COMPARISON OF WALKING AND CYCLING TO SCHOOL IN UNITED STATES: EVIDENCE FROM NHTS 2017 AND 2009 DATA

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ABSTRACT

Active commuting (i.e., walking and cycling) to school is naturally inferred as healthful and sustainably equitable. However over the past few decades, rapid urbanization and expanding traffic infrastructure has caused a decline in walking and cycling all over the world. Children with sedentary life styles are more at risk of having health issues like obesity and cardiovascular diseases. Nonetheless, walking and cycling to attend school has gradually increased in some countries and states of the world. This study examines predictors of increase or decrease in active commuting for attending school in United States using NHTS 2017 survey data. The findings shows a gradual decrease of 47% to 44% in car use in 2017 and a substantial increase of 4% and 19% in walking and cycling. In addition, in the year 2017 walking and cycling trips for going to school has been increased 3.9 times and 3.4 times respectively. California had highest percentage (38%) of walking trips among all the states. However the walking trips are decreased by 3.6% as compared to trips in 2009. Between the years 2009-2017 a substantial decrease has been observed for the states of Iowa (41.5%), South Carolina (69%) and Wisconsin (60%). Results of MNLR models for 2009 and 2017 shows that males are more likely to do cycling and waking for going to school as compared to females, but the smaller co-efficient value in 2017 model for males going to school by cycling can be accredited to increase in the percentage of female population in these years.

INTRODUCTION

Walking and cycling improves energy efficiency and are sustainable means of transport *(Gao et al., 2017).* Prevalence of walking and cycling and monitoring them among different population subgroups because of dissimilar rates is of paramount importance. Cycling itself is considered as a specific travel mode or as an alternative to car driving *(Olafsson et al., 2016).* As per US Census Bureau report the proportion of people walking to work among citizens has decreased 4 times in 2009 over the past few decades *(Pucher et al., 2010).* Being integral elements of active travel, an orderly data analysis of walking and cycling is essential for finding out the turnaround for different subgroups. This study focuses on walking and cycling to school in United States to promote active transportation, improve the built environment to be more accommodative for walking and cycling and to assess plans and implementation programs that will improve safety for the same using NHTS 2017 data. For NHTS 2009 data US households were contacted through randomly generated telephone numbers for information related to "household, person, vehicle and trip". However for NHTS 2017 survey FHWA underwent major changes in survey by executing address based sample and shifting to self-completed web based survey instead of interviewer assisted telephone surveys. Assimilating the physical activities students need, walking and bicycling also helps forming health habits among the students that can last a life time *(Kwaśniewska et al., 2010; Moscato et al., 2015).*

There is an utter need of dire attention to create multimodal environment for encouraging active commuting and eliminating the negative consequences of lack of physical activity among scool children *(Steiner et al., 2006).* After the launch of Safe Route to School (SRTS) programme in California in 1997 that focused on safety via infrastructure development, the US Congress budgeted $1.2 Billion for it. However after its termination in June 2012 a new transportation bill with the name "MAP-21" (Moving Ahead for Progress in the 21st Century) was passed by Congress. SRTS got merged with other bicycling and walking funding programme called "Transportation Alternatives". After successful implementation of SRTS programme and "Transportation Alternatives" post evaluation of 55 schools in Florida, Mississippi, Washington and Wisconsin in 2014, walk to school rate increased from 9.8% to 14.2% *(SRTS guide. 2015).* Accordingly, framing policies to grow or cause to grow the interest of public for cycling and walking, understanding the relation among some factors and establishing a connection among their determinants are essential.

The objective of the study is to make a comparison of walk to school and factors affecting the choice of mode for going to school.

METHODOLOGY

Data Analysis

The data used in this particular report is based on two recent surveys of NHTS (2009-2017) to measure changes in walking and cycling for attending school in United States. Descriptive

statistics are applied to infer the changes in walking and cycling for attending school in different states of United States. Trip file of NHTS data contains sufficient demographic, socio-economic, built environment and individual characteristics of commuters.

The outliers, missing and negative responses from the date were eliminated for further statistical analysis after selecting the required variables. The Data is filtered to have the children trip data to or from school.

- Those trips are considered made by commuters of age less than 18 years,
- trips made on Saturday and Sunday were excluded,
- trips during the summer vacations i.e. for the month of July and August removed from the data;
- and the trip made between the time 6:00am to 9:00am and 2:00pm to 17:00pm were included to get the final school trips.

The variable "R_Age" is transformed into four bins with ranges; 5-10, 11-13, 14-15 and 16-18. Variables for house hold family income and HHVEHCNT and count of household vehicles were categorized into different levels as shown in **table-1**. Respondent age "R_Sex" and URBRUR (Urban/Rural) are binary variables and HHSIZE, (the count of house hold members) and TRVLCMIN (trip duration in minutes) are taken as continuous variables. Ten states with highest number of trips are selected for detailed analysis of active transportation mode to school for demographic regions among all states. Followed by statistical analysis, Multinomial logistic regression was used to analyze NHTS data sets and evaluate the significant factors influencing the behavioral change in the years between 2009 and 2017.

Table -1 Variable Bins and Description

Variable	Bin	Description
EDUC	*Less Than High School*	Respondent having less than high school education.
	High School Degree	Respondent attained high school degree.
	College Degree	Responded with diploma of College degree.
	University Degree	Respondent accomplished Bachelor's, Graduate or Professional degree
HHVEHCNT	0	If Count of Household vehicles = 0
	1	If Count of Household vehicles = 1
	2	If Count of Household vehicles = 2
	3	If Count of Household vehicles = 3
	4	If Count of Household vehicles = 4
	>4	If Count of Household vehicles > 4

HHSTATE	AZ	Respondent household state, Arizona
	CA	Respondent household state, California
	GA	Respondent household state, Georgia
	IA	Respondent household state, Iowa
	MD	Respondent household state, Maryland
	NC	Respondent household state, North Carolina
	NY	Respondent household state, New York
	SC	Respondent household state, South Carolina
	TX	Respondent household, Texas
	WI	Respondent household, Wisconsin

RESULTS

Analysis of 2009 and 2017 NHTS data in **Fig 1** shows that use of car has been decreased from 47% to 44% in 2017, whereas, use of public transport experienced an increase of 56%. Similarly, school bus as a mode of transportation has been increased 5 times than in 2009. However walking and bicycling for all destination purposes, observed an increase of 4% and 24% respectively. Likewise in the year 2017 walking and cycling trips for going to school has been increased 3.9 times and 3.4 times respectively.

Ten states having the highest number of trips for going to school in 2017 were considered for analysis. Results showed that use of car for going to school as a mode of transportation is highest among all other modes in these states as shown in **Fig 2**. Percentage of use of car for going to school was 54% in 2009 while it decreased to 38% in 2017. However, use of school bus, public transport, bicycle and walk for going to school has increased 3.8, 1.6, 3.4 and 2 times respectively between the years in 2009 and 2017 in these states.

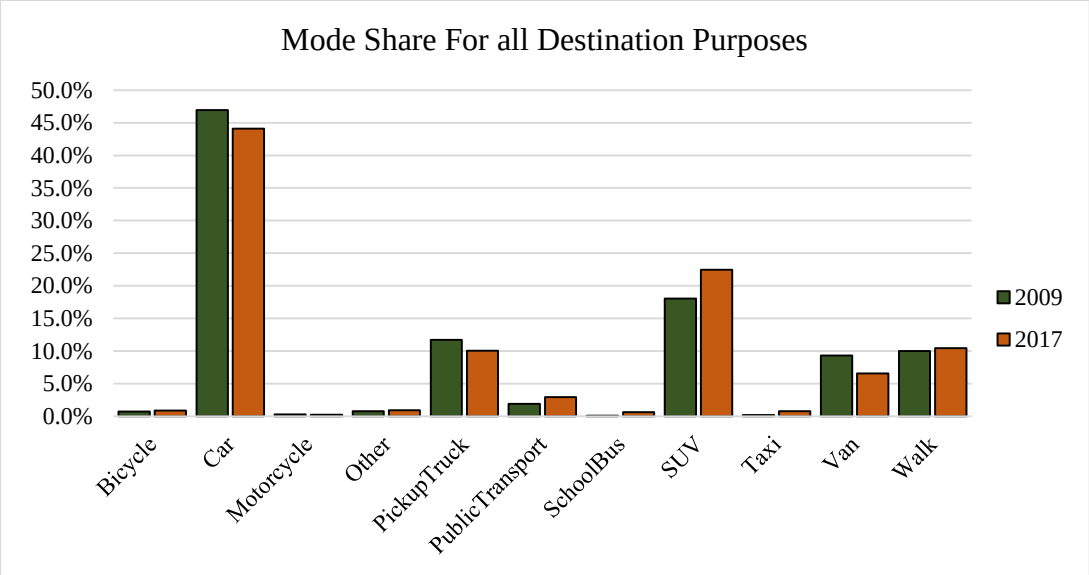

Fig: 1 Mode Share for All Destination Purposes all Over United States

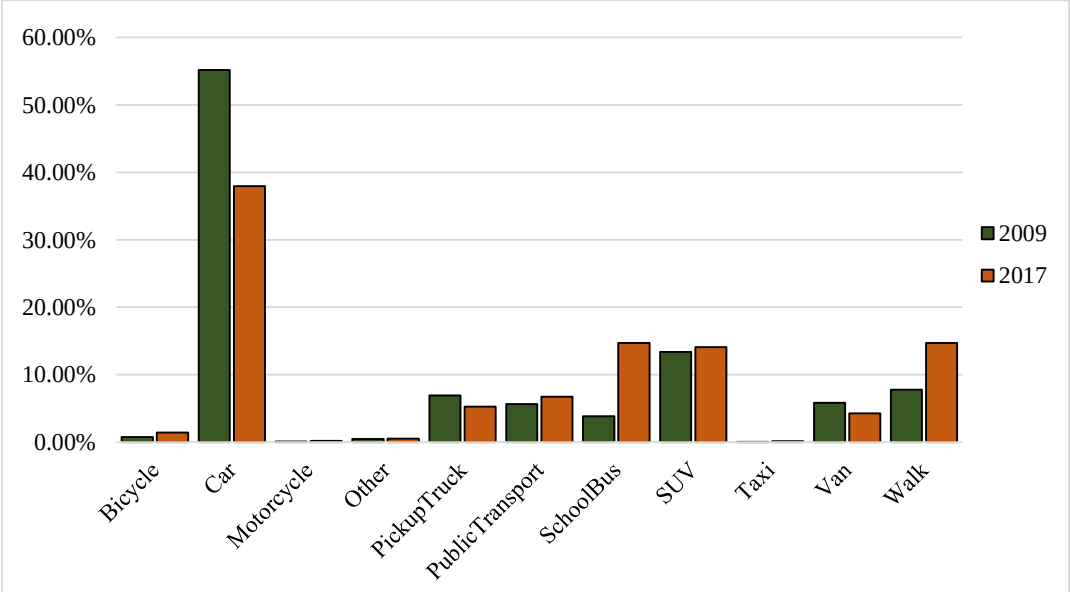

Fig: 2 Mode Share to School for all states

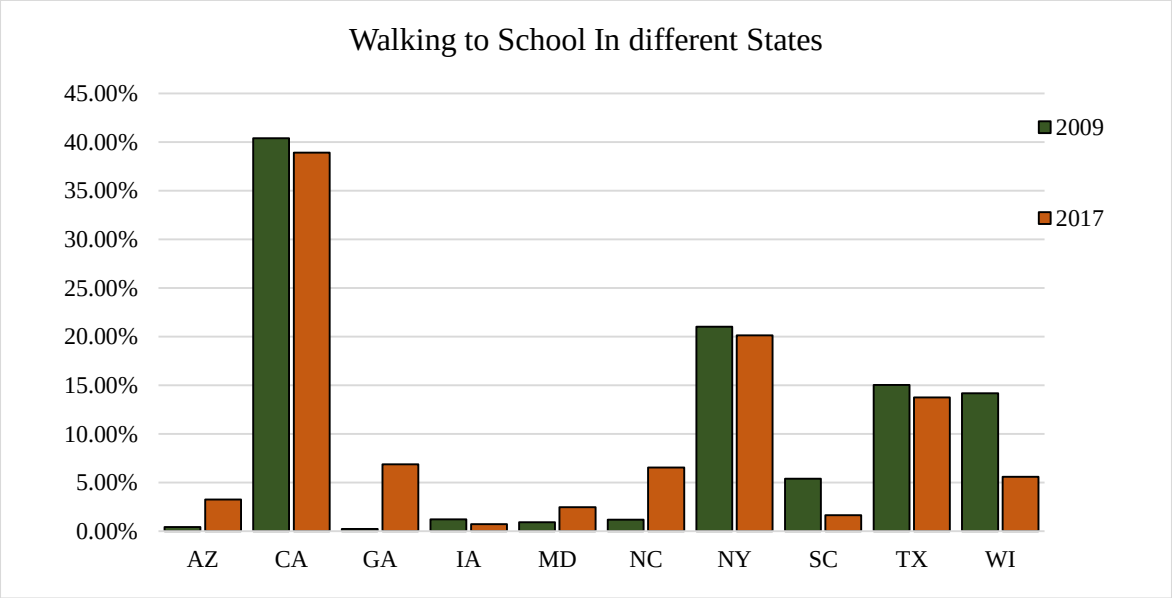

Fig: 3 Walking to School in different States

As per results Georgia (GA) noticed a significant increase of 32 times in walking trips to school in 2017. Likewise walking trips to school in Arizona (AZ), Maryland (MD) and New York (NY) experienced an increase by 7.6, 2.7 and 5.6 times in 2017 respectively. California had highest percentage (38%) of walking trips among all the states. However the walking trips are decreased by 3.6% as compared to trips in 2009. Between the years 2009-2017 a substantial decrease has been observed for the states of Iowa (41.5%), South Carolina (69%) and Wisconsin (60%).

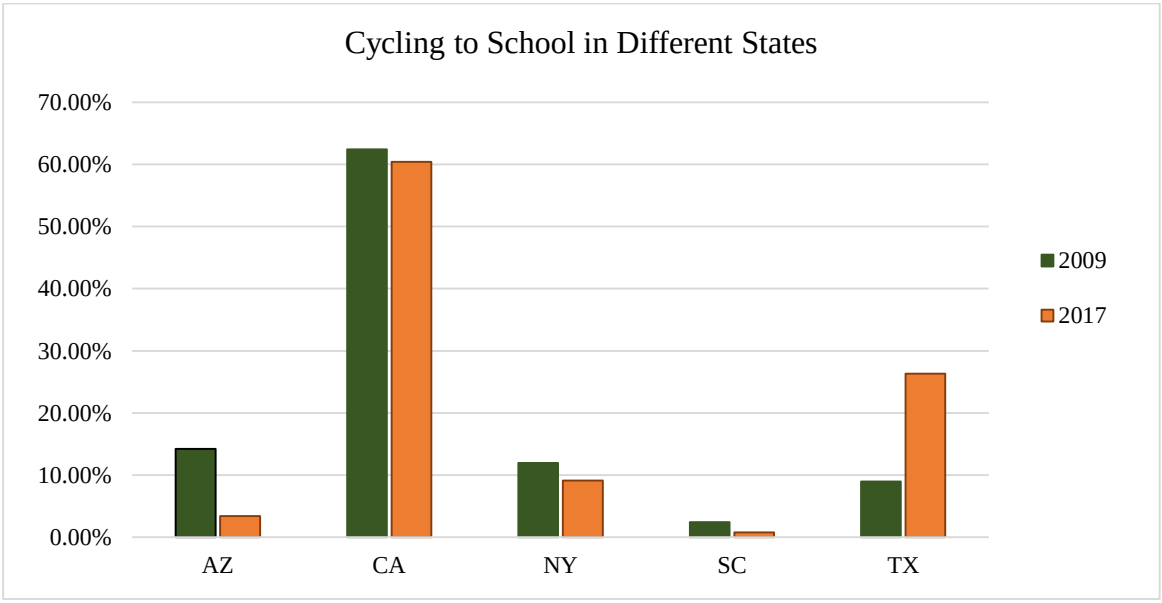

Fig: 4 Cycling to School in Different States

Because of the missing data for the rest of sates in NHTS 2009 survey, the remaining five states (Arizona, California, New York, South Carolina and Texas) were considered for comparing cycling trips to schools between years 2009-2017. Texas in contrast, noticed a 3 times increase in cycling trips to schools as compared to a considerable decrease in cycling trips for the rest of states in 2017.

Results of MNLR models presented in **Table-2** for 2009 and 2017 shows that males are more likely to do cycling and waking for going to school as compared to females, but the smaller co-efficient value in 2017 model for males going to school by cycling can be accredited to increase in the percentage of female population in these years.

The negative coefficient values of 2009 and 2017 models for TRVLCMIN (trip travel time) variable shows that people going to school prefer walking and cycling for trips with shorter travel time. However it is evident from smaller negative coefficient value of TRVLCMIN variable for 2017 model that people explicitly prefer "walking and cycling" to school for trips with longer travel time as compared to that in the year 2009.

Table- 2 Multinomial Logistic Regression Model Results

	NHTS 2009		**NHTS 2017**	
Correlates	**Bicycle**	**Walk**	**Bicycle**	**Walk**
R_SEX	2.600***	0.136	1.122***	0.171**
TRVLCMIN	-0.131***	-0.087***	-0.045***	-0.047***
HHSIZE	-0.554*	0.431***	0.012	0.219***
HHVEHCNT0	5.900***	5.205***	2.518***	3.604***
HHVEHCNT1	2.073	2.281***	1.630***	1.582***
HHVEHCNT2	-0.022	1.012**	1.097**	0.831***
HHVEHCNT3	0.884	0.19	0.464	0.689***
HHVEHCNT4	0.067	0.461	0.442	0.408**

Note: $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

The coefficients of HHVEHCNT (house Hold Vehicle Count) variables shows that people possessing no vehicle are more probably going to prefer walking or cycling as compared to the household with vehicle ownership. Vehicle ownership governs the probability of walking and cycling and validates its decrease with increase in number of vehicles in a household and vice versa.

Conclusion

The overall increase in walking and cycling trips are due to the reason of 30% reduced car trips between the years 2009-2017. Consequently, the notable decrease in use of car for purpose of attending school can be attributed to the considerable increase in use of school bus, walking and cycling between years 2009-2017. The decrease in walking trips for Iowa (41.5%), South Carolina (69%) and Wisconsin (60%) can be attributed to the increase in trips on school bus.

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