GONZALO RODRIGUEZ MEMORIAL FOUNDATION

ROAD SAFETY PLAN FOR CHILDREN - EDU-CAR

Report of Studies
The critical situation of children as passengers of vehicles

Study and Assessment of Restraint Systems for Children Aged 0 – 14 years old in Montevideo

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April, 2009

Montevideo, Uruguay

INDEX

INTRODUCTION

This study presents the findings of a study on the use of Child Restraint Systems (CRS) in private motor vehicles (cars and vans), in Montevideo. The present study was carried out in the area of Rambla República de Chile, opposite to the Museo Oceanográfico (Oceanographic Museum), in March 2009.

The study is part of the research activities of the **Road Safety Plan for Children - EDU-CAR**, carried out by **Gonzalo Rodriguez Memorial Foundation**.

Gonzalo Rodriguez Memorial Foundation (GRMF) is a **non-profit non-governmental organization**, with **legal status** in Uruguay since October 2000 and registered in USA and England. Created in memoriam of the Uruguayan racer Gonzalo "Gonchi" Rodriguez (1971 - 1999) and with the motto "More education, health, and development", GRMF has developed several educational programs that have helped more than 15,000 Uruguayan children and teenagers. Through its EDU-CAR Plan, GRMF has now started a project promoting Road Safety for those representing the most important component of the population of a country: its children.

The present study allows us to get to know the use of Child Restraint Systems and the way in which children travel in such devices in private cars and vans in Montevideo.

Results not only shed light on the current situation of child restraint systems in the capital city of the country, but also set a precedent since there are no similar studies in Uruguay collecting this kind of data. Another objective of this study is to generate input for future research on the subject.

I. METHODOLOGICAL FRAMEWORK

Information on the methodology used for the making of the present study follows.

I. 1. Scope of study

Due to the fact that no similar studies have been carried out in Uruguay, this investigation on safety elements' prevalence in vehicles has an exploratory nature, trying to describe the reality at study.

I. 2. Objectives of the study

- General objective: To qualitatively and quantitatively analyze Child Restraint Systems (CRS) in Montevideo.

- Specific objectives:
  - To study different types of existing CRS in Montevideo.
  - To be familiar with their correct use and identify current misuse.
  - To be able to quantify parents and care givers' perception on how a child should travel safely.
  - To study, *in situ*, behaviors, beliefs and realities related to child-passenger safety in private vehicles.

I. 3. Type of study

This study falls in the category "observational with a maximum interaction, parked vehicles (to be studied)", according to criteria established in ([3]). Each vehicle's data (case) was collected in a spreadsheet structured, predefined, and designed for Gonzalo Rodriguez Memorial Foundation.

I. 4. Universe of the study

I.4.i. Target population

Target population is composed by users of Child Restraint System (CRS) and the CRS systems used in Montevideo.

I.4.ii. Sampling framework

First Phase: based on information collected during events carried out in specific areas, list of places where families in private vehicles with children aged between 0 – 14 were *a priori* expected to be found.
Second Phase: Places with CRS vehicles count; a sample is taken (with a probability proportional to size, measured through percentage of private vehicles observed traveling with children and installed CRS during phase one), variables of interest are analyzed.

I.4.iii. Units of observation

In the first phase: all circulating vehicles on randomly chosen days and times.
In the second phase: all those vehicles with at least one child restraint system (CRS), with or without passengers, CRS and children traveling in them, and drivers of said vehicles.

I.4. iv. Units of analysis

- Child Restraint Systems;
- vehicles with at least one CRS and;
- occupants (driver and children aged 0 - 14 years old traveling in a CRS).

I. 5. Collection of final sample

I. 5. i. First phase or Pilot phase

Different reasons motivated the use of this sampling technique in two phases, mainly used when there are problems with the sampling framework. During this study there was little or no information available regarding the target population. This technique is also used for estimation when several types of no answers are detected ([7]).
This technique has two phases: in the first phase, a big enough sample of elements is taken, to then subsample considering information that is "cheap and accessible" collected in that first sample.

During this study a list was made of possible places where families with children aged 0 – 14 years old may be found traveling in their private vehicles (free time activities, traveling to other parts of the city, etc.), then a subsample was taken and the corresponding study carried out.

In all these points private vehicles were counted on different days and times – mainly at weekends - differentiating those traveling with children from the rest, and within this category, all those with at least one Child Restraint System (CRS) installed. This First Phase was carried out with staff from the Foundation previously trained for recognition of CRS in moving and parked vehicles.

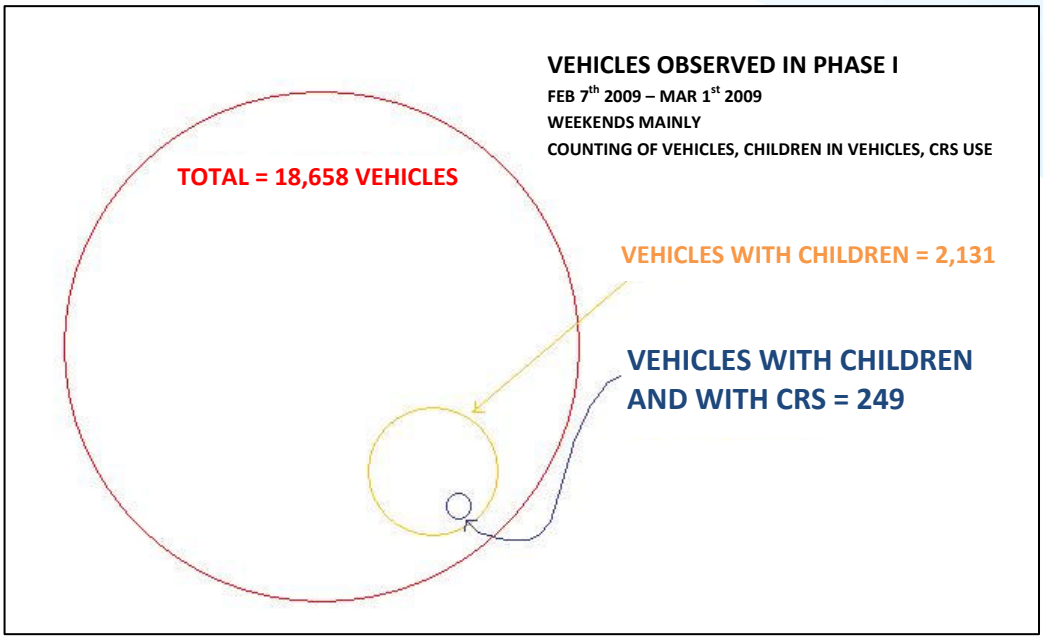
Results obtained are shown below:

- **Total number of vehicles studied:** 13,658 (100%).
- **Total number of vehicles traveling with children:** 2,131 (15.6%).
- **Total number of vehicles traveling with children and CRS: 249** (which represent 11.7% of 2,131 vehicles traveling with children, and 1.82% of 13,658 studied vehicles).

According to observations, the number of vehicles traveling with elements of the target population is very small, so it demands a special effort from researchers to obtain information of the quality presented in this study.

Following a diagram summarizing the situation:

Diagram 1



I. 5. ii. Second Phase

Information collected in the First Phase was used as an input for the Second Phase in order to determine the place/places in which to carry out the studies. Due to logistic issues, as well as human and material resources, only one of the possible places was chosen: the surroundings of the Oceanographic Museum. This place was selected with proportional probability to size sampling, according to the percentage of CRSs observed in the pilot phase.

I. 6. Technical Team

The Technical Team responsible for the field work was composed by the staff members and volunteers from Gonzalo Rodriguez Memorial Foundation, as well as students from Automotive Mechanics Course

(specialized Mechanic in Vehicles' Corrective Maintenance) from the Technical Education Center, *Talleres Don Bosco*, who worked voluntarily.

I. 7. Number of cases studied (Second Phase)

Total of vehicles	**247**
Total of vehicles with children on board	221
Total of vehicles with no children on board	26

Total of children (0 - 14 years old)	**292**
Total of children with CRS	211
Total of children without CRS	81

Total of CRS	268

I. 8. Date and place of field work

The field work for the Pilot Phase was carried out between February 7th and March 1st, 2009, and for Phase 2 or the Final Study, between March 14th—22nd, 2009. The Second Phase was carried out on two consecutive weekends, at the same point - on Rambla República de Chile, in the surroundings of the Oceanographic Museum, at different moments of the solar day. All days considered, field work covered the period between 9:00 a.m. and 6 p.m.

II. CHARACTERISTICS OF VEHICLES STUDIED

As mentioned in Chapter 1, 247 private vehicles were studied (cars and vans), each of them carrying at least one Child Restraint System. Of all cars studied, 221 were traveling with children, while the other 26 traveled without children.

Following, some of the aspects considered when studying vehicles: type of vehicle, vehicle's age, whether they counted with airbag or ISOFIX or LATCH Systems.

II. 1. Type of vehicles studied

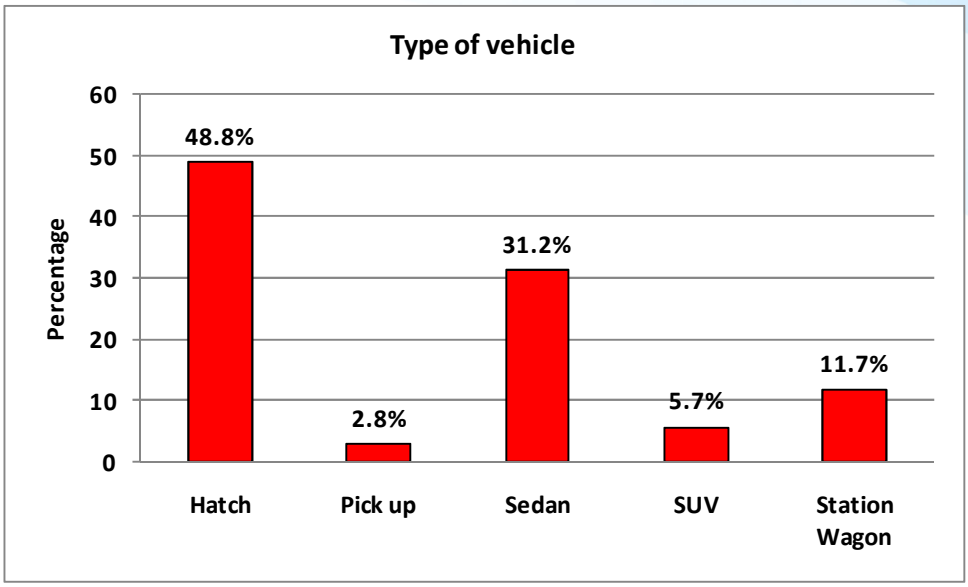
Table 1 and Graph 1 show that 48.6% of vehicles are *Hatch-back*, while 31.2% are sedan. At the same time, 11.7% of vehicles correspond to *Station Wagon* vans (rural), 5.7% to *SUV*, and 2.8% to *Pick Up vans*.

Table 1

Type of vehicle

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Hatch	120	48.6	48.6	48.6
	Pick up	7	2.8	2.8	51.4
	Sedan	77	31.2	31.2	82.6
	SUV	14	5.7	5.7	88.3
	Station Wagon	29	11.7	11.7	100.0
	Total	247	100.0	100.0	

Graph 1


Type of vehicle
Percentage
60
50
40
30
20
10
0
48.8%
2.8%
31.2%
5.7%
11.7%
Hatch
Pick up
Sedan
SUV
Station Wagon

II. 2. Age of vehicles studied

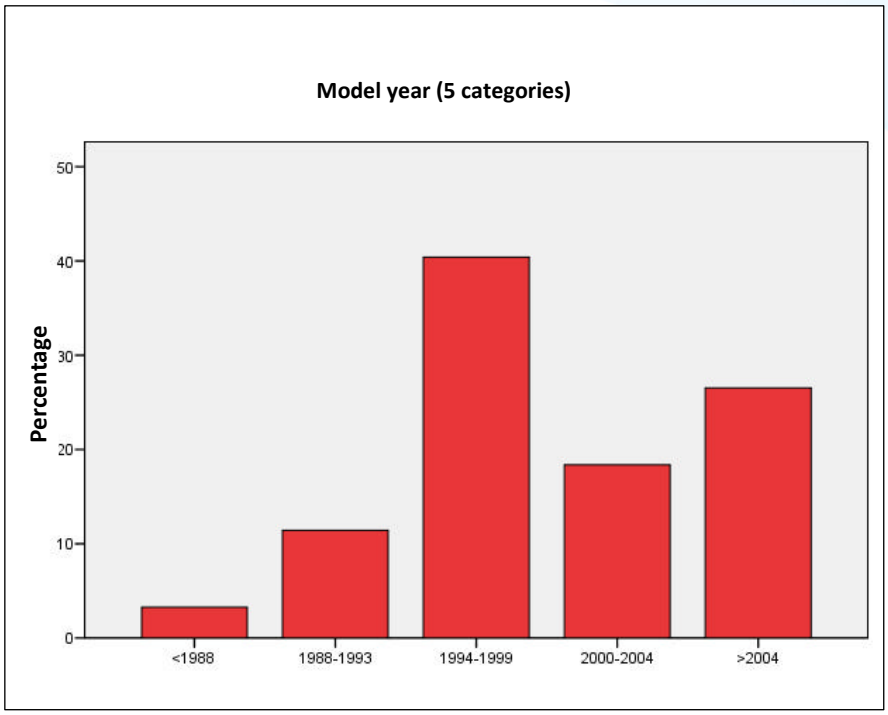
Regarding the studied vehicles' age, 40.4% were made between 1994 and 1999. 26.5% between 2005 – 2009, while those made between 2000 and 2004 represented 18.4%, vehicles made between 1988 and 1993 represented 11.4% and the oldest vehicles (made before 1988) 3.3%.

Table 2

Model year

		Frequency	Percentage	Valid Percentage	Accumulated percentage
Valid	<1988	8	3,2	3,3	3,3
	1988-1993	28	11,3	11,4	14,7
	1994-1999	99	40,1	40,4	55,1
	2000-2004	45	18,2	18,4	73,5
	>2004	65	26,3	26,5	100,0
	Total	245	99,2	100,0	
	System missing values	2	,8		
Total		247	100,0		

Graph 2


Model year (5 categories)
Percentage
50
40
30
20
10
0
<1988
1988-1993
1994-1999
2000-2004
>2004

II. 3. Airbag

As shown in Table 3 below, 77.7% of studied vehicles did not have airbag in the front seat, while 21.9% did have this safety element.

Table 3

Frontal Airbag

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Does have	54	21.9	21.9	21.9
	Does not have	192	77.7	77.7	99.6
	Does not know/does not answer	1	.4	.4	100.0
	Total	247	100.0	100.0	

62.2% of the subpopulation of vehicles that did have airbag in the front seat had automatic activation, while 37.8% of vehicles had manual airbag activation.

Table 4

Frontal Airbag * Airbag activation mechanism Crosstabulation

		Airbag activation mechanism		Total
		Automatic activation	Mechanical activation	Automatic activation
Have frontal airbag	Recount	28	17	45
	%	62.2%	37.8%	100.0%

II. 4. LATCH and ISOFIX systems

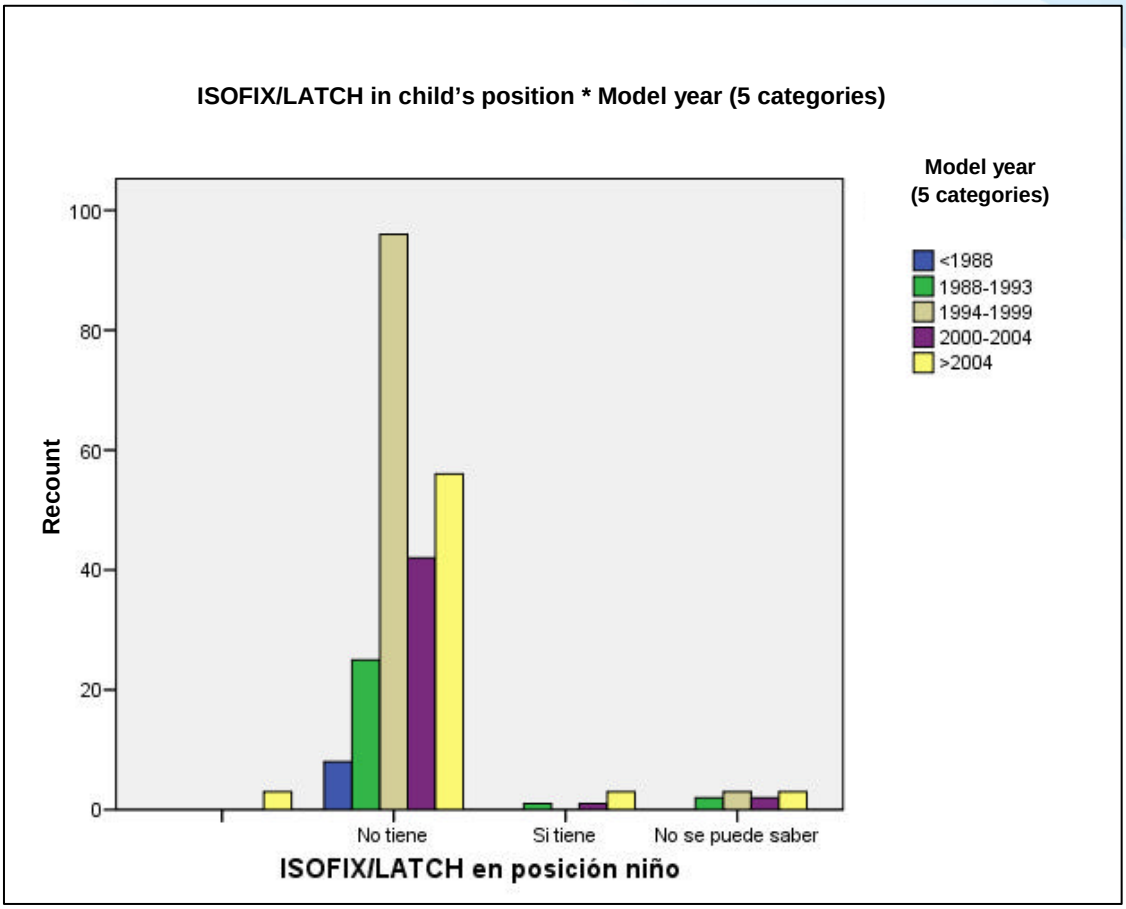
LATCH or ISOFIX systems make CRS installation in the vehicle easier. Table 5 shows that these systems were missing in the child's position in the great majority of cars studied (92%). These systems were only present in 2% of cars studied.

Table 5

ISOFIX/LATCH in child's position * Model year (5 categories) Crosstabulation

ISOFIX/LATCH in child's position			Model year (5 categories)					Total
			<1988	1988-1993	1994-1999	2000-2004	>2004	
	Does not have	Recount	8	25	96	42	56	227
		%	100,0%	89,3%	97,0%	93,3%	86,2%	92,7%
	Does have	Recount	0	1	0	1	3	5
		%	,0%	3,6%	,0%	2,2%	4,6%	2,0%
	Cannot be seen	Recount	0	2	3	2	3	10
		%	,0%	7,1%	3,0%	4,4%	4,6%	4,1%
		Recount	0	0	0	0	3	3
		%	,0%	,0%	,0%	,0%	4,6%	1,2%
Total		Recount	8	28	99	45	65	245
		%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Graph 3


ISOFIX/LATCH in child's position * Model year (5 categories)
Model year
(5 categories)
<1988
1988-1993
1994-1999
2000-2004
>2004
Recount
100
80
60
40
20
0
No tiene
Si tiene
No se puede saber
ISOFIX/LATCH en posición niño

III. INSPECTION OF CHILD RESTRAINT SYSTEMS

As mentioned in Chapter 1, 268 Child Restraint Systems were studied in 247 cars. Of those 268 CRSs, 211 were carrying children, this shows that 57 CRSs were not being used at the moment of the study, either because there were no children in the vehicle or because those present were not using the system.

This chapter will exclusively focus on the studied Child Restraint Systems (not on the children restrained which are studied in Chapter V). Areas included will range from technical aspects such as types of CRS, number of points of harnesses (for those CRS with harnesses) and whether they comply with technical standards or not as well as aspects related to the origin of said passive safety elements.

III. 1. Type of Child Restraint System (CRS)

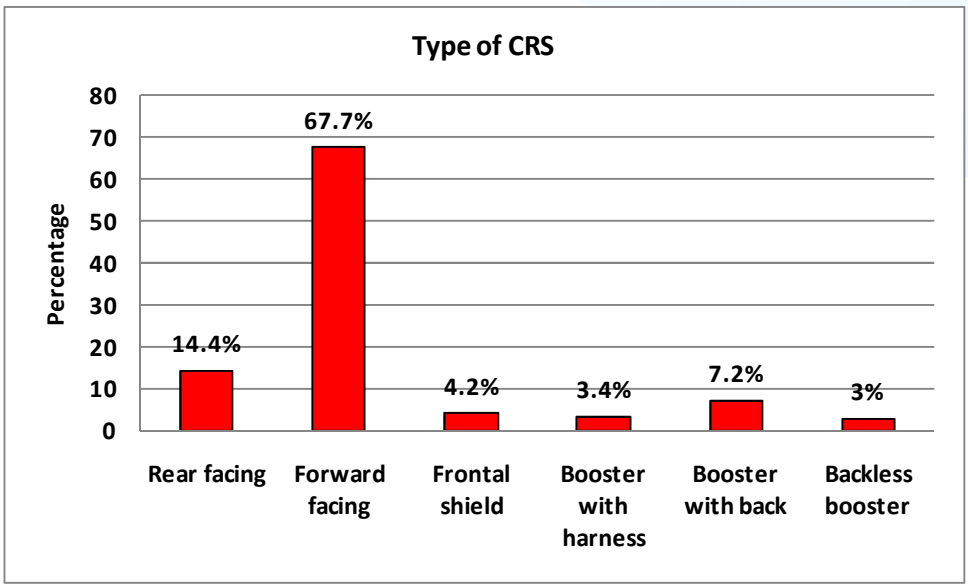
Regarding CRS studied, 67.7% corresponded to forward facing seats, 14.4% of CRS studied were rear facing and 4.2% with a shield; 13.6% of CRS assessed were booster seats: 3.4% boosters with harness, 7.2% high back boosters, 3% backless boosters.

Table 6

Type of CRS

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Rear facing	38	14.2	14.4	14.4
	Forward facing	178	66.4	67.7	82.1
	Frontal Shield	11	4.1	4.2	86.3
	Booster with harness	9	3.4	3.4	89.7
	Booster with back	19	7.1	7.2	97.0
	Backless Booster	8	3.0	3.0	100.0
	Total	263	98.1	100.0	
System	missing values	5	1.9		
Total		268	100.0		

Graph 4


Type of CRS
Percentage
80
70
60
50
40
30
20
10
0
14.4%
67.7%
4.2%
3.4%
7.2%
3%
Rear facing
Forward facing
Frontal shield
Booster with harness
Booster with back
Backless booster

III. 2. Harnesses' points

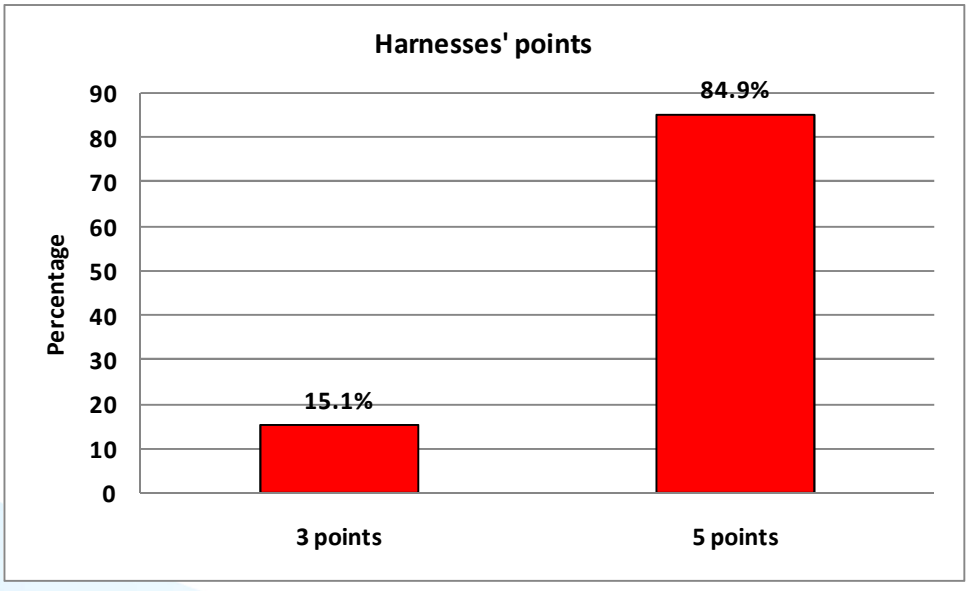
Regarding the number of points of the harnesses (of those CRS with harness), 84.5% were five-point harnesses, while 15.1% had two points.

Table 7

Harness' points

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	3 points	34	12.7	15.1	15.1
	5 points	191	71.3	84.9	100.0
	Total	225	84.0	100.0	
System missing values		43	16.0		
Total		268	100.0		

Graph 5



III. 3. CRS indication of compliance with technical standards

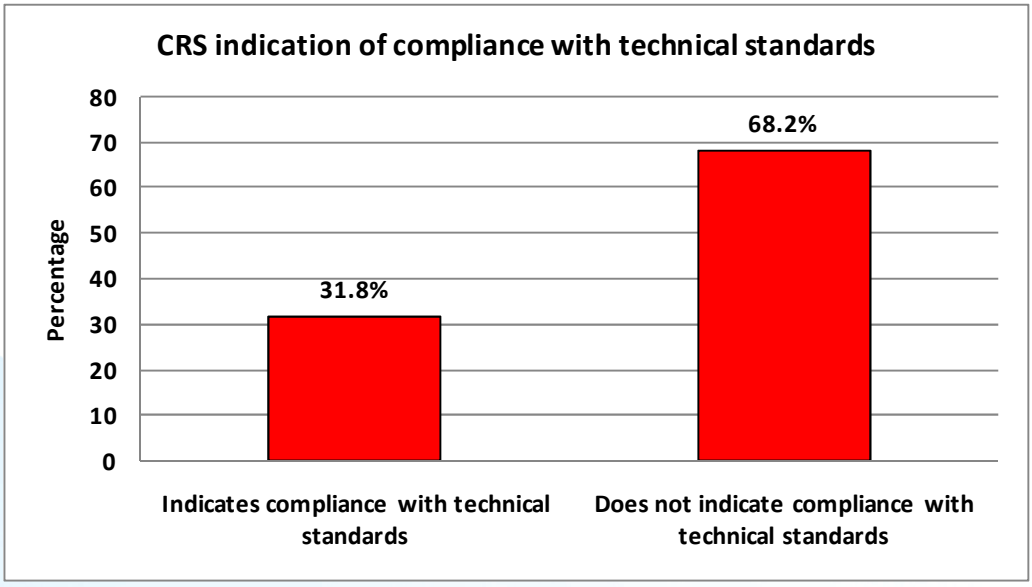
Regarding technical standards, 68.2% of CRS did not show any compliance with internationally recognized technical standards or it was impossible to control its compliance. Only 31.8% of CRS studied showed compliance with some internationally recognized technical standard.

Table 8

CRS indication of compliance with technical standards

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Does indicate compliance with technical standard	67	25.0	31.8	31.8
	Does not indicate compliance with technical standard/cannot be seen	144	53.7	68.2	100.0
	Total	211	78.7	100.0	
System missing values		57	21.3		
Total		268	100.0		

Graph 6



Following, Table 9 shows that 19% of studied CRSs indicated compliance with UN ECE R44 Standard (European Union – International), while 8.1% showed compliance with the American Standard FMVSS213, and 4.7% showed compliance with other standards.

Table 9.

Indication of compliance with technical standards

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	ECE regulation	40	14.9	19.0	19.0
	FMVSS regulations	17	6.3	8.1	27.0
	Others	10	3.7	4.7	31.8
	Does not have a regulation/cannot be seen	144	53.7	68.2	100.0
	Total	211	78.7	100.0	
System missing values		57	21.3		
Total		268	100.0		

IV. PROFILE OF STUDIED VEHICLES' DRIVERS

This chapter presents socio-demographic information about the 247 drivers of those 247 vehicles studied.

IV. 1. Gender of the vehicles' drivers

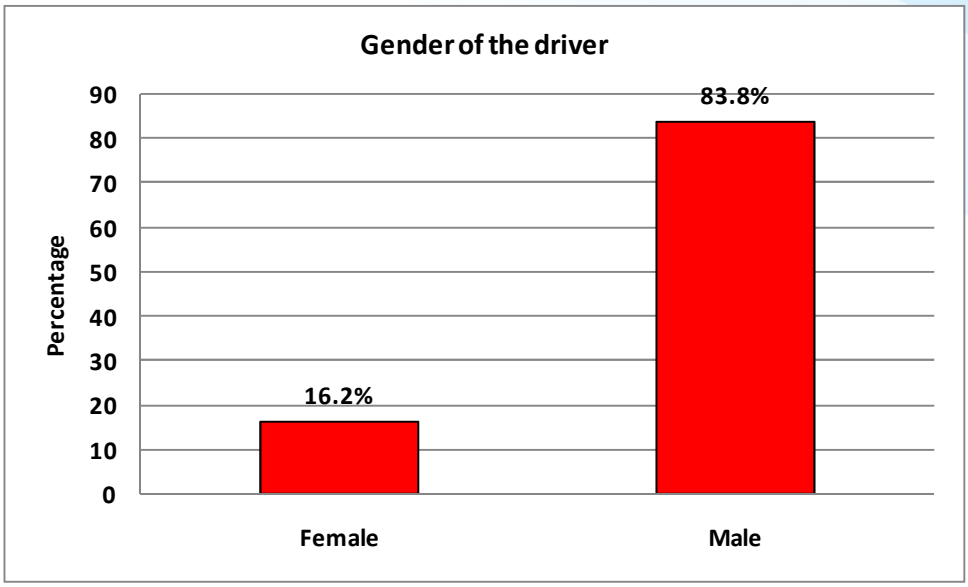
As shown in Table 10, the majority of drivers studied were men, 83.8%. Women drivers represented 16.2% of the sample.

Table 10

Gender of the driver

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Female	38	15.4	16.2	16.2
	Male	196	79.4	83.8	100.0
	Total	234	94.7	100.0	
System missing values		13	5.3		
Total		247	100.0		

Graph 7


Gender of the driver
Percentage
90
80
70
60
50
40
30
20
10
0
16.2%
83.8%
Female
Male

IV. 2. Age of the vehicles' drivers

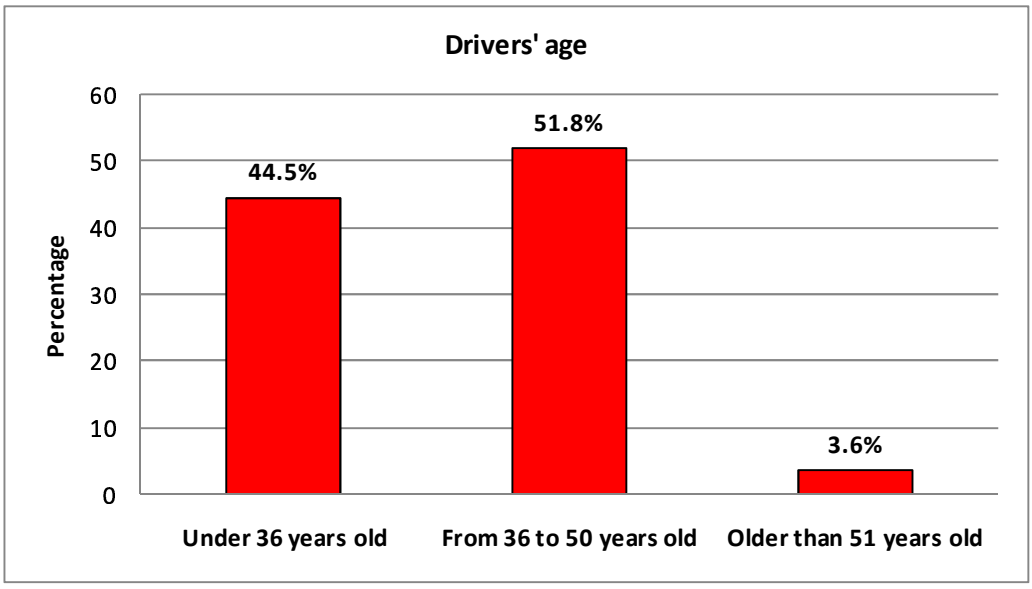
Regarding the age of drivers, 51.8% were between 36 - 50 years old. The number of drivers under 36 years old reached 44.5%, while 3.6% of the sample was 51 years old or more.

Table 11

Drivers' age

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Under 36 years old	110	44.5	44.5	44.5
	From 36 to 50 years old	128	51.8	51.8	96.4
	Older than 51 years old	9	3.6	3.6	100.0
	Total	247	100.0	100.0	

Graph 8



IV. PROFILE OF CHILDREN TRAVELING IN VEHICLES STUDIED

Information on 292 children aged between 0 - 14 years old traveling in 221 of 247 vehicles studied.

V. 1. Children's age

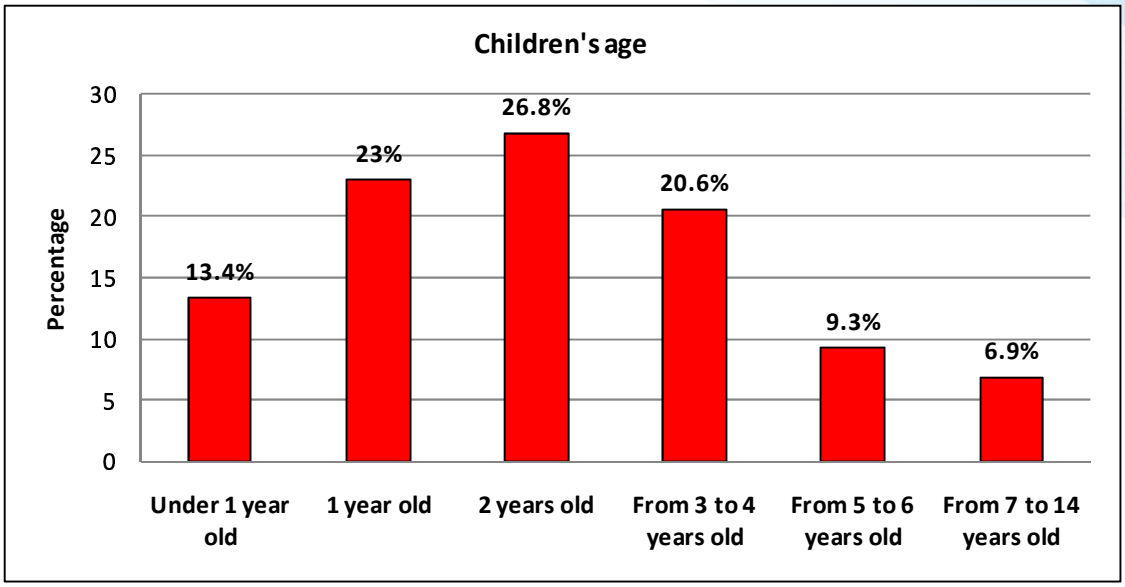
Regarding age, as shown in Table 12 and Graph 9, there existed a similarity between age groups corresponding to 1-2 years old and 3-4 years old, which represented respectively, 23%, 26.8% and 20.6%. On the other hand, children under 1 year of age represented 13.4% of the sample, while those between 5 and 6 years old represented 9.3% of observations and the group between 7 and 14 years of age, 6.9%.

Table 12

Children's age

		Frequency	Percentage	Valid Percentage	Accumulated percentage
Valid	Under 1 year old	39	13.4	13.4	13.4
	1 year old	67	22.9	23.0	36.4
	2 years old	78	26.7	26.8	63.2
	Form 3 to 4 years old	60	20.5	20.6	83.8
	From 5 to 6 years old	27	9.2	9.3	93.1
	From 7 to 14 years old.	20	6.8	6.9	100.0
	Total	291	99.7	100.0	
System missing values		1	.3		
Total		292	100.0		

Graph 9


Children's age
Percentage
30
25
20
15
10
5
0
13.4%
23%
26.8%
20.6%
9.3%
6.9%
Under 1 year old
1 year old
2 years old
From 3 to 4 years old
From 5 to 6 years old
From 7 to 14 years old

V. 2. Children's weight

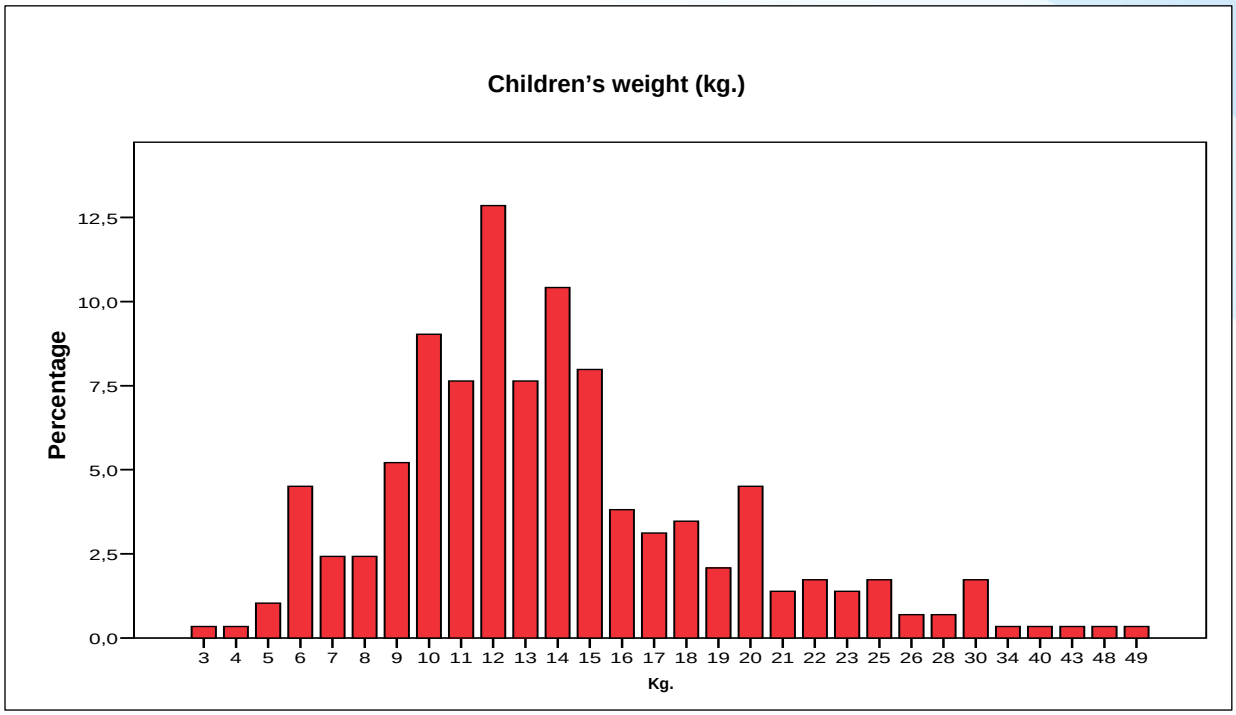
Regarding children's weight in Kilograms, information provided by drivers (most of them parents) showed that children studied ranged from 3 - 49 kg. 75.7% of children (percentile 75) weighted less than 17 kg., while average weight was 14.25 kg.

Table 13

Children's weight

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	3	1	.3	.3	.3
	4	1	.3	.3	.7
	5	3	1.0	1.0	1.7
	6	13	4.5	4.5	6.3
	7	7	2.4	2.4	8.7
	8	7	2.4	2.4	11.1
	9	15	5.1	5.2	16.3
	10	26	8.9	9.0	25.3
	11	22	7.5	7.6	33.0
	12	37	12.7	12.8	45.8
	13	22	7.5	7.6	53.5
	14	30	10.3	10.4	63.9
	15	23	7.9	8.0	71.9
	16	11	3.8	3.8	75.7
	17	9	3.1	3.1	78.8
	18	10	3.4	3.5	82.3
	19	6	2.1	2.1	84.4
	20	13	4.5	4.5	88.9
	21	4	1.4	1.4	90.3
	22	5	1.7	1.7	92.0
	23	4	1.4	1.4	93.4
	25	5	1.7	1.7	95.1
	26	2	.7	.7	95.8
	28	2	.7	.7	96.5
	30	5	1.7	1.7	98.3
	34	1	.3	.3	98.6
	40	1	.3	.3	99.0
	43	1	.3	.3	99.3
	48	1	.3	.3	99.7
	49	1	.3	.3	100.0
	Total	288	98.6	100.0	
System missing values		4	1.4		
Total		292	100.0		

Graph 10


Children's weight (kg.)
Percentage
12,5
10,0
7,5
5,0
2,5
0,0
3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 25 26 28 30 34 40 43 48 49
Kg.

V. 3. Children's height

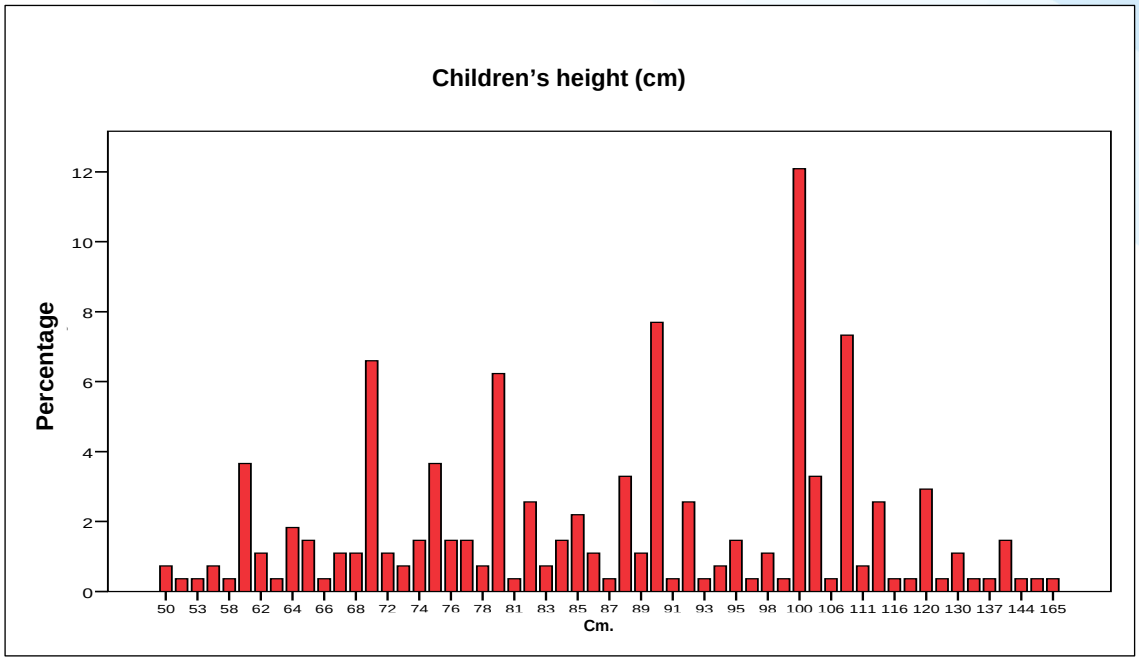
Regarding the height of children studied, and according to information provided by the drivers of the vehicles studied, Table 14 shows that children were between 50 cm and 1.65 meters. 77.3% of children studied (percentile 75) reached one meter and a half, while average height was 89.69 cm. The mode or most frequent observation was 1.00 meter.

Table 14

Children's height

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	50	2	.7	.7	.7
	51	1	.3	.4	1.1
	53	1	.3	.4	1.5
	55	2	.7	.7	2.2
	58	1	.3	.4	2.6
	60	10	3.4	3.7	6.2
	62	3	1.0	1.1	7.3
	63	1	.3	.4	7.7
	64	5	1.7	1.8	9.5
	65	4	1.4	1.5	11.0
	66	1	.3	.4	11.4
	67	3	1.0	1.1	12.5
	68	3	1.0	1.1	13.6
	70	18	6.2	6.6	20.1
	72	3	1.0	1.1	21.2
	73	2	.7	.7	22.0
	74	4	1.4	1.5	23.4
	75	10	3.4	3.7	27.1
	76	4	1.4	1.5	28.6
	77	4	1.4	1.5	30.0
	78	2	.7	.7	30.8
	80	17	5.8	6.2	37.0
	81	1	.3	.4	37.4
	82	7	2.4	2.6	39.9
	83	2	.7	.7	40.7
	84	4	1.4	1.5	42.1
	85	6	2.1	2.2	44.3
	86	3	1.0	1.1	45.4
	87	1	.3	.4	45.8
	88	9	3.1	3.3	49.1
	89	3	1.0	1.1	50.2
	90	21	7.2	7.7	57.9
	91	1	.3	.4	58.2
	92	7	2.4	2.6	60.8
	93	1	.3	.4	61.2
	94	2	.7	.7	61.9
	95	4	1.4	1.5	63.4
	97	1	.3	.4	63.7
	98	3	1.0	1.1	64.8
	99	1	.3	.4	65.2
	100	33	11.3	12.1	77.3
	105	9	3.1	3.3	80.6
	106	1	.3	.4	81.0
	110	20	6.8	7.3	88.3
	111	2	.7	.7	89.0
	115	7	2.4	2.6	91.6
	116	1	.3	.4	91.9
	118	1	.3	.4	92.3
	120	8	2.7	2.9	95.2
	121	1	.3	.4	95.6
	130	3	1.0	1.1	96.7
	132	1	.3	.4	97.1
	137	1	.3	.4	97.4
	140	4	1.4	1.5	98.9
	144	1	.3	.4	99.3
	150	1	.3	.4	99.6
	165	1	.3	.4	100.0
	Total	273	93.5	100.0	
System missing values		19	6.5		
Total		292	100.0		

Graph 11


Children's height (cm)
Percentage
0
2
4
6
8
10
12
50 53 58 62 64 66 68 72 74 76 78 81 83 85 87 89 91 93 95 98 100 106 111 116 120 130 137 144 165
Cm.

V. 4. Children's seating position

Table 15 shows that the great majority of children studied were traveling in the back seat. Only 3.2% of children were traveling in the front seat, in the passenger's seat (position 3).

Table 15

Child's seating position

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Position 3	9	3.1	3.2	3.2
	Position 4	91	31.2	32.0	35.2
	Position 5	46	15.8	16.2	51.4
	Position 6	134	45.9	47.2	98.6
	Position 7	1	.3	.4	98.9
	Position 9	3	1.0	1.1	100.0
	Total	284	97.3	100.0	
System missing values		8	2.7		
Total		292	100.0		

V. 5. Children's restraint in the vehicle

V. 5. i. Children's restraint in the vehicle

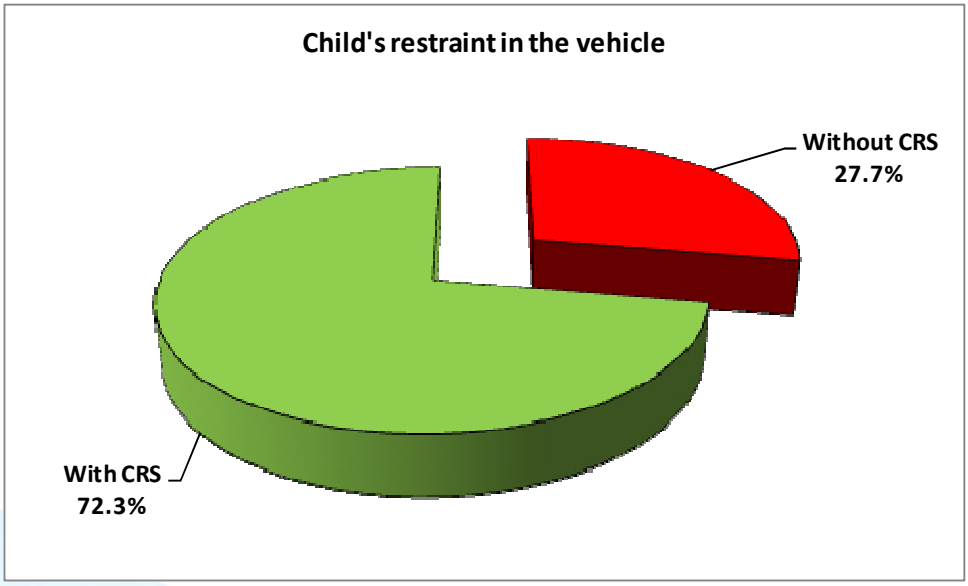
As shown in Table 16, 27.71% of children were traveling unrestrained, and 72.3% was doing so in a CRS.

Table 16

Child's restraint in the vehicle

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	With CRS	211	72.3	72.3	72.3
	Without CRS	81	27.7	27.7	100.0
	Total	292	100.0	100.0	

Graph 12



On the other hand, Table 17 shows the type of restraint children traveled in. The table shows that 20.5% of children traveled unrestrained (without CRS or seat belt), and 2.1% was traveling restrained by 2-point seat belt, and 5.1% was wearing 3-point seat belts, 72.3% of children traveled in CRS.

Table 17

Children's restraint

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Children without any restraint system	60	20.5	20.5	20.5
	Children without CRS fastened with 2-point belt	6	2.1	2.1	22.6
	Children without CRS fastened with 3-point belt	15	5.1	5.1	27.7
	Children in CRS	211	72.3	72.3	100.0
	Total	292	100.0	100.0	

V. 5. ii. Children's restraint in vehicle according to their age

When studying child restraint systems according to age, results showed that the highest number of children restrained were those aged between 1 and 2 years old, 86.6% and 82.1% respectively.

The great majority of children under 1 year as well as those between 3 and 4 years old, were also in a CRS, however, in smaller numbers, 79.5% and 76.7% respectively.

Figures for children aged between 5 and 6 showed important differences, in fact, 59.3% of children in that age range were traveling unrestrained. However, it was in the age group between 7 and 14 were lack of CRS was most significant: 100% of children in that age group were traveling unrestrained, even when this was necessary for their safety considering their ages, weights and heights.

Table 18

Children's age * Child restraint in the vehicle Crosstabulation

			Child restraint in the vehicle		
			With CRS	Without CRS	Total
Children's age	Under 1 year old	Recount	31	8	39
		Children's age %	79.5%	20.5%	100.0%
	1 year old	Recount	58	9	67
		Children's age %	86.6%	13.4%	100.0%
	2 years old	Recount	64	14	78
		Children's age %	82.1%	17.9%	100.0%
	From 3 to 4 years old	Recount	46	14	60
		Children's age %	76.7%	23.3%	100.0%
	From 5 to 6 years old	Recount	11	16	27
		Children's age %	40.7%	59.3%	100.0%
	From 7 to 14 years old	Recount	0	20	20
		Children's age %	.0%	100.0%	100.0%
Total		Recount	210	81	291
		Children's age %	72.2%	27.8%	100.0%

V. 5. iii. Child restraint according to seating position in the vehicle

If child restraints are studied according to seating position in the vehicle, results show that from those children traveling in a CRS, more than half of them (54.6%) travel in position 6 in the back seat (that is to say, in the back seat behind the passenger's seat).

Also, 31.7% were traveling in position 4 in the rear seat (behind the passenger's seat), while 12.7% did so in the middle position of the rear seat, position 5. Children traveling in a CRS in passenger's seat, position 3, represented 0.5% of the total. The same value was found for children traveling in position 9[1].

[1] See Methodological Annexe.

Regarding children traveling unrestrained most cases were traveling in position 3 in the rear seat. As mentioned before, of those children traveling unrestrained, 10.1% were traveling in said position while only 0.5% of children in CRS were traveling in position 3. However, most children traveling without CRS were also traveling in the rear seat: 32.9% in position 4, 25.3% in position 5 and 27.8% in position 6. Also, 1.3% was traveling in position 7, while 2.5% did so in position 9.

Table 19

Child restraint in the vehicle * Child's seating position Crosstabulation

			Child's seating position						
			Position 3	Position 4	Position 5	Position 6	Position 7	Position 9	Total
Child restraint in the vehicle	With CRS	Recount	1	65	26	112	0	1	205
		% of child restraint in the vehicle	.5%	31.7%	12.7%	54.6%	.0%	.5%	100.0%
	Without CRS	Recount	8	26	20	22	1	2	79
		%of child restraint system in the vehicle	10.1%	32.9%	25.3%	27.8%	1.3%	2.5%	100.0%
Total		Recount	9	91	46	134	1	3	284
		% of child restraint in the vehicle	3.2%	32.0%	16.2%	47.2%	.4%	1.1%	100.0%

VI. CHILDREN IN CHILD RESTRAINT SYSTEMS

Results from the 211 children studied traveling in a CRS are presented in this chapter. This section will analyze the way in which CRSs were installed in the vehicles and the way in which children were traveling in those systems.

VI. 1. Children's weight and CRS group

Tables 20 and 21 show CRS groups in which children should travel and their corresponding facing direction, the direction the seat should face, according to the child's weight (for European systems) and child's height (USA systems).

Table 20

Children's weight	CRS Group	Corresponding direction of CRS
Up to 10 kg.	0	Rear facing
Up to 13 kg.	O+	Rear facing
From 9 to 18 kg	1	Forward facing
From 15 to 25 kg	2	Forward facing
From 15 to 25 kg	3	Forward facing

Source: United Nations SAFETY REGULATIONS (UNECE R44).

Table 21

1st. STEP	**Children MUST travel in an appropriate rear facing seat in the vehicle's back seat from birth until they are 1 year old or weigh 10 kg.**	
2nd. STEP	**From 1 year old or 10 kg until they are approximately 4 years old or weigh 20 kg. Children MUST travel in an appropriate forward facing seat in the back seat of the vehicle**	
3rd. STEP	**From 4 years old or 4 kg until they are 8 years old or until they are more than 1.5 m tall. Children MUST travel in a booster seat (it is better if it is complete; with back) in the vehicle's back seat**	
4th. STEP	**From 8 years old until they are 12 and more than 1.5 m tall. Children MUST travel in the back seat wearing a 3-point seat belt, Booster seat not necessary.**	
5th. STEP	**From 12 years old until they are 14 and shorter than 1.5 m tall they MUST travel in the vehicle's back seat wearing a 3 point- seat belt and a booster seat. Between 12 and 14 years old and taller than 1.5 m tall they can travel in the front seat wearing a 3 point-seat belt.**	

Table 22 shows CRS being used at the moment of the study, segmenting said observation according to weight in kilograms.

Table 22
Child's weight * CRS group Crosstabulation

			CRS Group								Total
			Group 0	Group 0+	Group 0+_1	Group 1	Group 1_2	Group 2	Group 2_3	Group 3	Group 0
Child's weight	4	Recount	1	0	0	0	0	0	0	0	1
		% Child's weight	100.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%
	5	Recount	2	0	0	0	0	0	0	0	2
		% Child's weight	100.0%	.0%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%
	6	Recount	5	5	1	0	0	0	0	0	11
		% Child's weight	45.5%	45.5%	9.1%	.0%	.0%	.0%	.0%	.0%	100.0%
	7	Recount	2	3	0	0	0	0	0	0	5
		% Child's weight	40.0%	60.0%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%
	8	Recount	2	4	0	0	0	0	0	0	6
		% Child's weight	33.3%	66.7%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%
	9	Recount	1	3	0	7	0	0	0	0	11
		% Child's weight	9.1%	27.3%	.0%	63.6%	.0%	.0%	.0%	.0%	100.0%
	10	Recount	4	6	1	6	0	0	0	0	17
		% Child's weight	23.5%	35.3%	5.9%	35.3%	.0%	.0%	.0%	.0%	100.0%
	11	Recount	2	4	3	8	0	1	0	0	18
		% Child's weight	11.1%	22.2%	16.7%	44.4%	.0%	5.6%	.0%	.0%	100.0%
	12	Recount	1	8	3	17	0	0	0	0	29
		% Child's weight	3.4%	27.6%	10.3%	58.6%	.0%	.0%	.0%	.0%	100.0%
	13	Recount	0	3	1	11	1	0	1	0	17
		% Child's weight	.0%	17.6%	5.9%	64.7%	5.9%	.0%	5.9%	.0%	100.0%
	14	Recount	0	0	0	19	0	1	1	0	21
		% Child's weight	.0%	.0%	.0%	90.5%	.0%	4.8%	4.8%	.0%	100.0%
	15	Recount	0	0	1	8	1	0	0	4	14
		% Child's weight	.0%	.0%	7.1%	57.1%	7.1%	.0%	.0%	28.6%	100.0%
	16	Recount	0	1	2	5	0	0	0	2	10
		% Child's weight	.0%	10.0%	20.0%	50.0%	.0%	.0%	.0%	20.0%	100.0%
	17	Recount	0	0	1	3	0	2	0	0	6
		% Child's weight	.0%	.0%	16.7%	50.0%	.0%	33.3%	.0%	.0%	100.0%
	18	Recount	0	0	0	2	0	1	0	3	6
		% Child's weight	.0%	.0%	.0%	33.3%	.0%	16.7%	.0%	50.0%	100.0%
	19	Recount	0	0	0	3	0	0	0	1	4
		% Child's weight	.0%	.0%	.0%	75.0%	.0%	.0%	.0%	25.0%	100.0%
	20	Recount	0	1	1	2	1	0	0	1	6
		% Child's weight	.0%	16.7%	16.7%	33.3%	16.7%	.0%	.0%	16.7%	100.0%
	21	Recount	0	0	0	1	0	0	0	2	3
		% Child's weight	.0%	.0%	.0%	33.3%	.0%	.0%	.0%	66.7%	100.0%
	22	Recount	0	0	0	0	0	0	1	0	1
		% Child's weight	.0%	.0%	.0%	.0%	.0%	.0%	100.0%	.0%	100.0%
	23	Recount	0	0	0	0	0	1	0	0	1
		% Child's weight	.0%	.0%	.0%	.0%	.0%	100.0%	.0%	.0%	100.0%
	25	Recount	0	0	0	0	0	0	0	2	2
		% Child's weight	.0%	.0%	.0%	.0%	.0%	.0%	.0%	100.0%	100.0%
Total		Recount	20	38	14	92	3	6	3	15	191
		% Child's weight	10.5%	19.9%	7.3%	48.2%	1.6%	3.1%	1.6%	7.9%	100.0%

This table shows that with a few exceptions, children studied were traveling in CRS appropriate to their weights. However, some mistakes were detected and they should be mentioned.

- Seven children over 10kg, 11kg and 12kg, were studied (3.3% of total children traveling in a CRS) traveling in CRS corresponding to Group 0. This difference between weight and CRS group may result dangerous. If children heavier than the suggested weight travel in seats designed for lighter children, they may not perform efficiently thus exposing the child to serious injuries.
- A 20-kilogram child was studied in a CRS group 0+/1, even when those groups were designed for children weighing up to 18 kg.
- Twenty one children weighing 9, 10 and 11 kg were observed in a Group 1 CRS, what is to say, children significantly smaller than the seats capacity. This difference in weight and CRS group also exposes the child to serious injuries, exposing the child to possible impacts or injuries.
- Children weighing 13kg were detected traveling on booster seats that are not designed for such small weight.
- Two children weighing 13kg. and 14kg. were found in a group 2 CRS, seats not designed for their size.

VI. 2. Children's weight and configuration of CRS used

Table 23 shows Child Restraint Systems configuration used according to the child's weight in kilograms.

Table 23

Child's weight * Configuration of CRS used Crosstabulation

			Used CRS configuration					
			Conf. 0	Conf. 0+	Conf. 1	Conf. 2	Conf. 3	Total
Child's weight	4	Recount	1	0	0	0	0	1
		% Child's weight	100.0%	.0%	.0%	.0%	.0%	100.0%
	5	Recount	2	0	0	0	0	2
		% Child's weight	100.0%	.0%	.0%	.0%	.0%	100.0%
	6	Recount	5	6	0	0	0	11
		% Child's weight	45.5%	54.5%	.0%	.0%	.0%	100.0%
	7	Recount	1	2	1	0	0	4
		% Child's weight	25.0%	50.0%	25.0%	.0%	.0%	100.0%
	8	Recount	2	3	0	0	0	5
		% Child's weight	40.0%	60.0%	.0%	.0%	.0%	100.0%
	9	Recount	2	0	8	0	0	10
		% Child's weight	20.0%	.0%	80.0%	.0%	.0%	100.0%
	10	Recount	3	2	12	0	0	17
		% Child's weight	17.6%	11.8%	70.6%	.0%	.0%	100.0%
	11	Recount	1	5	10	1	0	17
		% Child's weight	5.9%	29.4%	58.8%	5.9%	.0%	100.0%
	12	Recount	0	7	20	0	0	27
		% Child's weight	.0%	25.9%	74.1%	.0%	.0%	100.0%
	13	Recount	0	1	13	1	0	15
		% Child's weight	.0%	6.7%	86.7%	6.7%	.0%	100.0%
	14	Recount	0	0	19	2	0	21
		% Child's weight	.0%	.0%	90.5%	9.5%	.0%	100.0%
	15	Recount	0	0	10	0	3	13
		% Child's weight	.0%	.0%	76.9%	.0%	23.1%	100.0%
	16	Recount	0	0	8	0	2	10
		% Child's weight	.0%	.0%	80.0%	.0%	20.0%	100.0%
	17	Recount	0	0	4	2	0	6
		% Child's weight	.0%	.0%	66.7%	33.3%	.0%	100.0%
	18	Recount	0	0	2	2	1	5
		% Child's weight	.0%	.0%	40.0%	40.0%	20.0%	100.0%
	19	Recount	0	0	3	0	1	4
		% Child's weight	.0%	.0%	75.0%	.0%	25.0%	100.0%
	20	Recount	0	1	4	0	1	6
		% Child's weight	.0%	16.7%	66.7%	.0%	16.7%	100.0%
	21	Recount	0	0	1	0	2	3
		% Child's weight	.0%	.0%	33.3%	.0%	66.7%	100.0%
	22	Recount	0	0	0	0	1	1
		% Child's weight	.0%	.0%	.0%	.0%	100.0%	100.0%
	23	Recount	0	0	0	1	0	1
		% Child's weight	.0%	.0%	.0%	100.0%	.0%	100.0%
	25	Recount	0	0	0	0	2	2
		% Child's weight	.0%	.0%	.0%	.0%	100.0%	100.0%
Total		Recount	17	27	115	9	13	181
		% Child's weight	9.4%	14.9%	63.5%	5.0%	7.2%	100.0%

In accordance with the information detailed for the CRS group, data recorded in table 23 shows that in most cases the used CRS configuration was the correct one. However, there are, certain cases that do not follow the correct configuration, these are:

- A child weighing 7 kilograms was observed traveling in a CRS with frontal group 1 configuration.
- Ten children between 18 kg and 21 kg were observed traveling in a CRS with group 1 configuration, which means that they were over the allowed weight for that group.
- Four children weighing 11kg, 13 kg and 14 kgs were observed traveling in CRS with group 2 configuration.
- Twenty children under 9 kg traveling in front facing CRS were observed. This represents a risk since up to that weight they need to travel in rear-facing CRS in order to protect their heads and necks in case of frontal crashes or sudden deceleration.

VI. 3. Children's weight and direction of CRS

Table 24

Child's weight * direction of CRS Crosstabulation

			Direction of CRS		
			Forward facing	Rear facing	Total
Child's weight	4	Recount	0	1	1
		% Child's weight	.0%	100.0%	100.0%
	5	Recount	0	2	2
		% Child's weight	.0%	100.0%	100.0%
	6	Recount	3	8	11
		% Child's weight	27.3%	72.7%	100.0%
	7	Recount	2	4	6
		% Child's weight	33.3%	66.7%	100.0%
	8	Recount	4	2	6
		% Child's weight	66.7%	33.3%	100.0%
	9	Recount	11	1	12
		% Child's weight	91.7%	8.3%	100.0%
	10	Recount	20	2	22
		% Child's weight	90.9%	9.1%	100.0%
	11	Recount	19	0	19
		% Child's weight	100.0%	.0%	100.0%
	12	Recount	30	0	30
		% Child's weight	100.0%	.0%	100.0%
	13	Recount	20	0	20
		% Child's weight	100.0%	.0%	100.0%
	14	Recount	22	0	22
		% Child's weight	100.0%	.0%	100.0%
	15	Recount	17	0	17
		% Child's weight	100.0%	.0%	100.0%
	16	Recount	10	0	10
		% Child's weight	100.0%	.0%	100.0%
	17	Recount	6	0	6
		% Child's weight	100.0%	.0%	100.0%
	18	Recount	7	0	7
		% Child's weight	100.0%	.0%	100.0%
	19	Recount	4	0	4
		% Child's weight	100.0%	.0%	100.0%
	20	Recount	6	0	6
		% Child's weight	100.0%	.0%	100.0%
	21	Recount	3	0	3
		% Child's weight	100.0%	.0%	100.0%
	22	Recount	2	0	2
		% Child's weight	100.0%	.0%	100.0%
	23	Recount	1	0	1
		% Child's weight	100.0%	.0%	100.0%
	25	Recount	2	0	2
		% Child's weight	100.0%	.0%	100.0%
Total		Recount	189	20	209
		% Child's weight	90.4%	9.6%	100.0%

VI. 4. CRS group and configuration used

As it is shown in Table 25, 17 CRS were observed using an incorrect configuration for their group.

Table 25

CRS group *CRS configuration used Crosstabulation

			CRS used configuration					
			Config. 0	Config. 0+	Config. 1	Config. 2	Config. 3	Total
CRS group	Group 0	Recount	14	2	1	0	0	17
		% CRS Group	82.4%	11.8%	5.9%	.0%	.0%	100.0%
	Group0+	Recount	3	20	11	0	0	34
		% CRS Group	8.8%	58.8%	32.4%	.0%	.0%	100.0%
	Group 0+ _ 1	Recount	0	2	13	0	0	15
		% CRS Group	.0%	13.3%	86.7%	.0%	.0%	100.0%
	Group 1	Recount	0	3	86	0	0	89
		% CRS Group	.0%	3.4%	96.6%	.0%	.0%	100.0%
	Group 1 _ 2	Recount	0	0	3	0	0	3
		% CRS Group	.0%	.0%	100.0%	.0%	.0%	100.0%
	Group 2	Recount	0	0	0	6	0	6
		% CRS Group	.0%	.0%	.0%	100.0%	.0%	100.0%
	Group 2 _ 3	Recount	0	0	0	2	1	3
		% CRS Group	.0%	.0%	.0%	66.7%	33.3%	100.0%
	Group 3	Recount	0	0	0	1	13	14
		% CRS Group	.0%	.0%	.0%	7.1%	92.9%	100.0%
Total		Recount	17	27	114	9	14	181
		% CRS Group	9.4%	14.9%	63.0%	5.0%	7.7%	100.0%

VI. 5. CRS group and direction of CRS

Regarding the CRS group and the rear or frontal view, 39 CRS were being used in the incorrect orientation according to their designs. Particularly, the mistakes were observed in those seats that should have been facing backwards but were facing forward representing a risk for the children, potentially injuring their heads or necks in the event of crashes or decelerations.

Table 26

CRS group * Direction of CRS Crosstabulation

			Direction of CRS		
			Forward facing	Rear facing	Total
CRS Group	Group 0	Recount	7	13	20
		% CRS group	35.0%	65.0%	100.0%
	Group 0+	Recount	32	6	38
		% CRS group	84.2%	15.8%	100.0%
	Group 0+ _ 1	Recount	14	1	15
		% CRS group	93.3%	6.7%	100.0%
	Group 1	Recount	92	0	92
		% CRS group	100.0%	.0%	100.0%
	Group 1 _ 2	Recount	3	0	3
		% CRS group	100.0%	.0%	100.0%
	Group 2	Recount	6	0	6
		% CRS group	100.0%	.0%	100.0%
	Group 2 _ 3	Recount	3	0	3
		% CRS group	100.0%	.0%	100.0%
	Group 3	Recount	16	0	16
		% CRS group	100.0%	.0%	100.0%
Total		Recount	173	20	193
		% CRS group	89.6%	10.4%	100.0%

VI. 6. CRS use according to vehicle's seat belt

In the following section the way in which CRSs were being used in relation with seat belts during inspection is analyzed.

VI.6.i. CRS not buckled in the vehicle

89.1 % of children were traveling with the seat correctly buckled in the vehicle. However, 10 % of them were traveling in unbuckled CRS which means with a loose CRS that was not fastened in the vehicle seat. Traveling with the belt unbuckled is a serious mistake since the CRS, when loose, implies a risk for the child that is traveling in that seat. In case of a crash the CRS can crush the child and hurt him badly because of the impact with the vehicle interior.

Table 27

CRS not bucked in vehicle

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	No	188	89.1	89.1	89.1
	Yes	21	10.0	10.0	99.1
	Cannot be seen/ Not applicable	2	.9	.9	100.0
	Total	211	100.0	100.0	

VI. 6. ii. Wrong seat belt route

Regarding seat belt routing, 79.6% of the children traveling in a CRS were correctly fastened by the seat belt while 14.7% were traveling in a CRS with an incorrect belt routing.

Such mistake can determine that the CRS is not fastened by the belt in its correct place leaving the seat loose in the vehicle or breaking the CRS structure leaving the child unrestrained.

Table 28

Wrong seat belt route

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	No	168	79.6	79.6	79.6
	Yes	31	14.7	14.7	94.3
	Cannot be seen/ Not applicable	12	5.7	5.7	100.0
	Total	211	100.0	100.0	

VI. 6. iii. Seat belt behind the back

On the one hand, wearing the shoulder portion of the seat belt behind the back, for 3-point seat belts, is the same as wearing a 2-point seat belt, with all the risks this implies for the child. On the other hand, in the case the whole belt (2 or 3 points) is placed behind the child's back, then he/she is totally unrestrained, it means that he/she is just seating on it, without being restrained by the belt.

Regarding this aspect of the CRS, it was observed that 89.1 % of children did not have the belt in the back while 4.3% did.

Table 29

Seat belt in back

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Yes	9	4.3	4.3	4.3
	No	188	89.1	89.5	93.8
	Cannot be seen/ Not applicable	13	6.2	6.2	100.0
	Total	210	99.5	100.0	
System missing values		1	.5		
Total		211	100.0		

VI. 6. iv. Twisted seat belt

Among children wearing a CRS, 59.2% had the seat belt twisted, while 35.1% did not have the seat belt twisted.

Table 30

Twisted belt

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	No	74	35.1	35.1	35.1
	Yes	125	59.2	59.2	94.3
	Cannot be seen/ Not applicable	12	5.7	5.7	100.0
	Total	211	100.0	100.0	

VI. 6. v. Slack in seat belt to restrain CRS

Seat belt slack in CRS represents 65.9% of the total. The remaining 23.3% did have the seat belt well adjusted to the CRS. Besides, it is worth mentioning that none of the seats observed were tightly adjusted to the vehicle's seat. In case of crash or deceleration these mistakes allow the seat to move inside the vehicle hitting the vehicle's interior.

Table 31

Slack in seat belt to restrain CRS

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	No	49	23.2	23.2	23.2
	Yes	139	65.9	65.9	89.1
	Cannot be seen/ Not applicable	23	10.9	10.9	100.0
	Total	211	100.0	100.0	

VI. 6. vi. Seat belt under the arms

The 79.9% of children traveling in a CRS did not have the seat belt under any of their arms, while more than one every ten of the children observed (11%) did travel with the seat belt under one or both arms. In case of an accident this type of misuse may produce fracture of ribs and possible perforation of vital organs.

Table 32

Seat belt under the arms

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Yes	23	10.9	11.0	11.0
	No	167	79.1	79.9	90.9
	Cannot be seen/ Not applicable	19	9.0	9.1	100.0
	Total	209	99.1	100.0	
System missing values		2	.9		
Total		211	100.0		

VI. 7. CRS use regarding children

VI. 7. i. CRS on the wrong direction

When referring to the CRS direction, the direction to which it faces when installed, rear or forward facing, it is observed that 79.9% of children traveling in a CRS where doing so in the correct position. On the other hand, 16.1% of children in a CRS were transported incorrectly.

In case of a frontal crash, an incorrectly positioned CRS exposes young children to suffer severe head and cervical injuries. In fact, in the case of young children less than a crash is enough to hurt them, just a sudden deceleration may cause injuries.

Table 33

CRS on the wrong direction

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	No	167	79.1	79.1	79.1
	Yes	34	16.1	16.1	95.3
	Cannot be seen/ Not applicable	10	4.7	4.7	100.0
	Total	211	100.0	100.0	

VI. 7. ii. Slack in harness

Regarding the CRS harness, it was observed that 66.8% of them were not tightly adjusted which means that nearly seven out of ten children in a CRS were traveling with loose harnesses; therefore there was a 20.9% of children traveling with adjusted harnesses.

Due to the child's body shape, smaller shoulders compared to the rest of the body and a round trunk, if the harness is not well adjusted, in case of a crash, the child could easily slip off the straps remaining unrestrained in the vehicle.

Table 34

Slack in harness

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	No	44	20.9	20.9	20.9
	Yes	141	66.8	66.8	87.7
	Cannot be seen/ Not applicable	26	12.3	12.3	100.0
	Total	211	100.0	100.0	

VI.7. iii. Wrong harness height level

47.1% of children studied had the harness positioned at the right shoulders' height level while 40% did not have the correct harness height level.

Table 35

Wrong harness height level

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Yes	84	39.8	40.0	40.0
	No	99	46.9	47.1	87.1
	Cannot be seen/ Not applicable	27	12.8	12.9	100.0
	Total	210	99.5	100.0	
System missing values		1	.5		
Total		211	100.0		

VI.7. iv. Harness behind child's back

From surveyed children, 81.8% were transported without harnesses behind their backs while 6.7% did have the harnesses behind their backs; this means that their trunk or body was completely unrestrained.

Table 36

Harness in the back

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Yes	14	6.6	6.7	6.7
	No	171	81.0	81.8	88.5
	Cannot be seen/ Not applicable	24	11.4	11.5	100.0
	Total	209	99.1	100.0	
System missing values		2	.9		
Total			100.0		

VI.7. v. Harness adjustment too low

Half the children in a CRS (51.7%) were traveling with the right harness tightening height while more than one third of the children (36.5%) were transported with a very low harness which means that they had the harness chest buckle below armpit level. Having the harness chest buckle below armpit level implies that the chest buckle does not keep the chest straps together and in case of a crash the child could slip off the straps being completely unrestrained inside the vehicle.

Table 37

Harness adjustment too low

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	No	109	51.7	51.7	51.7
	Yes	77	36.5	36.5	88.2
	Cannot be seen Not applicable	25	11.8	11.8	100.0
	Total	211	100.0	100.0	

VI.7. vi. Harness under arm

81.3% of children traveling in a CRS were correctly wearing the harness; 7.2% were traveling with harnesses under their arm/s.

Children traveling with harnesses under the arm/s could result in broken ribs and injury to organs. It can also happen that he child remains unrestrained (slipping off of the harness' low section) being exposed to severe injuries.

Table 38

Harness under the arm

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Yes	15	7.1	7.2	7.2
	No	170	80.6	81.3	88.5
	Cannot be seen/ Not applicable	24	11.4	11.5	100.0
	Total	209	99.1	100.0	
System missing values		2	.9		
Total			100.0		

VI. 8. *Use of CRS user's manual*

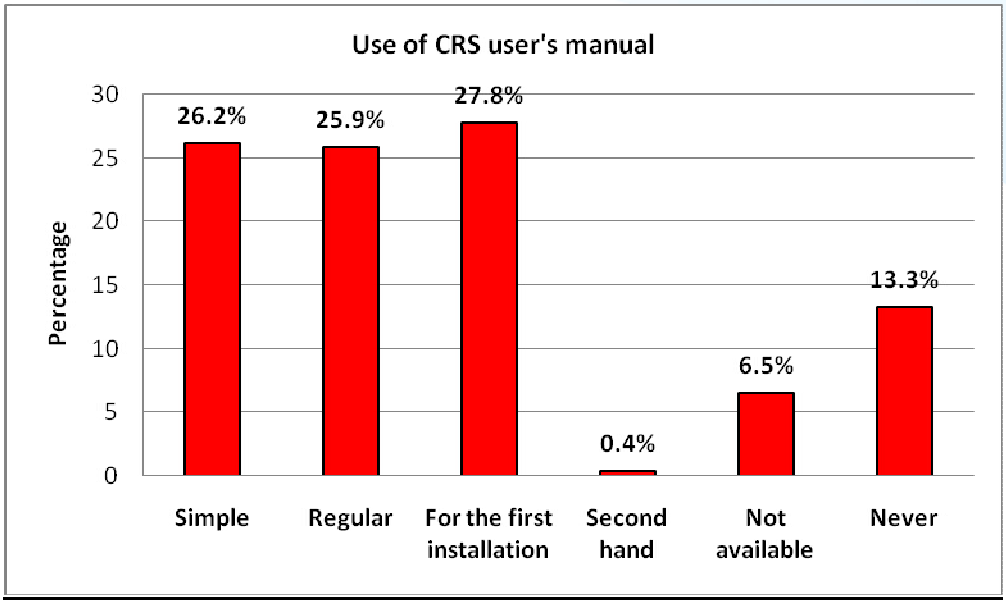
Regarding CRS user's manual, 26.2% of the CRSs were installed following instructions in the manual, which means, without reading it in detail. Likewise, 25.9% of CRS installed were regularly checked with the manual. At the same time, 27.8% of the installed seats were installed with the manual's help only for the first time (first installation) while 0.4% of the CRS did not have a manual available because they were second hand and 6.5% of the CRS did not have a manual available. Lastly, 13.3% of installed CRS did not follow the manual's instructions since their users never used them and following instead, pictograms and graphic indications.

Table 39

Use of CRS user's manual

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Simple	69	25.7	26.2	26.2
	Regularly	68	25.4	25.9	52.1
	For the first installation	73	27.2	27.8	79.8
	Second hand	1	.4	.4	80.2
	Not available	17	6.3	6.5	86.7
	Never	35	13.1	13.3	100.0
	Total	263	98.1	100.0	
System missing values		5	1.9		
Total		268	100.0		

Graph 13


Use of CRS user's manual
Percentage
30
25
20
15
10
5
0
26.2%
25.9%
27.8%
0.4%
6.5%
13.3%
Simple
Regular
For the first installation
Second hand
Not available
Never

VI. 9. Provenance of CRS

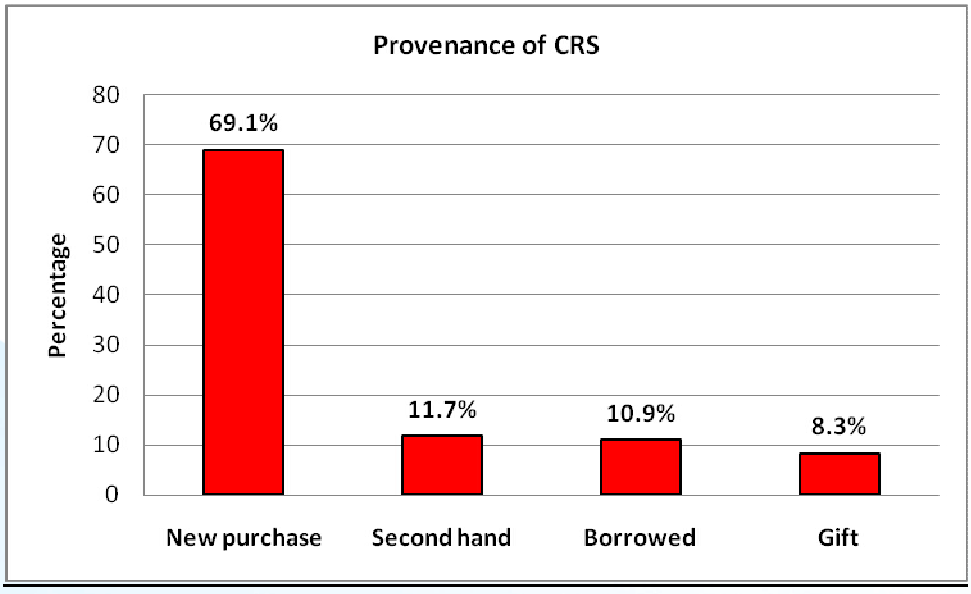
Regarding CRS provenance, 69.1% of CRSs were new while similar percentages correspond to used and borrowed CRSs; 11.7 and 10.9% respectively. 8.3% of CRS were given as a present to users.

Table 40

Provenance of CRS

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	New purchase	183	68.3	69.1	69.1
	Second hand	31	11.6	11.7	80.8
	Borrowed	29	10.8	10.9	91.7
	Gift	22	8.2	8.3	100.0
	Total	265	98.9	100.0	
System missing values		3	1.1		
Total		268	100.0		

Graph 14



VI. 10. Place of purchase of CRS

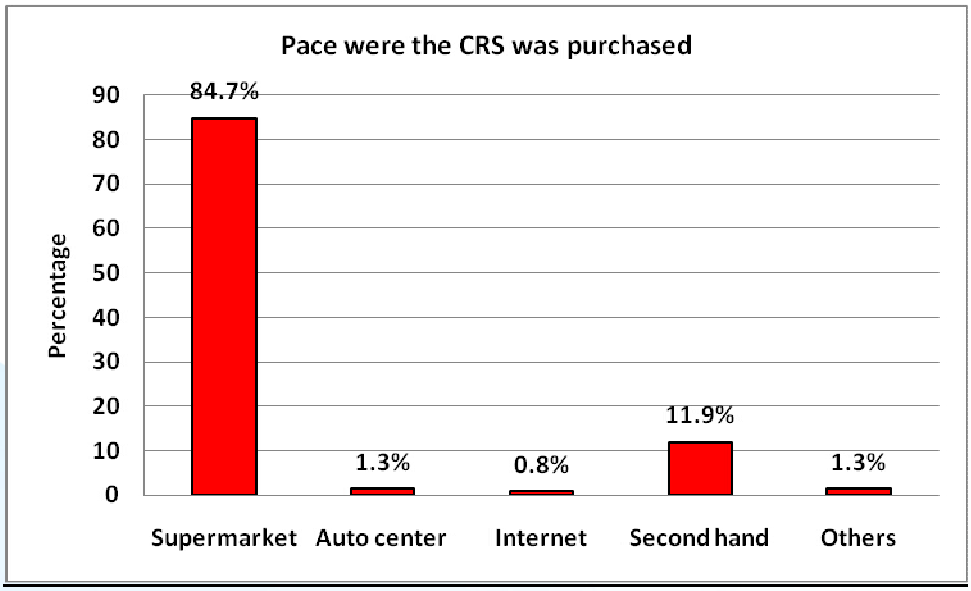
84.7% of CRS were bought in supermarkets (or baby shops). Fewer CRSs were purchased in car shops (spare-parts shops), through internet or other places; 1.3%, 0.8% and 1.3% respectively. At the same time, 11.9% of CRS were second hand.

Table 41

Place where the CRS was purchased

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Supermarket	200	74.6	84.7	84.7
	Auto center	3	1.1	1.3	86.0
	Internet	2	.7	.8	86.9
	Second hand	28	10.4	11.9	98.7
	Others	3	1.1	1.3	100.0
	Total	236	88.1	100.0	
System missing values		32	11.9		
Total		268	100.0		

Graph 15



VI.11. CRS selection criteria

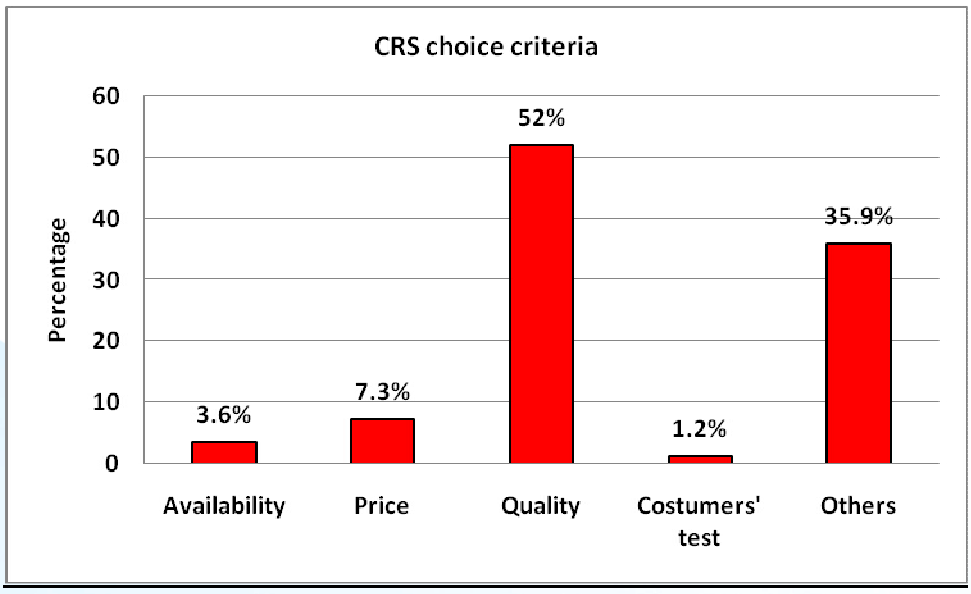
Regarding criteria for CRS selection, half of CRS (52%) were selected from the product's quality criteria or quality perceived by the buyer. Other criteria were the base for the selection for 35.9% of the CRS (In this category we find those CRS given as a present or second hand). Minor percentages of CRS were selected according to availability at the moment of buying them (3.6%) and chosen from consumers' test (1.2%), at the same time 7.3% of child restraint systems were selected according to price.

Table 42

CRS selection criteria

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Availability	9	3.4	3.6	3.6
	Price	18	6.7	7.3	10.9
	Quality	129	48.1	52.0	62.9
	Consumers' test	3	1.1	1.2	64.1
	Others	89	33.2	35.9	100.0
	Total	248	92.5	100.0	
System missing values		20	7.5		
Total		268	100.0		

Graph 16



VI.12. Advice at CRS selling points

Table 43 shows that 32.4% of CRS were bought without any piece of advice from retailer. A similar percentage, 31.5%, did not find any kind of advice available. There were some users who bought the seat but did not consider advice necessary or did not get any kind of help at the selling point.

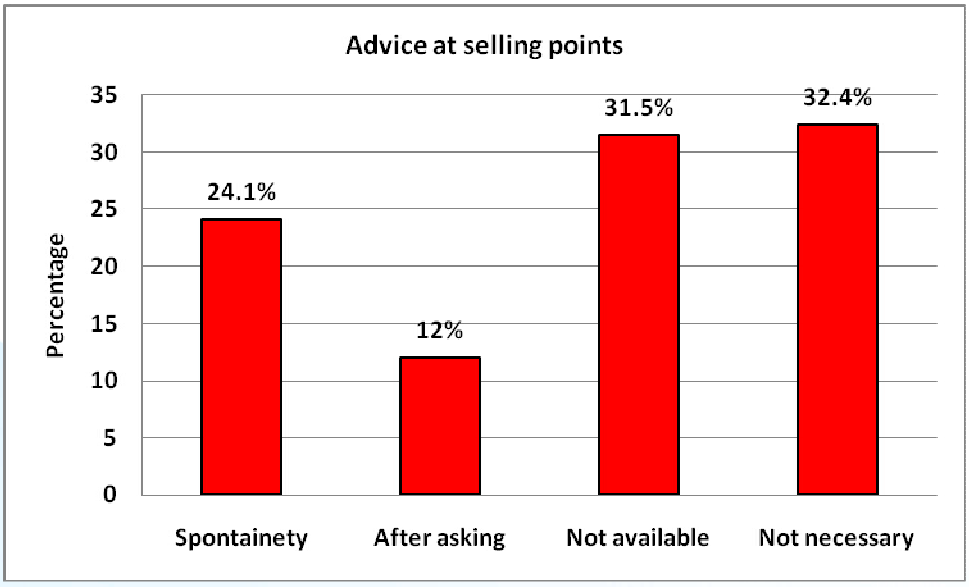
On the other hand, 24.1% of customers who bought a CRS got advice in a spontaneous way. In the same way, 12% of costumers got help after asking for it.

Table 43

Advice at selling points

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Spontaneity	58	21.6	24.1	24.1
	After asking	29	10.8	12.0	36.1
	Not available	76	28.4	31.5	67.6
	Not necessary	78	29.1	32.4	100.0
	Total	241	89.9	100.0	
System missing values		27	10.1		
Total		268	100.0		

Graph 17



VI. 13. Knowledge of and use of ISOFIX and LATCH systems for CRS installation

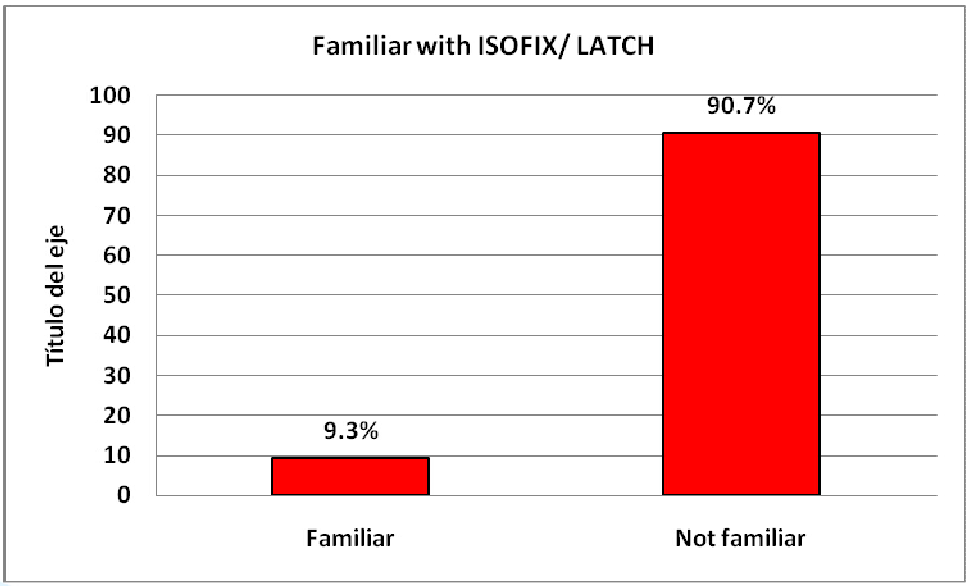
Regarding ISOFIX or LATCH systems, nine out of ten drivers interviewed (90.7%) declared to have no knowledge of these CRS installation systems while only 9.3% expressed knowing them.

Table 44

Familiar with ISOFIX LATCH

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Familiar	23	9.3	9.3	9.3
	Not familiar	224	90.7	90.7	100.0
	Total	247	100.0	100.0	

Graph 18



At the same time, as shown in Table 45, from those drivers who declared to know the ISOFIX and LATCH systems (23 people), most of them (21, 91.3%) declared not to use them. Only 8.7% of the drivers (2 people) declared to use them.

Table 45

Familiar with ISOFIX LATCH* Do you use ISOFIX/LATCH? Crosstabulation

		Do you use ISOFIX/ LATCH?		
		Does not use it	Uses it	Total
Familiar with ISOFIX/ LATCH	Recount	21	2	23
	%of those who know ISOFIX/ LATCH	91.3%	8.7%	100.0%

VI. 14. Awareness of airbag risks

In relation to potential airbag risks, 57.1% of the total interviewed drivers stated they were aware of it while 2.8% declared to have some knowledge. In the same way, 40.1% said they did not have any kind of knowledge about risks of CRS used with said system.

Table 46

Are you aware of Airbag risks?

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Not aware	99	40.1	40.1	40.1
	Partially aware	7	2.8	2.8	42.9
	Aware	141	57.1	57.1	100.0
	Total	247	100.0	100.0	

If we only consider the subpopulation that has frontal airbag, it can be seen that the percentage of drivers aware of its risks is 85.2% while those who partially know about it represent only 1.9% and those who know nothing about it represent 13%.

Table 47

Frontal Airbag contingency table* Are you aware of Airbag risks?

		Are you aware of Airbag risks?			
		Not aware	Partially aware	Aware	Total
Does have a frontal Airbag	Recount	7	1	46	54
	%	13.0%	1.9%	85.2%	100.0%

VI. 15. Knowledge of the safety context of the child as a vehicle occupant and use of child restraint systems

VI. 15. i. Knowledge of safety context of the child as a vehicle occupant

93.5% of the drivers expressed they were aware of the context in which a child must travel in order to do it safely, while 2.9% stated to have a partial knowledge. On the other hand, 3.7% declared not to know the way in which children must travel safely in a vehicle.

Table 48

Awareness of child safety

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Aware	229	92.7	93.5	93.5
	Partially aware	7	2.8	2.9	96.3
	Not aware	9	3.6	3.7	100.0
	Total	245	99.2	100.0	
System missing values		2	.8		
Total		247	100.0		

VI. 15. ii. Knowledge of legislation in force in Uruguay in relation to CRS

When referring to the knowledge of legislation in force in Uruguay in relation to CRS, Table 49 shows that 55.9% of drivers expressed not to know any kind of legislation in that respect, while 40% declared to have some knowledge about it, and 4.1% stated they only had a partial knowledge.

It is important to highlight that by the time the study was carried out and this report elaborated; there was no legislation in Uruguay of any kind to regulate child restraint systems use in vehicles.

Table 49

Knowledge of ongoing legislation

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Does know	98	39.7	40.0	40.0
	Partially knows	10	4.0	4.1	44.1
	Does not know	137	55.5	55.9	100.0
	Total	245	99.2	100.0	
System missing values		2	.8		
Total			100.0		

VI. 15. iii. Knowledge of CRS' proper or improper use before the interview

As indicated in Table 50, 82.4% of those interviewed declared to know about proper or improper CRS use. 2.6% of drivers stated they had a partial knowledge about it and 15% said they did not have any kind of knowledge about the proper or improper use of CRS.

Table 50

Consciousness of good use/misuse of CRS use before the interview

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Does know	192	77.7	82.4	82.4
	Partially knows	6	2.4	2.6	85.0
	Does not knows	35	14.2	15.0	100.0
	Total	233	94.3	100.0	
System missing values		14	5.7		
Total			100.0		

VI. 15. iv. Knowledge of the effects of CRS misuse.

Referring to knowledge of CRS improper use effects, 79% said they had knowledge about it and 3.4% expressed to have partial knowledge about the topic. In addition, 17.6% declared not to know about the possible effects of improperly using the CRS.

Table 51

Knowledge of effects of CRS misuse

		Frequency	Percentage	Valid percentage	Accumulated percentage
Valid	Does know	184	74.5	79.0	79.0
	Partially knows	8	3.2	3.4	82.4
	Does not know	41	16.6	17.6	100.0
	Total	233	94.3	100.0	
System missing values		14	5.7		
Total			100.0		

VII. CONCLUSIONS

One of the first aspects that needs to be highlighted in this research is the small number of CRSs; from 13,658 vehicles observed in the first stage of the study and in different parts of the city, only 1.82% (249) traveled with children and CRS at the same time. This concentrated observations on one of the possible places in order to minimize demand of resources and time.

Considering that every inspected vehicle had at least one CRS system, it has to be pointed out that a considerable percentage of children were traveling without using any kind of child seat. In this sense, one third of inspected children (28.1%) were not traveling in a CRS. These numbers are much larger in the case of older children.

This means that almost six out of ten children between 5 and 6 years old (59.3%) were not traveling in a CRS, while none of those aged between 7 and 14 years old were traveling in a CRS. If we consider the ample scientific evidence suggesting that all those under 1.50 mts. (mainly, but not exclusively, children, since adults and teenagers can also be below this line) should travel restrained by some kind of system, 99.3% of children studied should have been traveling in a CRS.

The above mentioned is enough evidence to show the main actors' lack of awareness related to traffic. However, nine out of ten drivers surveyed (93.5%) – most of the cases parents of child users of CRS in their vehicles-, stated they were aware of child safety elements in the vehicle, that is to say, knowledge of how children should travel safely. On the other hand, at least seven out of ten children traveling in a CRS at the moment of the survey were doing so with at least one checked misuse of CRS.

In the same way, 68.2% of child seats did not show any compliance with corresponding technical standards, or it was impossible to verify they did so. Besides, 44.1% of drivers answered they were aware of the existence of ongoing regulations over the use of CRS in Uruguay, when in fact, said regulations are currently inexistent.

Regarding CRS installation elements, 90.7% of drivers stated they had no knowledge of ISOFIX/LATCH systems to help installing CRS, information that goes hand in hand with the evidence that there were no children in the whole sample using said systems.

In reference to how the observed CRS were obtained, approximately one out of ten was borrowed. In the same way, the great majority (84.7%) of the CRS had been bought brand new, at supermarkets or baby stores, (69.1%) and in most cases (52%) they were selected according to the product's quality.

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IX. GLOSSARY

Top Tether: An anchor point in the vehicle to which the CRS is secured, used as a frontal anti-rotation device. It dramatically improves protection performance of CRS in the event of a crash, even when incorrectly attached or installed.

Booster: A firm seating platform used with a lap-shoulder belt that raises the child relative to the safety belt system to improve lap-shoulder belt fit. Booster seats improve belts fit and crash protection in several ways. That improves belt fit in order to avoid injuries. Seat belts and other safety systems are designed for occupants of at least 1.40 tall.

2-point seat belt: Seat belt with 2 anchorage points secured to the vehicle's structure. It only restrains the occupant's pelvis.

3-point seat belt: Seat belt with 3 anchorage points secured to the vehicle's structure. It restrains the occupant's pelvis and trunk. One of its sections is held flat across the passenger's shoulders, and across the pelvis.

Technical Standard: Document that establishes requirements to be met by a device or element to maximize possibilities of best performance under specific circumstances. In the case of seat belts, a Technical Standard indicates that a seat belt shows high probabilities (within specific safety levels) of keeping the occupant safe. The standard contains test protocols to be used and a minimum expected result for the element to be accepted.

CRS: Child Restraint System. Devices designed to safely restrain children to the vehicle, aiming at reducing injuries. The seat belt is not a CRS; examples of CRS are child seats, boosters and related systems.

X. METHODOLOGICAL ANNEXE

SAMPLING OPERATIONS - 5 PHASES

This subsection is based on concepts by Särndal, Swensson y Wretman ([8]) in Chapter I of the publication. It is not our intention to go into detail in the numbering carried out by the authors; this will only be a guide to highlight the most important aspects of the study.

1. Sample selection

- Target population, Sampling frame and Sampling unit

Target population or universe: The CRSs and users of Child Restraint System (CRS) in the department of Montevideo.

Sampling frame: 1st Phase: list of places where it is possible to find families with children aged 0 - 14 years old, based on information of events taken place in nearby areas; *2nd phase:* places where counting of vehicles with observed CRS is carried out; a sample is taken (with a probability proportional to size, measured through the percentage of observed private cars with children and installed CRS during phase one), and studying variables of interest.

Units of analysis: child restraint systems, vehicles and occupants (driver and CRS user(s)).

Units of sampling: 1st Phase: list of places mentioned above; 2nd Phase: circulating vehicles with at least one CRS installed and with occupants willing to take part in the survey.

Units of observation: Vehicles with at least one child restraint system (CRS), with or without passengers, the CRSs and their occupants, and drivers of these vehicles.

Cut-off sampling: it is a sampling procedure carried out when a part of the target population is excluded. The reasons for that exclusion may be: i) the difference between, the cost-benefit relationship of constructing and maintaining a sampling framework, and the accuracy obtained that does not make it justifiable; ii) the bias obtained in estimators is very little. This generally happens with populations whose $y_1,\ldots,y_N$ values are too concentrated on the left (assuming $y_k > 0$). Having a sampling framework with under coverage problems, unintentionally leads to this type of sampling. As a matter of fact, the sample for this study had to be adjusted, since the main stores in the city did not accept EDU-CAR's request of collecting information on percentages of CRS observed in their parking lots and surrounding areas during the first phase of the study. As a result, these places were not part of the framework's elements for the second phase of the sampling.

Modifications to original sampling plan: in the first place and taking into account experiences carried out in other countries ([1], [4], [5], [7]), it is important to know that some subpopulations tend to be not so well perceived by researchers during field work; particularly children younger than 1 year old.

To minimize this issue, other studies focused their attention on children leaving pediatricians' offices ([2], [7]) or even those leaving hospital after birth ([4]), but since hospitals are widely spread around the city (and in the whole country), this solution was not taken into account for organizational and financial reasons.

On the other hand, educational centers represented another possible place of study, basically considering the older children and the pre-adolescent population, but since the investigation started just before the beginning of school year – and taking into account the future replication of the study- it was hardly possible to include these places as clusters in the first phase, therefore, were finally dismissed.

- Sampling design $p(s)$ and inclusion probabilities, π_k

This is a non-probabilistic two-phase design. The first phase included a simple random sample design of the places previously mentioned, and used a list frame with these places. In

the second phase a sample size $n_i = 1$ was obtained, with a probability proportional to size, measured through those private vehicles observed with at least one CRS and also, through a list frame with complementary information.

- First phase π_{ak} =0,6 $\forall k \epsilon s_a$
- Second phase: $\pi_{9|s_a}$ =0,232 for the item selected

- Size of sample (n)

For a reasonable sample size the minimum number of observations was set in 200 vehicles with at least one CRS, taking into account the number of hours and work days.

- Variables of interest

- Data on vehicles: year, make and model, number of doors, type of vehicle
- Data on used CRS used: type, configuration, position in the vehicle
- Correct use according to height and weight for each child using it
- Observations on CRS misuse
- Observations on seat belt misuse
- Sources of information of CRS.
- Place of purchase of CRS being used in the vehicle at the moment of the survey9
- CRS selection criteria
- Probable reasons for CRS misuse

- Estimators

Generally speaking, qualitative variable proportion estimators were used:

$$\widehat{p_{t,j}} = \frac{\sum_{k=1}^{n} w_k 1_{\{y_{ik}=j\}}}{\sum_{j=1}^{J} \sum_{k=1}^{n} w_k 1_{\{y_{ik}=j\}}}$$

being $1_{\{y_{ik}=j\}} = \begin{cases} 1, & si\ y_{ik}\ toma\ el\ valor\ j \\ 0, & en\ otro\ caso \end{cases}$

$i = 1, \dots, I$ variables, $j = 1, \dots, J$ categories and $k = 1, \dots, n$ individuals taken from sample.

Results and conclusions are based on these sample proportions.

2. Data collection

- Measurement plan: plan where the way in which to collect data is determined. In this study, sample elements were observed and information about them collected using a form designed by EDU-CAR. Questions and their order were based on the questionnaire used by Herve *et al.* to detect the main ways of CRS misuse, taking into account all age groups ([3]).

3. Data processing

- Pre-processing

  Once field work activities were done, forms were double-checked.

- Data codification and entry

  Before carrying out the field work, existing codification was used for those variables related to the vehicle; these were taken from the study on passive safety elements in private cars, also carried out by EDU-CAR.
  Once entry mistakes were corrected, forms were scanned, later revised and data was manually entered because of the large number of detected mistakes when checking the data.

4. Estimation and analysis

- Calculation of sample estimates

Because of the number of vehicles observed during field work, expanded percentages were used. Percentages are expanded for studied vehicles to represent the total number of vehicles that went by that point.

Adjustment factor was $f_k = 3{,}9776$, and final weight $w_k = w_{ak} \times w_{k|sa} \times f_k = 28{,}575$

5. Publication of results and evaluation

- General statement of the conditions under which this survey was carried out.

This study was conducted with a non-representative sample in reference to days of the week. For different reasons, the weekend was selected as the best moment to carry out the survey:

- It was the best option when trying to minimize eventual stressful situations with drivers and occupants;
- Safe speed and flow of vehicles to work with;
- More probability of finding (and surveying) families with little children.

Of course that by selecting only one place for the study, we define a non-measurable design, since $\pi_{kl} = 0$, it is not possible to calculate from the sample, unbiased or nearly unbiased estimators of the estimator's variance.

It is important to mention that due to its intense flow of vehicles, heterogeneity of vehicles found and the proportion of private vehicles with detected CRS (based on the first phase), this was probably the "best situation" to work in.

According to data obtained in the first phase of the study, approximately 11.7% of vehicles analyzed in the first phase, traveling with children, had at least one CRS, data similar to the one obtained in an Observational Study[2], also carried out by EDU-CAR, which allowed us to know that 9.5% of children studied aged 0 - 14 years old were traveling in a CRS. It is important to bear in mind that this last study was carried out during three working days, in May, 2008.

Children aged between 1 – 14 years old were under-represented. However, and according to data from other countries with regulation in force related to this topic, these Uruguayan children hardly ever travel in CRS. The Observational Study also shows that the percentage of children aged 5 -14 years old - age group a little bit wider that the one consider for this study - traveling in CRS is very small (hardly above 1%).

- Recommendations

To ensure representation of the whole population, it is necessary to have better data collection and design methods. Possible solution: to use conventional designs together with techniques used for populations that are either too difficult to detect or too small to detect; adaptive sampling designs ([9]), capture–recapture methods ([9]), network sampling ([9]), etc. All these have long been used in biology and environmental sciences, among others.

There is another way of obtaining better results from the sampling point of view, a better level of auxiliary information available for third parties. There are adaptive ([9]), capture–recapture methods ([9]), network sampling ([9]), etc. There are other measures at international level, for instance the case of Vehicle Kilometers Traveled (VKT), that are still not of public domain in Uruguay, specially for those entities that carry out studies on mobility and related issues, such as kind of trips or frequency of travel of children aged 0 -14 years old (for example a origin-destiny matrix)([10]).

[2] *"Observational Study on the Use of Safety Elements in Vehicles in Montevideo, Salto, and Paysandú"*. Gonzalo Rodríguez Memorial Foundation, 2008.

We consider it important to carry out surveys that take into account data that represent the active vehicle fleet, such as level of activity, measured in VKT. This can be implemented in Uruguay through small modifications to the questionnaire carried out in the last National Survey on Household Income and Expenditure (ENGIH 2005-2006) ([6]).

XI. METHODOLOGICAL GLOSSARY

Aleatory: Term that comes from *alea*, which in Latin means *chance*, *uncertainty*.

- **Aleatory variable:** A function that assigns a value to each of the results of an aleatory experiment.

Quartile or Percentile: *Observation whose absolute accumulated frequency reaches the k% of observations of the sample. Special cases are percentile 50, also known as median, and the first and third quartile or percentiles 25 and 75 that define the Box Plot and its corresponding interquartile range.*

- **Box Plot:** Graph used in descriptive statistics to visually determine value dispersion of a sample. Besides, non-typical values are detected more easily using these graphs.

- **Interquartile Range (RI):** difference between the third and first quartile, (Q_3) - (Q_1), that is, they determine the central data of the variable studied:

Sampling design: Function that symbolizes selection probability of a sample s from a population U.
$P\{S = s\} = p(s)$, being S an aleatory variable.

Estimator: $\hat{\theta} = \hat{\theta}(y_1, y_2, \ldots, y_n)$ function of the sample that will be used to estimate a parameter of interest, θ, unknown to the researcher. We call this estimator non-biased if its average value or expected value coincides with the real value of the parameter $E(\hat{\theta}) = \theta$

Function: in Mathematics, the concept of function is used to describe relation between a given set of elements that may present different forms. To facilitate analysis, a function called *factor* is established, it

associates a set of labels to numbers. As an example, if our set A represents types of seat belts in each position of private vehicles,

$A = \{No\ tiene\ cinturón, 2\ puntas, 3\ puntas\}$

and B is a numerical set with only three consecutive numbers,

$B = \{1,2,3\}$

establishing the following association rules:

i) For each element in A there is an associated element in B

ii) there are no elements in A with more than one associated element

the following relationship between sets can be defined and, at the same time, facilitate calculations to the software used for the analysis and interpretation by the user of the results obtained:

Has no belt ↔ "1"

2 points ↔ "2"

3 points ↔ "3"

Inference: branch of Statistics that includes methods and procedures to draw conclusions about a population, based on a subpopulation, called *sample*.

- **Infererence based on sampling design:** When model's randomness is introduced by the researcher through selection method of the sample.
- **Inference based on model:** Firstly, a superpopulation model is defined to "model" the target population, U, in a specific way, so that, secondly the extracted sample, s, is observed. This model shall be the base for conclusions calculated for U.

- **Model-assisted inference:** A superpopulation model is used to build estimators, but the inference is based on the design. It represents a solution halfway between both forms of inference mentioned before

Parameter: parameter *is a* population characteristic. For example, the average age of a specific group of people, the percentage of vehicles older than 20 years old, etc. It is symbolized by .

Target population: Group of elements of which information is needed, delimitation criteria is established (spatial, temporal, etc.) according to the object of study.

- **Units of analysis:** Units of analysis correspond to the entity representative of what is going to be the specific object of study in a measurement, and refers to the object of interest of a research.

- **Units of sampling:** Unit of sampling corresponds to the basic entity that will allow access to the unit of analysis. In some cases, they correspond to each other.

- **Units of observation:** Element or group of elements of which information is gathered. Units of analysis and units of observation may or may not coincide.

Seating position: Arrows show vehicle direction considered for this study, positions were determined according to principles determined by Decina and Lococo in their observational study on prevalence of passive safety elements use in vehicles ([3]).

Position 3	Position 6	Position 9
Position 2	Position 5	Position 8
Position 1	Position 4	Position 7

Inclusion probability: the probability that an element of the population studied, $U = \{1, \dots k, \dots N\}$ belongs to the selected sample, s. Those most frequently used for parameter estimation are:

- First-order Inclusion probability: $P\{k \in s\} = P\{I_k = 1\} = \pi_k$
- Second-order inclusion probability: $P\{k \& l \in s\} = P\{I_k \times I_l = 1\} = \pi_{kl}$

being: $I_k = \begin{cases} 1, si\ k \in s \\ 0, en\ otro\ caso \end{cases}$

Outliers: specific observation that, numerically speaking "moves away" from the rest of data. Considering the interquartile range as a reference, there are two types of outliers:

- Mild outlier: the one for which $< Q_1 - 1.5 \times RI$ ó $> Q_3 + 1.5 \times RI$
- Extreme outlier: the one for which $< Q_1 - 3 \times RI$ ó $> Q_3 + 3 \times RI$