ACTIVITY PATTERNS, TIME USE, AND TRAVEL OF THE MILLENNIAL GENERATION: WHAT IS ALL THE HYPE ABOUT?

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ABSTRACT

The millennial generation, defined as those born between the late 1970s and the early 2000s, is the largest population segment in the United States. This generation has been found to show activity-travel behavioral patterns and choices different from those of previous generations; they travel less, own fewer cars, have lower drivers' licensure rates, and use alternative modes of transportation more than their counterparts in prior generation. The important question that has not been adequately addressed is: to what extent are these differences in activity-travel patterns likely to persist as the millennials age and experience various phases and stages of the lifecycle? To address this question, a longitudinal analysis of repeated cross-sections of the American Time Use Survey (ATUS) data is presented in this paper. The trend analysis shows that older millennials (born 1979-1985) are indeed aging to be increasingly similar to their prior generation counterparts in terms of their activity-time use patterns, although some differences – particularly in minutes driving cars – persist, while the evidence is yet to be uncovered for the younger millennials born 1988-1994. The findings suggest that differences in time use between millennials and the prior generation are likely to fade with age. Millennials may exhibit a lag in the adoption of activity-travel and time use patterns of predecessor generations due to delayed lifecycle phases; in the meantime, substantial sustainability benefits may accrue from the lag in adoption of more classic auto-oriented behaviors by millennials. Measures to try and sustain such benefits should be implemented.

Keywords: millennials, activity-time use patterns, travel behavior, cohort analysis, age effects, trend analysis, longitudinal analysis, lifecycle stages

1. INTRODUCTION

Many a headline posit that the millennial generation is redefining every aspect of the nation's social, political, demographic, technological, and economic fabric. The millennial generation, (sometimes referred to as Generation Y) is defined in this paper as those born between 1979 and 2003, now constitutes the largest segment of the US population at about 75.3 million individuals in 2015 (Pew Research Center, 2015). With their increasing presence and clout in the marketplace and workplace, it is not surprising that considerable attention is being paid to their priorities, lifestyle preferences, environmental values, technology adoption, and activity, travel, and housing choices. Millennials are being touted as the frugal generation (O'Connell, 2015) with respect to their spending habits, and the 'go-nowhere' generation (Buchholz and Buchholz, 2012) in their activity and travel patterns. Transportation planning professionals are grappling with trying to understand how travel demand will evolve in light of the unique behavioral patterns exhibited by the millennial generation.

There has been considerable interest in the recent past on the activity, travel, and time use patterns of millennials. Millennials, largely born and raised in an era of ubiquitous technology, is exhibiting mobility patterns that are different from those of their predecessor cohorts. This group has been found to exhibit lower rates of driver's licensure, display lower rates of car ownership, and undertake fewer trips and travel fewer miles and minutes on a daily basis (Polzin, 2014; McDonald, 2015).

Previous research has not been able to shed light on the effect of aging on the activity and travel trends of millennials; although there are differences when comparing young adults of today with the young adults of past generations (McDonald, 2015), it is uncertain whether the differences will persist into the future as the millennials age. Lyons (2015) suggests that differences will persist even as millennials age, and the advent of social media and technology-based services may indeed contribute to such lasting differences (Davis et al, 2012; van Wee, 2015). With myriad reports and surveys on the behavioral choices and lifestyle preferences of millennials, it has become difficult to separate hype from reality and fully assess how millennial activity and travel demand may evolve into the future.

In light of the dearth of longitudinal studies on the activity and time use patterns of millennials, this paper aims to present an in-depth analysis of trends in activity and time use for different age groups and generations. The analysis is performed using the American Time Use Survey (ATUS) 2003-2013 data series. This survey conducted by the Bureau of Labor Statistics (BLS) in the United States, provides repeated cross-sectional data on detailed out-of-home and in-home activity participation and time use for a representative sample of individuals aged 15 years and above. The 11 year span covered by the data includes the period of the worst recession in recent memory. Although the data constitute repeated cross-sections rather than a panel, the longitudinal information in the multi-year data set can be analyzed to see how activity-travel patterns have changed over time for specific age groups and cohorts, and how the recession may have played a role in shaping these trends. Questions such as the following can be answered through such a trend analysis: how different are the 18-24 year-old individuals of 2003-2004 (older millennials born 1979-1985) from the 18-24 year old individuals of 2012-2013 (younger millennials born 1989-1995)? The individuals who were 18-24 years of age in 2003-2004 (the early years of the ATUS) would have turned 28-34 years of age towards the end of the period covered by the multiyear ATUS data. Thus we examine how the 18-24 year old individuals evolve, in terms of their activity and time use patterns, as they progress in age. If the millennials are traveling less than other generations, then what are they doing instead? This type of longitudinal

analysis will help shed considerable light on how activity and time use patterns change over time for different generations, and offers the explicit ability to account for both aging effects and cohort effects in activity and time use trends.

The remainder of this paper is organized as follows. The next section provides an overview of some of the conflicting literature on millennials. The third section describes the data set used in this study and the overall trends that are present in the data. The fourth and fifth sections of the paper offer descriptive trend analyses of the data with a focus on cohort effects, aging effects, and differences across generations at specific age brackets. A discussion on the findings and concluding remarks are in the sixth and final section of the paper.

2. CONFLICTING REPORTS ON THE MILLENNIALS

Much is being written about the millennial generation. Millennials are held to be redefining the American Dream, no longer valuing home ownership, car ownership, and a steady job, but rather focusing on a purpose-driven life to create a better tomorrow and impact society (Guay, 2015). Some suggest that millennials no longer value ownership in an era that is seeing the burgeoning sharing economy (Lutz, 2014; O'Connell, 2015). Taken as a group, compared to previous generations, they tend to be more likely to prefer on-demand mobility services such as Uber and Lyft to traditional car ownership, rent accommodation through AirBnB, and stream their music through Spotify; why own when you can rent on-demand? Some surveys indicate that millennials are redefining the urban landscape as they tend to seek to live in dense urban environments that are less car-dependent (Nielsen, 2014). Two-thirds of millennials are renters, and they are more likely to be living with roommates or family members than alone.

Others have written that millennials are adventurous, increasingly seeking overseas travel experiences (Machado, 2014) at the expense of local day-to-day travel. They exhibit lower levels of car ownership, driving licensure rates, and mobility (in terms of travel time expenditures, trip rates, and vehicle miles of travel) when compared with previous generations (Polzin, 2014; McDonald, 2015; Lyons, 2015). In 2011, 66 percent of Millennials under age 25 owned a car, compared with 73 percent in 2007. There is a steady stream of editorials and blogs discussing how and why millennials are driving less (Jaffe, 2015), shunning cars (Badger, 2014), and utilizing alternative modes of transportation in greater numbers than prior generations. Millennials are delaying marriage and waiting to have children, perhaps in part due to financial woes brought about by the great recession (Lamberti, 2015). Indeed, it has been found that millennials are more likely to be in school (Thompson, 2012; Taylor et al, 2012) and less likely to be employed, married, or parents (Furstenberg, 2010; Pew Research Center, 2014).

While many of the headlines suggest the dawn of a new era with the emergence of the millennial generation, several key questions remain unanswered. There are the beginnings of a recognition that lifestyles and patterns of behavior may not necessarily be all that different in the future as millennials age. The zipcar annual millennial survey suggests that being a 'millennial' is related to where an individual lives (the contextual situation) as opposed to when the individual was born (Wester, 2015; zipcar, 2015). It appears that millennials may not be all that different from prior generations in the workplace in their motivations and desires (Biro, 2014). And Walker (2015) notes that: "it turns out that many millennials were not ever planning on settling in cities for good – they were just *putting off* the move to suburbs for a few more years". Rossenfeld (2015) notes that millennials will demand "urban burbs" – suburban locations that offer the amenities and benefits of city living without the associated challenges. A consistent finding among studies of millennials is that only 12-14 percent live in America's downtowns (Leanne and Brett, 2015);

while this fraction is larger than that of previous generations, the difference is not substantial enough to transform the urban landscape. As the economy improves and millennials move through various phases of their life, their housing preferences may mirror those of previous generations; the demand for new single-family homes may increase as millennials enter their 30s (Logan, 2014). A recent survey by the National Association of Home builders suggests that two-thirds of millennials want to live in the suburbs, 24 percent want to live in rural areas, and only 10 percent want to live in urban city centers (Hudson, 2015).

A longitudinal analysis of activity and travel patterns would provide considerable insights on how millennials are evolving with respect to their behavioral choices. In the transport arena, such analyses has been largely limited to comparing behaviors of specific age groups across cross-sections of the National Household Travel Survey (NHTS) conducted in 1969, 1977, 1983, 1990, 1995, 2001, and 2009 (Polzin, 2014; McDonald, 2015). While such comparisons offer interesting insights on trends in mobility variables, particularly over longer time spans, they do not adequately capture the aging effects and do not provide any information about the substitution of out-of-home activities with in-home activities. The American Time Use Survey data set, although covering a shorter 11 year span and being somewhat limited with respect to its measurement of mobility variables, offers key insights into both out-of-home and in-home activity engagement clearly enabling the identification of whether young adults are indeed spending less time outside the home and, if so, what they may be doing in place of traveling.

3. DATA DESCRIPTION AND OVERALL TRENDS IN TIME USE

The data for this study is derived from the 2003-2013 American Time Use Survey (ATUS) data series. The survey is administered to a representative sample of individuals aged 15 years and above to obtain detailed information about household and person-level socio-economic and demographic characteristics, and out-of-home and in-home activity engagement and time use patterns. In this research effort, data were combined for three pairs of neighboring years: 2003-2004, 2007-2008, and 2012-2013 to perform a trend analysis. Adjacent year data were combined to ensure that adequate sample sizes were available within the age and cohort groups of interest. These three snapshots were chosen for analysis to maximize the range in the period covered (the entire 11 year period) and to capture the effects of the recession, if any, that should be reflected in the 2007-2008 snapshot (with possible lingering effects into 2012-2013). Although the data includes information for individuals 15 years and above, the analysis in this paper is limited to adults (18 years and above) because minors are dependent on adults for activity and travel engagement. All of the analysis was carried out on weighted samples; unweighted sample sizes are provided at the end of each table for informational purposes.

Table 1 summarizes the characteristics of the entire sample at the three snapshots considered in this paper. As expected, the population is becoming increasingly diverse (albeit slowly) with a slight drop in the white race share accompanied by a rise in Asian and Hispanic subpopulations. The percentage of adults without a college degree is falling while the percentage with higher degrees is modestly rising, signifying a growing influence of millennials who are the most educated generation ever (The Council of Economic Advisors, 2014). The percentage employed shows a dip over time, possibly reflecting the tepid recovery from the recession and the aging of the baby boomers who are increasingly joining the ranks of the retired. The percentage who have spouses and children show steady declines, likely reflecting the delayed marriage and child-bearing among millennials, and the empty-nest lifestyles of baby boomer households.

The average total time (per day) that respondents spend alone remains rather unchanged over time, as does time spent with household members. Time spent with spouses shows a decline (consistent with the reduced presence of spouses in the household). Likewise, the time spent with friends (physical presence required) also registers a decrease, although there is some modest recovery in this category in the post-recession years. The rather large dip in 2007-2008 may be attributed to individuals not being able to afford discretionary activities during the recession (and the potential substitution effects of social media). In general, the overall trends are consistent with expectations and reflect some recessionary effects.

TABLE 1 Descriptive Statistics: Age 18 Years and Over

Variable	Category	Survey Pool		
		2003-04	2007-08	2012-13
Race	White	83%	82%	81%
	Black	12%	12%	12%
	Asian	3%	3%	4%
	All other	2%	3%	2%
Hispanic	Yes	13%	14%	15%
Highest Level of Education	No College Degree	35%	33%	31%
	Associate Degree	15%	15%	15%
	Bachelor's Degree	33%	33%	34%
	Master's Degree or Higher	17%	18%	19%
Currently in College*	Yes	22%	20%	22%
Labor Force Status	Employed	64%	66%	61%
	Unemployed	5%	5%	6%
	Not in Labor Force	30%	30%	33%
Income*	<$25,000	48%	42%	38%
	>$50,000	19%	25%	29%
Spouse Presence	Yes	55%	54%	51%
Child Presence	Yes	43%	42%	39%
Home Ownership	Owned/bought by household	76%	75%	72%
Time Spent… (Minutes)	Alone	287	286	288
	With household members	261	258	259
	With spouse only	99	97	96
	With spouse (others present)	163	160	157
	With friends	60	51	55
Sample Size (Unweighted)		*34,693*	*24,971*	*23,828*

*Computed based on valid cases

Table 2 presents a longitudinal exploration of the mean time use patterns in the data considering specific age groups at different survey snapshots. The time use patterns of 18-24 year olds, 25-34 year olds, and 35-54 year olds are observed in three different cross-sections. Although this table does not explicitly account for the cohort or aging effects, the trends seen in the table

offer some initial insights into how activity-time allocation patterns are changing over time for different age groups. Personal care and sleep did not have any location information recorded and are treated as purely in-home; travel did not have any in-home duration recorded.

In viewing the trends shown in Table 2, it should be noted that different populations are being compared over time, albeit in similar age brackets. For example, the 18-24 year olds are millennials in all three snapshots, but born in 1979-1985, 1983-1989, and 1988-1994 respectively in the three survey snapshots. Younger millennials sleep longer, spend less time on household activities, spend less time caring for non-household members, worked or looked for work considerably more hours in 2007-2008 at the height of the recession, and spent more time pursuing in-home (presumably online) education and less time pursuing out-of-home education in comparison to their same age counterparts in prior survey years. Younger millennials also spent less time on consumer purchases; this may be due to two possible factors – first, the recession may have resulted in a drop in purchasing power, and second the increase in online shopping may have facilitated the ability to make (equivalent) purchases in a shorter period of time. Socializing and relaxation registered a dramatic drop among 18-24 year olds during the recession (consistent with the spike in work duration) but recovered substantially for those 18-24 years of age in 2012-2013. In-home socializing and relaxation registered an increase for 18-24 year olds in 2012-2013 compared to the same age counterparts in 2003-2004, while out-of-home socializing and relaxation registered a decrease (possibly reflecting tighter monetary budgets, and some substitution of in-home technology-enabled socialization and relaxation). The 18-24 year olds traveled 11 minutes less, on average, than 18-24 year olds in 2003-2004. Other activities held steady in duration, while activities that are unable to code registered a dramatic increase for the 18-24 year old age group over time (these include activities during multitasking, activities that respondents refused to disclose, did not know/remember, or could not explain adequately).

Those aged 25-34 years in 2012-2013 are millennials (the older millennials), while those aged 25-34 years in 2003-2004 belong exclusively to the preceding Generation X (GenX). Those who are 25-34 years old in 2007-2008 are largely GenX, but include a few older millennials (this group covers birth years of 1973-1982). The 25-34 year olds depict an increase in sleep duration, rather similar to the 18-24 year olds. They register a drop in household activities duration, but spend more time in general on such activities consistent with their more advanced lifecycle stage. Unlike 18-24 year olds, the 25-34 year olds register a drop in time allocated to caring for household members presumably due to the postponement of marriage and child-bearing among this age group. Although not as pronounced as that seen for 18-24 year olds, the other age groups also register an increase in work duration in 2007-2008 and a drop in work duration in 2012-2013. Time spent for education increases for 25-34 year olds, suggesting that older millennials are returning to college at slightly advanced ages more than their equivalent age counterparts in prior years. The changes in time allocation to socializing and relaxation follow a pattern similar to those seen for 18-24 year olds, but the changes are substantially less dramatic in nature suggesting that the youngest adults were most affected by the recessionary forces. Sports and exercise duration held steady for older age groups, unlike the 18-24 year olds who registered an increase.

TABLE 2 Activity-Time Use Trends for Different Age Groups (Average Minutes per Day)

Activity	Place	Age (18-24)			Age (25-34)			Age (35-54)		
		03-04	07-08	12-13	03-04	07-08	12-13	03-04	07-08	12-13
Personal Care In-home Only	Total	44	46	46	42	43	42	46	45	45
Sleep In-home Only	Total	543	540	556	510	513	522	494	498	509
Household Activities	In-Home	53	51	48	87	86	81	113	111	105
	Out-of-Home	7	9	6	7	6	8	6	6	7
	Total	60	60	54	94	93	89	120	117	112
Caring For & Helping Household (HH) Members	In-Home	17	16	19	51	49	46	28	27	28
	Out-of-Home	3	4	3	9	9	9	8	8	9
	Total	21	20	22	60	58	55	36	36	37
Caring for & Helping Nonhousehold (NonHH) Members	In-Home	3	1	1	1	1	1	3	3	2
	Out-of-Home	8	8	5	8	4	4	7	5	5
	Total	11	9	6	9	5	5	11	7	7
Work & Work-Related Activities	In-Home	6	6	12	16	18	17	21	26	27
	Out-of-Home	187	218	169	252	257	238	248	249	238
	Total	193	223	181	268	275	255	269	275	266
Education	In-Home	21	26	24	6	7	11	3	3	4
	Out-of-Home	48	42	43	9	7	12	3	2	2
	Total	69	68	67	15	14	23	6	5	6
Consumer Purchases	In-Home	0	1	0	0	1	1	1	1	1
	Out-of-Home	23	22	18	25	22	22	24	23	22
	Total	24	23	18	25	22	23	25	24	22
Eating and Drinking	In-Home	26	27	30	33	33	36	37	38	39
	Out-of-Home	29	32	29	31	30	30	27	27	25
	Total	54	59	60	63	63	66	65	65	64
Socializing, Relaxing, and Leisure	In-Home	190	171	206	176	173	180	195	196	201
	Out-of-Home	87	81	75	52	53	50	40	39	39
	Total	278	253	281	228	226	230	235	236	241
Sports, Exercise, & Recreation	In-Home	3	2	4	2	2	2	2	3	3
	Out-of-Home	23	25	25	16	14	16	14	15	14
	Total	25	28	29	19	17	18	17	17	16
Travel Out of Home Only	Total	87	79	76	81	78	77	82	77	77
Other	In-Home	10	9	10	6	7	6	9	9	8
	Out-of-Home	15	14	15	15	15	14	20	19	17
	Total	24	23	25	21	22	20	29	28	25
Unable to Code	In-Home	4	5	7	4	5	9	5	7	8
	Out-of-Home	3	5	13	2	3	5	2	2	4
	Total	7	10	19	6	9	14	6	10	12
Sample Size (Unweighted)		*2,443*	*1,571*	*1,398*	*5,776*	*4,102*	*3,845*	*14,123*	*10,057*	*8,852*

Note: No out-of-home durations were recorded for personal care and sleep. No in-home duration was recorded for travel.

Travel time expenditure shows a decrease for both age groups; the magnitude of decrease is smaller for the 25-34 year age bracket because the 18-24 year olds of 2003-2004 exhibited an unusually high travel time expenditure compared to other groups. Over time expenditure has been settling for all age groups to a value of 76-77 minutes. Similar to the 18-24 year olds, the other age groups register substantial increases in activities that are unable to be coded although the magnitudes of increase are lower for 25-34 year old and 35-54 year old individuals. It appears that individuals at all stages of life are pursuing more complex activity patterns, likely involving greater use of ICT technologies such as smartphones and tablets, that are becoming difficult to code in the traditional activity categorization lexicon.

Overall, it can be seen that there are discernible trends in activity time allocation; however, barring a few exceptions, the trends are rather similar for the different age groups suggesting that differences seen among young adults over the course of a decade are not that unusual or inconsistent with changes exhibited by adults in the older age brackets. While the young adults may be showing larger magnitudes of difference over time, the general trends are consistent across age groups – providing the first indication that millennials may not be all that different.

4. A LOOK AT THE AGING EFFECTS

The overview in the previous section offered a summary of trends in the data sets without necessarily controlling for cohort or aging effects. In order to better isolate trends and identify aging effects, this section presents a trend analysis for three distinct cohorts: millennials born 1979-1985 (the older millennials), Generation X born 1973-1978 (the younger GenX, referred to as GenX1), and Generation X born 1967-1972 (the older GenX, referred to as GenX2). Millennials born 1979-1985 would be roughly in their early 20s in 2003-2004, in their mid- to late-20s in 2007-2008, and in their late 20s to early 30s by 2012-2013. GenX1 would largely be in their late 20s in 2003-2004 and early 30s in 2012-2013. The older GenX group (GenX2) would be in their early 30s in 2003-2004. Thus, it is possible to compare the evolution of activity-time use patterns of millennials as they progress through the aging process. No data is available for the GenX1 group in their early 20s, and no data is available for the GenX2 group in their early 20s and mid/late 20s, because these groups would fall into such age ranges prior to the commencement of the ATUS.

Table 3 presents the results of this comparison. The objective of this comparison is to qualitatively examine trends for numerical differences and similarities over time. It can be seen that, barring a few exceptions, the daily time allocation of the millennial generation is *neatly converging* to the corresponding values exhibited by GenX1 and GenX2 individuals in the late 20s/early 30s age range. Personal care activities are all just over 40 minutes in duration, sleep durations are settling at a value a little over 500 minutes, and household activities are approaching the 100 minute mark. Work and work related activities consume about 4.5 hours, and consumer purchase time durations are 24-25 minutes for all three cohorts in their late 20s/early 30s. Similar convergent trends can be seen for socializing and relaxation, sports and exercise, and other activities.

The few notable exceptions include eating and drinking to which millennials are found to dedicate a few additional minutes, on average, compared to their equivalent GenX groups in their late 20s/early 30s. Millennials are likely to be enrolled in college at a greater rate than their earlier GenX counterparts (Stilwell, 2014), and this is reflected in their higher time allocation to education (however, the decreasing trend with progression in age mirrors that depicted by the GenX1 group).

TABLE 3 Evolution of Activity-Time Use Patterns for Different Cohorts (Duration in Minutes)

Activity	Cohort (Year of Birth)	Age Stage			Converging With Age?
		Early 20s	Mid/Late 20s	Late 20s/ Early 30s	
Personal Care In-home Only	Millennials (1979-1985)	44	45	42	Yes
	GenX1 (1973-1978)	--	42	43	
	GenX2 (1967-1972)	--	--	44	
Sleep In-home Only	Millennials (1979-1985)	543	522	519	Yes
	GenX1 (1973-1978)	--	516	510	
	GenX2 (1967-1972)	--	--	503	
Household Activities	Millennials (1979-1985)	60	76	91	Yes
	GenX1 (1973-1978)	--	88	99	
	GenX2 (1967-1972)	--	--	106	
Caring For & Helping Household (HH) Members	Millennials (1979-1985)	21	40	60	Yes
	GenX1 (1973-1978)	--	53	64	
	GenX2 (1967-1972)	--	--	69	
Caring for & Helping Nonhousehold (NonHH) Members	Millennials (1979-1985)	11	6	5	Yes
	GenX1 (1973-1978)	--	10	6	
	GenX2 (1967-1972)	--	--	8	
Work & Work-Related Activities	Millennials (1979-1985)	193	274	266	Yes
	GenX1 (1973-1978)	--	268	276	
	GenX2 (1967-1972)	--	--	265	
Education	Millennials (1979-1985)	69	28	17	Yes, but lingering difference
	GenX1 (1973-1978)	--	20	12	
	GenX2 (1967-1972)	--	--	9	
Consumer Purchases	Millennials (1979-1985)	24	21	24	Yes
	GenX1 (1973-1978)	--	24	24	
	GenX2 (1967-1972)	--	--	25	
Eating and Drinking	Millennials (1979-1985)	54	61	66	No
	GenX1 (1973-1978)	--	64	64	
	GenX2 (1967-1972)	--	--	62	
Socializing, Relaxing, and Leisure	Millennials (1979-1985)	278	237	223	Yes
	GenX1 (1973-1978)	--	229	219	
	GenX2 (1967-1972)	--	--	220	
Sports, Exercise, & Recreation	Millennials (1979-1985)	25	20	18	Yes
	GenX1 (1973-1978)	--	19	18	
	GenX2 (1967-1972)	--	--	18	
Travel Out of Home Only	Millennials (1979-1985)	87	80	76	Yes
	GenX1 (1973-1978)	--	81	76	
	GenX2 (1967-1972)	--	--	81	
Other	Millennials (1979-1985)	24	21	21	Yes
	GenX1 (1973-1978)	--	20	22	
	Gen X2 (1967-1972)	--	--	24	
Unable to Code	Millennials (1979-1985)	7	10	14	No, but similar upward trend
	GenX1 (1973-1978)	--	5	8	
	GenX2 (1967-1972)	--	--	6	
Total Time In-Home	Millennials (1979-1985)	920	903	953	Yes
	GenX1 (1973-1978)	--	924	956	
	GenX2 (1967-1972)	--	--	950	
Total Time Out-of-Home	Millennials (1979-1985)	520	537	487	Yes
	GenX1 (1973-1978)	--	516	484	
	GenX2 (1967-1972)	--	--	490	
Sample Size (Unweighted)	*Millennials (1979-1985)*	*2,443*	*2,102*	*2,854*	
	GenX1 (1973-1978)	--	*2,974*	*2,771*	
	GenX2 (1967-1972)	--	--	*4,219*	

The "unable to code" category remains a category worthy of additional attention; millennials appear to be engaging in such activities (multitasking, activities not well-defined, activities that individuals do not wish to disclose) for a substantially longer duration than prior generations. Given the lack of a convincing narrative as to why millennials might be more likely to forget activities, or be unable to express what their activities are, it is conjectured that most of the difference involves multitasking activities that are difficult to code, which likely includes a large portion of technology use while other activities are being undertaken. It is possible that millennials, having grown up in an age of technology and multitasking (Silver, 2014), are prone to continuing and leveraging established habits and patterns of multi-tasking into their older adulthood. What is particularly noteworthy is the very steady convergence of total time spent in-home versus out-of-home (about 16 hours to 8 hours respectively). Unfortunately, it is not possible to compare the cohorts at the starting point (i.e., when all generations were in their early 20s). Based on research in the literature (e.g., Polzin, 2014; McDonald, 2015), it appears that the millennials (young adults of today) are behaving quite differently than the young adults of prior generations. This appears to imply that the millennials have different starting points in life; when they are in their early 20s, they are not behaving like GenX and Baby Boomers in their early 20s. However, despite having a different starting point, they seem to be settling into a rather similar end point once they age into their late 20s and early 30s and experience lifecycle phases of marriage, child-bearing, and labor force participation.

Table 4 presents a similar comparison for mode usage patterns. The ATUS data set does not provide travel-related information as detailed and rich as the National Household Travel Survey (NHTS). Nevertheless, it provides basic mode information for any activity that is classified as travel. The table shows time spent traveling by various modes and the trip rates by mode for the three cohorts of interest. Once again, it is seen that millennials are largely behaving like GenX1 and GenX2 cohorts when it comes to mode use patterns, in terms of travel as car passenger, by transit, or by non-motorized modes once they reach their late 20s/early 30s. However, a lingering difference remains in the level of *car driving* use. There is plenty of evidence, as noted earlier in the paper, that millennials are somewhat more likely to shun cars and drive less. The data here appear to support the literature; time spent traveling as a car driver held steady for millennials at 53 minutes even as they aged. GenX1 individuals spent 55 minutes traveling as car driver and GenX2 individuals spent, on average, 61 minutes traveling as car driver in the late 20s/early 30s. There is no clear evidence of convergence in the time allocation (or trip rate) for the car driver mode; millennials appear to be persistently lower than their prior generation counterparts. The higher prevalence of missing mode information for the millennial generation may be affecting the trends in this table.

5. FOCUS ON THE YOUNGER MILLENNIALS

The analysis in the previous section provided insights into the aging effects while controlling for cohort effects. The millennials considered in the previous section are the older millennials, those born between 1979 and 1985. As the youngest GenX (GenX1) individuals were born during 1973-1978, it is not all that surprising that the older millennials and the younger GenX1 group show similarities in activity-time use patterns. Although a number of surveys and studies define the millennial generation as that born beginning in the late 1970s, there are others who define the millennials as being born only after 1982 (Haughn, 2015). It may be argued that the technological service-based applications (apps) revolution really started only in the 1990s, and therefore it is the later millennials (those born in the 1990s and later) who would be truly different in their patterns.

TABLE 4 Evolution of Mode Use for Different Cohorts (Duration in Minutes)

Mode	Cohort (Year of Birth)	Age Stage			Converging With Age?
		Early 20s	Mid/Late 20s	Late 20s/ Early 30s	
Car Driver (Duration)	Millennials (1979-1985)	53	53	53	No, Millens Slightly Lower
	GenX1 (1973-1978)	--	58	55	
	GenX2 (1967-1972)	--	--	61	
Car Driver (Trip Rate)	Millennials (1979-1985)	3.18	3.05	2.94	No, Millens Slightly Lower
	GenX1 (1973-1978)	--	3.21	3.17	
	GenX2 (1967-1972)	--	--	3.44	
Car Passenger (Duration)	Millennials (1979-1985)	21	13	11	Yes
	GenX1 (1973-1978)	--	14	12	
	GenX2 (1967-1972)	--	--	11	
Car Passenger (Trip Rate)	Millennials (1979-1985)	0.96	0.66	0.52	Yes
	GenX1 (1973-1978)	--	0.64	0.56	
	GenX2 (1967-1972)	--	--	0.55	
Non-Motorized (Duration)	Millennials (1979-1985)	5	5	3	Yes
	GenX1 (1973-1978)	--	3	3	
	GenX2 (1967-1972)	--	--	3	
Non-Motorized (Trip Rate)	Millennials (1979-1985)	0.58	0.43	0.35	Yes
	GenX1 (1973-1978)	--	0.38	0.36	
	GenX2 (1967-1972)	--	--	0.34	
Public Transit (Duration)	Millennials (1979-1985)	5	4	3	Yes
	GenX1 (1973-1978)	--	3	3	
	GenX2 (1967-1972)	--	--	3	
Public Transit (Trip Rate)	Millennials (1979-1985)	0.13	0.11	0.10	Yes
	GenX1 (1973-1978)	--	0.09	0.09	
	GenX2 (1967-1972)	--	--	0.09	
Other (Duration)	Millennials (1979-1985)	1	2	1	Small Numbers
	GenX1 (1973-1978)	--	1	1	
	GenX2 (1967-1972)	--	--	1	
Other (Trip Rate)	Millennials (1979-1985)	0.02	0.02	0.02	Small Numbers
	GenX1 (1973-1978)	--	0.02	0.01	
	GenX2 (1967-1972)	--	--	0.01	
Missing Mode (Duration)	Millennials (1979-1985)	2.5	2.6	3.6	No
	GenX1 (1973-1978)	--	2.7	2.8	
	GenX2 (1967-1972)	--	--	3.1	
Missing Mode (Trip Rate)	Millennials (1979-1985)	0.19	0.19	0.22	No
	GenX1 (1973-1978)	--	0.18	0.19	
	GenX2 (1967-1972)	--	--	0.18	

In an attempt to control for age effects, and better understand the activity-time use patterns of younger millennials relative to older millennials, additional analysis was undertaken to compare time allocation patterns across cohorts. Table 5 presents a comparison of activity-time use patterns for four groups:

- Generation X individuals born 1970-1976: 27-33 years old in ATUS 2003-2004
- Older Millennials born 1979-1985: 27-33 years old in ATUS 2012-2013

- Older Millennials born 1979-1985: 18-24 years old in ATUS 2003-2004
- Younger Millennials born 1988-1994: 18-24 years old in ATUS 2012-2013

Comparing columns A and B, it can be seen that older millennials and GenX individuals show both similarities and significant differences when they are 27-33 years of age. Equality of means cannot be rejected for personal care, household activities, caring for household members, work, education, sports and exercise, and travel by alternative modes. In addition, equality of means cannot be rejected for total time spent in-home and out-of-home. The takeaway is that older millennials show some patterns of similarity with their GenX counterparts at the older 27-33 year age bracket, but there are clearly lingering and statistically significant differences that have sustained as millennials aged; they sleep more, eat and drink more, multi-task (unable to code) more, and drive/ride-in a car less – consistent with the stereotype that they are lazy (Linn, 2014) and go-nowhere (McDonald, 2015). In other words, there are both patterns of convergence and lingering differences as millennials age (in comparison to their prior generation counterparts).

Comparing columns B and C (t-test in last column), i.e., older millennials at 27-33 years of age to themselves at 18-24 years of age, it can be seen that they have gone through the expected significant transformation with aging (consistent with results presented in the last section). Most activity categories show statistically significantly different durations, including total time spent in-home and out-of-home. Their time spent driving a car remains steady at 53 minutes, but their time spent as a car-passenger drops (as expected with aging) from 21 minutes to 11 minutes. As older millennials progress through life stages, they are becoming increasingly like their GenX counterparts at the same age, with some lingering statistically significant differences. It may be conjectured that the older millennials are converging to the patterns of GenX, but with a lag; in other words, perhaps the older millennials will mirror the patterns depicted by 27-33 year old GenX individuals when they hit the age range of 34-39. Given that millennials are choosing delayed marriage, child-bearing, and entry into the labor force, such a lag may indeed be expected; it is not the generation that makes the difference, but "it's actually a stage of life issue" (Linn, 2014). This remains, however, an open question worthy of further research; will millennials converge to patterns of prior generations, albeit with a lag, *or*, will lingering differences remain in millennial time use patterns (even after accounting for lifecycle stage) due to pervasive technology, service-based applications, and different lifestyle preferences?

The comparison between means in columns C and D suggests that older millennials and younger millennials are not very different in their time use patterns as young adults (18-24 years old). In comparing activity durations by purpose, it is found that the means are largely not statistically significantly different, except for a few activity categories, namely, caring for non-household members, consumer purchases, and those unable to code. However, what is noteworthy is that the total durations spent in-home (and out-of-home) are statistically significantly different. Time spent traveling is significantly different as well, largely attributable to differences in car-driving and car-passenger modes. The similarity in total activity durations by purpose, but significant differences in total in-home and out-of-home (and travel) durations, clearly points to a *location substitution* in effect. The younger millennials (at 18-24 years) are pursuing activities in-home significantly more than the older millennials did when they were 18-24 years old. They are pursuing activities to the same degree, but at a different location – *in-home* – which is also contributing to reduced travel. Figure 1 provides further insights into the activity time differences that contribute to the large in-home duration difference.

TABLE 5 Comparison of Activity-Time Use Patterns for Different Cohorts at the Same Age (Duration in Minutes)

Activity	Born 1970-76 GenX at Age 27-33 (Data 03-04) (A)	Born 1979-85 Older Mill at Age 27-33 (Data 12-13) (B)	t-test: (A) vs (B)	Born 1979-85 Older Mill at Age 18-24 (Data 03-04) (C)	Born 1988-94 Younger Mill at Age 18-24 (Data 12-13) (D)	t-test: (C) vs (D)	t-test: (B) vs (C)
Personal Care (Except Sleep)	42	42	CR	44	46	CR	CR
Sleep	506	519	R	543	556	CR	R
Household Activities	94	91	CR	60	54	CR	R
Caring For Hhld Members	59	60	CR	21	22	CR	R
Caring for Non-HH Members	9	5	R	11	6	R	R
Work & Work-Related	272	266	CR	193	181	CR	R
Education	14	17	CR	69	67	CR	R
Consumer Purchases	26	24	R	24	18	R	CR
Eating and Drinking	62	66	R	54	60	CR	R
Social, Relaxing, and Leisure	228	223	R	278	281	CR	R
Sports, Exercise, & Recreation	19	18	CR	25	29	CR	R
Unable to Code	6	14	R	7	19	R	R
Other	20	21	CR	24	25	CR	CR
Total In-Home	**932**	**953**	**CR**	**920**	**963**	**R**	**R**
Total Out-of-Home	**508**	**487**	**CR**	**520**	**477**	**R**	**R**
Travel	**82**	**76**	**R**	**87**	**76**	**R**	**R**
Car Driver	59	53	R	53	42	R	CR
Car Passenger	12	11	R	21	20	R	R
Public Transit	3	3	CR	5	5	CR	CR
Non-Motorized	3	3	CR	5	5	CR	R
Other	1	1	CR	1	1	CR	CR
Missing	3	4	CR	2	3	CR	CR
Sample Size (Unweighted)	*4198*	*2854*	--	*2443*	*1398*	--	--

Null Hypothesis: H_0 → means are equal

CR: Cannot Reject Null Hypothesis ($p > 0.05$)

R: Reject Null Hypothesis ($p \leq 0.05$)

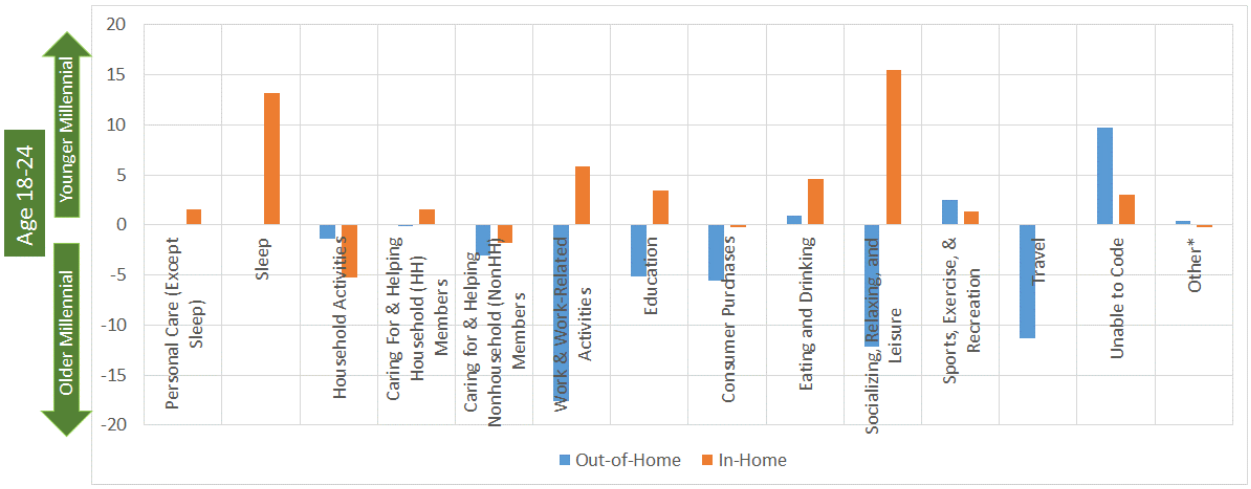

FIGURE 1 Difference in activity durations between younger and older millennials.

In Figure 1, the orange bars refer to in-home duration differences while the blue bars refer to out-of-home duration differences. If the bars are in the positive territory, it means that younger millennials are spending more time in the respective category; if the bars are in the negative territory, then it means that older millennials are spending more time in the respective category. In general, the additional time spent in-home for younger millennials can be attributed to sleep, social-relaxation, work, eating/drinking, and unable to code. Clearly younger millennials are spending more leisurely time at home, but they are also studying and working more at home than did older millennials when they were 18-24 years of age. Why are younger millennials spending more time at home than older millennials did in young adulthood? Is it because of the post-recessionary period of tighter budgets, is it because of technology and social media, or is it because of fundamentally different lifestyle preferences and living arrangements? These are questions that remain subjects of future research as additional data on millennial behavior becomes available.

6. DISCUSSION AND CONCLUSIONS

The findings in this paper suggest that the much-discussed and written-about transformative changes that millennials may bring about in society likely constitutes more hype than reality. The longitudinal trend analysis using the American Time Use Survey (ATUS) in this paper shows that as millennials age into their 30s, they are increasingly showing activity-time use patterns that resemble those of the Generation X groups when they were in their early 30s, although some differences in time use remain. The additional 20 minutes they spend at home can be largely attributed to sleep and activities unable to be coded (multitasking, and activities difficult to define). Older millennials continue to show reduced levels of driving compared to Generation X individuals at even the more advanced age of 27-33 years old; the extent to which this reduced driving level is attributable to the new reality brought on by the recession (as opposed to a fundamental difference in preferences) is unclear and worthy of further research. Should a transportation planning agency assume no differences in car driving levels in a healthy economy scenario? Or are these differences in driving levels so fundamental to the generation's mindset that lower levels of personal vehicle use can be assumed for this large population segment regardless of the economic scenario? Additional cross-sections of data are needed before such questions can be answered.

The generation that depicts more remarkably different patterns in *activity location* is the younger millennial cohort born between 1988 and 1994. In total, younger millennials 18-24 years old are spending 40 more minutes at home than the older millennials did when they were 18-24 years old. It is unclear whether younger millennials will begin to converge to activity-time use patterns of prior generations as they age (like the older millennials are). The statistics suggest that millennials have a different starting point (at young adulthood, 18-24 years) in terms of their activity and travel choices, and these differences slowly fade as they age. During the period that differences exist, millennials drive less; and this period of lower car ownership and vehicle use certainly yields tangible benefits in terms of reduced energy consumption, vehicle miles of travel, and emissions. These benefits are undoubtedly substantial and are worthy of recognition in transportation planning processes. The differences do fade (as shown in the aging analysis of this paper), but some differences persist, at least through the 27-33 year age bracket covered in this analysis. It is unclear if the differences will continue to persist, or fade further as the millennials age into their late 30s, early 40s, and beyond. It is possible that delayed lifecycle stages experienced by millennials (delayed marriage, child-bearing, and entry into labor force) will are simply contributing to a lag in the convergence of activity-time use patterns.

A variety of hypotheses may be postulated to explain why small – but important – differences between millennials and prior generations could persist into the future. First, millennials may be fundamentally different in their lifestyle preferences and choices, and the way they utilize services and process information. Second, because millennials grew up in a technology-driven age, they are highly technology-savvy; interactions and communications facilitated through social media and instant messaging may reduce the need for physical interaction, and therefore travel. The severe prolonged recession and uneven economic recovery have also been blamed for this specific cohort delaying establishment of independent households, postponing the acquisition of motor vehicles and driver's licenses, and traveling less for a variety of mandatory, maintenance, and discretionary activities. With a tight labor market characterized by limited job opportunities and stagnant/low wages, many millennials have had to continue living with family and settle for low-paying and/or part-time work. As a result, these individuals may not have the discretionary income that would facilitate high levels of participation in discretionary activities such as socializing, recreation, eating meals outside of the home, shopping, and sports. It is also conjectured that this generation grew up in an era of greater awareness of the potential adverse impacts of vehicular travel on greenhouse gas emissions, air quality, the sustainability and livability of communities, energy security, and quality of life. Their proclivity towards lower levels of vehicle ownership and mobility may be, at least in part, due to their attitudes, perceptions, and values being different and more environmentally sensitive in comparison to prior cohorts.

It is unclear whether information and communications technologies (ICT) truly contribute to reduced levels of mobility. In a study that is somewhat dated, Robinson et al (2000) found no significant or consistent evidence of time displacement from mass media use or social activities as a result of internet or computer use. Blumenberg et al (2012) find that web use does not substitute for travel; further, they find that a higher level of web use is associated with increased person miles of travel across all age categories, presumably because web use, auto access, and personal travel are all positively associated with education and income. While there is clear evidence that millennials use technology more than prior generations (Pew Research Center, 2014), there is a lack of confirmatory evidence on the relationships between travel and ICT use for the millennial generation. Unfortunately, the ATUS data does not provide a separate category for ICT use, and may be missing ICT use when such use is secondary to a primary activity. Enhancements in the

recording of ICT-related activities and secondary/tertiary activities in the ATUS data would help unravel the patterns of complementarity and substitution that may exist between out of home activity-travel engagement and ICT use.

In summary, it can be concluded that the hype surrounding the differences exhibited by millennials in their activity-travel patterns is not completely warranted; while there are some differences in activity and time use patterns even as they age, it is possible that a lagged lifecycle effect is contributing to the differences – and these differences may fade further over time as millennials experience advanced phases of life.

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