

Child Occupant Safety: Towards Implementation of Child Restraint System Law in Malaysia

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REVIEW

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Abstract – The World Health Organization (WHO) has consistently recommended that all countries regardless of their income add the requirement for Child Restraint System (CRS) to their traffic regulations in order to promote road safety. Malaysia is adopting the CRS regulation in 2020. This paper aims to discuss the readiness and mapping of the roadmap towards the implementation of the law. In a temporal view of road crashes, CRS was part of ‘during-crash’ passive safety components i.e. to provide protection during the crash impact phase. This analysis includes the CRS benefits and issues, related road safety strategic programmes, the current legal framework, and local research findings based on observational studies. CRS usage and acceptance are on the rise, although still at a nascent stage. This situation can be considered as ‘below satisfactory compliance level’, hence a more inclusive solution is needed, including the introduction of technology, to influence or compel parents to ensure their children are always secured by CRS while on the road.

Keywords: Child Restraint System (CRS), Child Safety Seat (CSS), child safety, child car occupant

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1.0 INTRODUCTION

The most significant risk factor for death and severe injury in road traffic is travelling unrestrained. Child Restraint System (CRS) has been proven to reduce the injury severity and risk of fatality on children during catastrophic road traffic crashes. Unrestrained child occupants are at high risk for ejection, have a triple mortality rate and increases injury severity (Scheidler et al. 2000). Due to the immense safety benefits of CRS, the World Health Organization (WHO), the FIA Foundation for the Automobile and Society (FIA Foundation), the Global Road Safety Partnership (GRSP), and the World Bank, has consistently recommended that all countries, add the requirement for CRS to their traffic regulations in order to promote road safety (FIA Foundation, 2009).

Appropriate CRS has been specifically designed to protect children of all sizes and ages. A child should be in an appropriate CRS, car seat or booster seat until they have reached 135 cm of height and weight at least 36 kg. According to Haddon Matrix, CRS is one of the passive safety items that contribute to saving the lives of the occupant during the event of a crash by mitigating the crash injury severity as shown in Figure 1 (Jawi et al., 2016; Haddon 1980). Appropriate CRS recommended practice is shown in Table 1.

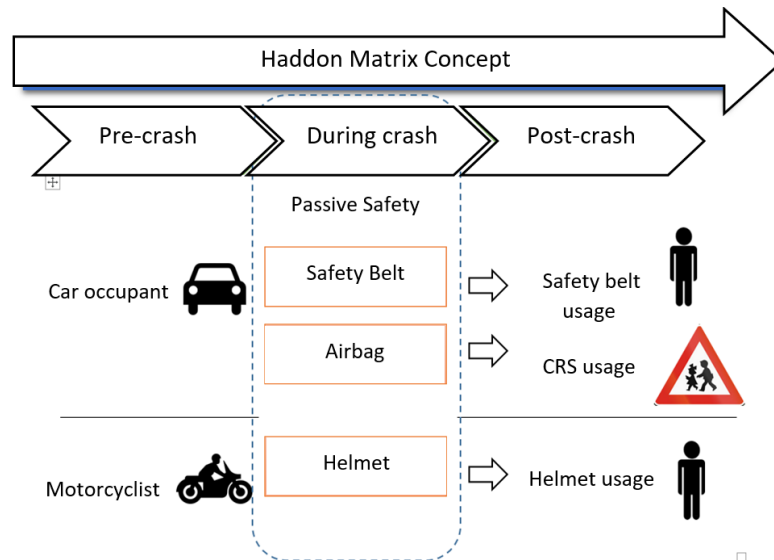






Figure 1: Conceptual framework of vehicle occupant safety (Jawi et al., 2016)

Table 1: Child occupant safety best practices recommendation

Child Occupant Safety	Rear Facing Seat	Forward Facing Seat		Belt Positioning Booster Seat		Seat belt
Seat Selection				 High-back booster	 Backless booster	Adult 3-point seat belt
Child Height	0-83 cm	≥ 71 cm	≥ 100 cm	≤135 cm		At least 135cm
Child Weight	0-13 kg	9-18 kg	15-25 kg	22-36 kg		No weight requirements
When should change to different CRS	Child's head above the top of the seat	Child's ears are above the top of the seat		Child's ears are above the top of the seat (for high back booster)		<ul style="list-style-type: none">• Sits with back against vehicle back seat• Shoulder belt across collarbone and chest• Lap belt across hips or upper thighs• Knees bent comfortably at the edge of the seat• Sits like this throughout the journey
Seat Location	All children under age 12 are recommended to sit on the rear seat.					

Globally, experts, manufacturers and lawmakers continue to make improvements on CRS to offer better protection towards child occupant safety. For example, CRS requirements and crash test regulations continue to evolve, CRS are now come with side impact protection (i-size) and ISOFIX and Top-tethers system will be made universal. Recently, CRS seems to be interest among parents. They are started conducting their own research on CRS options and some of them go the extra mile of getting their CRS checked for proper installation. The basic requirement to increase the usage rate of CRS in protecting child occupant is the enactment of the law (Brown et al. 2010, New Zealand Ministry of Transport 2017). This review aims to discuss and explain the current CRS usage situations, public readiness, and roadmap towards the implementation of the CRS law.

2.0 METHODOLOGY

This study utilized a systematic reviewing technique to discuss child occupant safety encompassing of the local research findings on CRS usage and issues, public acceptance and readiness, related road safety strategic programs, current legal framework, and roadmaps towards the implementation of the CRS law. The author evaluated previous relevant published studies in order to explain the status quo and overall framework on the issues of child occupant safety in this country.

The keywords used for gathering published papers relevant to this study were child safety, child occupants, child restraint system, law and implementation, seatbelt law, parents' willingness to pay, seat belt and helmet enforcement, enforcement activity, effective enforcement.

3.0 RESULTS AND DISCUSSION

This section shall discuss parents' perception and readiness and effective framework on CRS law implementation.

3.1 Readiness and Acceptance

Figure 2 shows the three important aspects that are interrelated in terms of CRS usage namely the child sizes and physical needs, CRS types and features, and car anchorage systems (Weaver et al. 2013). The following discussion is on the readiness from the perspective of parents as a user as well as both CRS and car manufacturers' point of view.

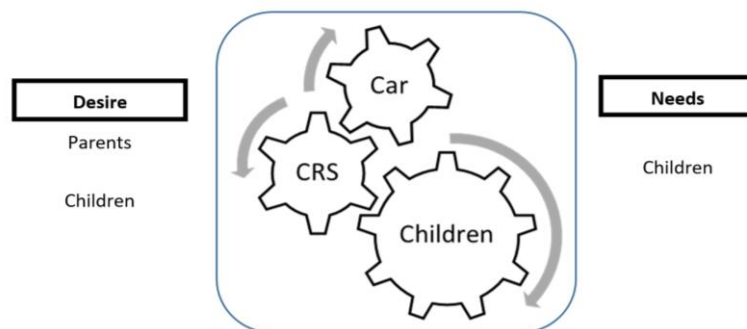


Figure 2: Child occupant protection concept

Based on observational studies conducted in recent years, CRS use could still be considered low (Figure 3). Effort to look into CRS usage was first conducted by Kulanthayan et al. in 2004, whereby the observation was taken place at Melaka on the availability of CRS in the car (Kulanthayan et al., 2010). Later, Ariffin et al. (2014) had started a public observation in Kajang among parents who sent their children to the daycare center. It was reported that the CRS usage rate was low, below 10%. Then, a yearly observation was conducted in regard to the commencement of OPS Selamat, a yearly traffic enforcement enhancement during the festive season. The rate of CRS usage was inconsistent over the years (considering the limitation of the observation method, this is the best-known data). In 2014 and 2015, CRS usage was dropped drastically to 2.4% (Shariff et al., 2015) and 3.3% (Lamin et al., 2015). In the year 2017 and 2019, the usage rate is quite promising and recorded the highest rate from all these eight years' observation period, i.e. 30% (Borhan, 2017) and 38.4% (Syed Tajul Arif et al., in press). However, the rate is still below 50%, if that is presumably the satisfactory level.

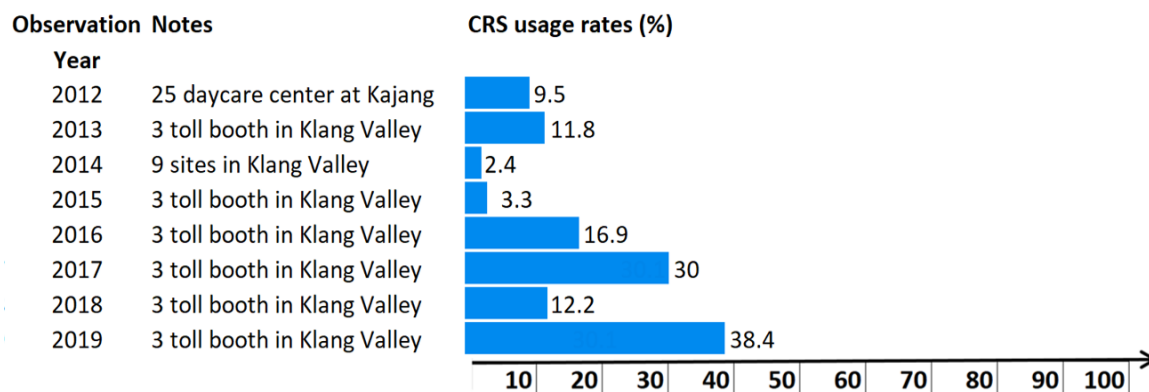


Figure 3: Rate of CRS voluntary usage among parents in Malaysia

Parallel to the observational studies, a few local questionnaire surveys were also conducted to gauge public acceptance and readiness in using CRS for their children. Female drivers are 98 % more likely to use CRS while travelling with children compared to male drivers (Borhan, 2017). Correspondingly, belted drivers were four times likely to use CRS for their children when travelling (Ariffin et al. 2014). According to a study by Low et. al, (2016) price is the main factor that contributed to non-use of CRS among the respondents followed by children's refusal to sit in the CRS.

In terms of knowledge, almost all parents were knowledgeable and aware of CRS availability and almost two-third had prior experience using CRS (Paiman et al., 2018b). However, only 65% know how CRS functions thus possibly indicating that a substantial proportion of them may have a superficial understanding, which may lead to CRS misuse. Investigation on CRS misuse in Malaysia found that high misuse rate was recorded (87%) especially on older children; aged four years and above (Paiman et al., 2018a). Misuse of CRS may cause the children not getting full protection and further exposed to injuries (Brown et al., 2010).

CRS in Malaysia are readily available and are widely sold in most departmental stores and hypermarkets. There were two categories of CRS available in the Malaysian market; local brand and imported international brand. Local brands are Sweet Chery, Koopers, Safe n Sound and imported brands are Britax, Maxi-Cosi, and etc. In terms of regulations compliance, most of the CRS were certified to UN R44 as the majority of them were manufactured in the same factory as imported CRS and were re-branded into the local brands. However, there is still a small percentage of CRS sold here that were not certified and complied with UNR44 or R129.

For vehicle readiness, as the rear seat is the safest position for all children under age 12 years (Braver et al. 1998, Berg et al. 2000), all new car models under category of M1, less than eight seaters of passenger seat, in Malaysia have to comply with the UN R16 three-point seatbelt for rear-seat occupant starting from 2011. The adoption of this regulation is not just to mandated the usage of seat belts for rear car passengers, but also to allow the installation of CRS in the rear seat. In 2015, Malaysia had adopted the UN R17, standard ISOFIX mounting system. Thus, due to great support from the automotive industry, most cars in the market, including the entry-level Proton Saga and Perodua Axia have ISOFIX mounts as standard safety features of the car. The ISOFIX system is an alternative to three-point seatbelt to reduce the CRS installation problem. All cars in the Malaysian market, under the M1 category, are ready for CRS installation.

3.2 Roadmap Towards CRS Law Implementation

As agreed by Ehiri et al. (2006), the enactment of CRS law is the basic requirement to ensure the increment of CRS usage. As explained earlier, CRS had become popular among parents especially in the Klang Valley urban area. All type of CRS is also readily available in the market. In addition, Malaysian cars are ready with the installation systems for all CRS types. Thus, it is an ideal time to start the wheel on the implementation of the CRS usage law in Malaysia.

In order to mapping the framework of implementation roadmap towards CRS law enactment, a conceptual model for community intervention is adopted to improve child occupant safety (Figure 4), based on previous systematic review and published method (Zaza et al., 2001a; Zaza et al., 2001b).

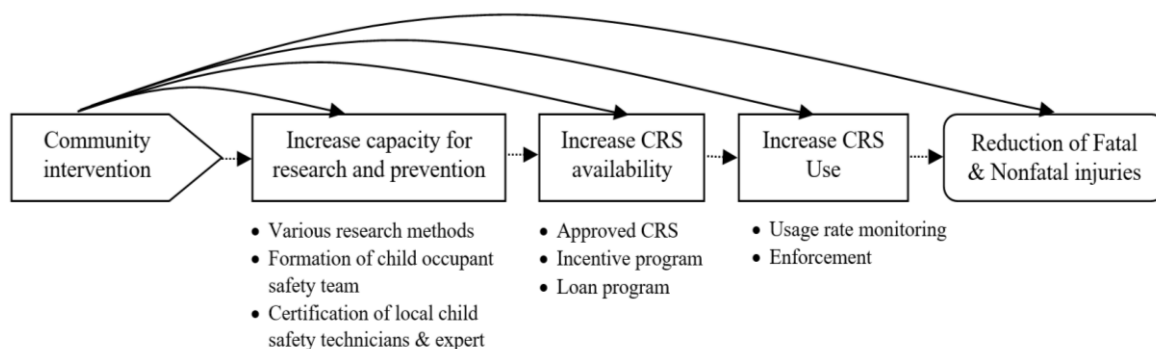


Figure 4: Conceptual approach of interventions to implement CRS law

3.2 Law and Legislative Framework

Jawi et al. (2016) and Ab Rashid & Jawi (2019) had explained the complexity of the integration process at the government level for any initiative or new law to be successful. The process needs to be efficiently communicated and executed at all relevant government agencies and levels. The law and regulation adaptation execution is carried out in stages. Grace period is being given to give ample time to the related agencies and organization for acting towards the introduction of the new law and regulations. For the purpose of CRS law implementation in Malaysia, the government had made a priority in providing the ideal environment to ensure the sustainability of the law. In recent years, the government has been focusing on improving the regulation standards of the CRS product and car components to ensure the fitment of both items could be integrated. Figure 5 shows the chronology of UN Regulation adoption related to CRS in Malaysia.

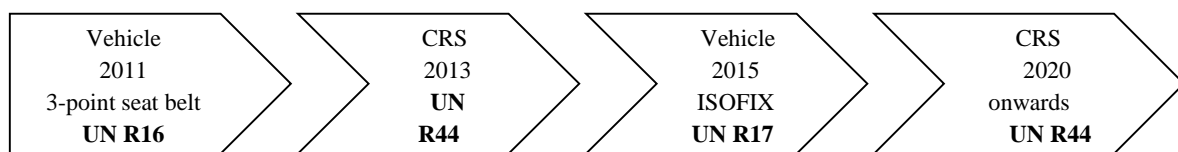


Figure 5: Chronology of UN Regulation adaptation in Malaysia, related to CRS

The UN R44 regulation has long been introduced and used as a standard for the approval of the CRS. It has been used for over 30 years worldwide and was adopted by Road Transport Department Malaysia since 2013 (Solah et al., 2014; Abdul Wahab et al., 2017). While UN R129 was included by UN WP 29 in November 2012 and enforced on 9 July 2013. There are a few differences and improvements in the latest Regulation which are the UN R129, begin in 2013, using reference based on the children's height as it is a belief that the parents are more aware of their children's height as compared to weight. This regulation is also set more advanced safety standards, for example, the introduction of side impact dynamic testing, based on more recent safety data (Apsler et al. 2003, Edwards et al. 2006). Figure 6 shows the label of each regulation, note that the difference in term of reference category of weight in UN R 44 and height in UN R129. During this transition timeframe, both rules UN R44 and UN R 129 are suggested to be run in parallel and both may still be applied. It is believed that UN R129 will subsequently substitute UN R44 when the third phase is completed and enforced.



Figure 6: Label of UN Regulations

With the implementation of CRS product with ECE R approval, MIROS is closely working together with other government agencies, the working parties are agreed that MIROS introduce the QR Code labelling system in addition to the existing R44/R129 sticker label. This initiative is to give extra input in guiding parents and enforcer in identifying the approved CRS and also guiding them in ways of installing CRS correctly. Additionally, this QR code system will enable for approved CRS database. Figure 7 shows the sample of the QR Code.



Figure 7: CRS QR Code labelling sample

3.2 Enforcement

Enforcement of occupant protection devices including seat belts, helmet and CRS is a proven strategy for increasing the use of such devices, both for adults and children (Zaza et al., 2001b). Effective traffic law enforcement is a key factor in ensuring that child occupant is being protected. Enforcement strategy is suggested to be carried out in stages; first awareness phase where the enforcement officer educate and guide parents on the CRS importance and benefits. The second phase is then the actual penalties enforcement as shown in Table 2.

Table 2: Phases of enforcement strategies based on the aims of treatment.

Nature of Enforcement	Phase 1: Awareness	Phase 2: Punishment
Aim	Raise fear of detection and punishment	Apprehend and punish offenders to discourage re-offending

A reliable and meaningful enforcement strategy by employing an evidence-based strategy that is based on casualty data are proven effective (Sprague & Walker, 2007). Thus, restraint use among children prior to a crash need to be measured for further action taken. Currently, CRS use rates could not be calculated because the current accident report did not record the existence of CRS being used prior to a crash. Thus, CRS's actual contribution to reducing death cannot be measured.

4.0 CONCLUSION

Wider use of CRS could have a significant role in preventing child traffic injuries. The challenge to injury prevention professionals is to identify the best way of promoting the CRS usage nationally. Arguably a moral obligation exists to offer all children a fair chance of surviving to adulthood by providing a conducive environment with affordable risk protection devices. Just like adult seat belts or any behavior, regulation will not guarantee much death prevention unless everyone plays their part to drive safely and responsibly.

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REFERENCES

- Ab Rashid, A.A., & Jawi, Z.M. (2019). Improvement of Psychosocial Supportive Mobility through 7-seater Vehicles: The Scope of Child Restraint System. *Journal of the Society of Automotive Engineers Malaysia*, 3(1), 89-95.
- Abdul Wahab, M.A.F., Jawi, Z.M., Hamid, I.A., Solah, M.S., Latif, M.M., Isa, M.H.M., Abdul Khalid, M.S., Ariffin, A.H. & Hamzah, A. (2017). Automotive consumerism in Malaysia with regard to car maintenance. *Journal of the Society of Automotive Engineers Malaysia*, 1(2), 137-153.
- Apsler, R., Formica, S.W., Rosenthal, A.F., & Robinson, K. (2003). Increases in booster seat use among children of low income families and variation with age. *Injury Prevention*, 9(4), 322-325.
- Ariffin, M.Q.M., Soid, N.F.M., Borhan, N., & Sukardi, A. (2014). Child restraints system use among children while travelling to day care centres Kajang, Malaysia. *Journal of Asian Scientific Research*, 4(7), 356.
- Berg, M.D., Cook, L., Corneli, H.M., Vernon, D.D., & Dean, J.M. (2000). Effect of seating position and restraint use on injuries to children in motor vehicle crashes. *Pediatrics*, 105(4), 831-835.
- Borhan, N. (2017). *CRS Usage in Vehicles Entering Klang Valley in Effectiveness of OPS Selamat 8/2016: An Evaluation Study*. MRR No. 241, Malaysian Institute of Road Safety Research.
- Braver, E.R., Whitfield, R., & Ferguson, S.A. (1998). Seating positions and children's risk of dying in motor vehicle crashes. *Injury Prevention*, 4(3), 181-187.
- Brown, J., Hatfield, J., Du, W., Finch, C.F., & Bilston, L.E. (2010). The characteristics of incorrect restraint use among children traveling in cars in New South Wales, Australia. *Traffic Injury Prevention*, 11(4), 391-398.
- Edwards, S.A., Anderson, R.W.G., & Hutchinson, P. (2006). *A survey of drivers' child restraint choice and knowledge in South Australia*. Centre for Automotive Safety Research, The University of Adelaide.
- Ehiri, J.E., Ejere, H.O., Magnussen, L., Emusu, D., King, W., & Osberg, J.S. (2006). Interventions for promoting booster seat use in four to eight year olds traveling in motor vehicles. *Cochrane Database Syst. Rev.*, 1, CD004334.
- FIA Foundation (2009). *Seat-belts and child restraints: a road safety manual for decision-makers and practitioners*. London, FIA Foundation for the Automobile and Society, 2009.
- Haddon, W. (1980). Options for the prevention of motor vehicle crash injury. *Israel Journal of Medical Sciences*, 16(1), 45-65.

- Jawi, Z.M., Isa, M.H.M., Mohamed, N., Awang, A., & Osman, M.R. (2016). A systemic analysis of the usage of safety items among Malaysian private vehicle users. *Journal of Mechanical Engineering and Sciences*, 10(3), 2262-2274.
- Kulanthayan, S., Razak, A., & Schenk, E. (2010). Driver characteristics associated with child safety seat usage in Malaysia: A cross-sectional study. *Accident Analysis & Prevention*, 42(2), 509-514.
- Lamin, F., Osman, M.R., Low, S.F., Ishak, S.Z., & Wong, S.V. (2015). *Effectiveness of OPS Selamat 7/2015: An Evaluation Study*. MRR No. 211, Malaysian Institute of Road Safety Research.
- New Zealand Ministry of Transport (2017). *Child restraints*. Retrieved from <http://www.transport.govt.nz/land/childrestraints/>
- Paiman, N.F., Deros, B.M., Hamzah, A., Kak, D.W., Solah, M.S., & Ahmad, Y. (2018a). A study on the use and misuse of Child Restraint System (CRS) in Malaysia. *Journal of the Society of Automotive Engineers Malaysia*, 2(1), 5-13.
- Paiman, N.F., Deros, B.M., Solah, M.S., Hamzah, A., & Osman, M.R. (2018b). Drivers' knowledge and attitudes towards child restraint system (CRS) usage. *Malaysian Journal of Public Health Medicine*, 18 (Special Issue 2), 66-72.
- Scheidler, M.G., Shultz, B.L., Schall, L., & Ford, H.R. (2000). Risk factors and predictors of mortality in children after ejection from motor vehicle crashes. *Journal of Trauma and Acute Care Surgery*, 49(5), 864-868.
- Shariff, S., Borhan, N., & Ali, A. (2015). *Child restraint system use in vehicles among children aged 0-11 in Klang Valley*. Paper presented at Conference of ASEAN Road Safety 2015, Kuala Lumpur, Malaysia.
- Solah, M.S., Isa, M.H.M., Hamzah, A., Ariffin, A.H., Ahmad, Y., Jawi, Z.M. & Kassim, K.A.A. (2014). Assessment of Child Occupant Protection in ASEAN NCAP. *Applied Mechanics and Materials*, 660, 804-810.
- Sprague, J., & Walker, H. (2007). *Creating schoolwide prevention and intervention strategies*. Effective Strategies for Creating Safer Schools, The Hamilton Fish Institute on School and Community Violence & Northwest Regional Educational Laboratory, Washington DC.
- Syed Tajul Arif, S.T.M., Manan, M.M.A., Low, S.F., Khairil Anwar, A.K., & Ishak, S.Z. (in press). *Evaluation of the Effectiveness of Ops Bersepadu Hari Raya Aidilfitri Year 2019*. Submitted for MIROS Research Report (MRR), Malaysian Institute of Road Safety Research.
- Weaver, N.L., Brixey, S.N., Williams, J., & Nansel, T.R. (2013). Promoting correct car seat use in parents of young children: challenges, recommendations, and implications for health communication. *Health Promotion Practice*, 14(2), 301-307.
- Zaza, S., Carande-Kulis, V.G., Sleet, D.A., Sosin, D.M., Elder, R.W., Shults, R.A., Dinh-Zarr, T.B., Nichols, J.L., Thompson, R.S., & Task Force on Community Preventive Services. (2001a). Methods for conducting systematic reviews of the evidence of effectiveness and economic efficiency of interventions to reduce injuries to motor vehicle occupants. *American Journal of Preventive Medicine*, 21(4), 23-30.
- Zaza, S., Sleet, D.A., Thompson, R.S., Sosin, D.M., Bolen, J.C., & Task Force on Community Preventive Services. (2001b). Reviews of evidence regarding interventions to increase use of child safety seats. *American Journal of Preventive Medicine*, 21(4), 31-47.