Gender, mobility and travel behavior in Pakistan: Analysis of 2007 Time Use Survey

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ABSTRACT

Pakistan's national economic growth framework views connectivity between people and settlements as an engine of economic development. However, a little is known about the patterns of mobility across socioeconomic segments of the country. The study aims to explore gender differences in travel behavior across urban and rural areas that remain unexplored due to the non-availability of suitable data. The paper employs national dataset of 2007 Time Use Survey (TUS) carried out to measure gendered time use in paid and unpaid work activities. In TUS, a national sample of 37830 respondents living in 19380 households, ageing 11 and above, was selected for household and time diary surveys during the whole year 2007. Time use diary recorded various activities carried out by respondents in forty eight 30-minute long episodes of the past day, their context locations and simultaneity, according to 125 activity codes based on UN designed International Classification of Activities for Time Use Surveys. Preprocessed TUS, that is publically available from Pakistan Strategy Support Program, was analyzed using longitudinal data analysis techniques. According to the results, large gender differences are found in travel behavior related to trip rate, travel mode, duration and purpose of travel. Female are more likely to be immobile as 55 percent female respondents did not report any trip in the diary day as compared to just 4 percent male respondents. Women make lesser daily trips (2.8) than men (5.4) and the greatest difference exist for leisure and sociocultural trips. Women are more automobile dependent as their share of automobile trips (13 %) is greater than men's share (10 %). Period of adulthood and marriage seems to restrict female mobility and leisure travel strongly. Female travel behavior is largely shaped by sociocultural, economical and built environment of the country. The findings points out the need for gender sensitive transport and land use policies in the country as women are more likely to be immobile or travel less due to their concerns related to safety, security and quality of transportation. Potential sources of bias and research directions are pointed out at the end.

1. INTRODUCTION

Desire to travel is intrinsic to human being and mobility is considered a basic right of all individuals (Yago, 1983). Growing literature on travel behavior highlights significant differences gender in mobility and travel patterns (Law, 1999). In the developed world and many developing countries, women make more trips than men and in less developed countries, women travel longer and carry loads on their heads (Gething et al., 2012, Mark Blackden and Wodon, 2006). However, in some developing countries, women may be less mobile than men, and as a whole, their travel patterns are more complicated and often include short distance travelling, trip chaining and time crunched household serving trips (Pucher and Renne, 2003, Dobbs, 2005). Women mobility needs are also significantly different from men and literature shows that women are more concerned about personal safety, security and quality of service (Li et al., 2004, Vokolkova and Michalek, 2007, Cottrill and Thakuriah, 2009, Dupont and Krakutovski, 2009, Vaughn, 2009, Whitzman, 2013). These differences in attitudes and needs are rooted in gender differences in activity participation, roles and responsibilities in daily lives and sociocultural norms of the society (Mauch and Taylor, 1997). Understanding gender difference in travel behavior is important to identify women transportation needs and mobility requirements (Meyer, 2004, Kalter et al., 2009, Dupont and Krakutovski, 2009). Our transport systems may not recognized these important differences and thus

become less responsive to women needs and requirements. While gender differences in travel behavior are relatively well known in developed countries; this phenomenon has got far less attention in the developing world, where it is believed that the differences might be wider and even unique in some aspects (Duchène, 2011, Peters, 1998 , Nobis and Lenz, 2004, Julie Babinard and Scott, 2009). Porter (2007) noted that *"transport remains a surprisingly neglected area among gender specialists and transport specialists are still reluctant to take on gender issues"*. Therefore, this paper seeks to extend current research on travel behavior in developing countries by examining gender disaggregated travel patterns in Pakistan using activity time use data. Time use data is considered a key set of information for activity based travel behavior modeling (Kitamura, 2001, Kitamura et al., 1997). While household travel surveys form the primary source of information for it, they often provide an 'incomplete' set of information on daily activity patterns due to their 'travel only' nature of enquiry (Pinjari and Chandra, 2011, Bhat and Koppelman, 1999). Time use data provides a more complete spectrum of human activity participation including travel, in-home and out of home activities (Harvey and Spinney, 2012, Kitamura et al., 1997, Levinson and Kumar, 1995, Acharya, 1982). Many of travel behavior researchers argue combining data from household travel surveys and time use surveys in travel behavior analysis due to the unique set of information provided by the time use surveys (Hubert et al., 2008, Michelson, 2005). The fact that time use datasets are 'harmonized' for inter country comparisons (Converse, 1972, Esquivel et al., 2008, Harvey and Spinney, 2012), makes them more useful for modeling travel behavior across geographies. Pakistan's Time Use Survey provides a good starting point for measuring patterns of mobility and activity participation in the country, and this study aims to do so. The specific questions, this paper addresses are:-

1. Do women and men have different mobility and travel patterns across urban and rural areas of the country?
2. How do travel patterns (trip rate, mode choice, travel purpose and duration) vary by age, marital status and main role across gender
3. What are the implications of these differences for country's growth and transport policy?

The following Section 2 'Study Area' provides socio economic background for transport and mobility in Pakistan, to give the reader an opportunity to grasp the contextual base of the study. Section 3 'Data and Methods' describes design, collection and processing of data; and the methodology to extract travel behavior information from the time use diaries. The later Section 4 'Gender, Mobility and Travel Behavior' explores patterns of travel behavior in detail and how do they vary across geography and demographic groups defined by age, marital status and income level of the respondents. At the end, Section 5 'Conclusions and Recommendations' summarizes the new findings of the study, implications of results for country's transport related policy of economic growth, further research directions and potential sources of biases in the study.

2. STUDY AREA

Pakistan houses nearly 180 million people with 37 % of them living in urban areas (Planning Commission, 2011b). Aided by high population growth rate and constant rural to urban migration, its cities are constantly increasing in size and numbers (Planning Commission, 2011c). From 1951 to 2005, number of small cities of population below 100,000 increased from 238 to 515, medium cities with population up to 500, 000 increased from 10 to 59 whereas the number of large cities, housing more than 500,000 people,

increased from 2 to 12 (Government of Pakistan, 2009). Consistent increase in population, size of cities and decrease in rail based transportation has put extra pressure on demand for road based transportation in the country (Kosec et al., 2012, Mehdi et al., 2011, Addleton, 1984, Burki, 1973, Planning Commission, 1960). Since early 1960s, road based transport has taken a central role in country's transport strategy as it carried, in year 2010, more than 92 percent passenger transport and 95 percent of cargo movement in the country (Planning Commission, 2011d). A study estimated that country's current transport demand will triple by 2025 (JICA, 2006). With every passing year, transportation is considered an even more important factor in country's economic growth policy that emphasis connectivity between people, cities and places of production (NTRC, 2011, Planning Commission, 2011a). The work by international donor organizations such as World Bank indicated that nearly 85 % villages and nearly all cities are connected with major road network (Essakali, 2005). The government of Pakistan also aims to double the current road density of 0.31 to 0.62 km/km2 till 2018 (Planning Commission, 2011d). However, due to lower automobile ownership, majority of its population is dependent on public transport for personal mobility. In the strategy of road, urban flyovers and highway construction, the goal of providing adequate public transport based mobility is somehow not reached. Transport authorities of the country are unable to cater for the transportation needs of its growing population. Quality of road network and non-availability of adequate mobility options consistently obstruct the mobility and connectivity in the country's ever expanding urban and rural areas (Imran, 2009, Qureshi and Huapu, 2007, Russell and Anjum, 1997). A panel study by International Food and Policy Research Institute (IFPRI) and Pakistan Strategy Support Paper (PSSP) found that commuting behavior in country is moving towards 'personal automobile' based mobility (Nazli and Haider, 2012). Motorcycles are replacing Bicycles and usage of 4 wheelers vehicles like Bus/Van has also decreased since 2007 (Nazli et al., 2012). Ownership of motorcycles has rocketed in the dominate middle class being a 'quicker and reliable' mean of transport than busses and vans (Imran, 2010a).

While the country's booming urban population has started to create a mark on political and cultural stage of the country (see Kugelman (2013) for brief discussion), their mobility issues are also becoming increasingly persistent and chronic in nature (Imran, 2010b, Haider and Badami, 2004). Major cities are unable provide an acceptable public transport network for their residence Available means of public transport are generally categorized as 'inadequate' due to major issues with service quality, coverage, fleet shortage and poor enforcement (Imran, 2010b). The users of public transportation are often left at the mercy of private bus operators (Citynews Lahore, 2010). However, female travelers are more severely affected than male due to their special mobility needs in the conservative sociocultural settings of the state. Women are considered 'family honor' and often require permission of travel from head of household (Sathar and Kazi, 1997). While travelling without male, women are sometimes charged with extra fare or sometimes taken to wrong bus stops. They often face harassment, stalking and poor travel environment in public transport and walking on urban roads (Pakistan Television, 2011, Express Television, 2012, Aurat Foundation, 2012, Population Council, 2003, Sohail, 2000). Knowing this hostile travel conditions, families do not allow women to travel without male especially the young adults. Urban female might be the most affected intersection of gender and geography as urban areas are considered more conservative in their social settings. In this way, women travel horizons are spatially and temporally restricted and demand attention from the policy makers (Hoodbhoy, 2013). In the ongoing attempt to realize a road based transportation system for economic growth and connectivity in the country, study of gender differences in travel behavior and mobility requirements have got little attention. Assessments of travel

and issues of mobility are few and area-specific mostly for big cities (Rizwan Hameed and Nadeem, 2006). Such studies are not a statistical and theoretical representative of the entire country due to their area-specific nature and scope of data collection. While Pakistan, as in many developing countries, does not conduct national level transport surveys like National Household Travel Surveys in many developed nations, there is a need to utilize alternative sources of data which can provide reliable description of travel behavior and mobility levels. Such studies, like time use surveys, can provide sound basis for gender sensitive policy intervention in mobility and transportation issues (Adeel and Feng, 2012).

3. DATA AND METHODS

The study is based on time use diary data collected through Pakistan's first ever national Time Use Survey 2007 (TUS), carried out by the Pakistan Bureau of Statistics with funding from UNDP. The purpose of carrying out TUS was to measure the role of women in labor force, paid and unpaid work activities in order to draw women friendly welfare programs and budgeting (Pakistan Bureau of Statistics, 2008). The data has been collected from a nationally representative sample of 19600 households surveyed during the whole year 2007 by door to door questionnaire survey. TUS questionnaire has two parts, a household part and a time diary part. The household part of questionnaire enquired household's socioeconomic status like household size, type of housing, income and access to various facilities. The time diary part enlisted demographic information of the respondent and activities carried out by him or her in the past day. Respondents were asked to recall and mention up to three activities for each of 48 pre-defined episodes of half hour duration from 4:00 am to 4:00 am. Recalled activities were classified according to the UN recommended ICATUS (International Classification of Activities for Time Use Surveys) scheme detailed in United Nations (2005) that was first proposed by Harvey and Niemi (1993). Based on the guidelines, a maximum of 144 activities were recorded per respondent along with their context location and simultaneity in each episode. Context location for each activity was recorded in two variables; 'Location Code 1' that identified activity location by broad land use type (own residence, other's residence, agricultural workplace, public place, travelling or waiting and other places) whereas 'Location Code 2' described general location 'inside' or 'outside' of the building or the type of mode used (walking, personal automobile, taxi, train, bus, bicycle and other modes), if travelling.

TUS represents country's urban and rural population in each of the four provinces. For this purpose, entire stratum of country's urban areas published in 2005 Economic Census (Pakistan Bureau of Statistics, 2005) and rural areas published in 1998 Population Census was taken as sampling frame. As nearly 40 percent population is urban, 40 percent of the sample size was surveyed from urban areas and remaining 60 percent was surveyed from rural areas. A three stage stratified random sampling procedure was applied for sample selection similar to other national surveys. At first stage, 652 urban and 736 rural Primary Sampling Units (PSU) were selected from the sampling frame by probability proportional to size method where a larger PSU had higher chances of selection. PSUs are the entire Enumeration Blocks (each consists of 200-250 households) in urban areas and village/mouza in rural areas. At the second stage, sample households were selected from the PSUs through systematic sampling using published list of houses and every 16th urban and 12th rural household was selected for survey with a random start. At the third stage, two respondents were selected from each selected household for time use diary by Kish grid selection. This method, developed by Kish (1949), is a probability sampling technique used to select individuals from multiple potential respondents (Laurie, 2004). Using this method, a table of household size and member's rank enabled selection of respondents systematically for time use diary survey.

1 Household questionnaire was asked from adult member of the household whereas the time use diary was
2 surveyed from two respondents above 10 years of age from each household. TUS sample was distributed
3 evenly over four quarters to account seasonal variation in time use.

4 The sample excluded few administrative areas like Federally Administered Tribal Areas (FATA) and
5 some districts of Khyber Pakhtunkha (the then called as North West Frontier Province) that were mostly
6 located at difficult terrain or in places with security vulnerabilities. Homeless population and those who
7 cannot be categorized as a household, for example day time household workers and children living away
8 from home, were also excluded from the sample. All the excluded population forms nearly 3 percent of
9 the sampling universe. The survey was carried out by hiring local female surveyors and facilitation from
10 local political leaders and multiple visits to the household increased the response rate of survey up to 98.9
11 percent. A total of 19380 household questionnaires and 37830 time use diaries were filled completely and
12 data was digitized and processed in STATA. Pakistan Strategy Support Program has provided TUS data
13 free of cost on their website for research purposes. Key demographic characteristics of the sample are
14 given in table 1 below showing distribution of respondents by area, province, age group, education, main
15 activity and source of income, feelings about diary day and availability of transport mode in the
16 household across gender.

Table 1 sample characteristics

Socioeconomic Characteristics	male		female		Overall	
	n	%	n	%	n	%
Sample size	18,321	48.4	19,509	51.6	37,830	100.0
Urban	7,422	40.5	7,495	38.4	14,917	39.4
Rural	10,899	59.5	12,014	61.6	22,913	60.6
Province						
Punjab	8,092	44.17	9,000	46.13	17,092	45.18
Sindh	4,615	25.19	4,424	22.68	9,039	23.89
NWFP (Khyber Pakhtunkha)	2,986	16.3	3,828	19.62	6,814	18.01
Baluchistan	2,628	14.34	2,257	11.57	4,885	12.91
Age group						
10 to 19	5,860	32.0	5,636	28.9	11,496	30.4
20 to 29	3,593	19.6	5,045	25.9	8,638	22.8
30 to 39	3,359	18.3	3,812	19.5	7,171	19.0
40 to 49	2,415	13.2	2,316	11.9	4,731	12.5
50 to 59	1,446	7.9	1,346	6.9	2,792	7.4
60 to 69	1,008	5.5	868	4.5	1,876	5.0
70 to 79	462	2.5	342	1.8	804	2.1
80 to 89	139	0.8	116	0.6	255	0.7
90 & Above	39	0.2	28	0.1	67	0.2
Education level						
No formal education	5,762	31.5	11,252	57.7	17,014	45.0
K.G. but below primary	2,181	11.9	1,669	8.6	3,850	10.2
Primary but below middle	3,548	19.4	2,489	12.8	6,037	16.0

Middle but below matric	2,359	12.9	1,371	7.0	3,730	9.9
Matric but below intermediate	2,210	12.1	1,363	7.0	3,573	9.4
Inter. but below degree	1,093	6.0	749	3.8	1,842	4.9
Degree and above	1,168	6.4	616	3.2	1,784	4.7
Marital status						
Never married	8,084	44.1	6,736	34.5	14,820	39.2
Currently married	9,775	53.4	11,648	59.7	21,423	56.6
Widow/widower	413	2.3	1,058	5.4	1,471	3.9
Divorced	49	0.3	67	0.3	116	0.3
Main Role						
employed	12,691	69.3	3,270	16.8	15,961	42.2
student	3,726	20.3	2,789	14.3	6,515	17.2
Unpaid worker	123	0.7	11,483	58.9	11,606	30.7
doing nothing	1,781	9.7	1,967	10.1	3,748	9.9
Main source of income						
Wage/salary	5,781	31.6	1,270	6.5	7,051	18.6
own business	5,504	30.0	435	2.2	5,939	15.7
Government grant	167	0.9	39	0.2	206	0.5
Investment	34	0.2	13	0.1	47	0.1
Other household member	1,027	5.6	2,456	12.6	3,483	9.2
Remittance	88	0.5	268	1.4	356	0.9
Compensation	27	0.2	21	0.1	48	0.1
Other	256	1.4	64	0.3	320	0.9
No personal income	5,437	29.7	14,943	76.6	20,380	53.9
Diary day						
Monday	2,929	16.0	3,120	16.0	6,049	16.0
Tuesday	3,060	16.7	3,167	16.2	6,227	16.5
Wednesday	3,021	16.5	3,157	16.2	6,178	16.3
Thursday	2,738	14.9	2,868	14.7	5,606	14.8
Friday	2,403	13.1	2,716	13.9	5,119	13.5
Saturday	1,744	9.5	1,675	8.6	3,419	9.0
Sunday	2,426	13.2	2,806	14.4	5,232	13.8
Feeling about diary day						
Busy	5,641	30.8	4,550	23.3	10,191	26.9
comfortable	6,785	37.0	7,743	39.7	14,528	38.4
not too busy	5,895	32.2	7,216	37.0	13,111	34.7
Transport mode in household						
Car	1,265	6.9	1,241	6.4	2,506	6.6
motorcycle	3,592	19.6	3,449	17.7	7,041	18.6
cycle	6,531	35.7	6,543	33.5	13,074	34.6

Source: Author's calculations using Time Use Survey (2007)

Sample characteristics show that urban population is 40.5 %, female subsample is 51.6 %, young adults from 10 to 29 years of age make 53.2 % while elderly aging 60 or above form 9% of total surveyed population. Being the largest province in the country, Punjab province covered 45.18 % and combined share of Baluchistan and KPK was 30.9 % of the total sample. On marital status, 39.2% reported being unmarried, 56.6 % reported currently married while 4.2 % reported being divorced or widowed. On main source of income, 60.6 % of respondents reported having a job or personal business, 29.7 % expressed no personal source of income; 5.6% reported receiving income from other household member and remaining 3.2 % reported income from government grants and other sources. On vehicle type ownership, 6.6 percent of respondents reported having car, 18.6 % reported motorcycles while 34.6 % of the sample reported having cycle in their house. 60.3 % sample reported being employed; and from the rest not having an employment, 20.3 % reported being student, 9.7 % people reported 'doing nothing' and 0.7 % reported doing unpaid household works. Main role of the respondent other than employment was extracted from the questions '5.21: if not available for work, then why?' And the expressed reason behind not working was taken as the main role of respondent. Time diaries were prepared for the whole week period with least respondent share of 9.7 % for Saturdays, nearly 13 % for Fridays and Sundays and 15 to 16 % for rest of the days. Least diaries were reported for Saturdays due to the general holiday on next survey day. TUS sample characteristics show that, as compared to male respondents, larger proportion of female interviewees reported being in adult age group, having lower education levels, currently married or divorced, doing unpaid work, dependent on others for income, and feeling 'not enough busy' on the diary day. As the analysis section highlights, these demographic factors play an important role in women travel decisions in the country.

Measuring Travel Behavior

The paper measures four characteristics of activity travel behavior: trip rate, mode choice, duration and purpose of travel. TUS recorded time use in 125 detailed 3-digit activity codes that, when combined, form 10 broad activity categories defined by ICATUS. Each of 10 broad activity categories describes 'travel' activity with at least one distinct 3-digit activity code, usually ending with '80'. These travel related activity codes were identified and the ten broad activity categories were divided into 20 broad groups, 10 representing the activity and 10 representing travel for that activity. The data was recoded to separate 'activity' and 'travel' time use and summarized for travel duration, number of trips, mode choice and trip purpose for each respondent by longitudinal analysis techniques described in Singer and Willett (2003) and Michelson (2005). For simultaneous activities, 30-minute episode time was allotted to each of the activities while in case of non-simultaneous activities; episode duration was divided equally among them. As a result activity time for the diary day was 1440 minutes or higher. This method helped preserving actual time spent by each activity as if a person was sleeping during travel in an episode, both travel and sleep activities were given 30 minutes each. Detailed ICATUS activities are often reduced to small number of activities in activity behavior modeling (Acharya, 1982, Pentland et al., 1999). For travel behavior analysis, this study converted ICATUS activity classification into 3 activities of Reichman classification, developed by Reichman (1976), namely subsistence, maintenance and leisure activities. As the official report does not provide a detailed description of the travel activity due to its focus on work duration assessment, the overall figures reported in this work may differ from the official summary of travel patterns due to methodological differences in data analysis. For example, in the official report, activity time has been equally divided between simultaneous activities which may under represent travel time whereas in this reported research, simultaneous activities have been treated differently to preserver

1 travel activity time. Similarly this paper carries detailed analysis of travel activity which has not been
2 provided in official final report, (Pakistan Bureau of Statistics, 2008), due to their limited scope of work.

3 **4. GENDER, MOBILITY AND TRAVEL BEHAVIOR**

4 Out of total 37830 respondents, 26441 (69.89%) reported travelling during diary day while 11389 (30.11
5 %) did not report any trip. A total of 120173 trips were recorded from the survey, including 103999 (86.5
6 %) by walk, 7626 (6.4 %) by automobile, 2905 (2.4 %) by cycle, 2500 (2.1 %) by bus, 2175 (1.8 %) by
7 taxi including rickshaw, 912 (0.8 %) trips by other modes (e.g. animal driven carts) and just 56 trips by
8 train. While rural dwellers reported more trips by walk (67389 or 90.6 %) than urban residents (36610 or
9 79.9%), their share of motorized trips was smaller (6.3%) than urban areas (16.7%). Table 2 below details
10 total trips by mode of transportation used across respondents in urban/rural and gender categories.

Table 2 Total trips by mode across geography and gender reported in Pakistan Time Use Survey 2007

	Overall		Urban		Rural		Male		Female	
Mode	n	%	n	%	n	%	n	%	n	%
Walking	103999	86.5	36610	79.9	67389	90.6	82696	86	21303	88.6
personal automobile	7626	6.4	5032	11	2594	3.5	6099	6.4	1527	6.3
taxi	2175	1.8	1109	2.4	1066	1.4	1551	1.6	624	2.6
train	56	0	31	0.1	25	0	47	0	9	0
bus	2500	2.1	1465	3.2	1035	1.4	2038	2.1	462	1.9
bicycle	2905	2.4	1306	2.9	1599	2.2	2838	3	67	0.3
other	912	0.8	257	0.5	655	0.9	842	0.9	70	0.3
Total	120173	100	45810	100	74363	100	96111	100	24062	100

Source: Author's calculations using Time Use Survey (2007)

11

Gender and Mobility Decisions

13 On average, 30 % respondents (11389) did not report travel in any of their 144 activity episodes.
14 However, the mobility decisions and the number of trips vary considerably across gender. A large number
15 of female respondents (10722) did not report travel activity as compared to relatively small (667) male
16 respondents. Female were one third (8787) of the total travelers (26441) and their immobility rate was
17 nearly 55.4 % as compared to 3.64 % for men. Other than higher immobility rates, female are less likely
18 to make more than 2 trips per day as compared to male population (table 3). 29 .7% of female respondents
19 (i.e. 66 percent of mobile women) reported one to two trips in diary day, 11.1 % (or 24.5 percent of
20 mobile women) reported making three to four trips whereas only 4.2 % female (9.1 percent of mobile
21 women) reported more than 4 trips in diary day. From male sample, 25.5 % respondents (i.e. 21.8 percent
22 of mobile men) reported one to two trips, 20.3 % (31.3 percent of mobile men) reported three to four trips,
23 10.3 % (i.e. 18.6 percent of mobile men) reported making five to six trips whereas 13.8 % respondents (i.e.
24 28.3 percent of mobile men) reported 7 or more trips in their diary day.

Table 3 Total daily trips across gender

	Overall		Male		Female	
Total daily trips	N	%	N	%	N	%

Zero	11,389	30.1	667	3.6	10,722	55.0
1 to 2	9,641	25.5	3,845	21.0	5,796	29.7
3 to 4	7,673	20.3	5,517	30.1	2,156	11.1
5 to 6	3,881	10.3	3,285	17.9	596	3.1
7 to 10	3,373	8.9	3,139	17.2	234	1.1
More than 10	1,873	4.9	1,868	10.2	5	0.0
Total	37,830	100	18,321	100.0	19,509	100

Source: Author's calculations using Time Use Survey (2007)

More than half of the women reported immobility which is almost doubles than previously known immobility levels in the developing world. Similar levels of immobility have been reported in Shefali (2000) in their Dhaka metropolitan area sample. The time use data highlights that nearly 79 % of male population made more than two trips per day while approximately 85 % of total female respondents reported making less than two trips in the time use diary. Nearly half of the male respondents made more than 5 trips as compared to less than 5 % female respondents as detailed in figure 1 below.
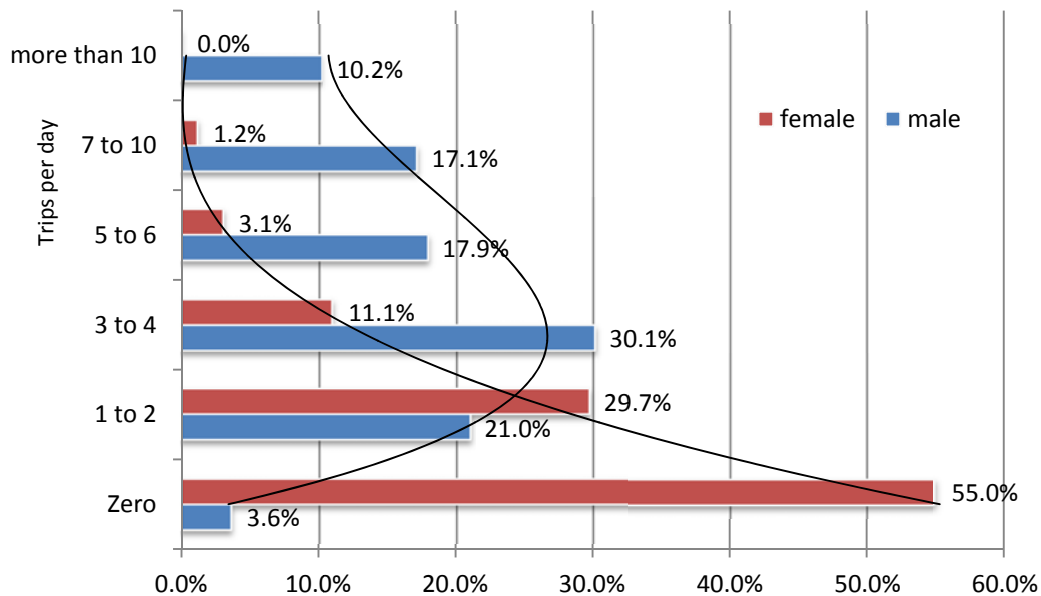
Figure 1 Percent of respondents by mean daily trip across men and women in Pakistan

One-way ANOVA results verify significant gender differences in trip rates (at Pr>Chi2= 0.0 and F Stat = 5621) with mean trips per day of 5.5 and 2.8 for male and female respectively). While immobility is concentrated on female side of gender, urban areas seem to carry larger immobility burden than rural areas. Urban female were more immobile (56.9 %) than rural female (53.7 %) and urban male were slightly more immobile (3.9%) than rural male (3.5 %) as shown in table 4.

Table 4 Mean daily trip distribution by men and women

	Overall		Urban male		Rural male		Urban female		Rural female	
Mean Daily trips	N	%	N	%	N	%	N	%	N	%
Zero	11,389	30.1	286	3.9	381	3.5	4,266	56.9	6,456	53.7

1 to 2	9,641	25.5	1,744	23.5	2,101	19.2	2,254	30.1	3,542	29.5
3 to 4	7,673	20.3	2,233	30.0	3,284	30.1	760	10.1	1,396	11.6
5 to 6	3,881	10.3	1,260	17.0	2,025	18.6	168	2.3	428	3.6
7 to 10	3,373	8.9	1,149	15.5	1,990	18.3	46	0.6	188	1.6
More than 10	1,873	4.9	750	10.1	1,118	10.3	1	0	4	0
Total	37,830	100	7,422	100	10,899	100	7,495	100	12,014	100

1 Other than higher immobility in urban areas, larger share of urban men and women make 1 to 2 trips per
2 day (23.5 % and 30.1 % respectively) as compared to rural men and women (19.2 % and 29.5 %). For the
3 respondents reporting more than 2 trips per day, rural men and women reported greater trip frequencies
4 than their urban counterparts. The results show that rural people are more out-going than urban residents
5 and that there may be various socioeconomic and accessibility factors associated with this mobility
6 differences across urban and rural areas.

Figure 2 Percent respondents by mean daily trips across urban and rural areas

9 One-way ANOVA shows significant gender differences in trip across geography (F Stat =2136.1).
10 Bonferroni, Scheffe and Sidak multiple comparison tests show that the trip rate differences between the
11 four groups are significant and that the male-female differences are larger (1.18 trips per day) than the
12 rural-urban differences (0.12 trips per day) at 0.00 significant level.

13 **Gender, Geography and Mode Choice**

14 On average, mobile population of the country makes 4.5 trips per day out of which 3.9 (86.5%) trips are
15 done walking, 0.3 (6.3 %) are done by private automobile like car and motorcycle etc., 0.1 trips are done
16 by bicycle, bus and taxi (2.4 %, 2.1 % and 1.8 % respectively), and less than 1 percent trips are done by
17 other means of transportation whereas train trips remain near to negligible. On average, public transport
18 and bicycle/other modes trips were found 3.9 % and 3.2% of the total trips.

Table 5 Modal split for mean daily trips by gender and area

	Overall		Female		Male		Urban		Rural	
Mode	n	%	n	%	n	%	n	%	n	%
By mode										

1. Walking	3.9	86.5	2.4	88.5	4.7	86.0	3.5	79.9	4.2	90.6
2. Private automobile (Car, Motorcycle)	0.3	6.3	0.2	6.4	0.3	6.4	0.5	11.0	0.2	3.5
3. Taxi	0.1	1.8	0.1	2.6	0.1	1.6	0.1	2.4	0.1	1.4
4. Train	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
5. Bus	0.1	2.1	0.1	1.9	0.1	2.1	0.1	3.2	0.1	1.4
6. Bicycle	0.1	2.4	0.0	0.3	0.2	3.0	0.1	2.9	0.1	2.2
7. Other	0.0	0.8	0.0	0.3	0.0	0.9	0.0	0.6	0.0	0.9
Total	4.5	100	2.7	100	5.4	100	4.4	100	4.6	100
By type of transport										
Walking (1)	3.9	86.5	2.4	88.5	4.7	86.0	3.5	79.9	4.2	90.6
Private automobile (2)	0.3	6.3	0.2	6.4	0.3	6.4	0.5	11.0	0.2	3.5
Public transport (3,4,5)	0.2	3.9	0.1	4.7	0.2	3.7	0.3	5.7	0.1	2.9
Other Non-motorized (6,7)	0.1	3.2	0.0	0.6	0.2	3.9	0.2	3.4	0.1	3.0
Total	4.5	100.0	2.7	100.0	5.4	100.0	4.4	100.0	4.6	100.0

Source: Author's calculations using Time Use Survey (2007)

1

2 As table 5 shows above, women make nearly half of the daily trips (2.7) as compared to men (5.4). This
3 difference is mainly due to reduced walking trips by women (2.4) as compared to men (4.7). Women trip
4 characteristics vary significantly from men by modal split as well. Their share of walking trips (88 %) is
5 higher than men (86 %) and share of motorized trips (1 %) is lower than men (4%). This phenomenon is
6 linked to their limited access to modes of transportation and ability to pay for motorized trips. Women's
7 share of private automobile trips is similar to the men (6 %) but they make higher percent of public
8 transport trips (4.7 %) than men (3.7%) showing their increased dependency on public transport.
9 Similarly, women's share of non-motorized trips by 'Cycle and other modes' is also lower than men (0.6
10 % and 3.9 % respectively) as women are not expected to ride bicycles or use other (less common) means
11 of transportation e.g., intermediate modes of transportation (IMTs). While differences in trip rates are
12 larger between men and women, mode choice differences are somehow greater between urban and rural
13 areas of the country. Rural dwellers make more trips per day (4.6) as compared to urban residents (4.4)
14 and their share of walking trips (4.2 or 91 %) is also greater than urban residents who make 3.5 or 80 %
15 trips by walk. Use of private automobile is greater in urban areas (11 %) as compared to rural areas (3%)
16 and public transport based trips are also higher in urban areas (6 %) than rural area (3%). Greater use of
17 motorized means of transportation in urban areas is probably due to the fact that the urban dwellers have
18 higher income levels, greater dependency and easier availability of public means of transportation. High
19 percentage of walking trips is already known in Pakistan, however, this study finds a much lower share of
20 public transport based trips in the national sample as compared to the city specific studies like NESPAK
21 (2012) and Imran (2009). This is probably due to the fact that most of the previous studies have been
22 undertaken in large metropolitans like Karachi and Lahore with ever-stretching urban areas and gigantic
23 urban population that rely on public transport for daily commute. Such studies of metropolitan areas tend
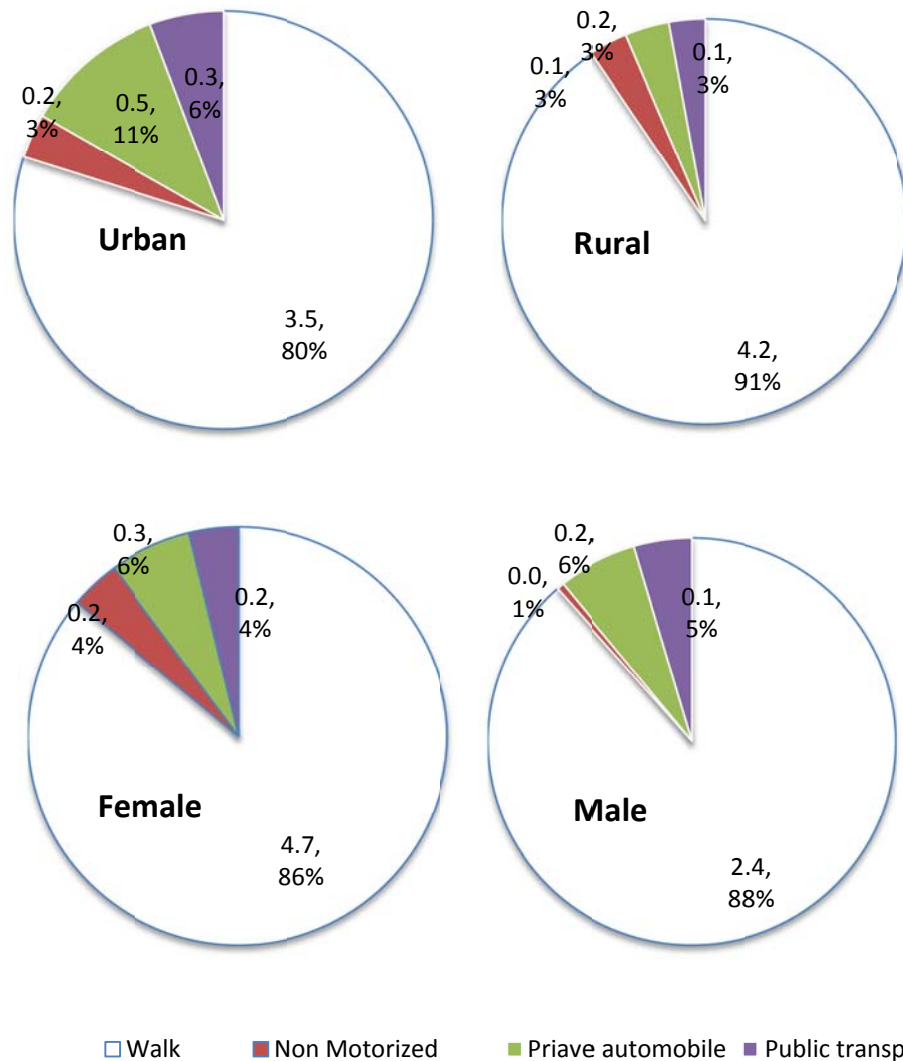24 to ignore mobility characteristics in smaller size cities and rural areas.

25

Urban / Rural / Female / Male

Walk   Non Motorized   Priave automobile   Public transport

Figure 3 Mean daily trips by mode by gender and area in Pakistan

1

Gender and Travel Purpose

3   While gender to a large extent and geography to a small extent seems to effect travel decisions and trip
4   rates in Pakistan, socioeconomic status and personal characteristics of respondents also effect mode
5   choice more and travel purpose. Automobile usage in Pakistan varies considerably by main role of the
6   respondents between genders which, to some extent, is linked with their age and access to resources.
7   Overall, female reported greater share of travel by automobile than male travelers. Within female group,
8   share for automobile and public transport based trips is highest for female students (10% and 5 %) second
9   highest for unpaid female workers (6% and 5%) and reduces for female doing nothing 5% and 4%
10   respectively. Ironically, share of automobile based trips was found lowest for employed women (4% each)
11   among all female. It shows challenge of travel for female students and house ladies doing household care
12   work. Employed women also made highest percent of non-motorized and walking trips (93%) among all
13   female. On the other hand, situation is different among male travelers. Employed men experience greatest
14   share of private automobile and public transport, 7 % and 4 % respectively, and least share of walking

trips (84%) among all male travelers. Whereas, male unpaid workers and free timers reported lowest automobile trips (3 %) and highest walking trips (93 %) that might be due to their reduced access to economic resources and personal means of transportation. However non-motorized trips are highest among employed male that shows their extra usage of bicycles and other modes of transportation for quicker mobility and reduction of transportation cost.
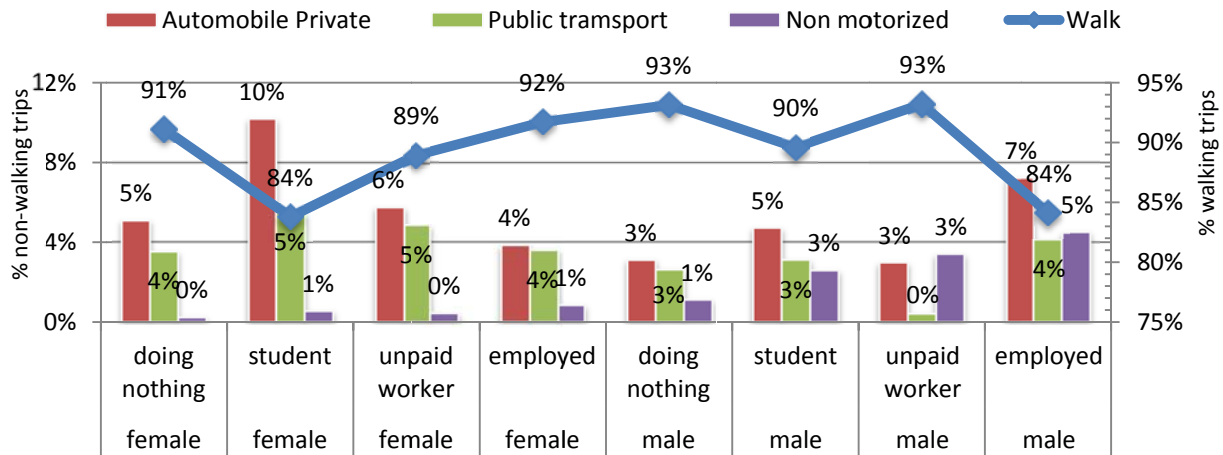
Figure 4 Modal split by role and gender of the travelers

One-way ANOVA and Bonferroni, Scheffe and Sidak multiple comparison tests verify mode choice difference across gender and geography with a few exceptions; that the gender differences in personal automobile and walking trips were only significant in rural areas and trips by other modes were statistically similar between the male travelers across urban and rural areas. Data shows that the young female students are more dependent on personal automobiles probably due to security issues and fear of crime. This issue might be more significant for ethnic minorities and communities facing social exclusion and violence in the country. Other than their lower walking trips and difficult travel conditions for women, the data shows that women travel less than men for leisure purpose as well. On average, female reported 0.8 trips per day as compared to 2.4 trips by male respondents in the diary day. It is expected that patriarchal system in the households and concerns of security at public places like parks and bus stops plays a significant role in female mobility to leisure activities. Leisure activity travel is largely affected by marital status of the women and men. Unmarried respondents made more trips per day than married respondent's probably due to the lesser household and childcare activities. However female leisure travel is more affected than male members (Figure 5). While unmarried women reported more than 2 trips per day for leisure activities; married, divorced or widow female respondents reported on average 1 trip per day as compared to 3.5 and 2.9 trips per day respectively for male respondents.
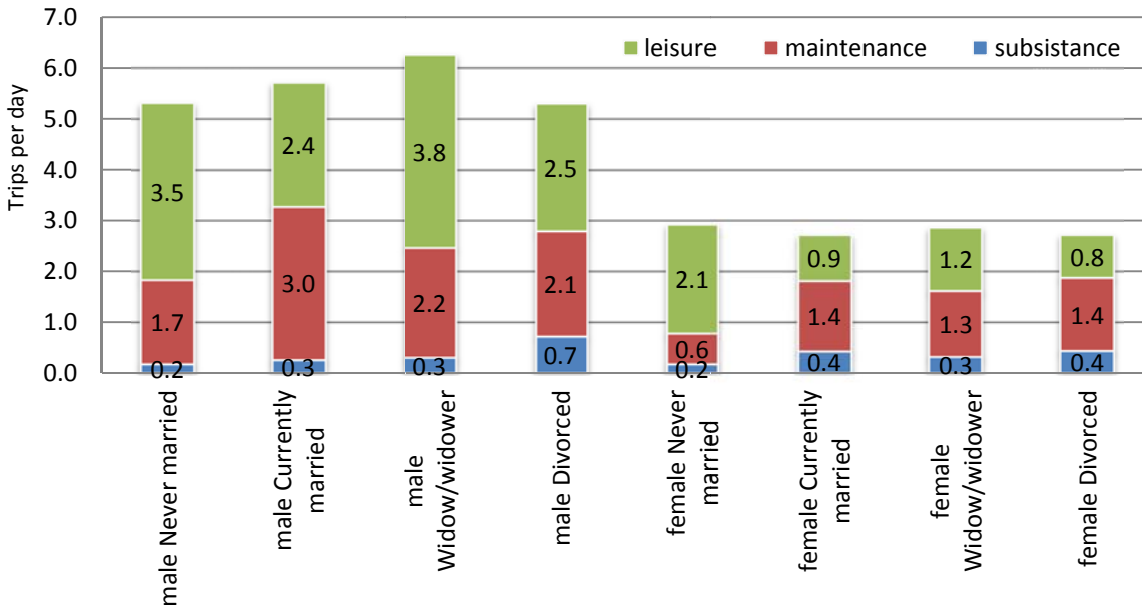
2   **Figure 5 Mean trips across male and female by their marital status for different activities**

3   Subsistence travel dominates the travel patterns of students and employed female (2.4 and 2.1 trips per
4   day) that account for 70 to 80 percent of their daily travel budget. However they undertake fewer leisure
5   trips per day (0.3 and 0.4 trips per day or nearly 10 % of total trips) as compared to free timer and unpaid
6   worker female respondents who reported 1.4 and 1.2 trips per day respectively that make 50 % of their
7   daily total trips (figure 6). On the other hand, leisure trips dominate the daily travel purpose of male
8   population in all roles and accounts 50 to 70 percent of their total daily trips. When we compare trip rates
9   between gender, male students and employed make more maintenance trips per day (0.5 and 0.7) than
10   female counterparts (0.2 and 0.5) however subsistence trips were found slightly greater for male than
11   female respondents. For male population, subsistence trips are statistically different for after marriage and
12   before marriage stages.
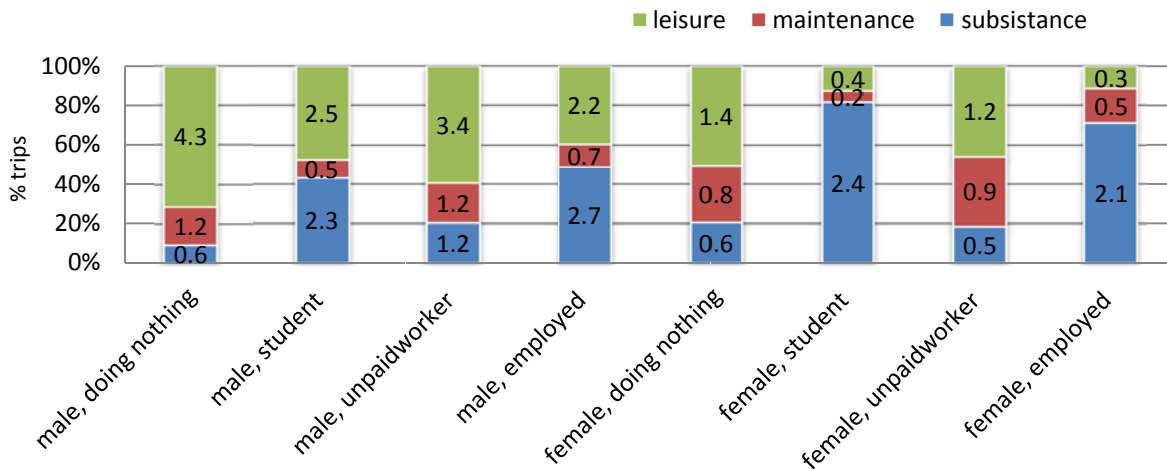
14   **Figure 6 Mean trips across male and female by their main role**

Among female, travel activity is considerably affected by her age and marital status. Generally female leisure travel is reduced to half after wedding and eases with the age however they travel considerably less than men for leisure activities. Marriage seems to affect the leisure trips of female due to their increased household care and child bearing responsibilities while their maintenance trips are doubled. In this way women try to combine maintenance trips with social activities and there are chances that women try to find leisure within their maintenance purpose travel by visiting friends during trip or out of home activity participation. However, reduction is greater for female as compared to male who still make multiple leisure trips daily. There are chances that enhancing mobility needs especially walking environment in urban and rural areas might increase the leisure trips like early morning walk for female population.

Trip Durations and Travel Time Budget

While female trip rates are nearly half of the male travelers, their daily travel time budget is also less than men at the national level. On average, female travel daily for 65 minutes as compared to 117 minute travel time for male travelers representing that female travel time budget is 44.4 percent less than men. There are evidences that in villages of Balochistan, women travel for hours to fetch water and firewood, but the data shows that more than 90 percent of country's households have water, electricity and natural gas inside their house. At the national level, female daily travel duration is not much affected by these extremes and their mean daily travel duration is less than men confirming the hypothesis that the female travel less and nearer to their residential places than male travelers.

ANOVA results show that Mean trip duration is slightly higher for female (24.4 minutes) as compared to male (23.5 minutes) but different are significant in urban areas only. Mean daily travel duration by men and women for ten broad activities is given in figure 7 below. It shows that, as compared to men, female travel duration is 19 to 20 percent shorter for work and community services, 4 to 6 percent shorter for education and household care whereas 28.3 percent shorter for sociocultural activities. However, female travel duration was found longer than men for personal care travel by 21.4 percent, for maintenance travel by 51 percent.
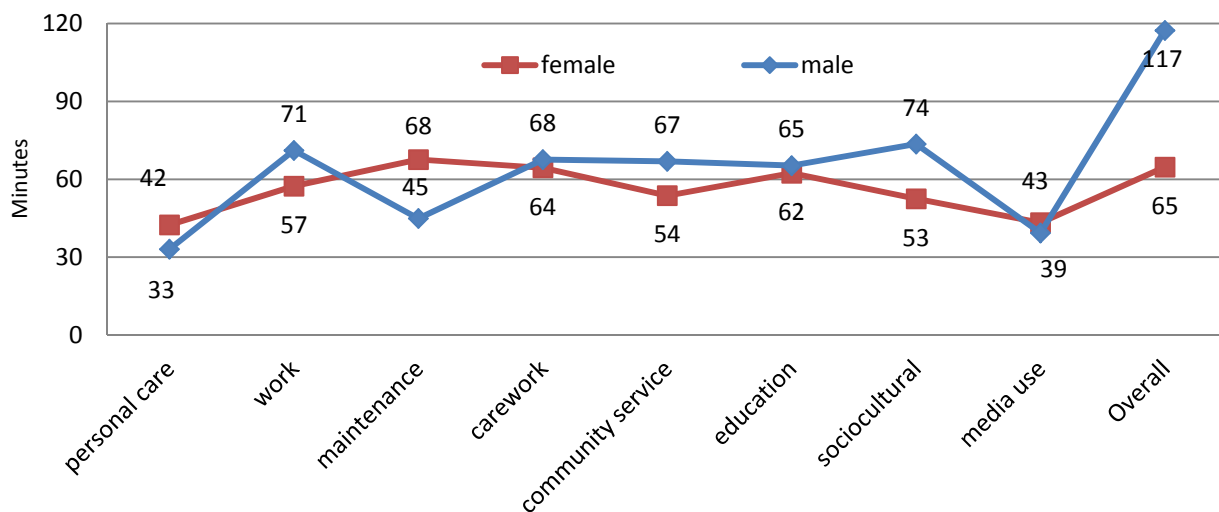
Figure 7 mean daily travel duration by purpose across men and women

Results highlight that majority of Pakistani women carry responsibilities for household maintenance related tasks outside home. Other than personal care travel, women face a restricted mobility environment for work and sociocultural travel. It seems that the poor condition of public transport and lack of affordability to personal automobiles has restricted women mobility for work most significantly than for access to education. Female student sometimes travel by escort or in groups to the nearby school whereas the adult female mobility to workplace is restricted due to the non-availability of suitable travel conditions.   Female mean trip duration is also shorter than male by bus (41 versus 49 minutes per trip), by bicycle (28.8 versus 26.4 minutes per trip) and other means (24.9 versus 34.3 minutes per day of transportation. However, female trip duration was found greater than male for train, personal automobile and walking trips. Increased mean trip duration by personal automobile shows the increased reliance of women on personal means of transportation for mobility.
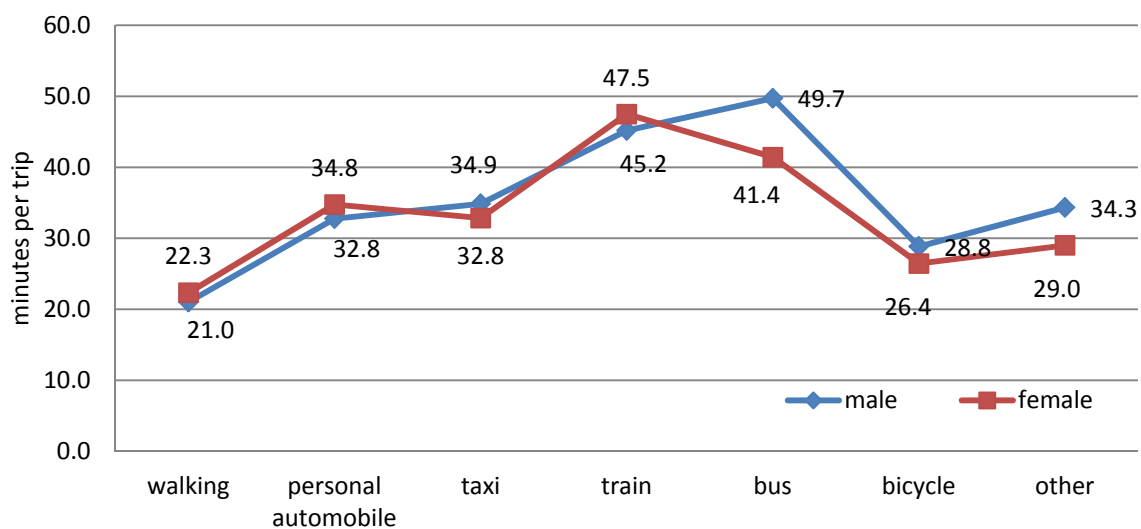
Figure 8 Mean trip duration by mode across area

Keeping in view that women do not drive motorcycles and mostly travel as passengers, increased trip duration by personal automobiles might be due to the fact that women car passengers might be more than men. Increased walking trip duration in women may represent a number of reasons including their short period socialization with other female during walk and the time spent in shopping food and other necessities from street hawkers and open air stalls on the road. The fact that rural female tend to spend more time walking for buying household goods from urban areas and due to their longer travel duration as compared to urban residents, may also increase their mean walking trip duration. One-way ANOVA, Bonferroni, Scheffe and Sidak multiple comparison tests find that mean travel duration for train and taxi is statistically not different across gender; and for the other modes, differences are statistically significant. The indifferent can be attributed to low demand for travel in train and taxi due to availability and costs issues with these modes of transportations.

5.   CONCLUSIONS AND RECOMMENDATIONS

This paper quantifies the differences in mobility and travel behavior across male and female population of the country. While the study reaffirms previously known facts about travel behavior, it also contributes unique information to existing literature on travel behavior in Pakistan specifically and in developing

countries in general. Most of the previous studies on the subject focused urban travel behavior of major cities, rural travel patterns were somehow overlooked and the already known literature needed fresh evidences for knowing current travel behavior differences across urban rural areas. Similarly, few previous studies have explored gender differences in travel behavior and activity participation and the current paper fills that gap too. The results highlight wide mobility gaps between men and women across the country and it appears that gender mobility differences are much greater than the urban rural differences. While rural people appeared more mobile than urban residents, female freedom of mobility is somehow restricted in the country. Nearly 55 percent women were immobile in the diary day as compared to less than 4 percent men and the instances of immobility were higher in urban women (57 %) than the rural women (54 %). Overall, female made half of the trips (2.7) as compared to male respondents (5.4) and the differences were mainly due to walking trips (men made 2.3 more trips). Similarly, men performed more leisure trips (2.4) than women (0.8). Female daily travel time budget is 44 percent shorter than male and their travel time for subsistence and leisure activities is also shorter. Female mean trip duration is slightly higher for walking and personal automobile trips whereas considerably lower for travel by bus, bicycle and other means of travel. Female students reported highest dependence on personal automobile and public transport while the male students reported the lowest. Female mean travel duration by bus and bicycle is much shorter than male due to the potential issues with public transport and bicycle based travel in the country. Risk of security and interaction with unwanted men seems to affect female trips and mode choice, the most. Socioeconomic variables like age, marital status and main role of respondents seem to affect the trip characteristics of women more than men.

A number of research directions can be drawn from this work. Firstly, there is a need to explore the widespread phenomenon of female immobility in detail. What is female opinion about immobility? Does it represent a form of 'transportation disadvantage' which reduces female access to various services and opportunities? How do the current mobility and travel patterns affect her access to economic resources, personal wellbeing and social inclusion in the city? Is there a 'latent demand' for women mobility? If yes, then to what extent? How transport and land use policy can help facilitate women mobility, reduce their automobile dependency and promote leisure trips? And what cost effective interventions are needed? Land use policy, probably, has a more important role for facilitating active transportation and leisure travel of women because of the nature of spatial growth and cultural norms of the society. Gender aware land use policy is needed to provide women friendly streets and land use in newly planned housing estates in the country. For the areas already developed, like inner city areas, transport policy should also facilitate mobility and accessibility for the non-motorized travelers as 80 to 90 percent of travel is done walking. For enhancing physical connectivity of people and destinations, there is a need to consider walking environment as important as the construction of roads and flyovers in the urban areas. Female tend to travel less due to various issues of accessibility and mobility and increasing walkability in is expected to favor women more than men. Increasing walkability can help reducing female immobility and automobile dependence and may increase their leisure travel as well. Walkable streets should be encouraged within the social norms for better social acceptance. This can be done, for example, through segregating pedestrian walkways by gender. If a road has dual walkways on both sides, female security might be improved by promoting one walkway as female and children – priority walkway. Gender segregation at public places is a common phenomenon in the country. However, the degree of gender sensitivity in transportation environment seems the least as compared to the other built environments like schools, offices and even public parks. Gender sensitive interventions will help creating safer streets that is also a

common desire for mobility in country's religious culture. Similarly, there is a need to bring rural areas into transport policy and connectivity framework. Rural people are in clear majority and so is their travel demand however they lack access to public transport and important services like healthcare, educational centers and good shopping places. The wide geographical differences in accessibility have been rarely pointed out in terms of travel demand in rural areas and their actual level of access to public transport. The authors aim to discuss it in their ongoing research on transportation disadvantage in Pakistan. Country's development policies should also utilize national level datasets to their full potential for well informed decisions in urban planning and transportation projects.

The study attempts to quantify travel behavior of Pakistanis for the first time in country's known history of transport planning. The quality of results might be affected somehow, if not greatly, by the quality of dataset used. TUS was designed to calculate gender based working hours and the travel information was not the focus point of this data collection strategy. Travel activities were noted to get a more complete picture of activity time use and thus the study design can generate potential source of bias in the results. At first, the data collection might omit some of the travel activity on the diary day. TUS collected 3 activities per half hour episode however there is a possibility of existence of more than three activities in an episode (unreported activity). Secondly, there may be other instances of unreported travel where respondents might change their location without specifying a travel activity or the respondent might not even mention the change of location at all (unreported travel and activity both). Similarly the time use might be upward biased as all activities of an episode were given equal time. Measurement of the nature of bias and its impact on travel behavior data needs further analysis. However, the results are expected to be sufficiently reliable in their level of detail and convey a meaningful picture of the travel behavior patterns. By quantifying the travel behavior through a nationally representative dataset, the results provide a comprehensive set of information as a first step on the long road of travel behavior analysis in the country. Similar efforts can be carried out in other countries using their time use survey datasets. Because of the ability of time use surveys to be 'harmonized' across countries and regions, it is possible to compare patterns of activity travel across space and time. Studying travel behavior through time use data can provide a useful bench mark for measuring travel behavior in developing countries and it can enhance the utility of expensive time use surveys well beyond the calculation of time use in paid and unpaid work activities.

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