

# Evaluation of factors influencing the usage of child car seats for nursery school travel

Road Safety and Digitalization 08-10 June 2022 • Athens, Greece

Ioanna Armouti<sup>1</sup>, Roja Ezzati Amini<sup>2\*</sup>, Constantinos Antoniou<sup>2</sup>

<sup>1</sup>Swiss Approval Technische Bewertung S.A. Inspection and Certification Body Trapezountos & Digeni Akrita Street, 19200 Elefsina, Greece <sup>2</sup>Chair of Transportation Systems Engineering, Technical University of Munich, Arcisstrasse 21, 80333 Munich, Germany,

> <u>ioanna.armouti@swissapproval.gr</u> <u>roja.ezzati@tum.de</u> <u>c.antoniou@tum.de</u>

### Abstract

Children are among the most vulnerable road users and exposed to a high risk of traffic crash-related injuries and fatalities. This research investigates various factors influencing the usage of child car seats for commuting to nursery schools. An experimental study is piloted in three suburbs of Athens, Greece, with distinct differences in socioeconomic status and built environment characteristics. A self-administered parental questionnaire is completed for 734 children attending municipality nursery schools, collecting information on, for instance, the traffic safety practices for preschool children and child-parent interactions. Regression and structural equation models are estimated to examine the factors that affect the usage of child car seats. The results obtained from these models can be used to drive quantitative policy decisions.

Keywords: preschool children; child restraint systems; child car seats; socioeconomic status

<sup>&</sup>lt;sup>1</sup> \* Corresponding author. Tel.: +49-1777731223

E-mail address: roja.ezzati@tum.de



# 1. Introduction

Child passengers of motorized vehicles are exposed to a substantial risk of crash-related injuries and fatalities [1]. For example, in Greece, the fatality rate of child passengers accounts for 55% of deaths from known causes in the age group [2]. One effective measure for reducing child-related death and the severity of the injuries is child restraint systems (CRS). Therefore, in many countries, including Greece, children younger than seven must be restrained with CRS in a vehicle. However, the compliance rates in Greece are relatively low –approximately 57% of drivers use CRS [3-4].

Several studies investigated the CRS by exploring the factors that may influence the use and misuse of such systems in the vehicles, such as the parent's knowledge of road safety and the impact of CRS on children's safety [5-6]. Besides, the frequency of CRS usage is linked to the driver's socioeconomic status (SES) (e.g., education, income level) and family size, i.e., a higher SES and smaller families tend to use CRS more often [7]. Furthermore, parental perceptions of the hazard associated with trip types may also influence the CRS. This suggests that parents may identify certain trip types to be safer (e.g., short trips) and thus, change the usual pattern of restraint use [8-9]. Regarding the nursery school travel, the environmental factors (e.g., distance to the nursery school), children's age, weather, and personal factors (e.g., work-related issues of parents) can affect the travel choices of parents and nursery school travel behaviors accordingly [10-12].

This study aims to identify the factors linked with the child's car seat usage for the daily trip to nursery school. Several studies investigated various aspects of school travel, while only a few research focused on preschool children. This paper examines whether the factors affecting CRS and booster seat use in other studies worldwide also apply in Athens –as the case study– and whether there are area-specific factors.

# 2. Case Study and Data Collection

This paper selected three suburban municipalities of Athens, Greece, as case studies: Fyli, Ilioupoli, and Kifissia. These municipalities have various socioeconomic and built environment characteristics of a typical low (Fyli), medium (Ilioupoli), and high SES (Kifissia). A questionnaire was developed and administered to a sample of parents living in three suburbs of Athens, Greece, and having at least one child attending the municipality nursery school. The target age group was defined as children between nine months to five years old. In addition, the following main elements were specified for examination through the collected data:

- The family travel patterns to and from nursery schools
- The trip characteristics of nursery schools
- The child-parent interactions
- The traffic safety climate (i.e., the individual attitudes and perceptions of traffic safety in the daily commutes)
- The family structure and SES (e.g., parent's level of education, annual family income)

The distribution and collection of the questionnaires took place in 2014 in 24 municipality nursery schools in the studied areas. Finally, the complete data for 734 children attending these nursery schools were collected.

# 3. Model Estimation and Results

Initially, a generalized linear model was formulated to capture the degree of child car seat use. The parameters influencing the usage of child car seats were extracted from the questionnaire and participants' responses. The estimation results of the model are summarized in Table 1. The model utilized the number of motorways and pedestrian paths in each municipality to examine the impact of these factors on car seat use. The network-based measures can help generalize these findings by suggesting that more pedestrian ways and motorways contribute to higher car seat use. As model results suggest, higher usage of car seats was observed when both male and female drivers accompanied the children to school, and when more than two female children older than the examined age bracket were in the car. Besides, socioeconomic factors (e.g., education level, family structure) and safer attitudes (e.g., use of driver seat belts, involvement in traffic crashes) were correlated with child car use.



In the next step, a structural equation modeling approach was applied to approximate the safety perception of the participants and quantify it as a latent variable. As shown in Table 2, the latent variable "traffic safety climate" was constructed by four indicators. For identification purposes, the coefficient of the variable father's education level was normalized to 1, and others were estimated through the model. Further, Table 2 summarizes the results of the structural equation model specification. Besides, this study uses the three most common measures of fit for structural equation models: (I) the Root Mean Square Error of Approximation (RMSEA), (II) the Standardized Root Mean Square Residual (SRMR), and (III) the Comparative Fit Index (CFI). According to the literature review, the values of measures indicate a good fit [13-14].

Fable 1.	Generalized	linear	model	estimation	results

Parameter	Estimated value	t-value
Intercept	0.169	1.411*
Pedestrian path length/area	2.464	3.644
Motorway length/area	1.509	2.429
Driver gender: male/female	0.075	1.945*
No. of children in car $>2$	-0.207	-3.245
Child gender dummy: female	-0.076	-2.292
Child age	-0.044	-2.084
Father tertiary education dummy	0.058	1.612*
Family size dummy: couple with one child	0.083	2.098
Use of driver seat belt: frequently	0.499	8.227
Use of driver seat belt: always	0.598	9.311
Parent involved in traffic crashes dummy	0.060	1.797*
Null deviance	91.93	(512 d.o.f)
Residual deviance	68.778	(501 d.o.f)
AIC	451.02	

AIC

Note: \*Insignificant at the 95% confidence interval

	Estimate	Std. Err.
Latent variables		
Traffic safety climate	=~	
Father tertiary education dummy	1	
Use of driver seat belt: frequently or always	2.248	2.699
Safety level of children commute	2.446	2.536
Unsafe traffic to walk dummy	-0.802	-1.889
Regression		
Use of child car seat	~	
Traffic safety climate	2.903	2.733
Pedestrian path length/area	2.573	3.984
Motorway length/area	1.674	2.829
Child gender dummy: female	-0.064	-1.940
Child age	-0.048	-2.255
Driver gender: male and female	0.082	2.120
Family size dummy: couple with one child	0.103	2.610
Measures of Goodness of fit	Va	lue
RMSEA	0.0	)59
SRMR	0.0	)39
CFI	0.	75

#### Table 2. Structural equation model estimation results

## 4. Discussion

This study investigated the factors affecting the use of child car seats for nursery school travel. The findings of this study show that several factors influence the child restraint systems used for everyday commute to nursery school. Socioeconomic status, traffic safety climate, and road network infrastructure (a denser road infrastructure) positively influence the use of CRS. Whereas increasing number of children accompanied at the same time, large families, one-parent families with one child, and parents of the older child tend to use CRS less often. Besides, parents' safety perception, permissiveness, inconvenience, and situational factors affect parents' decisions regarding CRS usage.



#### 5. Conclusions

The underlying aim of this study is to understand the parameters that influence the use of car seats for the daily trip to nursery school. Three suburbs of Athens with notable differences in SES are considered case studies. The research presents a methodological approach for quantifying factors influencing the use of child car seats. Besides, the concept of traffic safety culture is explicitly modeled using a latent variable and used as an explanatory variable in a structural equation model that captures the factors affecting child car seat use. The results obtained from these models can be used to drive policy decisions quantitatively.

### References

- 1. Adminaite, D., Jost, G., Stipdonk, H., Ward, H., & Calinescu, T, "Reducing child deaths on European roads," in European Transport Safety Council ETSC, 2018.
- 2. Dedoukou, X, "Unintentional injuries in childhood," 2014. [Online]. Available: http://www2.keelpno.gr/blog/?p=4529&lang=en.
- 3. WHO (World Health Organization), "WHO Global Status Report," 2013. [Online]. Available: http://www.who.int/violence\_injury\_prevention/road\_safety\_status/2013/country\_profil es/greece.pdf?ua=1.
- 4. Yannis, G, "Use of child seat in Greece," seminar for Child Safety in the car The Greek Reality The Norwegian/Scandinavian model organized by the Royal Norwegian Embassy in Greece. Athens, 24 November 2009.
- 5. Koppel, S., Muir, C., Budd, L., Devlin, A., Oxley, J., Charlton, J.L., Newstead, S, "Parents' attitudes, knowledge and behaviours relating to safe child occupant travel," Accident Analysis & Prevention, vol. 51, p. 18–26, 2013.
- 6. Ramsey, A., Simpson, E., Rivara, F.P, "Booster seat use and reasons for non-use," Pediatrics, 2000.
- Durbin, D. R., Elliott, M. R., & Winston, F. K, "Belt-positioning booster seats and reduction in risk of injury among children in vehicle crashes," Jama, vol. 289, no. 21, pp. 2835–2840, 2003.
- 8. Emery, K.D., & Faries, S.G, "The lack of motor vehicle occupant restraint use in children arriving at school," School Health, vol. 78, pp. 274–279, 2008.
- Simpson, E. M., Moll, E. K., Kassam-Adams, N., Miller, G. J., & Winston, F. K, "Barriers to booster seat use and strategies to increase their use," Pediatrics, vol. 110, no. 4, pp. 729–736, 2002.
- 10. Yu, C. Y., & Zhu, X, "Impacts of residential self-selection and built environments on children's walking to school behaviors," Environment and Behavior, vol. 47, pp. 268–287, 2015.
- 11. Waygood, E.O.D., & Friman, M, "Children's Travel And Incidental Community Connections," Travel Behaviour and Society, vol. 2, pp. 174–181, 2015.
- 12. Oxford, L., & Pollock, J, "How actively do children travel to their pre-school setting?," Transport and Health, vol. 2, pp. 151–159, 2015.
- MacCallum, R. C., Browne, M. W., & Sugawara, H. M, "Power analysis and determination of sample size for covariance structure modeling," Psychological Methods, vol. 1, pp. 130–149, 1996.
- 14. Hu, L., & Bentler, P. M, "Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives," Structural Equation Modeling, vol. 6, p. 1–55, 1999.