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RESEARCH ARTICLE

LEVEL OF ADHERENCE AND DETERMINANTS OF PRACTICING CHILD RESTRAINT SYSTEM IN THE VEHICLE AMONG GUARDIANS OF CHILDREN ATTENDING KINDERGARTEN SCHOOLS IN THE WESTERN SECTOR OF MAKKAH CITY, JANUARY 2020. A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Motor Vehicle Crash (MVC) is the second leading cause of morbidity and mortality in children. Therefore, it is essential to keep children protected in the car by practicing child passenger safety arrangements known as Child Restraint System (CRS). **Objectives:** To assess the level of adherence and determinants of practicing CRS in the vehicle among guardians of children. **Subjects and Methods:** Analytic cross-sectional study has been conducted among the guardians of children attending Kindergarten (KG) schools in the western sector of Makkah city, Saudi Arabia. A self-administered validated questionnaire was used for data collection. It consists of two sections: the first section concerned with socio-demographic data and general information about the participants, and the second section assessed the practice and the application of CRS. **Results:** The study included 342 guardians. The age of more than half of them (57%) ranged between 30 and 50 years and almost three-quarters (75.1%) of them were females. Always using the seat belt was mentioned by slightly more than half of the participants (52.4%). Almost half of the participants (49.4%) reported the current existence of the children's car seats. Adherence to the Child Restraint System (CRS) in the Vehicle was reported by almost half of the participants (50.9%). The highest rate of adherence to the CRS in the Vehicle was observed among participants aged between 20 and 29 years (63.8%) whereas the lowest rate was observed among those aged over 50 years (39.2%), $p=0.011$. Regarding the marital status, single participants had the highest rate of adherence to the CRS (60%) whereas divorced participants had the lowest rate (20.8%), $p=0.005$. Postgraduate participants had a higher rate of adherence to the CRS compared to university or below university graduated (65.6% versus 47.1% and 50%, respectively), $p=0.038$. Participants whose income exceeded 20000 SR/month were more adherent to the CRS (60%) than those with lower income, $p=0.046$. **Conclusion:** Adherence of guardians to CRS in the vehicle was insufficient, that is consistent with the inadequate level of adherence worldwide, and further reconsideration is needed for the safety of children in vehicles.

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INTRODUCTION

Motor Vehicle Crash (MVC) can cause massive casualties worldwide; its related injuries and deaths are becoming a global public health problem. While reducing MVC mortality was a significant public health achievement of the 20th century for the United States (US), more than 2 million people are injured, and 32,000 are killed each year from MVCs⁽¹⁾. MVC has become the second leading cause of morbidity and mortality in children, second only to infectious disease. As reported by the World Health Organization (WHO), MVCs accounted for more than 262,000 children

deaths, almost 30% of all injury deaths among children⁽²⁾. In Saudi Arabia, according to the Institute for Health Metrics and Evaluation, Motor Vehicle Crash (MVC) accounts for 7.6% of the total deaths reported in all age groups, with an estimated mortality rate of children younger than five years was 4.09 per 100,000⁽³⁾. It is essential to keep children protected in the car by practicing child passenger safety arrangements known as Child Restraint System (CRS), which includes a car seat, booster seat, and seat belt as appropriate. With correct practicing of CRS, the probability of death in an MVC decreased by approximately 74%, while the risk of serious injury can be reduced by 67%⁽⁴⁾. Due to the limitation of publication estimates, the practice of CRS in Saudi Arabia, and according to crash data reports, the adherence to CRS is expected to be infrequent. Children are different from adults, as they have weaker neck muscles carrying their relatively large heads to their bodies.

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While car seat belts provide the appropriate protection for adults, unfortunately, for children, they do not⁽⁵⁾. On the other hand, they might increase the risk of injury in the event of a crash or emergency braking. e.g., Booster seats can decrease the chance of injury by 59% when compared with seat belt use alone⁽⁴⁾. The protective impact of using CRS has been known for many people; however, the criteria of selection and installation remain unclear. A common misconception states that children between 3 to 8-year-olds are too old to use a booster seat⁽⁴⁾. According to the Center of Disease Control (CDC), it is necessary to buckle up children in a car seat, booster seat, or seat belt, whatever appropriate for their age, weight, and height as the following:

-) Rear-facing car seat: from birth until the age of 2-4 years. Installed in the back seat, and used until the upper limits of weight or height are achieved according to the seat's owner's manual⁽⁶⁾.
-) Forward-facing car seat: at the age of 4-5 years after outgrowing rear-facing seat. Also installed in the back seat, and used until the upper limits of weight or height are achieved according to the seat's owner's manual⁽⁶⁾.
-) Booster seat: After outgrowing forward-facing seat and till seat belts fit correctly⁽⁶⁾.
-) Seat Belt: when seat belts fit properly without a booster seat. Around 9-12 years. Seat belts fit properly when the shoulder belt lays across the chest (not the neck), and the lap belt lays across the upper thighs (not the abdomen)⁽⁶⁾.

It is essential not to seat children in the front seat opposite to an airbag. When possible, buckle the child in the middle of the back seat because it is the safest spot in the vehicle⁽⁶⁾.

Although in Saudi Arabia, the use of CRS is legally mandatory, there is no enforcement to warrant adherence. Furthermore, the implementation of a child transportation policy with age-appropriate height and weight specifications is urgent. Compliance with CRS can be enhanced through legislation and enforcement, in addition to increasing public awareness⁽³⁾.

Aim: The study aims to assess the level of adherence and determinants of practicing CRS in the vehicle among guardians of children attending KG schools in Makkah city western sector, therefore, to promote the adherence to prevent potential injuries in case of MVC.

Objectives

-) To estimate the level of adherence of practicing CRS in the vehicle among guardians of children attending KG schools in Makkah city western sector, January 2020.
-) To identify determinants of practicing CRS in the vehicle among guardians of children attending KG schools in Makkah city western sector, January 2020.

Literature Review: In Saudi Arabia, recent studies have been conducted to highlight the use of a car safety restraint system for children. One cross-sectional study conducted by AlSallum GA et al., to assess the knowledge, attitude, and practice of children car seats among guardians of children

aged seven years or younger, at Unaizah city, in Qassim region, carried out on public and private pediatric clinics, from May to June 2018. Of 350 respondents, aged 25-35 years, where 77.1% were females, 57.3% do not install CRS in the vehicle while only 57 participants reported consistent use of car seats every time the child rides in the vehicle⁽⁷⁾.

In another cross-sectional study conducted by Mohammed Alsanea et al., to evaluate the use of the CRS and patterns of child transportation in Riyadh, in 2018, with 385 participants, only 36.6% reported the availability of a child seat in their cars (95% CI: 31.8–41.7%) and only 52.2% of them, 74 participants, reported consistent use⁽³⁾. Approximately 30% of children younger than five years were restrained during car journeys while the most common pattern of child transportation was sitting on the front seat on the lap of an adult passenger (54.5%). Around 13.5% of participants driving with children were involved in MVC, and 63.5% of these children were unprotected by any CRS⁽³⁾. In addition, one prospective study conducted in Jeddah, among guardians of children seen during a routine well-baby clinic visit in 2000, by Jan MM et al., measuring Infant and child safety practices of guardians, including car safety system, showing that with 289 participants, 88% of mothers interviewed, and only 8% of the participants reported using a child car seat. Moreover, 10% of the participants reported that their children use car seat belts⁽⁸⁾.

Among Arabian Gulf countries, one cross-sectional survey aims to assess the knowledge, attitudes, and practice of CRS conducted in Kuwait, in 2013, by Raman SR et al., at five Kuwaiti university campuses, with guardians of children aged 18 years or younger, 552 responded, few guardians 36% were aware of using the appropriate child seats, but only 26% reported using one. Over 44% of guardians seated their children in the front seat, while 41.5% have seated their children in their lap while driving⁽⁹⁾.

In Asia, a similar cross-sectional survey aims to explore the knowledge, attitudes and practice regarding CRS carried out from April to May 2014, in Shenzhen, China, by Liu S et al., showed that out of 3,768 respondents who had at least one child aged 6 years or younger and owned a car, 1,047 (27.8%) had a CSR, and 864 (22.9%) were using this restraint system. The level of knowledge and a positive attitude about the car safety system is demonstrated to be higher among the participants who were male, had an advanced educational degree, higher income, and owned an expensive car, or had an older child. While the likelihood of CRS using was higher if respondents drove more frequently or for greater distances. Also, it depends on the age of the children ride in the car, as the age of children decreased, the frequency of using CRS increased ($P = .0274$). Respondents who owned CRS and those who are frequently using it had a higher level of knowledge and a positive attitude⁽¹⁰⁾. One more study designed to analyze influencing factors for CRS practice in Shanghai and Shenzhen, China, conducted by Deng X et al., of 7528 guardians' of children, aged 6 years or younger who owned private cars, 39.23% reported to install CRS in the vehicle and 17.14% reported consistent use of it⁽¹¹⁾. The guardians' higher level of education, good family income, younger age of children, and a higher level of awareness about the importance of children's safety were decisive factors for using CRS. On the other hand, the main reasons for not practicing CRS included children's refusal

(67.36%), short travel distance (53.79%), difficulty in installation of the car seat in the vehicle (53.10%), narrow car space (32.41%), and needless (25.75%)⁽¹¹⁾.

In Europe, the Belgian Road Safety Institute (BRSI) conducted its first roadside survey to estimate the prevalence of use and misuse of CRS and to identify predictors of misuse based on observations in real traffic conditions in Belgium. The survey carried out in September 2011 by Mathieu R et al., of 1461 children were observed, more than 50% of the children were not restrained correctly, and 10% were not restrained at all. 63%, 24%, and 75% of children at the age of 10 years, eight years, and younger, respectively, were correctly restrained in the vehicle. Many drivers were unaware of their incorrect practices in installing and using the CRS, or they have underestimated the risk. Some reasons that justify their misuse include low attention to safety measures, a child's refusal to be restrained, and problems with the CRS⁽¹²⁾.

In the US, a cross-sectional study purposed to evaluate the Situational Use of CRS in children aged 4-10 years from March to April 2017. The study conducted among parents and caregivers, aged 18 years and older, by McDonald CC, et al., of 409 respondents, those who reported most often using booster seats and car seat were 282 and 127, respectively, with lack of adherence in situations involving rental cars, driving to near places, narrow space in the vehicle or the child is in someone else's vehicle ($p < 0.05$)⁽¹³⁾. A further observational, cross-sectional study designed to assess child passenger safety practices between drivers transporting children 15 years and younger in Indiana from 2009-2015, conducted by O'Neil J et al., 4,876 drivers were questioned, and 7,725 children were observed in cars. Out of 1,115 infants and toddlers observed, infants <1 year, a rear-facing seat installation ranges from 84% to 91% while for toddlers aged 12-17 months, it ranges from 12-61%. Of the 1,653 vehicles observed, a car seat installed in a forward-facing was 27%-66%. Among children aged 4-7 years, booster seat use decreased from 72% to 65% during the study period. For children aged 12 years or younger, more than 85% of them were seated in a rear seat vehicle position, and 31% were observed in the front seat⁽¹⁴⁾.

METHODOLOGY

Study Design: An analytic cross-sectional study was done.

Study Area: The city of Makkah lies in the western region of Saudi Arabia. Its full name is Makkah Al-Mukarramah or the Holy City of Makkah; this unique name reflects its stature for all Muslims as it has Almasjid Alharam or called the Holy Mosque, which holds Al-Kaaba representing the Qibla. Education services in Saudi Arabia are classified into governmental, private, and foreign education, which is subdivided into general and special-needs education. Levels are distributed between early childhood education in preschool or KG stages and elementary, intermediate, and secondary stages. The education department in Makkah city is distributed among main offices incorporating the north, south, east, west and, central office as well as the office of private and foreign education. In the western sector of Makkah city, the total number of general education KG schools is found to be 37, wherein 29 of them are private, and 8 are governmental schools. The study included all these 37 private and governmental KG schools.

Study Population: The target population of this study implicates the guardians of children attending KG schools in the western sector of Makkah city during the study period.

Inclusion Criteria: Guardians including (father or mother), or any person who is legally responsible for the care of the child and who currently providing care to the child, involving guardians of all nationalities.

Sample Size: With one guardian for every child -as provided officially by the Ministry of Education statistical guide- the number of children attending private KG schools is 2093 (67.7%), whereas the number of children attending the governmental KG schools is 1000 (32.3%). With a total number of 3093 children attending governmental and private KG schools, the sample size is calculated using Raosoft statistical program with confidence interval 95%, a margin of error of 5%, and response distribution 50%, and determined to be 342. The sample size included 232 children from private KG schools (67.7%) and 110 children from governmental KG schools (32.3%) in proportion to the total number of the study population.

Sampling Technique: As KG schools are divided between two lists, private and governmental school lists, one school from each list was selected by simple random sampling using Random number Generator statistical calculator. Convenient sampling was applied at the selected schools to cover the vast number of children in the limited timeline provided. After that, if the sample size is not covered, the next school on the list was selected to cover the sample size.

Data Collection Tool: A self-administered questionnaire reviewed by two family medicine consultants for validation was used for data collection. It consists of two sections: First section concerned with socio-demographic data and general information about the participants who are filling the questionnaire (age, gender, nationality, marital status, and relation to the child, number of family members, educational level, occupation, income, number, and style of a family vehicle). The second section assessed the practice and the application of CRS. An electronic version of the questionnaire written in Arabic was distributed between all participants involved in the study. Responses of the participants to the questions regarding the proper restraining of the child in the car were assessed according to the CDC recommendations for the CRS selection and installing.

Data Collection Technique: The data was collected throughout four weeks. In the first week, the selected KG schools involved in the study were visited to communicate with the school administration to obtain children lists and their guardians' contact information, either for the mother, father, or the child's caregiver. Phone numbers provided by the school administration were contacted by a phone call to introduce the investigator, explain the aim and objectives of the study, as well as the study questionnaire, also, to obtain primary verbal consent and to clarify that any participant has the right to withdraw from the study at any time. For those participants who were interested in the study, they were contacted via text messages, including a link to the electronic questionnaire. Conclusive consents from the participants were obtained through the sentence (By answering questions of this questionnaire; you agree to participate in the study). At the beginning of the second week, if no response within

three days, the particular participants were contacted again by a phone call, and the school administration was involved as well to remind the participants to complete the questionnaire. At the end of the same week, and if the sample size was not covered, the next KG school on the list was involved. Thus, the earlier procedures were repeated during the next two weeks until the targeted number was achieved.

Variables:

Dependent variables

Level of adherence and practicing of CRS in the vehicle.

Independent variables

Guardian' age, gender, nationality, marital status, and relation to the child, number of family members, educational level, occupation, income, number and style of a family vehicle, children mostly travel accompanied whom in the vehicle.

Data Entry and Analysis: Data were entered into a personal computer and analyzed using the Statistical Package for Social Sciences (SPSS) software version 25.0. Descriptive statistics (e.g., number, percentage) and analytic statistics using the chi-square test were applied to test for the association and/or the difference between categorical variables. A p-value of less than 0.05 was considered statistically significant.

Pilot Study: A pilot study was conducted among 10% of the sample size (34 children) attending one of the KG schools at the central area of Makkah city with full application of the methodology and using the same questionnaire to assess the methods, feasibility, and duration. As feedback, the questionnaire was clear, no modifications were needed. Approximately 9 minutes were needed to complete the questionnaire.

Budget: A self-funded study was carried out.

RESULTS

Results: The study included 342 guardians. Figure 1 shows that almost two-thirds of them were recruited from private kindergartens (67.8%).

Socio-demographic and general information: Table 1 represents the socio-demographic and general information of the guardians who participated in the study. The age of more than half of them (57%) ranged between 30 and 50 years. Almost three-quarters (75.1%) of them were females. Saudi nationality represents 95% of them. The majority of them were married (77.5%). More than half of them (54.7%) were index child's mothers. Family size ranged between 1 and 3 among 71.3% of the participants. Nearly two-thirds (65.8%) were university graduates. Almost half of them (49.7%) were governmental employees whereas 29.8% were housewives/not working. The family income of 29.8% of them ranged between 10,000 and <15,000 SR/month and that of 22.5% of them ranged between 15,000 and 20,000 SR/month. About two-thirds of them (63.1%) had more than one family vehicle. Regarding the style of the family vehicle, Sedan ranked first (66.4%), followed by family vehicles with three rows of seats (63.2%).

Utilizing safety procedures for children in vehicles:

Always using the seat belt was mentioned by slightly more than half of the participants (52.4%) whereas never or rare use was mentioned by 10.5% of them. The often driver in case of presence of children in the car was mothers (72.2%) and fathers (62%). Almost half of the participants (49.4%) reported the current existence of the children's car seats. However, among them, always use was reported by 48.5% whereas never or rare use was reported by 7.7% of them. Table 2. Almost two-thirds of participants aged over 50 years (67.1%) compared to none of those aged below 20 years reported always using the seat belt, $p < 0.001$. Most males (78.8%) compared to only 43.6% of females reported always use of seat belt in cars, $p < 0.001$. Two-thirds of divorced and 55.5% of married participants compared to none of widowed and 35.6% of single persons reported always using the seat belt, $p = 0.006$. Most fathers (73.3%) compared to only 36.7% of brothers/sisters were always using the seat belt, $p = 0.002$. About two-thirds of retired participants (68.8%) compared to 20% of those working in business were always using the seat belt, $p = 0.001$. There was a significant steady increase in the rate of always using a seat belt with an increase in the income; being 45.2% with an income of <5000 SR/month and 66.7% with an income exceeded 20000 SR/month, $p = 0.008$. Having more than one care was significantly associated with a higher rate of always using a seat belt (56.5% versus 44.5%), $p = 0.030$. Other studied factors (the type of kindergarten, nationality, family size, and educational level) were not significantly associated with the frequency of using a seat belt in vehicles Table 3

Participants recruited from private kindergarten reported a higher rate of the existence of children car seats in vehicles compared to those recruited from governmental kindergarten (56.5% versus 34.5%), $p < 0.001$. Older participants (>50 years) were more likely to have children car seats in vehicles than younger persons. However, the difference was borderline insignificant, $p = 0.058$. Males were more likely to report the existence of children's car seats than females (60% versus 45.9%), $p = 0.024$. Almost two-thirds of divorced (62.5%) and 52.8% of married participants compared to 12.5% of widowed and 28.9% of single persons reported the existence of children car seats in vehicles, $p = 0.002$. Many persons not directly related to children such as private drivers (81.6%) compared to 20% of brothers/sisters reported the existence of children car seats in vehicles, $p < 0.001$. Participants with smaller family size (1-3 persons) were more likely to report the existence of children car seats in vehicles compared to those with higher family size (>7 persons) (54.9% versus 35.3%), $p = 0.006$. There was a significant steady increase in the rate of the existence of children car seats in vehicles with an increase in the income; being 32.3% with an income of <5000 SR/month and 62.7% with an income exceeded 20000 SR/month, $p = 0.026$. Other studied factors (nationality, educational level, occupation, and the number of cars) were not significantly associated with the existence of children's car seats in vehicles Table 4. Table 5 summarizes the reasons mentioned by participants for the non-existence of the children's car seats in their vehicles. Most trips are short not necessitating having a children car seat (65.3%), small car not accommodating children

Variables	Frequency	Percentage
Age in years		
<20	10	2.9
20-29	58	17.0
30-39	99	28.9
40-50	96	28.1
>50	79	23.1
Gender		
Male	85	24.9
Female	257	75.1
Nationality		
Saudi	325	95.0
Non-Saudi	17	5.0
Marital status		
Single	45	13.2
Married	265	77.5
Divorced	24	7.0
Widowed	8	2.3
Relation to the index child		
Father	60	17.5
Mother	187	54.7
Brother/sister	30	8.8
Grandmother/grandfather	38	11.1
Others	27	7.9
Family size		
1-3	244	71.3
4-7	81	23.7
>7	17	5.0
Educational level		
Below university	56	16.4
University	225	65.8
Postgraduate	61	17.8
Occupation		
Not working/housewife	102	29.8
Governmental job	170	49.7
Private job	27	7.9
Business	16	4.7
Retired	22	6.4
Others	5	1.5
Income (Saudi Riyals/month)		
<5000	31	9.1
5000-9999	57	16.7
10000-149999	102	29.8
150000-20000	77	22.5
>20000	75	21.9
Number of family vehicles		
Non	2	0.6
One	124	36.3
>one	216	63.1
Style of the family vehicle*		
Sedan (two rows of seats)	227	66.4
Family (three rows of seats)	216	63.2
Sports (one row of seats)	27	7.9

*Not mutually exclusive

Table 2. Utilizing different safety procedures for children in vehicles among the participants

Variables	Frequency	Percentage
Frequency of using a seat belt for children		
Never	12	3.5
Rare	24	7.0
Sometimes	41	12.0
Often	86	25.1
Always	179	52.4
Who is the often driver in case of the presence of children in the car?*		
Father	212	62.0
Mother	247	72.2
Private driver	48	14.0
Others	21	6.1
The current existence of the children car seats		
Yes	169	49.4
No	173	50.6
If yes, the frequency of using children car seats (n=169)		
Never	5	3.0
Rare	8	4.7
Sometimes	16	9.5
Often	58	34.3
Always	82	48.5

*Not mutually exclusive

Table 3. Factors associated with the frequency of using a seat belt in vehicles among the participants

	Frequency of using a seat belt					p-value*
	Never N=12 N (%)	Rare N=24 N (%)	Sometimes N=41 N (%)	Often N=86 N (%)	Always N=179 N (%)	
Type of kindergarten						
Governmental (n=110)	5 (4.5)	7 (6.4)	19 (17.3)	25 (22.7)	54 (49.1)	0.280
Private (n=232)	7 (3.0)	17 (7.3)	22 (9.5)	61 (26.3)	125 (53.9)	
Age in years						
<20 (n=10)	0 (0.0)	2 (20.0)	4 (40.0)	4 (40.0)	0 (0.0)	<0.001
20-29 (n=58)	5 (8.6)	10 (17.2)	6 (10.3)	10 (17.2)	27 (46.6)	
30-39 (n=99)	4 (4.0)	5 (5.1)	11 (11.1)	27 (27.3)	52 (52.5)	
40-50 (n=96)	2 (2.1)	5 (5.2)	15 (15.6)	27 (28.1)	47 (49.0)	
>50 (n=79)	1 (1.3)	2 (2.5)	5 (6.3)	18 (22.8)	53 (67.1)	
Gender						
Male (n=85)	0 (0.0)	0 (0.0)	1 (1.2)	17 (20.0)	67 (78.8)	<0.001
Female (n=257)	12 (4.7)	24 (9.3)	40 (15.6)	69 (26.8)	112 (43.6)	
Nationality						
Saudi (n=325)	10 (3.1)	22 (6.8)	39 (12.0)	83 (25.2)	171 (52.6)	0.337
Non-Saudi (n=17)	2 (11.8)	2 (11.8)	2 (11.8)	3 (17.6)	8 (47.1)	
Marital status						
Single (n=45)	2 (4.4)	8 (17.8)	8 (17.8)	11 (24.4)	16 (35.6)	0.006
Married (n=265)	10 (3.8)	13 (4.9)	28 (10.6)	67 (25.3)	147 (55.5)	
Divorced (n=24)	0 (0.0)	2 (8.3)	2 (8.3)	4 (16.7)	16 (66.7)	
Widowed (n=8)	0 (0.0)	1 (12.5)	3 (37.5)	4 (50.0)	0 (0.0)	
Relation to the index child						
Father (n=60)						0.002
Mother (n=187)	0 (0.0)	0 (0.0)	1 (1.7)	15 (25.0)	44 (73.3)	
Brother/sister (n=30)	9 (4.8)	13 (7.0)	28 (15.0)	52 (27.8)	85 (45.5)	
Grandmother/grandfather (n=38)	2 (6.7)	6 (20.0)	4 (13.3)	7 (23.3)	11 (36.7)	
Others (n=27)	0 (0.0)	3 (11.1)	5 (18.5)	6 (22.2)	13 (48.1)	
Family size						
1-3 (n=244)	10 (4.1)	19 (7.8)	28 (11.5)	58 (23.8)	129 (52.9)	0.391
4-7 (n=81)	2 (2.5)	2 (2.5)	12 (14.8)	24 (29.6)	41 (50.6)	
>7 (n=17)	0 (0.0)	3 (17.6)	1 (5.9)	4 (23.5)	9 (52.9)	
Educational level						
Below university (n=56)	3 (5.4)	2 (3.6)	9 (16.1)	16 (28.6)	26 (46.4)	0.789
University (n=225)	6 (2.7)	18 (8.0)	25 (11.1)	57 (25.3)	119 (52.9)	
Postgraduate (n=61)	3 (4.9)	4 (6.6)	7 (11.5)	13 (21.3)	34 (55.7)	
Occupation						
Not working/housewife (n=102)	6 (5.9)	10 (9.8)	17 (16.7)	22 (21.6)	47 (46.1)	0.001
Governmental job (n=170)						
Private job (n=27)	4 (2.4)	5 (2.9)	19 (11.2)	53 (31.2)	89 (52.4)	
Business (n=5)	0 (0.0)	4 (14.8)	2 (7.4)	4 (14.8)	17 (63.0)	
Retired (n=16)	0 (0.0)	3 (60.0)	0 (0.0)	1 (20.0)	1 (20.0)	
Others (n=22)	1 (6.3)	1 (6.3)	1 (6.3)	2 (12.5)	11 (68.8)	
Income(Saudi Riyals/month)						
<5000 (n=31)						0.008
5000-9999 (n=57)	3 (9.7)	4 (12.9)	4 (12.9)	6 (19.4)	14 (45.2)	
10000-149999 (n=102)	2 (3.5)	3 (5.3)	10 (17.5)	12 (21.1)	30 (52.6)	
150000-20000 (n=77)	3 (2.9)	10 (9.8)	14 (13.7)	25 (24.5)	50 (49.0)	
>20000 (n=75)	2 (2.6)	3 (3.9)	9 (11.7)	28 (36.4)	35 (45.5)	
Number of cars (n=340)						
One (n=124)	12	24	41	86	177	0.030
More than one (n=216)	9 (7.3)	9 (7.3)	17 (13.7)	34 (27.4)	55 (44.5)	
	3 (1.4)	15 (6.9)	24 (11.1)	52 (24.1)	122 (56.5)	

*Chi-square test

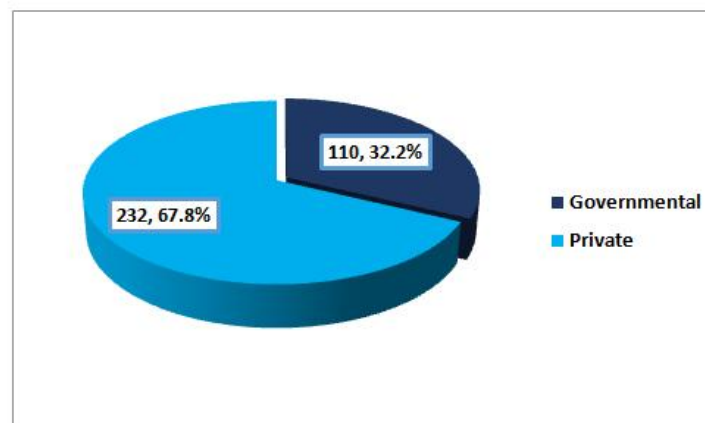


Figure 1. Type of kindergarten from which participants in the study were recruited

Table 4. Factors associated with the current existence of the children car seats in vehicles among the participants

	The current existence of the children car seats		p-value*
	No N=173 N (%)	Yes N=169 N (%)	
Type of kindergarten Governmental (n=110) Private (n=232)	72 (65.5) 101 (43.5)	38 (34.5) 131 (56.5)	<0.001
Age in years <20 (n=10) 20-29 (n=58) 30-39 (n=99) 40-50 (n=96) >50 (n=79)	6 (60.0) 28 (48.3) 49 (49.5) 59 (61.5) 31 (39.2)	4 (40.0) 30 (51.7) 50 (50.5) 37 (38.5) 48 (60.8)	0.058
Gender Male (n=85) Female (n=257)	34 (40.0) 139 (54.1)	51 (60.0) 118 (45.9)	0.024
Nationality Saudi (n=325) Non-Saudi (n=17)	163 (50.2) 10 (58.8)	162 (49.8) 7 (41.2)	0.486
Marital status Single (n=45) Married (n=265) Divorced (n=24) Widowed (n=8)	32 (71.1) 125 (47.2) 9 (37.5) 7 (87.5)	13 (28.9) 140 (52.8) 15 (62.5) 1 (12.5)	0.002
Relation to the index child Father (n=60) Mother (n=187) Brother/sister (n=30) Grandmother/grandfather (n=38) Others (n=27)	26 (43.3) 102 (54.5) 24 (80.0) 14 (51.9) 7 (18.4)	34 (56.7) 85 (45.5) 6 (20.0) 13 (48.1) 31 (81.6)	<0.001
Family size 1-3 (n=244) 4-7 (n=81) >7 (n=17)	110 (45.1) 52 (64.2) 11 (64.7)	134 (54.9) 29 (35.8) 6 (35.3)	0.006
Educational level Below university (n=56) University (n=225) Postgraduate (n=61)	32 (57.1) 113 (50.2) 28 (45.9)	24 (42.9) 112 (49.8) 33 (54.1)	0.470
Occupation Not working/housewife (n=102) Governmental job (n=170) Private job (n=27) Business (n=5) Retired (n=16) Others (n=22)	55 (53.9) 86 (50.6) 12 (44.4) 4 (80.0) 8 (50.0) 8 (36.4)	47 (46.1) 84 (49.4) 15 (55.6) 1 (20.0) 8 (50.0) 14 (63.6)	0.497
Income (Saudi Riyals/month) <5000 (n=31) 5000-9999 (n=57) 10000-149999 n=102) 150000-20000 (n=77) >20000 (n=75)	21 (67.7) 34 (59.6) 53 (52.0) 37 (48.1) 28 (37.3)	10 (32.3) 23 (40.4) 49 (48.0) 40 (51.9) 47 (62.7)	0.026
Number of cars (n=340) One (n=124) More than one (n=216)	171 67 (54.0) 104 (48.1)	169 57 (46.) 112 (51.9)	0.296

* Chi-square test

Table 5. Reasons for not the existence of the children car seats in vehicles according to the participants` opinion

	Frequency N=173	Percentage
Not important/not used	13	7.5
Difficulty in fixing children car seat	53	30.6
Small car not accommodating children car seat	96	55.5
Most trips are short not necessitating having a children car seat	113	65.3
Children refusal	89	51.4
Usual restraining of the child with seat belt	85	49.1
Usually, the child sits on other passenger`s lap	84	48.6
The high cost of a children car seat	15	8.7
The child is older than using children car seat	28	16.2
It is impossible to have children car seats in all cars in case of having more than one car	19	11.0

Table 6. Adherence and practicing of CRS in the vehicle among the participants, according to CDC recommendations (the most suitable method to fix the child in the car)

CDC Recommendations	Frequency	Percentage
Birth till age 2-4 years (Rear-facing car seat) 	178	52.0
Age of 4-5 years (Forward-facing car seat) 	156	45.6
Age of 6-9 years (Booster seat) 	155	45.3
Age 9-12 years (Seat belt) 	304	88.9
The most suitable place for a car seat (Middle of the back seat)	161	47.1

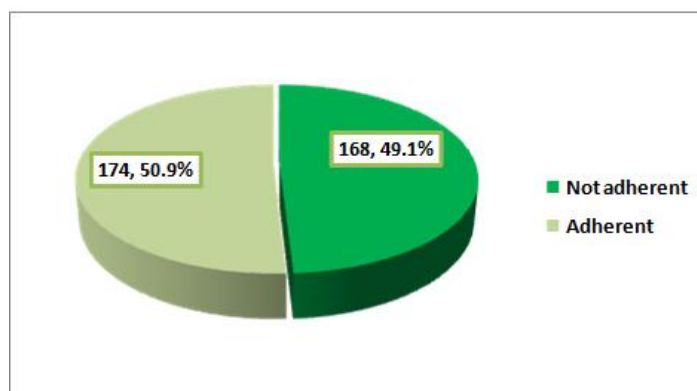
**Figure 2. Level of adherence and practicing of Child Restraint System in the Vehicle among the participants.**

Table 7. Factors associated with adherence of the participants to the Child Restraint System in the Vehicle

	Adherence to the Child Restraint System in the Vehicle		p-value*
	Not adherent N=168 N (%)	Adherent N=174 N (%)	
Type of kindergarten Governmental (n=110) Private (n=232)	60 (54.5) 108 (46.4)	50 (45.5) 124 (53.4)	0.167
Age in years <20 (n=10) 20-29 (n=58) 30-39 (n=99) 40-50 (n=96) >50 (n=79)	5 (50.0) 21 (36.2) 40 (40.4) 54 (56.3) 48 (60.8)	5 (50.0) 37 (63.8) 59 (59.6) 42 (43.8) 31 (39.2)	0.011
Gender Male (n=85) Female (n=257)	43 (50.6) 125 (48.6)	42 (49.4) 132 (51.4)	0.755
Nationality Saudi (n=325) Non-Saudi (n=17)	161 (49.5) 7 (41.2)	164 (50.5) 10 (58.8)	0.501
Marital status Single (n=45) Married (n=265) Divorced (n=24) Widowed (n=8)	18 (40.0) 125 (47.2) 19 (79.2) 6 (75.0)	27 (60.0) 140 (52.8) 5 (20.8) 2 (25.0)	0.005
Relation to the index child Father (n=60) Mother (n=187) Brother/sister (n=30) Grandmother/grandfather (n=38) Others (n=27)	34 (56.7) 88 (47.1) 12 (40.0) 14 (51.9) 20 (52.6)	26 (43.3) 99 (52.9) 18 (60.0) 13 (48.1) 18 (47.4)	0.566
Family size 1-3 (n=244) 4-7 (n=81) >7 (n=17)	119 (48.8) 39 (48.1) 10 (58.8)	125 (51.2) 42 (51.9) 7 (41.2)	0.711
Educational level Below university (n=56) University (n=225) Postgraduate (n=61)	28 (50.0) 119 (52.9) 21 (34.4)	28 (50.0) 106 (47.1) 40 (65.6)	0.038
Occupation Not working/housewife (n=102) Governmental job (n=170) Private job (n=27) Business (n=5) Retired (n=16) Others (n=22)	49 (48.0) 91 (53.5) 9 (33.3) 2 (40.0) 9 (56.3) 8 (36.4)	53 (52.0) 79 (46.5) 18 (66.7) 3 (60.0) 7 (43.7) 14 (63.6)	0.307
Income (Saudi Riyals/month) <5000 (n=31) 5000-9999 (n=57) 10000-149999 n=102) 150000-20000 (n=77) >20000 (n=75)	18 (58.1) 24 (42.1) 61 (59.8) 35 (45.5) 30 (40.0)	13 (41.9) 33 (57.9) 41 (40.2) 42 (54.5) 45 (60.0)	0.046
Number of cars (n=340) One (n=124) More than one (n=216)	166 65 (52.4) 101 (46.8)	174 59 (47.6) 115 (53.2)	0.315

* Chi-square test

children car seat (55.5%), children refusal (51.4%), usual restraining of the child with a seat belt (49.1%) and usually the child sits on other passenger's lap (48.6%) were the most frequent reasons.

Adherence to CRS in the vehicles: From Table 6, slightly more than half of the participants (52%) reported that they should use a rear-facing car seat for children from birth to the age of 2-4 years. However, most of the participants (88.9%) reported that they use seat belts with children aged between 9 and 12 years. Less than half of them could recognize that forward-facing car seats should be used for children in the age of 4-5 years (45.6%) and booster seats should be applied for the age group 6-9 years (45.3%). Additionally, less than half of them (47.1%) could recognize that the most suitable place for a car seat is in the middle of the back seat. Overall, adherence to the CRS in the Vehicle was reported by almost half of the participants (50.9%) as seen in Figure 2.

The highest rate of adherence to the CRS in the Vehicle was observed among participants aged between 20 and 29 years (63.8%) whereas the lowest rate was observed among those aged over 50 years (39.2%), $p=0.011$. Regarding the marital status, single participants had the highest rate of adherence to the CRS (60%) whereas divorced participants had the lowest rate (20.8%), $p=0.005$. Postgraduate participants had a higher rate of adherence to the CRS compared to university or below university graduated (65.6% versus 47.1% and 50%, respectively), $p=0.038$. Participants whose income exceeded 20000 SR/month were more adherent to the CRD (60%) than those with lower income, $p=0.046$. Table 7.

DISCUSSION

In few recent decades, CRS, mostly car seats, and seat belts have received great attention all over the world⁽¹⁵⁾, despite that, in Saudi Arabia, road traffic accidents are still common

and responsible for the greatest loss of disability-adjusted life years⁽¹⁶⁾. Saudi Arabia has one of the highest rates of road traffic accidents with consequent mortality and morbidity associated with it, as the mortality rate-related to road traffic accidents was estimated as 27.4 per 100,000 persons⁽¹⁷⁾. In Saudi Arabia, the problem is not in the use of CRS as it is obligatory by law, but the problem is in the adherence of people to its use as there is no enforcement to implement adherence⁽³⁾. The present study was conducted to assess the level of adherence and practicing of CRS in the vehicle and identify its determinants among guardians of children in Makkah Al-Mukarramah city. In the present study, the always using of the seat belt was mentioned by 52.4% of the participants whereas never or rare use was mentioned by 10.5% of them. Quite similar findings were observed in a study carried out in Qassim (Saudi Arabia), where 56.7% of guardians complied with the seat belt policy, moreover, 70% of the children never used seat belt while traveling and only 8.2% adhere to the seat belt guidelines⁽⁷⁾. In another Saudi study carried out in Riyadh, compliance with wearing a seat belt while driving was reported by 43% and 13.3% of health-care providers non-health-care providers, respectively⁽¹⁸⁾. In China, only 15.7% of guardians reported using a safety seat every time the child rode in the vehicle⁽¹⁹⁾. However, a higher rate was observed in Canada (79.2%)⁽²⁰⁾.

The always use of seat belt was more observed among participants aged over 50 years in the present survey. In a study carried out in Riyadh, there was no association between the age of the participants and compliance with seat belt wearing⁽¹⁸⁾. However, in Nigeria, older persons were less compliant with wearing seat belts⁽²¹⁾. Also, the always use of seat belt was more observed among males than females. The same has been observed by others^(3, 22-24). However, in Nigeria, compliance with wearing a seat belt was higher among females⁽²¹⁾. No logical explanation for this finding, although females generally respecting the law more than males. The current study found that fathers were more careful to always use seat belts compared to brothers/sisters. This finding goes hand by hand with age. In the present survey, there was a steady increase in the rate of always using a seat belt with an increase in the income of the guardians of children. As income is often considered to be an indicator of higher socioeconomic status and could reflect high awareness of the benefits of always wearing a seat belt while driving.

The American Academy of Pediatrics reported that the correct use of car safety seats helps in keeping children safe⁽¹⁵⁾. The current study revealed that 49.4% of the participants reported the current existence of the children's car seats. However, among them, the always use was reported by 48.5% whereas never or rare use was reported by 7.7% of them. In the Qassim region, 57.3% of guardians did not install CRS in the vehicle while only 16.3% reported consistent use of car seats every time the child rides in the vehicle⁽⁷⁾. In Riyadh, 36.6% of the participants reported the availability of a child seat in their cars, and only 52.2% of them, reported consistent use⁽³⁾. In an old study carried out in

Jeddah, only 8% of the participants reported using a child car seats. Moreover, 10% of the participants reported that their children use car seat belts⁽⁸⁾. In Kuwait, few guardians (36%)

were aware of using the appropriate child seats, but only 26% reported using one⁽⁹⁾. Overall, the rate of existence and proper use of car seats in our Region is inadequate. In the present study, participants recruited from private kindergarten, having higher income and those having smaller family size reported a higher rate of the existence of children car seats in vehicles compared to those recruited from governmental kindergarten and having bigger family size. This could be explained by the relatively higher education and financial status of such participants and their more awareness about the importance of children's car seats. Male guardians in the current study were more likely to report the existence of children's car seats than females. This agrees with other studies carried out in China⁽¹⁰⁾. The reasons mentioned by participants in the present study for the non-existence of the children car seats in their vehicles were the fact that most trips are short not necessitating having a children car seat, small car not accommodating children car seat, and children refusal. In a study carried out in Riyadh by Alsanea M, et al⁽³⁾, the most common pattern of child transportation was sitting on the front seat on the lap of an adult passenger. In Unaizah city (Saudi Arabia), child refusal (22.8%) and not viewing child safety seats as important (22.3%) were the most frequently reported reasons for the non-existence of car seats in vehicles⁽⁷⁾. In Kuwait, over 44% of guardians seated their children in the front seat, while 41.5% have seated their children in their lap while driving⁽⁹⁾.

In China, the main reasons for not practicing CRS included children's refusal (54%), short travel distance (53.8%), difficulty in installation of a car seat in the vehicle (53.1%), narrow car space (32.4%), and needless (25.8%)⁽¹¹⁾, which are quite similar to reasons reported in the current survey with a little bit different in sequence of the importance of factors, which could reflect cultural variation between Saudi Arabia and China. In another Chinese study, Bingham et al., reported "difficulties on finding safety seat", followed by the cost" as reasons for not having car seats⁽²⁵⁾. In Europe, many drivers were unaware of their incorrect practices in installing and using the CRS, or they have underestimated the risk and justified their misuse by low attention to safety measures, a child's refusal to be restrained, and problems with the CRS⁽¹²⁾. In the US, driving to near places, using rented cars, narrow space in the vehicle, or the child's refusal were reported reasons for not having CRS⁽¹³⁾. In Belgium, low attention level to safety, the child's resistance to being restrained, and problems with the CRS installation were the main reasons for not using⁽²⁶⁾. The observed variation of reasons could be explained by different visions between countries in keeping their child safe in vehicles.

A CRS is the most suitable mean to protect children when traveling in a car as it has been observed in a previous Saudi study that none of the children injured in road traffic accidents were restrained⁽²⁷⁾. Despite that, in the present study, 52% of the participants reported that they should use a rear-facing car seat for children from birth to age of 2-4 years and 88.9% reported that they use the seat belt with children aged between 9 and 12 years. Less than half of them could recognize that forward-facing car seat should be used for children in the age of 4-5 years and booster seats should be applied for in the age group 6-9 years.

In the US, for infants aged <1 year, a rear-facing seat installation ranged between 84% to 91% while for toddlers

aged 12-17 months, it ranged between 12-61% while car seat installed in a forward-facing ranged between 27% and 66% as well as among children aged 4-7 years, booster seat use decreased from 72% to 65% during the study period and for children aged 12 years or younger, more than 85% of them were seated in a rear seat vehicle position, and 31% were observed in the front seat⁽¹⁴⁾. Comparison between the two studies is not practical as in the present study, we assessed the awareness and not the practice while in the US study, they assessed the practice and, on many occasions, awareness did not transform into practice. Therefore, further study is warranted to assess the actual practice of CRS use in vehicles.

In the present study, adherence of guardians to CRS in the vehicle was reported by almost half of the participants (50.9%). In Riyadh, 63.5% of children were unprotected by any CRS⁽³⁾. In China, 39.2% of guardians reported installing CRS in the vehicle and 17.1% reported consistent use of it⁽¹¹⁾. However, in another Chinese study, the rate of having CRD was 27.8% whereas the rate of adherence to it was 22.9%⁽¹⁰⁾. In Europe, the Belgian Road Safety Institute (BRSI) revealed that more than 50% of the children were not restrained correctly in vehicles, and 10% were not restrained at all⁽¹²⁾. So, it seems that the inadequate application of CRS is a worldwide problem necessitating prompt action.

Younger (20-29 years) and single participants were more adhere to the CRS in the vehicle compared to those aged over 50 years. This could be explained by their ability to deal more perfectly with the complicated system of installation of CRS in vehicles. The same has been observed by others^(26, 28). Postgraduate participants had a higher rate of adherence to the CRS compared to lower educated. The same has been observed in China^(10, 11). In agreement with others^(10, 11), participants with higher income in the present study were more adhere to the CRD than those with lower income. Overall, we can conclude that adherence of guardians of children in Makkah city to CRS is not enough and need reconsideration, and this could be one of the causes of the relatively high mortality rate of children in road traffic accidents in Saudi Arabia.

Strengths and limitations

Up to the researcher's knowledge, this is the first study that investigated the adherence to CRS and its determinants, particularly the socio-demographic characteristics of guardians of children in Makkah city. However, a few limitations should be addressed. This study did not assess the practice by observing the proper installation of CRS, but only assessed knowledge through reporting participants' responses to questions. The nature of the questionnaire as a self-reporting one is subjected to bias (under or over-reporting). Finally, the conduction of the study in kindergarten only could impact the generalizability of the results over the entire population in Makkah.

Conclusion

The existence of children car seats in vehicles, as well as their always utilization in Makkah city, is not enough as they were reported by almost half of guardians of children. The main observed reasons for the non-existence of the children's car seats in vehicles were the fact that most trips are short not necessitating having a children's car seat, small car not

accommodating children's car seat, and children's refusal. Also, adherence of guardians to CRS in the vehicle was reported by almost half of the guardians. Younger (20-29 years), single participants, those with higher education and higher income were more likely to adhere to the CRS in the vehicle compared to others.

Recommendation

Based on the study findings, the following are recommended:

1. Conducting workshops for guardians of children regarding the importance of the existence of CRS in vehicles. These workshops should include practical parts of the proper selection and installation of the CRS.
2. Guardians of children should be instructed to consider all possible safety precautions while driving.
3. Laws for the mandatory existence and use of CRS in cars, while children are ridding, should be effective.
4. Investigating the real practice of CRS use is recommended in an observational study.
5. Further larger study included a wide range of people representing all categories in Makkah is warranted to have a more clear view of the problem.

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