

## Gender Differences in Travel Behavior for Daily Trips in Kathmandu Valley

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### Abstract

Kathmandu valley is the main center for economic activities and with it travel demand has increased drastically in the Valley in the recent years, along with rapid growth in population. This paper brings into highlight, the role of gender on urban mobility, for daily trips, by assessing the gender differences in travel behavior of workers and students, in commuting their work and educational trips respectively. Household survey was carried out in different parts of the study area, using random sampling. Data was analyzed to associate gender with travel mode choice and trip length. The statistical analysis of the travel data shows that there is a significant level of association between gender and the way, they travel. The modal share and trip length varies significantly between men and women, more prominently for work trips. For educational trips, the variation is observed comparatively, to a lesser extent. For work trips, men are using more of the private vehicles and relying less on public transport and non-motorized means of travel, as compared to women. It is also revealed that males are commuting longer trip distances as compared to females. From the findings, recommendations are made for gender equality in urban transport and promotion of sustainable urban mobility, emphasizing the use of public transport and non-motorized modes of transport.

**Keywords:** Daily Trips, Gender, Kathmandu Valley, Travel Behavior

### Introduction

Travel behavior is generally referred to as how people travel and what they do over the space. (Hayes, 1993). Travel behavior is characterized by mainly trip purpose, trip distance, trip frequency and modal choice (Banister, Watson, & Wood, 1997). Socio-demographic factors have a significant role in determining travel behavior and Gender is one of them, that accounts the differences in the way people travel.

Study of the travel behavior that associates gender with, mobility and sustainable development has only recently begun to emerge in the body of literature on gender and mobility. One of the reasons behind this is due to the lack of gender-differentiated statistics, which makes it difficult to understand gender differences in relation to reasons for making journeys, journey frequencies, distance traveled, or mobility-related problems in accessing services and employment (CIVITAS, 2014). Many researches on gender and travel characteristics revealed that a difference exists in the way men and women, travel in both developed and developing countries, more importantly with respect to choice of the mode, trip distance and frequency of trips (Oyesiku, 2002; Peter, 2000). In case of developed countries, gender difference in travel behavior is a well-known fact. However, for developing countries, this issue has received much less attention, where there is a possibility that difference might be wider and even unique in some aspects (Babinard & Scott, 2009; Duchene, 2011; Nobis & Lenz, 2004; Peters, 1998). A study of the gender related travel behaviour in towns and cities in developing countries will help the planners, policy formulators and city managers to identify appropriate and sustainable measures, to address urban transport problems of women and the possible direction of future development (Adetunji, 2012).

Globally, there are many studies, done to analyze the gender difference in travel behavior. The reason behind gender differences in travel behavior has been the subject of a variety of interpretations according to Hanson and Johnson (1985) and the authors claim that the level of women's mobility is dependent primarily on spatial and economic factors, mainly related to lower average incomes, the location of female-dominated occupations in metropolitan areas, and women's greater dependence on public transit. While economic and spatial factors clearly play a role in determining women's home and work location choices, commuting patterns, and employment outcomes, a number of scholars have

argued that an unequal division of power and labor in the household is an important determinant of gender variation in travel behavior (Hanson & Pratt, 1990; Madden, 1981; Preston, McLafferty, & E., 1993).

Many papers have highlighted the differences in travel behaviour due to gender as a significant factor, with women recognized as being more likely to adopt sustainable travel behaviour, compared with men. Perhaps the strongest link between travel behaviour and gender was found by Polk (2003, 2004) in studies of travel behaviour in Sweden. Polk (2004) found a significant relationship between sustainable travel patterns and gender. Women were more willing to reduce their use of the car than men, more positive towards reducing the environmental impact of travel modes and more positive towards ecological issues. Polk (2004) concludes by stating that researchers must consider gender as a factor in attitudinal research on car use.

Moriarty and Honnery (2005) studied urban travel in all Australian State capital cities. Although the major emphasis was on studying the relationship between the distance from place of residence to the Central Business District (CBD) of each city and the impact on travel behaviour, their study found that women on average travel less often and for shorter distances than men. In a study of travel behaviour and constraints of low-income households and females in Pune, India, Astrop, Christan, and Babu (1996) reported that there are gender variations in household trip frequencies, trip distance and modal choice. According to them, women depend mostly on foot for short trips and rely on public transport particularly bus when long distances are involved, while men depend on family-owned vehicles, mostly motorcycles and scooters, to meet their travel demands. Extent of mobility also varies as per the gender. According to research carried out by Adeel, Anthony, and Zhang (2014) in Pakistan, women made only half the trips as men do and women spend more time in travel using public transport, which makes their leisure time short. The authors emphasized that socio-economic variables like age, marital status and household responsibility seem to affect the trip characteristics of women more than men. However, in the study carried out by Conger (2001) in Knowville, USA, it was observed that women made more trips than men do, at the ratio of 3.61 to 3.29 trips per day. So, it is quite evident that the gender difference in travel behavior is subjected to vary with place and social environment. Therefore, gender differences in travel behavior needs to be studied, specific to the area.

## **Objectives**

It is very important to bring the issue of gender and travel behavior into the highlight, if gender equality in transport sector is to be promoted. This paper aims to study the gender difference in travel behavior, for the Kathmandu Valley. Two aspects - mode choice and trip length of men and women, for daily trips that includes work and educational trips, were analyzed in this paper with respect to gender using statistical analysis, to study the difference in the way, they travel.

## **Study Area**

The study area for the research is the Kathmandu Valley, Nepal that comprises of three districts, Kathmandu, the capital city, Lalitpur and Bhaktapur with a population of about 3 million (CBS, 2021), that includes 1.52 million male and 1.48 million female population. The valley is recognized as the economic and administrative center of the nation. It is the main attraction center for employment and educational opportunities and as a result, it is in the process of rapid urbanization along with population growth and increasing city sprawl. This has a direct implication on travel demand that has increased drastically over the past few decades. The Urban land use of the Kathmandu Valley can be classified into various zones mainly residential, commercial, mixed, conservation, agricultural, industrial, institutional and urban expansion. The city core is very dense where much of the population and facilities are concentrated (Figure 1).

Level of auto-mobilization has escalated dramatically and more importantly, the concern is in the share of private vehicles that has gone up sharply, as compared to public transport. Use of private vehicles is getting popular for both men and women. Public transport that is operating within the valley, lacks

quality service and as a result, it is not proving to be attractive to most commuters. The level of dissatisfaction with public transport is very high. The main reason is due to the fact that the current public transport is not able to provide quality service to the people. It applies especially for women, where majority of them do not feel comfortable, particularly due to overcrowding, as revealed by the study conducted by CEN/CANN (2012). Also, the transport system is not friendly to pedestrians and cyclist. It is very important that gender issues are taken into consideration for sustainable urban mobility. However, in context of Kathmandu Valley, role of gender on urban mobility has not received much attention. This paper emphasizes this issue, by analyzing the relationship between gender and travel behavior.

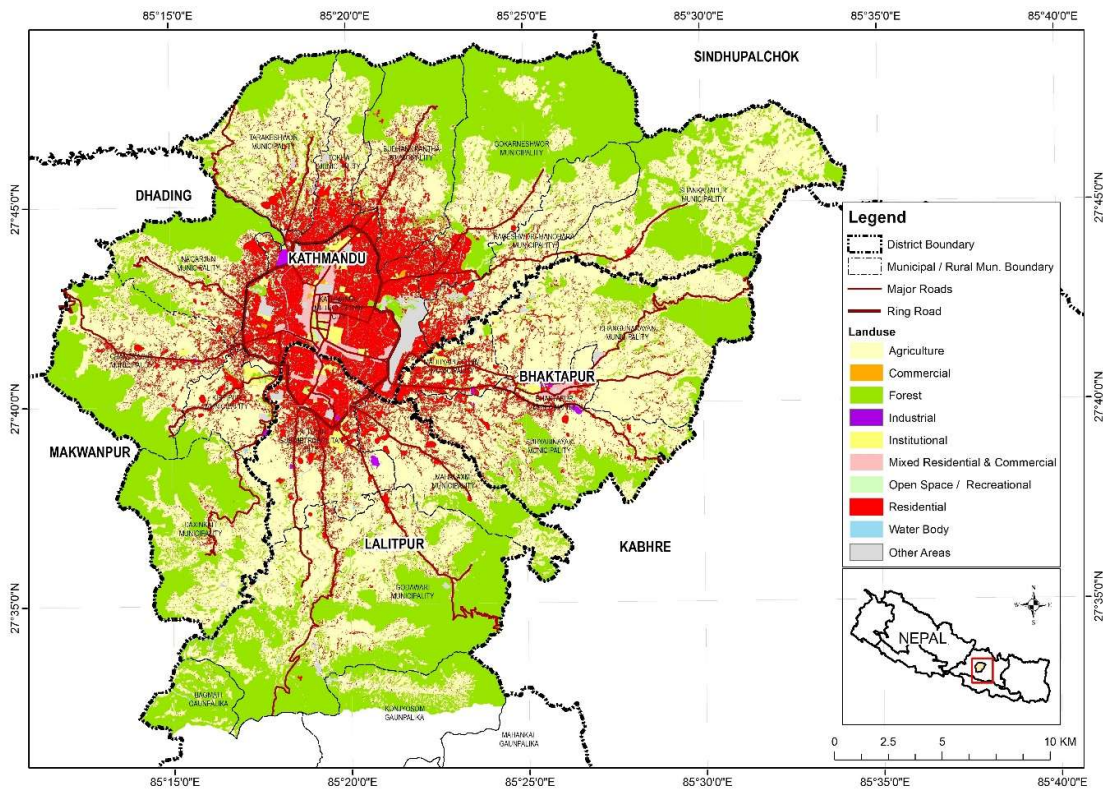


Figure 1: Urban Land use and Road Network of Kathmandu Valley

### Methodology

The research is the correlational research where the statistical relationships between variables of travel characteristics and gender were assessed. Using cross-sectional household questionnaire survey data was collected from 2300 households using proportionate stratified random sampling. Trip data of the household members, who are either a worker or a student (primary school or above) in commuting their work and educational trips respectively, were collected. The surveyed samples include trip data of 3603 work trips 2658 and educational trips, collected from household members. About 67 % of the respondents are male, and 33 % are females.

Data analysis was done using descriptive and inferential statistical analysis. Bivariate analysis using chi-square statistic was carried out, to test the dependence of two variables. Independent t-test was also used to compare means. The Chi-Square statistic was used to evaluate Tests of Independence using a cross-tabulation that presents the distributions of two categorical variables simultaneously. To conclude the hypothesis with 95% confidence, the p-value of the Chi-Square statistic should be less than 0.05. If p-value is less than 0.05, we can conclude that the variables are not independent of each other and that there is a statistical relationship between the categorical variables. Chi-square test was extended together with effect size using Cramer's V to guide us the strength of the relation. The value of 0.1 can

be taken as small effect and 0.3 and 0.5 as medium and large effect respectively (Cohen, 1988). Odd’s ratio was calculated as an additional measure of effect size for more precise interpretation of comparison (Field, 2009).

**Results and Discussion**

***Trip Rate per Household***

The trip rate helps to assess the extent of mobility. Table 1 shows the trip rate per household per day for work and educational trips. Work trip rate of men per household is found to be more, almost three times, that of women. It shows that men are more involved in employment as compared to women. It also reflects that the level of employment of women is low, meaning that they are mostly involved in household activities. For educational trips, the difference is marginal, but still, trip rate of males is higher. For females, educational trip rate per household per day is 0.49, whereas for males, it is 0.67.

*Table 1: Trips per HH per Day*

Gender	Work Trip Rate	Edu. Trip Rate	Aggregate
Female (F)	0.40	0.49	0.89
Male (M)	1.17	0.67	1.83

***Modal Share***

The modal share of work and educational trips is shown in Table 2 by gender. For educational trips, there is minimal variation in modal shares of males and females. For work trips, there is a considerable difference in modal share by gender.

*Table 2: Modal Share by Trip Purpose*

Mode Category	Travel Mode	Educational Trips		Work Trips	
		Female	Male	Female	Male
Private	Car	2.7%	2.5%	7.5%	25.2%
	Motorcycle/Scooter	13.8%	21.4%	32.1%	54.3%
Public	Tempo	1.8%	1.6%	4.3%	.6%
	Microbus	5.7%	4.5%	8.1%	2.9%
	Bus	47.0%	45.5%	18.5%	8.8%
Non-Motorized	Bicycle	0.2%	1.1%	0.0%	1.0%
	Walking	28.9%	23.5%	29.4%	7.3%

The difference by gender for each travel mode is further whereby statistical tests were done to observe the nature of the relationship between a particular mode choice and gender.

***Gender and Mode Choice***

Using bi-variate analysis, two categorical variables are cross-tabulated with the dependent variable showing the choice of each mode - car, motorcycle, public transport, walking and bicycle against gender as an independent variable, for both work and educational trips.

***Car Users***

Table 3 shows the cross-tabulation between the choice of a car and the gender for work and educational trips. The result of the chi-square test shows the relation to be significant for work trips with medium effect size (Cramer’s V = 0.2). More of the men are using car for their work trips, shown by odd’s ratio of 4.22, which indicates that men are over four times more likely to use a car, as compared to females.

The relation is, however, not significant for educational trips. The figures show very few cases, less than 3 % of the students, using a car for the trip.

Table 3: Car × Gender

Trip Purpose	Gender	User		Non-User		Pearson Chi Square	P-Value	Cramer's V	Odds Ratio (M:F)
Work	F	7.2%	65	92.8%	838	130.0	< 0.05	0.2	4.22
	M	24.9%	652	75.1%	1964				
Educational	F	2.7%	30	97.3%	1084	0.4	Not Significant.	N/A	N/A
	M	2.6%	39	97.4%	1483				

**Motorcycle / Scooter Users**

For motorized 2-wheeler vehicle use, that includes both motorcycles and scooters, the results of chi-square test (Table 4) show the relation to be significant for both work and educational trips. The difference is more observed for work trips, with medium effect size (Cramer’s V = 0.2) and odds ratio of 2.5, indicating that men have more tendency to use motorcycles, as compared to women, for going to their work places. For educational trips, the extent of variation in the use of motorcycles is less. Males have however, slightly higher tendency to use 2-wheelers, shown by odd’s ratio of 1.7. But the use of scooters is becoming popular among female students, as well, and its use could possibly rise in future. Overall, motorcycles or scooters are becoming very common for both males and females, and we can expect its share to rise in futute, if the current trend continues.

Table 4: Motorcycle × Gender

Trip Purpose	Gender	User		Non-User		Pearson Chi Square	P-Value	Cramer's V	Odds Ratio (M:F)
Work	F	32.20%	291	67.80%	612	132.5	< 0.05	0.2	2.5
	M	54.40%	1424	45.60%	1192				
Educational	F	13.60%	151	86.40%	963	25.6	< 0.05	0.1	1.7
	M	21.20%	323	78.80%	1199				

**Public Transport Users**

When it comes to the use of public transport by gender, for work trips, women are more dependent on its use as compared to men. It is reflected from Table 5, which shows the result of chi-square to be significant with medium effect (Cramer’s V = 0.22) and odd’s ratio of 0.31. It indicates that females are near about 3 times more likely to use public transport for work trips as compared to males. The relation is, however, not significant for educational trips, which indicates that both male and female students have somewhat equal tendency to use public transport. Table 5 shows about 50 % of both male and female students are using public transport.

Table 5: Public Transport × Gender

Trip Purpose	Gender	User		Non-User		Pearson Chi Square	P-Value	Cramer's V	Odds Ratio (M:F)
Work	F	31.00%	286	69.00%	636	170.3	< 0.05	0.22	0.31
	M	12.30%	329	87.70%	2352				
Educational	F	54.50%	607	45.50%	507	2.3	Not Significant	N/A	N/A
	M	51.40%	783	48.60%	739				

**Non-motorized Modes – Walking and Cycling**

When analyzing walking trips, also, in this case, more women are walking to reach their workplaces as compared to men. The odds ratio of 0.19 infers those women are over five times more likely to walk as compared to males. For educational trips, both males and females, share of walk trips does not differ much [Odd’s Ratio = 0.8] and as such gender is not an influencing factor for walking trips, in case of students. It is further indicated by the chi-square statistic which is although significant, it is very weak. The value of Cramer’s V for the relation is only 0.06.

Table 6: Walking × Gender

Trip Purpose	Gender	User		Non-User		Pearson Chi Square	P-Value	Cramer's V	Odds Ratio (M:F)
Work	F	30.00%	271	70.00%	632	295	< 0.05	0.3	0.19
	M	7.50%	196	92.50%	2420				
Educational	F	29.10%	324	70.90%	790	9.8	< 0.05	0.06	0.8
	M	23.70%	360	76.30%	1162				

No. of bicycle users is the least of all modes (Table 2). For work trips, none of the females are found to use bicycles in the surveyed sample. The results of Chi-square test are also not showing any meaningful results, as the number of bicycle users is very few. It shows that it is the least attractive option for both work and educational trips for both sexes.

Table 7: Bicycle × Gender

Trip Purpose	Gender	User		Non-User		Pearson Chi Square	P-Value	Cramer's V	Odds Ratio (M:F)
Work	F	0.00%	0	100.00%	903	9	< 0.05	0.05	N/A
	M	1.00%	26	99.00%	2590				
Educational	F	0.20%	2	99.80%	1112	7.9	< 0.05	0.06	6.2
	M	1.10%	17	98.90%	1505				

**Gender and Trip Length Variation**

For comparing trip distances of males and females, independent sample t-test was carried out. The dependent variable is the gender and independent variable is the trip length. To discover whether the effect is substantive, effect size (r) was also calculated. In general effect size of 0.5 or above is taken as strong effect (Field, 2009). Table 8 shows the independent-test test carried out to compare mean trip length of males and females for work and educational trips. For work trips, the difference of average mean trip length between males and females is quite significant (p < 0.01) with medium effect size (r = 0.20). From the table, it shows that males are commuting longer trip distance as compared to females. Average trip distance for male is 4.6 km, whereas for females, it is 3.4 km. For educational trips, the difference is not significant. We can say that there is no substantive difference in average trip length for educational trips between males and females. It shows that there is not much variation in the distribution of trip length of male and female students. For males it is around 3.5 km and for females, 3.3 km, showing only the minimal difference.



Table 8: Independent Sample t-test for Trip Length

Trip Purpose	Gender	N	Mean (km)	Std. Dev.	t	P-value (2-tailed)	DF	Effect Size (r)	Remarks
Work	M	2601	4.6	4.4	8.3	< 0.01	1804	0.20	Equal variance not assumed
	F	896	3.4	3.2					
Educational	M	1505	3.5	3.1	1.6	Not Significant	2653	N/A	Equal variance assumed
	F	1108	3.3	2.8					

**Conclusion**

Travel characteristics differ significantly between men and women for work trips. It is revealed that women make less work trips as shown by the trip rate of 0.40 and 1.17 per household, respectively for women and men. In terms of mode choice, men are using more of the private vehicles, more particularly, in the use of car, whereby men are four times more likely to use it for going to their work place. Motorcycle or scooters are popular among both men and women and it is having the highest share in modal share of both sexes. It is also identified from the analysis that women have more tendency, over three times likely to use public transport, as compared to men as shown by odd’s ratio following the chi square test. Regarding the use of non-motorized modes, many women are walking to go to their work places. Most disparity is seen in walking trips, where women are about five times more likely to travel by walking for their work trips as compared to men. Share of bicycles is found to be least of all in the modal share. It clearly reveals that cycling is not at all, proving to be an attractive option for both men and women. For work trips, none of the women are found to use cycle and it shows bicycle, revealing it further as un-preferred option for women. Regarding work trip length, it shows that males are commuting longer trip distance as compared to females, with average trip distance of 4.6 and 3.4 km respectively and difference is found to be highly significant as shown by independent t-test. For educational trip, the difference is not much significant, which means that gender has not much to do with the way students travel in terms of mode choice and trip length.

Overall, it shows that women, in general, have sustainable travel behavior as compared to men, due to their reliance on public transport and walking, to a greater extent. But at the same time, public transport users, that applies more to women, are compelled to spend more time traveling by public transport, due to lack of punctual public transport service, which means that they will have less leisure time or time for other productive activities, compared to private vehicle uses. Thus, public transport, with timely service and good comfort is very essential, if public transport users are to be given priority. This will also help to improve the share of public transport users, by encouraging more shift from private modes, applicable to both men and women. To promote sustainable urban mobility, emphasis should be given to public transport and non-motorized modes of transport and gender variation in travel demands needs to be given priority in implementing sustainable urban transport policy for gender equality.

**Further Research**

This paper has attempted to present some of the important insights on gender difference in travel behavior, but at the same time, it also opens pathway for further research in the field. In this research, focus had been made on work and educational trips only. Apart from these two trip purposes, there are other trip purposes like shopping and recreational trips which has not been discussed here. The socio-economic and demographic variables like income level, household structure, age group, household responsibility will also have influence in travel behavior along with gender. The preference of travel parameter like comfort, safety and other travel characteristics, that come associated with gender could also be the topic for further research.

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