Journal of Geotechnical and Transportation Engineering
Volume 3 | Issue 1
A Quantitative Impact Analysis of Attitudes towards Safety and Traffic on High School Students' Walking...
Firouzi and Mamdoohi

Received 10/3/2016 Accepted 5/11/2017
Published 6/27/2017
Corresponding Author:
Amir Reza Mamdoohi;
armamdoohi@modares.ac.ir
www.jgtte.com

A Quantitative Impact Analysis of Attitudes towards Safety and Traffic on High School Students' Walking to School

Iraj Firouzi
MSc Student, Socio-Economic Systems Engineering, Institute for Management and Planning Studies, Tehran, Iran
Email: i.firouzi@imps.ac.ir

Amir Reza Mamdoohi
Assistant Professor, Faculty of Civil & Environmental Engineering, Tarbiat Modares University, Tehran, Iran
Email: armamdoohi@modares.ac.ir

Abstract

An increase in motorized mode for school travels has a result of morning traffic and students' physical inactivity. Although, some research has been conducted was done considering economic, social and environmental parameters of students' travel behavior, but the effect of attitudes for mode choice was not considered significantly. The purpose of this research is to discuss effects of attitude towards safety and traffic together with economic and social parameters on high school mode choice (specially walking). To collect the economic and social data and investigation of safety and traffic's attitudes, written questionnaires were distributed among 656 students of 7 high schools (public and private, girls and boys) in two educational districts of Kerman. Choosing case samples were done classified and randomly. A multinomial logit model was applied for investigation of different parameters' effects on mode choice for school trip. to decrease safety and traffic attitudes' variables, an exploratory factor analysis was applied. Results show that students which have no accessibility to public transportation and evaluate highly their Safety knowledge are walking to school with more possibility.

Keywords: School mode choice, High school students, Logit model, Attitude, Factor analysis

1. Introduction

Transportation is one of the most important issues for a society; however, increasing daily trips and private transportation can be result in serious problems (ex. traffic issue, environmental pollutions and usage of fossil fuels) and prevalence of dangerous illnesses (ex. obesity and diabetes among children and adults). Researches on adults shows that a regular physical activity like walking and cycling, can increase the duration of lifetime, decrease the risk of some illnesses (like obesity, heart diseases and type 2 diabetes) and life quality's improvement [1].

On the other hand, a significant amount commuting is related to educational travels, specially some which related to undergraduate students. Considering that most of these travels are done in morning traffic peak hours, morning traffic jam can be reduced by decreasing of private vehicles' usage in the educational travels. Considering this issue, educational travels are so important for transportation's planners.
Some effective factors like economic and social parameters were applied for previous researches. The main purpose of research is to discuss effect of attitude towards safety and traffic issues while choosing high school students trip (specially walking) mode choice. Moreover, a multinomial logit model was applied for investigation of different parameters' effects on mode choice trip. Also, attitude towards traffic safety for school trip mode choice was applied together with economic and social parameters considering lack of this issue in the exist researches. To find latent variable and parameters' decreasing (Elimination of multicollinearity), an exploratory factor analysis was applied.

2. Literature Review

Different factors were mentioned as effective ones in the published literature. In the most researches, distance between houses and schools considered as an obstacle for educational travels [2, 3, 4]. Moreover, other parameters like; student individual's characteristics, economic and social variables were considered as effective factor.

Sex is one of the student's characteristics which can be expected to have an effect on trip mode choice. Considering transportation's researches which have been done in the area of kids' trip mode choice, male students (between 14 and 15 years old) walk to schools with higher possibility in comparison with female students in the same old rang [5]. Moreover, girls are more prohibited in publics with higher parents' observation in comparison with boys [6]. Also, no significant difference between boys' and girls' trip mode choice were published in some researches [7, 8].

SPSS 22 software has been used. In factor analysis if the value of KMO is higher than 0.5, the case study would have enough sufficiency to done factor analysis [20]. In this research, the value of KMO = 0.799 was obtained which shows enough adequacy of case study and based on Bartlet test (hypothesis of correlation lack between variables was rejected) there is a correlation between variables of attitude toward safety and traffic.

Table 2- Frequency analysis of mode use

Mode	Absolute frequency	Relative frequency
School transportation's service	194	42.2
Private vehicle	136	29.6
Walking	77	16.7
Other (taxi, bus, etc.)	53	11.5
Total	460	100

Table 3- Frequency analysis of Discrete independent variable

Variable	value	Absolute frequency	Relative frequency
Gender	Male (1)	245	53
	Female (0)	215	47
Grade	1th high school	151	32.2
	2th high school	158	34.7
	3th high school	146	32.1
Car ownership	No car (0)	40	8.8
	One car (1)	281	61.9
	Two or more cars (2)	123	29.3
Motorcycle ownership	No motorcycle (0)	346	76.4
	Ownership (1)	107	23.6
Father's education	Illiterate and elementary graduated	118	26.1
	High school graduated	183	40.5
	Bachelor and graduated	151	33.4
Mother's education	Illiterate and elementary graduated	114	24.8
	High school graduated	222	49.2
	Bachelor and graduated	115	25.5
Household income	Lower/ significantly Lower than the average	54	11.9
	average	299	65.7
	Higher /highly significantly than the average	102	22.4
Father employment's status	Full time	127	28.9
	Part time	192	43.6
	Retired	65	14.8
	Other	56	12.7
Mother employment's status	Housewife	150	32.8
	Employed	307	67.2
Public transportation Accessibility's status	Accessibility	335	73
	Non-accessibility	123	27

Table 4- KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.799
Bartlett's Test of Sphericity	Approx. Chi-Square	1361.042
	df	91
	Sig	0.000

Variables with communality less than 0.3 or others with communality more than 0.3 which has been uploaded on more than one factor with less than 0.2 differences were omitted from factor analysis's procedure. Considering different factor analyses, 13 factors were obtained by orthogonal method (varimax). With respect to Eigen values (3 factors have Eigen values more than one) and Scree plot, three final factors with 47.8 percentage of variance was obtained.

Table 5- Mean and standard deviation of Continuous Variables

Variable		Mean	S.D.
Attitude toward safety and traffic	Walking time home to school	55.39	47.95
	Walking time home to the nearest bus station	9.29	11.9
	Personal responsibility for safety in transport	1	0
	Priority of safety versus effectiveness in transport	1	0
	Safety knowledge	1	0

Table 6 - Factor Analysis of attitude toward safety and traffic

To which extent do you agree or disagree with the following statements about safety in transport	Factor loadings	Cronbach's α	Average corrected item-total correlation
Dimension 1. Personal responsibility for safety in transport			
I feel personal responsibility for prevention of accidents	0.533		
I think it is important always to focus on safety	0.560		
I feel responsibility for other people's safety	0.644		
It is important for me to do all I can to prevent accidents	0.713	0.748	22.5
Safety traffic is subject that people have to feel responsibility about it	0.614		
It is worth doing an extra effort to take care of my own safety	0.619		
I think it is important to encourage other persons to behave in a safe manner Dimension	0.626		
Dimension 2. Priority of safety versus effectiveness in transport			
A transportation company which is more profitable in economic concerns is better than one which consider safety issue more	0.614		
Society would come to a stop if all safety rules and regulations should be followed	0.696	0.624	14.7
Safety is important, but it is also important to arrive in time	0.771		
Governments have the largest responsibility in transportation's safety			
Dimension 3. Safety knowledge			
I know very well how I ought to take care of my safety when I use public transportation	0.814	0.516	10.5
I have good knowledge about safety in public transportation	0.878		

3.4. Multinomial logit

Logit models especially multinomial logit, have a huge usage in discrete choosing's literature. In these models, based on characteristics of mode and properties of decision maker, a utility function for each mode are considered. Then, based on Gambel distribution choosing possibility will be estimated. In other word, in this model the possibility of choosing "n" mode by "i" person within "K" will be calculated [21].

In this research for discus about the effect of economic and social variables and the role of attitude toward safety and traffic for educational travel mode choice (specially walking) for high school's students, a multinomial logit model has been applied. Results from table 4 shows that 88.5% of Kerman's students are using family private vehicle, school's transportation service and walking to go school. Other mode does not have a great portion. the model was made based on four modes (family private car, school's transportation service, walking and other modes). Other mode was chosen as a basic mode with zero utility.

Different variables (dummy, nominal, ordinal, continues and different combination of them) were considered for modeling procedure. After making more than 200 multinomial logit models by NLOGIT 4 software, final model was chosen. Table 7 shows significant Coefficient of each variables and the effect of trip mode choice on them.

4. Model results and analysis

Boys have less interest to use school transportation's service and private vehicle which shows their tendency to choose more independence modes. In other word, girls prefer to use family owned vehicle and school transportation's service to avoid challenges and way's dangers. Also, negative coefficient for being a boy may how that less independency which families are giving to their girls. Moreover, high school's students in higher grades have less interest to use family private vehicle which can show a direct relation between age and tendency to independency.

Students, which their family has a motorcycle, prefer to walk to school or use school transportation's service. Probably they do not use motorcycle because of their perception about its danger or their shame to their classmates. Moreover, helping younger kids may have higher priority for fathers than older ones considering their ability to go to school.

Students who have a retired father may use school transportation's service less than others because of lower family income. Also, boys which their father has a full-time job, use private vehicle less than others which may because of less father's free time.

The coefficient of mothers owned driving license is positive which shows they would get their children to school if they have a driving license. Also, walking rate for students who have mothers with higher educational level is lower. It seems that mothers with higher educational level have higher perception about environment's danger which lead them to forbid their children to walk to school.

Considering higher perceived walking time, boys have less interest to walk to school which may relate to below reasons;

1. After variance analysis, difference between mean Perceived walking time for boys and girls got to be reasonable which is 55 minutes for boys and 27 for girls and, shows that boys choose high school with more distance to houses. So, increasing in Perceived walking time for boys may make walking to school practically impossible. Considering that girls choose closer schools to their homes, Perceived walking time increase is not an effective factor on their walking interest and changing travel mode choice.
2. Boys can use bicycle for going to school so Perceived walking time increase makes them to prefer using bicycles which is a free charge and a fast mode.
3. Boys can trust easier to other transportation mode specially taxies and private drivers. So, their perceived walking time leads them to use other modes in comparison with girls.

The last variable which has an effect on travel mode choice is attitude towards safety and traffic. Students who have higher safety knowledge and don't have an access to public transportation, prefer to walk to school more.

Table 7- Result of school trip mode choice multinomial logit model

Travel mode	variable	Coefficient	P[|Z|>z]
school's transportation service	constant	2	0.00
	Male	-1.11	0.0016
	motorcycle ownership	0.58	0.041
	Father retired	-0.59	0.058
Private car	constant	2.26	00.00
	Male	-1.17	0.001
	Grade	-0.37	0.009
	Mother's driving license	0.45	0.07
	Fulltime employment father's boy	-0.58	0.081
walking	constant	2.29	0.00
	Safety knowledge for whom does not have an access	1	0.001
	Boys' Perceived walking time	-0.06	0.000
	Mother education	-0.66	0.006
	motorcycle ownership	0.86	0.01
LL(0)=-636.69	LL(C)= -585.38	LL(B)=-462.28	
$\boldsymbol{\rho_0^2 = 0.27}$		$\boldsymbol{\rho_c^2 = 0.21}$	

5. Conclusions and suggestions

The increasing use of private car on school trip leads to morning traffic and students' physical inactivity. This research has been done to discuss the effect of attitude toward safety and traffic on high school student's walking to school. A multinomial logit model has been considered to understand the effect of different factors on trip mode choice. Considering research lack, in addition to economic and social parameters the effect of attitude toward safety and traffic on high school trip mode choice was applied. To collect economic and social data and determination of attitude toward safety and traffic "in April 2015" a questionnaire was made and distributed among 656 students of Kerman with a return number of 604. To solve multicollinearity, finding latent variable and decreasing independent parameters an exploratory factor analysis was used. Based on results of more than 200 multinomial logit models, the final model for Kerman students travel mode choice' behavior included 8 variables. It was observed that Attitude towards safety and traffic has an effect on travel mode choice. Students who think that their knowledge about safety is high, prefer walking when there is no choice for using public transportation for going to school. So, by education students about safety, the probability of choosing walking to school will be increased for them. Sex has an effect on educational travel mode choice. While girls are more interested to use private vehicle and school transportation's service, boys prefer to choose more independent modes. By making culture and decrease dangers of way from home to school, girls will be encouraged to use public transportation and walking to school. Also, Perceived walking time's increase makes boys walk to school with lower probability and it can be a result of their biking facility and trusting on other transportation modes. So, by Perceived walking time's increase, they have more interest to use other modes. higher grade high school's students have less interest to use private vehicles. Student who has a family with owned motorcycle are more interested to walk to school and using school transportation's system. Also, high school boy students which have a father with full time job, go to school with private vehicle with lower probability. Student who have mothers that have driving license, use private vehicle with higher probability. Also, students that have higher educated mothers, walk to school with lower probability.

For future research, it would be suggested to consider other attitudes (attitudes toward walking and environment) and psychological parameters (specially danger's perception) for high school students' educational travel mode choice. Moreover, student travel's behavior of other age ranges can be considered and compared with high school's students. Considering that cronbach's alpha for third factor in the factor analysis has a mean value of 0.51, it would be suggested to use a confirmatory factor analysis for future work.

References

[1] R. Mitra, "Independent Mobility and Mode Choice for School

Transportation : A Review and Framework for Future Research Independent Mobility and Mode Choice for School Transportation: A Review and Framework for," *Transp. Rev.*, vol. 33, no. 1, pp. 21–43, 2013.
[2] N. C. McDonald, "Children's mode choice for the school trip: The role of distance and school location in walking to school," *Transportation (Amst).*, vol. 35, no. 1, pp. 23–35, 2008.
[3] M. Oliver, H. Badland, S. Mavoa, K. Witten, R. Kearns, A. Ellaway, E. Hinckson, L. Mackay, and P. Schluter, "Environmental and socio-demographic associates of children's active transport to school: a cross-sectional investigation from the URBAN Study," *Int. J. Behav. Nutr. Phys. Act.*, vol. 11, no. 1, pp. 70–82, 2014.
[4] A. Broberg and S. Sarjala, "School travel mode choice and the characteristics of the urban built environment: The case of Helsinki, Finland," *Transp. Policy*, vol. 37, pp. 1–10, 2015.
[5] R. Mitra and R. N. Buliung, "Exploring differences in school travel mode choice behaviour between children and youth," *Transp. Policy*, vol. 42, pp. 4–11, 2015.
[6] O. Stewart, "Findings from research on active transportation to school and implications for safe routes to school programs," *J. Plan. Lit.*, vol. 26, no. 2, pp. 127–150, 2011.
[7] S. L. Martin, S. M. Lee, and R. Lowry, "National prevalence and correlates of walking and bicycling to school," *Am. J. Prev. Med.*, vol. 33, no. 2, pp. 98–105, 2007.
[8] L. Grize, B. Bringolf-Isler, E. Martin, and C. Braun-Fahrländer, "Research Trend in active transportation to school among Swiss school children and its associated factors: three cross-sectional surveys 1994, 2000 and 2005," *Int. J. Behav. Nutr. Phys. Act.*, vol. 28, no. 7, pp. 1–8, 2010.
[9] A. Ermagun and A. Samimi, "Promoting active transportation modes in school trips," *Transp. Policy*, vol. 37, pp. 203–211, 2015.
[10] N. C. McDonald, "Active transportation to school: trends among US schoolchildren, 1969–2001," *Am. J. Prev. Med.*, vol. 32, no. 6, pp. 509–516, 2007.
[11] R. N. Buliung, R. Mitra, and G. Faulkner, "Active school transportation in the Greater Toronto Area, Canada: an exploration of trends in space and time (1986–2006)," *Prev. Med. (Baltim).*, vol. 48, no. 6, pp. 507–512, 2009.
[12] H. P. Van der Ploeg, D. Merom, G. Corpuz, and A. E. Bauman, "Trends in Australian children traveling to school 1971–2003: burning petrol or carbohydrates?," *Prev. Med. (Baltim).*, vol. 46, no. 1, pp. 60–62, 2008.
[13] S. Easton and E. Ferrari, "Children's travel to school—the interaction of individual, neighbourhood and school factors," *Transp. Policy*, vol. 44, pp. 9–18, 2015.
[14] M. Mehdizadeh, A. R. Mamdoohi, M. Fallah Zavareh, "A Mode Choice Model for Elementary School Trips Based on Cultural Variables (A Case Study)," The 13th International Conference on Traffic and Transportation Engineering (in Persian). 2014.
[15] T. E. McMillan, "The relative influence of urban form on a child's travel mode to school," *Transp. Res. Part A Policy Pract.*, vol. 41, no. 1, pp. 69–79, 2007.
[16] T. McMillan, K. Day, M. Boarnet, M. Alfonzo, and C. Anderson, "Johnny walks to school—does Jane? Sex differences in children's active travel to school," *Child. Youth Environ.*, vol. 16, no. 1, pp. 75–89, 2006.
[17] B.-E. Moen, "Risk perception, priority of safety and demand for risk mitigation in transport," 2008.
[18] H. Iversen and T. Rundmo, "Attitudes towards traffic safety, driving behaviour and accident involvement among the Norwegian public.," *Ergonomics*, vol. 47, no. 5, pp. 555–572, 2004.
[19] T. Rundmo, T. Nordfjærn, H. H. Iversen, S. Oltedal, and S. H. Jørgensen, "The role of risk perception and other risk-related judgements in transportation mode use," *Saf. Sci.*, vol. 49, no. 2, pp. 226–235, Feb. 2011.
[20] H. Abdi and L. J. Williams, "Principal component analysis," *Wiley Interdiscip. Rev. Comput. Stat.*, vol. 2, no. 4, pp. 433–459, 2010.
[21] K. E. Train, *Discrete choice methods with simulation*. Cambridge university press, 2009.