

Role of Children in Parents' Car Use Behavior

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Abstract

This paper demonstrated how related variables of children's school trips and the principle factors of the theory of planned behavior (TPB) influence parents' car use behavior along with socio demographic factors. An urban Iranian sample from Tehran, consisting of parents (men and women) with primary-school children was asked to fill in physical questionnaires. Sample characteristics next revealed by descriptive statistics. A block regression analysis was utilized to explore first; how TPB's factors and second; how children's transportation's related-variables increase the explained variance of parents' car use behavior beyond socio- demographic factors. Results show both TPB's factors and children's transportation block increased the explained variance of parents' car use behavior beyond socio demographic variables. Finally results are discussed due to the hierarchy pattern in the models.

Keywords: car use behavior; children's school trips; commuting trips; Theory of planned behavior.

1. Introduction

Clarifying the existing pattern of travel mode choice behavior would be a footstone to next policy setting for changing the behavioral pattern of motorized trips. This will illustrate how current behavior is influenced by different factors. Two major perspectives, traditional and psychological, have been widely considered to analyze travel mode choice behavior.

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Traditional perspective principally focuses on socio-demographic factors, the specifications of the travel mode and decisional situations (e.g. weather, day of travel, purpose of trip) [1]. Psychological perspective on the other hand focuses on psychological person characteristics. Research clearly indicates that psychological factors are performing better in predicting the travel mode choice than socio demographic and infrastructure differences [2] [3].

Two main trends are identified in psychological perspective in travel mode choice behavior. First trend is based on self-interest motive and typically presented by TPB [4]. Attitude, subjective norm, perceived behavioral control and intention are covered in this model. The second trend is based on pro-environmental motive and typically presented by norm-activation model (NAM) [5]. Personal norm, environmental awareness of consequences and environmental awareness of need are included in the latter model. A Comparison indicates that the self-interest model has a better predictive ability [6].

To enhance the predictor ability of the model, researchers tried enrich the models by combining factors from different aspects. This is because transportation mode choice is a complicated multi-aspects behavior. Accordingly, ‘habit’ is successfully introduced into the TPB [7], and to the NAM [8,9]. In another research, relation between situational features (mode cost, access to public transportation services, travel time) and psychological beliefs about environmental effects on car use is reported [10]. Situational, socio-demographical and psychological variables found to be significant simultaneously in another research [11]. A recent study, presented the Comprehensive Action Determination Model (CADM) which integrates among intentional, situational, and habitual variables [12].

In a similar approach, for the multi-aspects behavior of car use, this paper contribute focusing on children’s transportation variables to capture their influence on parents’ car use behavior considering household units. While parents are assumed to be the ultimate decision makers of their child’s mode choice [13], they are in return under the influence of their children’s school trips in their work trips’ mode choice. Accordingly, the aim of this paper is to investigate how much the variables related to children’s school trips would influence parents’ car use behavior in commuting trips. Both situational and psychological variables of children’s school trips are considered in this research. Additionally, we will examine how much psychological variables would add to explained variance of parent’s behavior in car use beyond socio-demographic factors. A sequential approach is utilized to clarify the effects of the two mentioned groups of variable on enhancing an initial model based on socio-demographic factors. This research is focusing on commuting trips as the greatest part of every day trips. Accordingly work trips of parents and school trips of children are under the consideration.

2. Methodology

2.1. Data collection

A survey was conducted in Tehran, Iran, from April 21st, 2015, through May 10th, 2015. The city was divided into six major zones. Since we could not cover all the primary schools, four schools have been chosen (girls/ boys/ public/ private) in each zone. A total number of 4000 questionnaires were distributed among students and filled by parents. The number of returned questionnaires was 1876, indicating a return rate of 47.39 percent.

2.2. Measures

As current analysis is a part of a research, collected data from a few sections of the questionnaire is utilized here. Three parts deal with TPB's factors (attitudes, subjective norms, perceived behavioral control and intentions) toward escorting children to school, car usage for work and school trips respectively. Next habit is measured and finally socio-demographic information was collected.

Attitude refers the degree to which a person appraises or evaluates a behavior in a favorable or unfavorable manner [4]. To measure attitude toward escorting child to school four items were used: "For me, escorting my child to school considering [safety matters / security matters/ convenience matters/ overall], is essential". In other parts, attitude is measured by two items: "For me, to use car [for school/work trips] from my current place of residence is overall [good/ pleasant]".

Subjective norm describes the perceived social pressure to perform/not to perform a behavior [4]. Subjective norm is assessed by two items: "most people who are important to me would support me to [escort my child/use my car for school/work trips] from my current place of residence", and "most people who are important to me think that I should [escort my child/ use my car for school/work trips].

Perceived behavioral control indicates people perception of ease or difficulty of performing a behavior [4]. Two items were used to measure perceived behavioral control, namely: "for me, to [escort my child / use my car for school/work trips] from my current place of residence is easy" and "my freedom to [escort my child / use my car for school/work trips] from my current place of residence is high".

Intentions are assumed to capture the motivational factor which indicates how hard people are willing to perform the behavior [4]. Intentions are measured by two items: "I intend to [escort my child / use my car for school/work trips] from my current place of residence", and "I try to [escort my child / use my car for school/work trips] from my current place of residence".

For each item, respondents were asked to select one answer on a Likert-type scale ranging from 1 (strongly agree) to 5 (strongly disagree) and the sum score of the items of each construct were calculated and used in subsequent analyses.

Response frequency measure (RFM) [7] is applied for habit measurement. Accordingly, it is asked which travel mode the respondent is most likely to use for grocery shopping/ other shopping/ visiting parents and friends/ going to park/ going to restaurant. Habit strength is then equals the times that "car" was chosen [1].

Car choice index is utilized as the dependent variable. The index is the number of reported trips by car divided by total number of reported trips [12].

2.3. Data analysis

In a pilot survey, the questions were corrected for probable misunderstandings due to interviewing by the

respondents. Cronbach’s alpha coefficients were calculated for all measures. Prior to model estimation, descriptive statistics were studied and associations between factors of interest were carried out by Bi-variate correlations. To examine the effects of different factors on the frequency car use, and whether the children related dimensions added to the explained variance above or beyond other control variables, a hierarchical block regression analysis (enter method) were performed utilizing IBM SPSS 22 software package.

3. Result

3.1. Test of the measurements

For reliability test, the internal consistency of the items was tested by Cronbach's alphas which can also show construct validity of measurements. Resulting alpha for each item is sufficiently high (Table 1), except for the PBC and intention of escorting child to school which are removed for further analysis.

Table1: Cronbach’s alpha of measurements

Behavior	Variable	Cronbach’s alpha
Escorting child to school	Attitude	.915
	Subjective Norm	.738
	PBC	.510
	intention	.580
Commute to work by car	Attitude	.782
	Subjective Norm	.822
	PBC	.735
	intention	.901
Commute to school by car	Attitude	.809
	Subjective Norm	.862
	PBC	.787
	intention	.922

3.2. Descriptive analysis

As summarized in Table 2, 47 percent of parents and 63.1 of children are female. The average age of parents is 40.4 years (SD = 6.54) and the average age of the children is 9.65 years (SD = 2.09).

A total of 41.6 percent have basic education (completed high school education or lower), while 39.3 percent report higher education (completed a university degree up to bachelor) and 19.1 percent completed master or

PhD degree.

Occupational status of 55.1 percent is reported as full time. Regarding income, 39 percent believe their income is lower than the average income of a typical household in Tehran, while 38.1 percent believe it to be the same and 22.8 percent believed to be higher.

5.9 percent of the respondents do not own a vehicle and 75.2 own one vehicle while others have two vehicles or more and 89.9 percent have driving license.

A total of 56 percent escort their child to school four times or more a week and 17.9 percent never escort their child to school. 28.1 percent of the children are never escorted to school neither by the respondents nor by other members of the household.

32 percent of the children weren't picked up to school by car and 46 percent were picked up four times or more per a week. 19.5 percent of the respondents didn't use their car and 40.8 percent used their car four times or more per a week in order to commute to work.

Table2: Frequency analysis of demographic characteristics of survey participants

Demographic Characteristics	Relative frequency (percent)	Demographic Characteristics	Relative frequency (percent)
Gender (parents)		Gender (children)	
Male	53	Male	36.9
female	47	female	63.1
Age in years (parents)		Age in years (children)	
Mean	40.04	Mean	9.65
SD	6.54	SD	2.09
Education			
high school education or lower	41.6		
Bachelor & Associate Degree	39.3		
Master & PhD	19.1		
Distance to work place		Distance to school	
Mean(SD)	13.93	Mean(SD)	3.85
SD	21.52	SD	8.28
Number of vehicles		Driving license	
0	5.9	Yes	89.9
1	75.2	No	10.1
>=2	18.9		
Income compare to average income in			
Much lower	12		
Lower	27		
Similar	38.2		
Upper	21.1		
Much Upper	1.8		

3.3. Bivariate correlations

Table 3 shows the bivariate correlations between car choice index and psychological dimensions. The strengths of the correlation coefficients ranged from small to moderate. The inter-correlations between the psychological variables were at the worst cases moderate, assuring that multicollinearity was not a matter of concern.

Positive coefficients of attitude and norm toward escorting and the car choice index indicates stronger psychological dimensions for escorting lead to higher car choice index. Similarly, positive sign of the coefficient between psychological dimensions toward car and car use index shows better feeling about car leads to more car use. Correlation coefficient between PBC and intention to use public transport indicates whenever using private car is perceived easy and available, stronger intention will exist to use car. Additionally high correlation among norm- intention and attitude-intention clearly indicates while a person feels favorable of using car or this behavior is supported by important people surrounding her, she will show a stronger intention to perform the behavior. Additionally, norm and attitude toward escorting are associated with high scores indicating while a person feel favorable of escorting her child, this behavior is supported by important people surrounding her. High correlation is recognized between norm and attitude toward car use in a similar way. Similarly, due to high correlation between PBC and norm toward car, while a person perceived easy and available car use, she perceived more support for car usage as well.

Table3: Bivariate correlations (Kendall’s tau coefficient) between car choice index and psychological dimensions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) car choice index		.02	.01	.31**	.27**	.33**	.18**
(2)Attitude toward Escorting			.57**	.09**	.10**	.09**	.04*
(3)Norm toward Escorting				.06**	.11**	.07**	.03
(4)Attitude toward Commuting to Work by car					.57**	.51**	.12**
(5)Norm toward Commuting to Work by car						.43**	.08
(6)PBC toward Commuting to Work by car							.11
(7)Intention toward Commuting to Work by car							

**P<0.01, *P=0.05

3.4. Regression on car choice index

A hierarchical multiple regression analysis (block regression) was employed to examine first; whether psychological factors and second; the children’s trip-related-variables would add to the explained variance above or beyond socio demographic variables. Three consequential steps were conducted in the analysis to control conventional variables when considering the effect of new variables. Results are reported in Table 4. The first step was to investigate the impacts of the demographic factors. Among seven variables entered in the model, 4 variables (age, two dummy variables of number of vehicles and dummy variable of high education)

showed significant β -weights. The demographic factors explained a statistically significant proportion of the variance in car choice index ($R^2=.17$).

The second step was to involvement of psychological dimensions toward car use behavior including attitude, norm, PBC and intention. These factors accounted for a significant increase in the variance of public transport use ($R^2=.47$, $R^2_{\text{change}}=.297$). While the significance of distance to work place vanishes, attitude, PBC and intention showed significant β -weights. This indicates including psychological variables are statistical predictors of public transport usage.

The regression model for the third and final step was conducted with a further inclusion of children's related variables including psychological factors toward car use for school trips and escorting children, demographic factors and situational factors. Significant β -weights for PBC, intention toward car use, norm to escort and car choice index for school trips, lead to a significant improvement to the value of R-square ($R^2=0.55$, $R^2_{\text{change}}=0.088$). This indicates that considering children's trip-related-variable would add to the explained variance beyond the psychological dimension of the second step.

4. Discussion

The presented data shows different types of variables are influencing car use for commuting trips. The three-level approach used for current study illustrates how different categories of variables would broaden our knowledge about car use. First; the results have implications for both the socio-demographic and psychological variables. Second; further support is provided for the predictive validity of the children's trip-related variables. These variables are both psychological and non-psychological variables.

FIRST STEP- socio-demographic variables showed to be good predictors of commuters' car use: owning more car leads to more car use for commuting trips. High educated parents use their car more frequent while older parents showed to use their car less. Gender didn't show significant β -weights. Distance to work place showed significant β -weight. For longer distances, less frequent private car use is recognized.

SECOND STEP- At the second step, inclusion of the psychological variables lead to a higher explanation of the variance. Results of hierarchical multiple regression analyses showed that these variables significantly account for a 29.7 percent increase in the variance of car usage after controlling the demographic variables. Attitude, PBC and intention showed significant influence on car use prediction. Amongst, intention showed the greatest β -weight which duplicates the results of other researchers while using same variables in different types of models [14,3,15].

Previous researches found a significant influence of subjective norms on intention and as a result indirect influence on the behavior of using a special mode (e.g. [3]). Similarly this study failed to show a direct influence of subjective norm on car use. Regarding the high correlation among norm with intention, previous research and the TPB, the overall conclusion would be to investigate the effects of subjective norm on car use behavior mediated by intention.

Table 4: Results of block regression of relative frequency of commuting to work by car

	Adj. R ²	Adj. R ² _{change}	F _{change}	Step1 β	Step2 β	Step3 β
Step 1	0.174	-				
Age				-0.107*	-0.101*	-0.094*
Gender(Ref. Female)				0.062	1.69	0.088*
No. of vehicle (1 car) (Ref. No car)				0.474***	0.308***	0.279***
No. of vehicle (>1 car) (Ref. No car)				0.605***	0.354***	0.307***
Distance to work place				-0.110*	-0.036	-0.057
Education(Bachelor)(Ref. Basic)				0.019	0.16	0.000
Education(Master or PhD)				0.158**	0.106*	0.082
Step 2	0.471	0.297	49.338***			
Attitude to car use for work trips					0.232***	0.262***
Norm car use for work trips					0.056	0.086
PBC to car use for work trips					0.195***	0.184**
Intention to car use for work trips					0.332***	0.327***
Step 3	0.559	0.088	12.448***			
Attitude to car use for school trips						0.132
Norm to car use for school trips						0.016
PBC to car use for school trips						0.015**
Intention to car use for school trips						0.006**
Attitude to escort child						0.033
Norm to escort child						0.014*
Age of child						0.001
Gender of child						0.002
Escort child Index						0.035
Car choice index for school trips						0.17**
Distance to school						0.028

* p < .05 , ** p < .01. , *** p < .001

Additionally, inclusions of psychological variables at the second step made the variable of distance to work vanish from the model.

THIRD STEP- The major objective of this study was to provide an examination of the necessity of considering children’s trip-related factors of school trips in explaining of parents’ car use by considering psychological and non-psychological variables of children’s school trips. This was investigated at the last step of the study.

Of the investigated variables PBC and intention toward car use, norm to escort and car choice index for school trips were found to significantly influence on car use for work trips. The influences of psychological variables of previous step remained significant during the last step. High education became insignificant at the last step. At the contrary, while gender was not qualified to be a predictor at the first and second step, it showed up at the final step: Men use their own car more frequent for their commuting trips.

Totally the final model explained 55 percent of parents' car use for commuting trips.

5. Conclusion

This study has successfully contributed to the literature on determinants of travelers’ behavior. Variables from different categories namely socio demographic, situational and psychological showed to be influential on car use

behavior. Totally the final models explained about 60 percent of the variance of parents' car use for commuting trips. Among socio-demographic variables, age, gender and number of vehicles showed to be influential on car use. Among other variables, attitude, PBC and intention toward car use, norm toward escorting children and car choice index for school trips showed major prediction ability of mode usage.

Furthermore, our research provided evidence of an association between children's trip-related variables school trips and parent's car use. It means not only one's own variables are influential on mode choice behavior, but also role in a household unit is interestingly effective on mode choice behavior for commuting trip. After controlling demographic and psychological variables, children-related-variables of mode choice for school trips were involved in the model which enhanced the variance prediction ability by 8.8 percent in parents' public and private transportation usage respectively.

Besides the examined variables in current research, including other variables related to mode's specification and features of the decisional situations (e.g. weather and purpose of trip) would lead to higher explanation of the variance. In addition, while the current model results in preliminary results, employing more capable models such as SEM would provide examination of different pattern of combination of the variables which would lead better understanding of complicated relationship of the influencing factors.

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References

- [1] C. A. Klöckner and T. Friedrichsmeier. "A multi-level approach to travel mode choice – How person characteristics and situation specific aspects determine car use in a student sample." *Transportation Research Part F*, vol. 14, pp. 261–277, 2011.
- [2] M. Hunecke, S. Haustein, S. Böhler and S. Grischkat. "Attitude-based target groups to reduce the ecological impact of daily mobility behavior." *Environment and behavior*, vol. 42, pp.3-43, 2010.
- [3] I. Donald, S. Cooper and S. Conchie. "An extended theory of planned behaviour model of the psychological." *Journal of Environmental Psychology*, vol. 40, pp. 39-48, 2014.
- [4] I. Ajzen. "The theory of planned behavior." *Organizational Behavior and Human Decision Processes*, vol. 50(2), pp. 179–211, 1991.
- [5] S. H. Schwartz and J. A. Howard. "A normative decision-making model of altruism. In J. P. Rushton & R. M. Sorrentino (Eds.)." *Altruism and helping behavior*, pp. 89–211, 1981.
- [6] S. Bamberg and P. Schmidt. "Incentives, morality or habit?" Predicting students' car use for university routes with the models of Ajzen, Schwartz and Triandis." *Environmental behavior*, vol. 35, pp. 264–285, 2003.
- [7] B. Verplanken, H. Aarts and A. Knippenberg. "Attitudes versus general habit: Antecedents of travel mode

- choice." *Journal of Applied Social Psychology*, vol. 24(4), pp. 285-300, 1994.
- [8] C. A. Klöckner, E. Matthies and M. Hunecke. "Problems of operationalizing habits and integrating habits in normative decision-making models." *Journal of Applied Social Psychology*, vol. 33(2), pp. 396–417, 2003.
- [9] C. A. Klöckner and E. Matthies. "How habits interfere with norm directed behaviour – A normative decision-making model for travel mode choice." *Journal of Environmental Psychology*, vol. 24(3), pp. 319–327, 2004.
- [10] C. M. Collins and S. M. Chambers. "Psychological and situational influences on commuter transport-mode choice." *Environment & Behavior*, vol. 37(5), pp. 640–661, 2005.
- [11] M. Hunecke, S. Haustein, S. Grischkat, Böhler and S. "Psychological, sociodemographic, and infrastructural factors as determinants of ecological impact caused by mobility behavior." *Journal of Environmental Psychology*, vol. 27, pp. 277–292, 2007.
- [12] C. A. Klöckner and A. Blöbaum. "A comprehensive action determination model – towards a broader understanding of ecological behaviour using the example of travel mode choice." *Journal of Environmental Psychology*, vol. 30(4), pp. 574–586, 2010.
- [13] T. McMillan. "Urban form and a child's trip to school: the current literature and a framework for future research." *J. Plann. Lit.* 19(4), 440–456, 2005.
- [14] C.-F. Chen and W.-H. Chao. "Habitual or reasoned? Using the theory of planned behavior, technology acceptance model, and habit to examine switching intentions toward public transit." *Transportation Research Part F*, vol. 14, pp. 128–137, 2011.
- [15] C.-F. Chen and W. TaiLai. "The effects of rational and habitual factors on mode choice behaviors in a motorcycle-dependent region: Evidence from Taiwan." *Transport Policy*, vol. 18, pp. 711–718, 2011.