become a growing cause of mortality in Brazil, following the same trend seen in more developed countries.<sup>2,8</sup> Child safety seats (CSS) or child safety restraint systems (CSRS), popularly known as "car seats," are intended to minimize deaths and potential sequelae among child passengers in motor vehicles. The proper use of CSRS can prevent deaths or irreversible injuries.<sup>1,12,23</sup> However, their use is not mandatory in many countries and use rates are very low in some of them.<sup>20</sup> Even in countries where this issue has been widely disseminated, most of the children killed in traffic accidents were not using any safety restraints.<sup>14</sup> In Brazil there are no published data on CSRS use. Although the need of CSRS use was addressed in the Brazilian Motor

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Vehicle Code,<sup>a</sup> it did not include specific regulations on that. But the *Conselho Nacional de Trânsito* (Contran – Brazilian National Motor Vehicle Council)<sup>b</sup> Resolution No. 277/2008 of July 2008 provided clear requirements for CSRS use in accordance with international regulations<sup>c</sup> establishing CSRS appropriate to the child's age and weight (Table 1).

There have recently been in the Brazilian literature review studies on CSRS use regulations,<sup>15,21</sup> book chapters,<sup>9,22</sup> and preliminary research studies.<sup>16,17</sup> Oliveira et al<sup>d</sup> investigated the level of parental knowledge on CSRS use regulations, and higher rates were seen among those with higher socio-occupational conditions (schooling and income).

The objective of the present study was to estimate the prevalence of child safety seat use and to analyze factors associated.

## METHODS

An observational cross-sectional study with stratified sampling was conducted in the city of Maringá, southern Brazil, between March and May 2007. The city is the third largest urban center in the state of Paraná and was divided into three socio-occupational areas based on income, schooling, and family head's occupation according to the *Observatório das Metrópoles* (Observatory of the Metropolises)<sup>e</sup> studies in the metropolitan area of the city.

Each of the three socio-occupational areas had public and private day care centers comprising six (A-F) strata as follows: A – private day care centers in an area of high income and schooling; B – private day care centers in an area of middle income and schooling; C – private day care centers in an area of low income and schooling; D – public day care centers in an area of high income and schooling; E – public day care centers in an area of middle income and schooling; F – public day care centers in an area of low income and schooling. However, a previous study<sup>17</sup> reported that 62.4% of children taken in motor vehicles to day care centers belonged to the subset comprising the three strata of private day care centers (strata A, B and C) and the stratum of public day care centers of a socio-occupational area of high

income and schooling (stratum D). Thus, the target-population of the present study was drawn from these four strata comprising 1,005 children attending 32 day care centers with nursery and pre-kindergarten services for children aged zero to four years.<sup>17</sup> It was estimated a sample size of 283 children with 5% error and 95% confidence interval. The stratified sampling was proportionate to the population size of each stratum. Data was collected first at the largest day care center in the stratum, followed by all other centers in a descending order by number of children until the sample at each stratum was achieved (Table 2).

Each day care center was studied at one single day and only the center's principal was previously informed on the date of data collection. During arrival time of children, in the early morning and early afternoon, vehicles driving children were approached and drivers were invited to participate in the study. Only those vehicles with children younger than four were eligible to participate in the study. For each vehicle, two previously trained data collectors would apply pre-tested semi-structured questionnaires.<sup>16</sup> These instruments were developed to collect information on gender of vehicle occupants, seat belt use by the driver, child and adult seat distribution, child and adult passenger use of safety restraints and child safety restraint use. Excluding the driver's seat, four passenger seats were considered: A – front seat; B – rear seat opposite to the driver's; C – central rear seat; D – rear seat right behind the driver's.

For data collection, one of the collectors would approach the driver explaining the study and the consent form. It was then collected information on the child's gender, age and weight, and the driver's and all other adult passenger's gender. At the same time, a second collector would observe the driver's and passenger's safety restraint status and their seat distribution in the vehicle. Children status as for seat restraint was categorized into four different situations: unrestrained; seated on an adult lap; using a seat belt; or using CSRS. The methodology of approach and data collection instruments were detailed elsewhere.<sup>16</sup>

Data analysis was carried out using Fisher's exact test through SAS program 9.1, and Mantel-Haenszel

<sup>a</sup> Ministério das Cidades. Departamento Nacional de Trânsito. Conselho Nacional de Trânsito. Código de Trânsito Brasileiro. Capítulo III – das normas gerais de circulação e conduta. Brasília; 1997 [cited 2006 Jul 26]. Available from: [http://www.pr.gov.br/mtm/legislacao/ctb/cap\\_iii.htm](http://www.pr.gov.br/mtm/legislacao/ctb/cap_iii.htm)

<sup>b</sup> Ministério das Cidades. Departamento Nacional de Trânsito. Conselho Nacional de Trânsito Resolução N. 277, de 28 de maio de 2008. Dispõe sobre o transporte de menores de 10 anos e a utilização do dispositivo de retenção para o transporte de crianças em veículos. Diário Oficial Uniao. 29 May 2008 [cited 2008 Oct 3]; Seção 1:76. Available from: [http://www.denatran.gov.br/download/Resolucoes/RESOLUCAO\\_CONTRAN\\_277.pdf](http://www.denatran.gov.br/download/Resolucoes/RESOLUCAO_CONTRAN_277.pdf)

<sup>c</sup> The Royal Society for Prevention of Accidents. Seat belts: advice and information. Birmingham: Available at: [www.rosipa.com/roadsafety/info/seatbelt\\_advice.pdf](http://www.rosipa.com/roadsafety/info/seatbelt_advice.pdf). [cited 2007 Oct 05].

<sup>d</sup> Oliveira SRL, Carvalho MDB, Santana RG, Camargo GCS, Luders L, Franzin S. Segurança de Crianças em Veículos: conhecimento dos pais sobre assentos de segurança infantil. Dados inéditos.

<sup>e</sup> Observatório das Metrópoles, Instituto de Pesquisa e Planejamento Urbano e Regional, Federação de Órgãos para Assistência Social e Educacional. Projeto Análise das Regiões Metropolitanas do Brasil: relatório da atividade 4: como andam as metrópoles brasileiras. 2005. [cited 2008 Jun 11]. Available from: [http://www.observatoriodasmetrolopes.ufrj.br/como\\_anda/como\\_anda\\_RM\\_maringa.pdf](http://www.observatoriodasmetrolopes.ufrj.br/como_anda/como_anda_RM_maringa.pdf).

**Table 1.** Regulations for child safety seat use by age and weight.

Group	Age	Weight	CSRS
0	Up to 9 months	Up to 10 kg	Baby carrier
0+	Up to 12 or 15 months	Up to 13 kg	Rear-facing seats
1	Between 9 and 48 months	Between 9 and 18 kg	Forward-facing seats
2	4 to 6 years	Between 15 a 25 kg	High booster
3	6 to11 years	Between 22 and 36 kg	Low booster

Source: Royal Society for Prevention of Accidents. Seat belts: advice and information. [cited 2007 Oct 5] Available from: [www.rosipa.com/roadsafety/info/seatbelt\\_advice.pdf](http://www.rosipa.com/roadsafety/info/seatbelt_advice.pdf).

chi-square test through Epi Info 3.5.1, and logistic regression through Statistica 7.1.

The study was approved by the Research Ethics Committee of *Universidade Estadual de Maringá* (Protocol No. 271/2006).

## RESULTS

Data were collected at 15 day care centers (Table 2) and all centers agreed to participate in the study. Of 370 vehicles approached, 301 were driving eligible children. There were 324 children aged zero to four years, 37 aged four to ten and 136 adults, totaling 798 individuals. There were on average 2.65 persons per vehicle. As for gender, 51.8% of the drivers were males. Of all drivers, 51.8% were using seat belts (60.4% of females and 44.9% of males). Of 324 children eligible, 51.9% were males, 42.9% were females and gender was not recorded (unknown) in 5.3%. Most children were older than 12 months old (89.2%).

CSRS use rate was 36.1%; 45.4% of children were unrestrained, 16.1% were seated on an adult lap, and

2.7% were using a seat belt. Of those children using CSRS, 89.7% were in a car seat, 5.1% in a baby carrier, 3.4% in a backless booster seat, and 1.7% in a high-back booster seat.

The univariate analysis showed that CSRS use was associated to: the child's age; child's category by age and weight; the driver's gender; seat belt use by the driver; correlation between seat belt use and driver's gender; seat position; stratum of day care center; number of passengers in the vehicle; and presence of a second child and adult passengers (Table 3). The child's gender did not affect CSRS use.

Given the statistical relevance of multiple variables, it was performed a logistic regression with variables regrouped by their significance in the univariate analysis. The results showed factors associated to CSRS use: children aged between 0 and 0+; subset of day care centers of strata A and B; and seat belt use by the driver (Table 4). In the logistic regression, the variable seat position in the vehicle was excluded due to the fact that no children using CSRS were in the front passenger seat, producing a variable with no variance.

**Table 2.** Sample distribution per stratum. City of Maringá, Southern Brazil, 2007.

Stratum	No. of day care centers	No. of children attending day care centers	Day care centers studied	Children studied
A <sup>a</sup>	14	356	3	116
B <sup>b</sup>	4	125	2	42
C <sup>c</sup>	10	198	7	66
D <sup>d</sup>	4	326	3	100
Total	32	1005	15	324

<sup>a</sup> Private day care centers in an area of high income and schooling

<sup>b</sup> Private day care centers in an area of average income and schooling

<sup>c</sup> Private day care centers in an area of low income and schooling

<sup>d</sup> Public day care centers in an area of high income and schooling

## DISCUSSION

Despite widespread information on mandatory use of seat belt in Brazil, only half the drivers were using it. The finding of low rates of CSRS is not surprising as this issue has been little explored in studies and poorly disseminated among Brazilians. Only 36.1% of the children were using any CSRS; 45.4% were unrestrained in the vehicle and were more susceptible to be ejected out of the vehicle and collide against other passengers and parts of the vehicle in the event of an accident, sudden breaking or curves. Unrestrained children may have inappropriate risky behaviors: get into the driving area, interfere with door and window opening/closing, and put parts of their own body outside the vehicle.<sup>13</sup>

The design of the present study did not allow to analyzing potential inappropriate fitting of CSRS in the vehicle or inadequate use of CSRS restraining belts or whether children using CSRS were correctly seated. It is noteworthy the finding of 46 children under four seated

**Table 3.** Univariate analysis of child safety seat use in terms of factors of interest. City of Maringá, Southern Brazil, 2007.

Variable	CSRS use		Crude OR	p-value
	Yes	No		
Child's age				
Up to 12 months	19	16	2.1 <sup>a</sup>	0.02
More than 12 months	98	191	1.0	
Child's gender <sup>b</sup>				
Male	65	103	1.32 <sup>a</sup>	0.28
Female	45	94	1.0	
Child's group by age and weight			2.95 <sup>c</sup>	<0.01
0	16	13	1.19	0.74
0+	19	13	1.0	
1	78	163	3.05	<0.01
2	4	18	8.04	<0.01
Number of children in the vehicle				
Only 1	97	146	1.17 <sup>a</sup>	0.01
Two or more	20	61	1.0	
Number of passengers in the vehicle				
Only 1	71	73	1.89 <sup>a</sup>	<0.01
Two or more	46	134	1.0	
Number of adult passengers in the vehicle				
None	88	108	1.44 <sup>a</sup>	<0.01
1 or more	29	99	1.0	
Day care center stratum				
Stratum A	54	62	1.0	
Stratum B	14	28	1.74	0.13
Stratum C	20	46	1.34	0.33
Stratum D	29	71	2.13	<0.01
Seat position in the vehicle				
			2.3 <sup>c</sup>	<0.01
A - front seat <sup>d</sup>	0	46	-	-
B - rear seat opposite to the driver's	50	48	1.0	
C - central rear seat	44	71	1.68	0.06
D - rear seat right behind the driver's	23	42	1.56	0.16
Driver's gender <sup>b</sup>				
Male	43	125	1.0	
Female	72	78	1.63 <sup>a</sup>	<0.01
Seat belt use by the driver <sup>b</sup>				
Yes	80	88	1.6 <sup>a</sup>	<0.01
No	37	118		
Correlation between seat belt use and driver's gender <sup>b</sup>			3.45 <sup>c</sup>	<0.01
Male using a seat belt	26	49	2.51	<0.01
Male not using a seat belt	17	76	5.96	<0.01
Female using a seat belt	52	39	1.0	
Female not using a seat belt	20	38	2.53	<0.01

CSRS: Child safety seat

<sup>a</sup> Fisher's exact test<sup>b</sup> These variables had missing information (missing gender in 17 children, missing gender in 6 drivers and missing seat belt use in 1 driver), resulting in losses lower than 10% for each variable.<sup>c</sup> Mantel-Haenszel chi-square test<sup>d</sup> OR estimates do not apply as no children was using CSRS in seat A

**Table 4.** Logistic regression model of variables related to the child safety seat use. Maringá, Brazil, 2007.

Variable	Adjusted OR	p-value
Children younger than 12 months old	1.14	0.81
Children 0 and 0+	3.76	<0.01
Female drivers using seat belt	1.09	0.85
Female drivers	1.71	0.20
Drivers using seat belt	2.45	0.01
Children in strata A and B	1.74	0.03
No adult passengers in the vehicle	1.40	0.4
Only one passenger in the vehicle	1.93	0.08

in the front seat with no CSRS. Although apparently contradictory, Contran's Resolution No. 277/08 allows that, in vehicles with no rear seat such as small pickup trucks, children can be seated in the front passenger seat using CSRS or seat belt when appropriate.<sup>a</sup> Aware of the need of not leaving their children unrestrained, some parents had them inappropriately held on an adult lap (16.1%) while others inappropriately used seat belts to restraint them (2.7%). Inappropriate early use of seat belt makes children more susceptible to abdominal and vertebral injuries (seat belt syndrome).<sup>4,23</sup>

Corroborating international data, CSRS use proved to be inversely proportional to the child's age<sup>3,10</sup> and was associated with the seat belt use by the driver.<sup>5</sup> The higher rate of CSRS use in day care centers located in strata A and B (Table 4) was most likely due to higher schooling and income of the population attending these centers, as indicated in the multivariate analysis and logistic regression.

The association between the driver's gender and seat belt use indicated that the presence of restrained female drivers in the vehicle favored CSRS use (OR= 3.45).

Among unrestrained male drivers, 81.7% of children were also unrestrained, suggesting that negligence with one's own safety was reflected in the child's care. In the present study, even among parents with higher schooling and income (strata A and B) who could afford private day care centers and CSRS, CSRS use rates were lower than those reported in developed countries.<sup>1,9</sup>

The high cost of several CSRS models has been investigated in studies including less privileged populations and they showed that strategies facilitating access to CSRS, together with education activities, can promote a significant increase in CSRS use. The mandatory use of CSRS is an important legal factor but it is not enough for compliance.<sup>6,7,11,18,19,24</sup>

Given low rates of CSRS use associated to slightly low rates of seat belt use by the drivers and the recent implementation of specific CSRS legislation, CSRS use is a challenge to preventive medicine in Brazil, requiring action focusing on raising awareness of safety transportation rules for children. Further studies are needed for developing strategies to promote CSRS use as a way to prevent injuries and deaths in children passengers of vehicles.

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