Typecasting Neighborhoods and Travelers

Analyzing the Geography of Travel Behavior Among Teens and Young Adults in the U.S.

Federal Highway Administration

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16. Abstract

This report presents a high-level analysis of the effects of location on personal travel and trends associated with place of residence and the travel behavior of younger populations (ages 20-34).

Seven distinct neighborhood typologies were created using data from the Environmental Protection Agency (EPA) Smart Location Database and the Decennial U.S. Census. Neighborhoods were classified in terms of the built environment and surrounding transportation system, using variables that provided information about jobs, housing and employment densities, intersection densities, transit supply, and types of developments. In addition, four distinct traveler types were developed using data from the National Household Travel Survey (NHTS) based on selected variables, including: miles of travel, daily trips, car ownership, mode use, and licensure. Neighborhood types and traveler types were then linked to explore travel characteristics associated with place of residence.

Findings suggest that location plays a role in personal travel decisions. Where people live, work, recreate, and how they travel are intimately related to the built environment. Youth are more likely to live in urban areas, compared to previous generations. Younger populations (ages 20-34) are more likely than other age groups to live in the central city; however, this often changes as they age and have children. Most young adults still live and move into suburban areas. Nationwide, just over half of all youth (53 percent) live in suburban neighborhoods. Despite the thought that younger populations are becoming more urban, current trends show that a significant number of youth are more commonly taking up residence in suburban neighborhoods, particularly in new developments. A large percentage of youth are carless and have shown a decline in trip making, most likely a result of their economic condition.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL L
gal ft^3	gallons	3.785	liters	m^3
yd^3	cubic feet	0.028	cubic meters	m^3
	cubic yards	0.765	cubic meters NOTE:	
	volumes greater than 1000 L shall be shown in m^3			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
^oF	Fahrenheit	5 (F-32)/9	Celsius or (F-	^oC
		32)/1.8		
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
^oC	Celsius	1.8C+32	Fahrenheit	^oF
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc fl
cd/m^2	candela/m^2	0.2919	foot-Lamberts	
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

* SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

TABLE OF CONTENTS

List of Figures

List of Tables

EXECUTIVE SUMMARY

Millennials are the talk of the town these days. They have replaced GenXers as the generational darlings of the media—from their collective obsession with mobile communications devices and social media, to their perceived tendencies toward both tolerance and entitlement, to their generally blasé attitudes towards politics, to their enduring infatuation with tattoos—Millennials are seen as distinct in many ways from the generations before them. Among their many traits perceived to be unique is travel.

Although vehicle travel has declined for almost all demographic groups during the 2000s, some of the largest declines have been among young adults. Young travelers have also have experienced a significant decline in licensing rates in comparison with previous generations. What's behind these trends—be they attitudinal, economic, or technological—has been the subject of much speculation, and the focus of the precursor to this report (Blumenberg et al., 2012). In addition to attitudes, economics, and technology, another explanation for the for the varied travel patterns of Millennials is geographic. Millennials, the story goes, tend to be less enamored of the suburban, auto-oriented lifestyles favored by their parents. Instead of three kids in the backyard, two cars in the garage, and a chicken in every pot, the latest generation of young adults is marrying later, prefers lively cities over staid suburbs, and gets around on foot, by bike, in public transit, and by Lyft and Uber, in addition to driving their own cars. Indeed, data from the U.S. Census show that youth are more likely than older adults to move to central-city neighborhoods where origins and destinations are more proximate and travel by alternative modes (such as by foot, bike, and public transit) is more common. Thus changes in the residential location of young adults today may have important, and potentially long lasting, effects on travel behavior in the years ahead.

In this study, we use individual data from the 2001 and 2009 National Household Travel Surveys and associated neighborhood-level data from the Environmental Protection Agency (EPA) Smart Location Database and the Decennial U.S. Census to examine geographic variation in the travel behavior of youth relative to other age groups. We used these combined data to perform five related, yet distinct analyses:

- The composition, character, and distribution of neighborhood types across the entire U.S.;
- Changes in the location of young adults across these neighborhood types over time and relative to other age groups;
- The composition, character, and distribution of types of youth travelers in the U.S., as well as the relationships between neighborhood types and youth traveler types;
- The relationship between neighborhood type and travel behavior (measured by person miles of travel, vehicle miles of travel, trips, access to automobiles, and travel mode) by age group; and
- The relationship between living in a particular neighborhood type and the likelihood of being a certain type of youth traveler.

Using first factor and then cluster analysis, we define seven distinct neighborhood types in terms of the characteristics of the built environment and transportation systems—but not in terms of the characteristics of the people in those neighborhoods or their travel. We labeled the seven neighborhood types based on the most salient characteristics of each: Mixed Use (urban), Old Urban, Urban Residential, Established Suburbs, Patchwork (Suburban), New Development, and Rural. We were then able to place virtually every single census tract in the country (including in Alaska and Hawai'i) in one of these seven neighborhood types. Figure 1 shows each neighborhood type, its prevalence, and basic built environment characteristics, as well as the characteristics of the people living in them. While there is substantial variation in the distribution of these neighborhoods across metropolitan areas, they tend generally to be arranged in a roughly concentric ring pattern described by classical Chicago School urban sociologist and geographer Ernest Burgess nearly a century ago. The rings include mixed use (urban) neighborhoods (which are also found in the central business districts of suburbs and small cities, as well as in major commercial/industrial areas) at the core, New Developments at the fringe, and rural areas outside of cities and suburbs, with other neighborhood types in between. These neighborhood types serve as the foundation of the subsequent analysis of the residential location and travel behavior of youth relative to older adults.

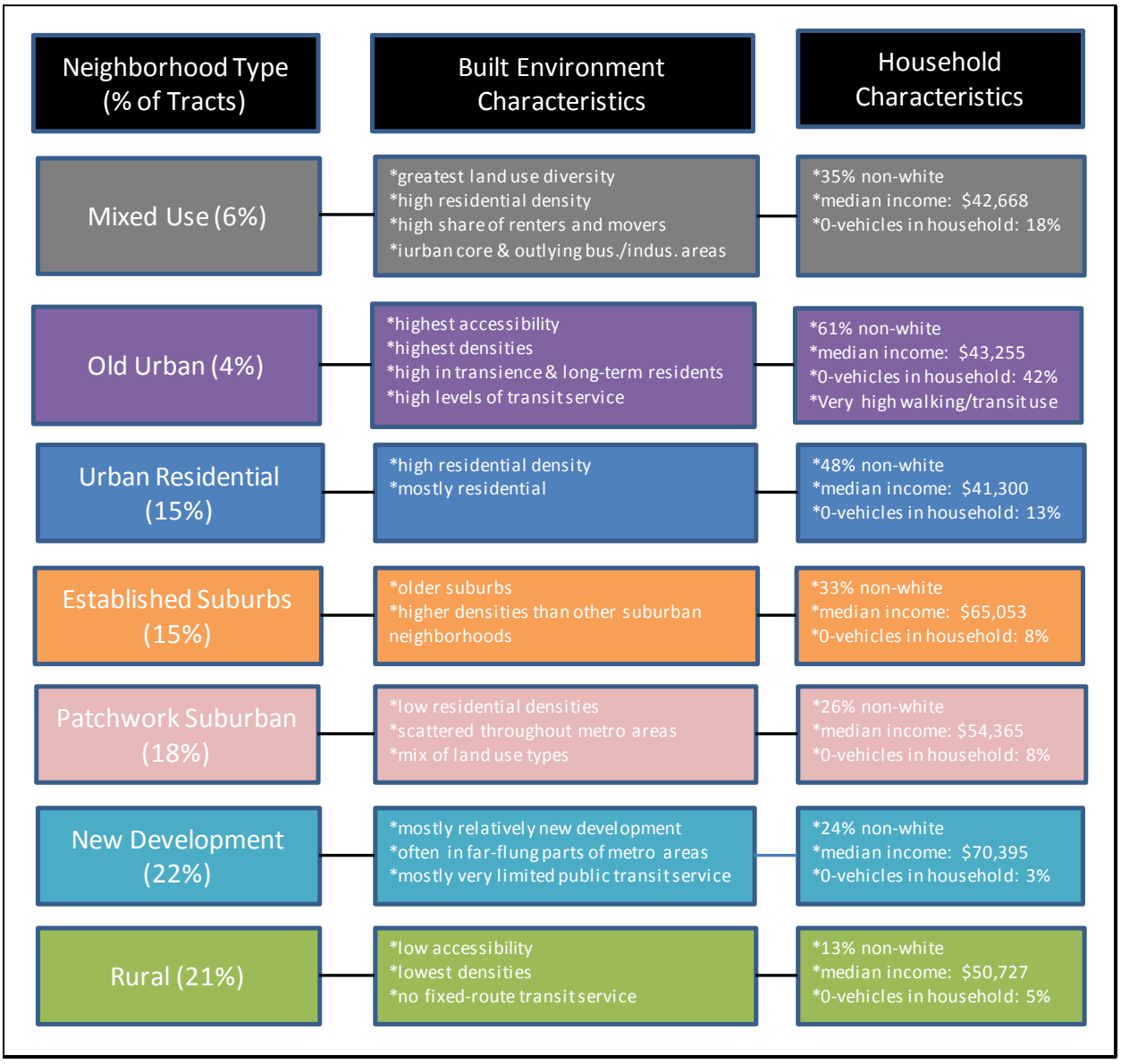


Figure 1. Chart. Neighborhood types.

Note: The neighborhood types are defined only by their built environment characteristics and not by their household characteristics.

Our principal findings are summarized below:

Neighborhood Types

- A majority of Americans live in suburbs. Nearly 3 out of 5 people (58%) live in the three suburban neighborhood types, while just over 1 in 5 (23%) live in the three urban neighborhood types. Figure 2 shows that only 4 percent of the population lives in Old Urban neighborhoods where transit service and use tends to be highest. In contrast 46 percent of the population (and 43% of census tracts) are located in Rural and New Development suburbs with little to no public transit service.

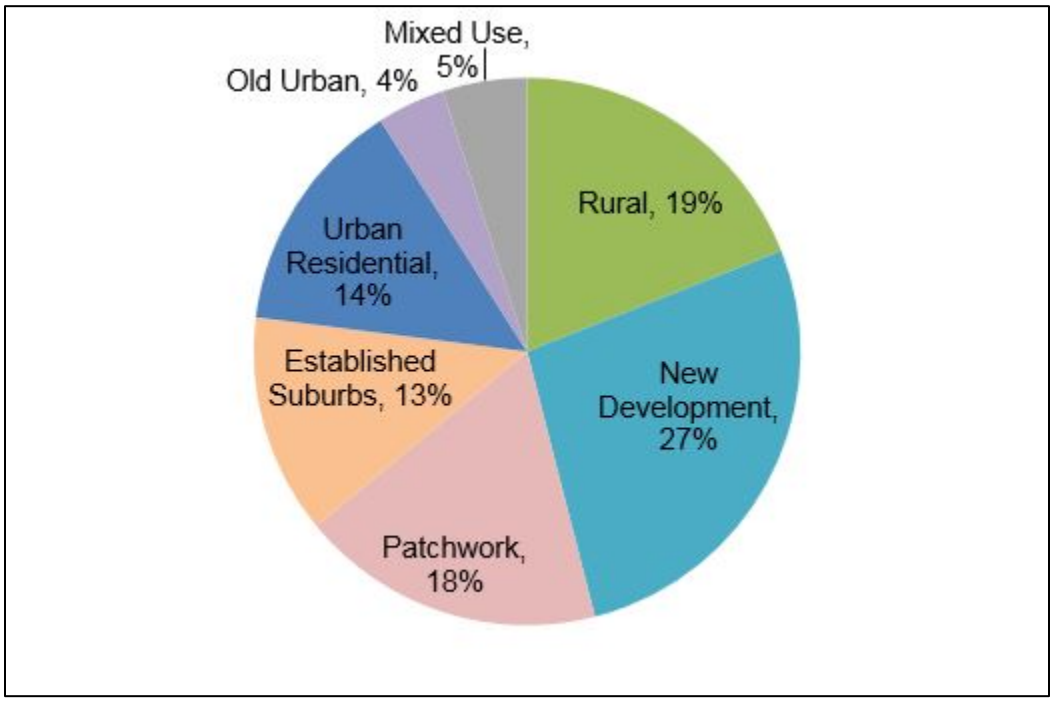


Figure 2. Chart. Residential location by neighborhood type.

- As Table 1 shows, the distribution of neighborhood types varies significantly within and across metropolitan areas.
  - Old Urban neighborhoods are concentrated in the very largest metropolitan areas. The top two metropolitan areas (New York and Los Angeles) collectively host about 10 percent of the U.S. population but 72 percent of transit-rich Old Urban neighborhoods in the U.S.
  - As the largest metropolitan area, New York, both the most neighborhoods and, perhaps not surprisingly, the greatest number of any metropolitan area for many of the neighborhood types (rural, patchwork suburban, established suburban, old urban, and mixed use). However, two other large metropolitan areas make an appearance on the leaderboard. Phoenix has the greatest number of New Development neighborhoods and Los Angeles has the greatest number of Urban Residential neighborhoods.

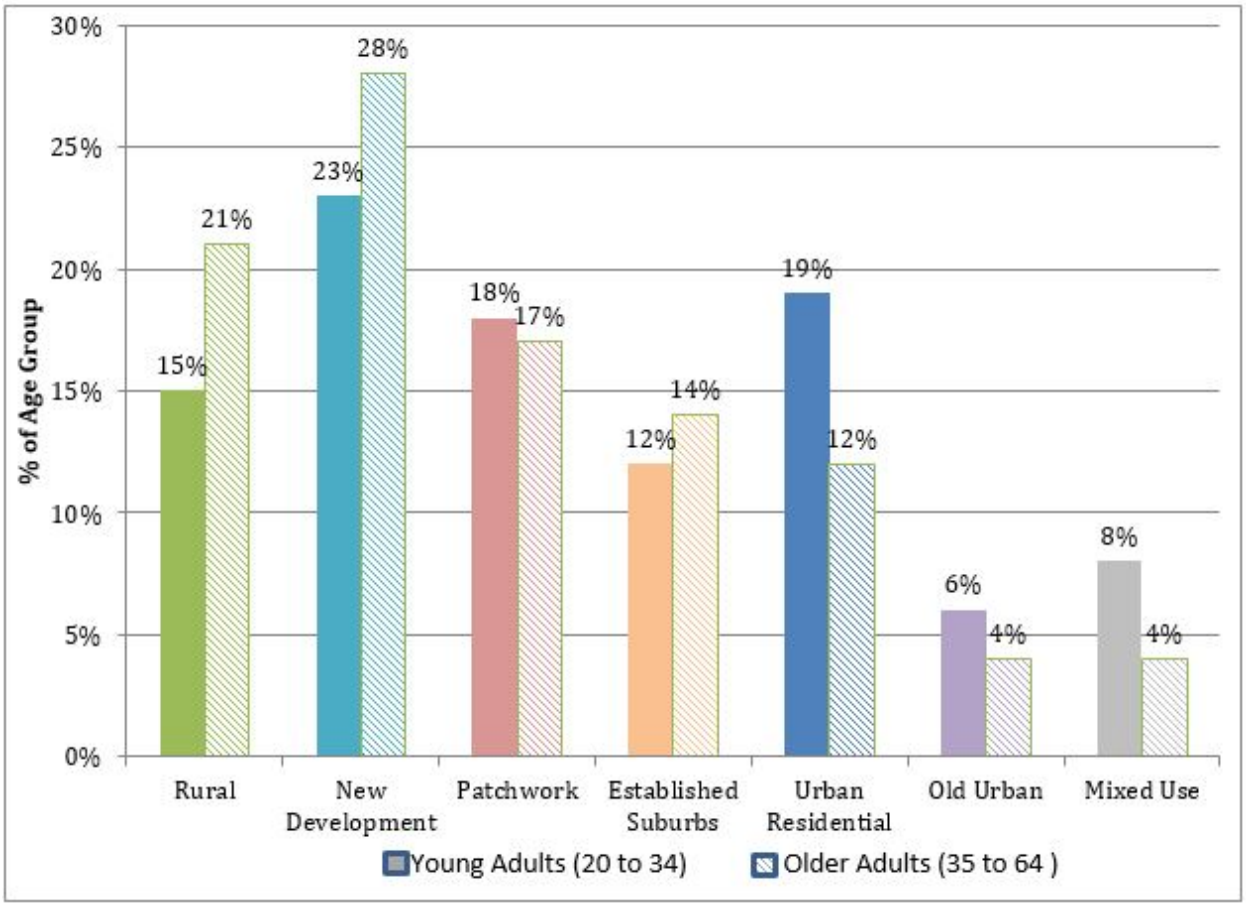
Table 1. Distribution of neighborhood types, across and within CBSAs.

Neighborhood Types	Highest # of Tracts (% of national tracts)*	Highest % of Tracts (%)
Rural	New York 161 (1%)	Central city, KY, Pierre Part, LA, Raymondville, TX, Summerville, GA (100%)
New development	Phoenix 524 (3%)	Palm Coast, FL (90%)
Patchwork suburban	New York 518 (4%)	Hood River, OR (75%)
Established suburbs	New York 1,418 (13%)	Scranton, PA (41%)
Urban Residential	Los Angeles 513 (5%)	Pecos, TX (40%)
Old urban	New York 1,630 (50%)	New York (36%)
Mixed-use	New York 232 (5%)	Ketchikan, AK (50%)

*The percent is the percentage of tracts of this neighborhood type. For example, New York is home to 161 rural census tracts, one percent of all rural census tracts in the U.S.

Residential Location of Youth

- Young adults are indeed more urbanized than middle-aged and older adults. While more than half of all youth live in suburban neighborhoods, a higher percentage of youth live in neighborhoods that tend to be found in urban areas—Urban Residential, Old Urban, and Mixed Use.



Source: U.S. Census, 2010.

Figure 3. Chart. Residential location of young and older adults by neighborhood type.

- Accounting statistically for other determinants of residential location, youth remain more likely than otherwise similar adults to reside in the three urban neighborhood types—Mixed Use, Old Urban, and Urban Residential neighborhoods.

- Different socio-economic characteristics tend to be associated residing in particular neighborhood types. For example, living independently (i.e. not with one's parents), the presence of a child, low incomes, and minority racial/ethnic status are positively associated with living in Old Urban neighborhoods.

- The data for this analysis do not include information on people moving from one neighborhood types to another. However, the data are suggestive of a "back-to-the-city-movement." After population losses in the 1990s, between 2000 and 2010 the number of young adults living in urban neighborhoods—Urban Residential, Old Urban, and Mixed Use—increased by over four million.

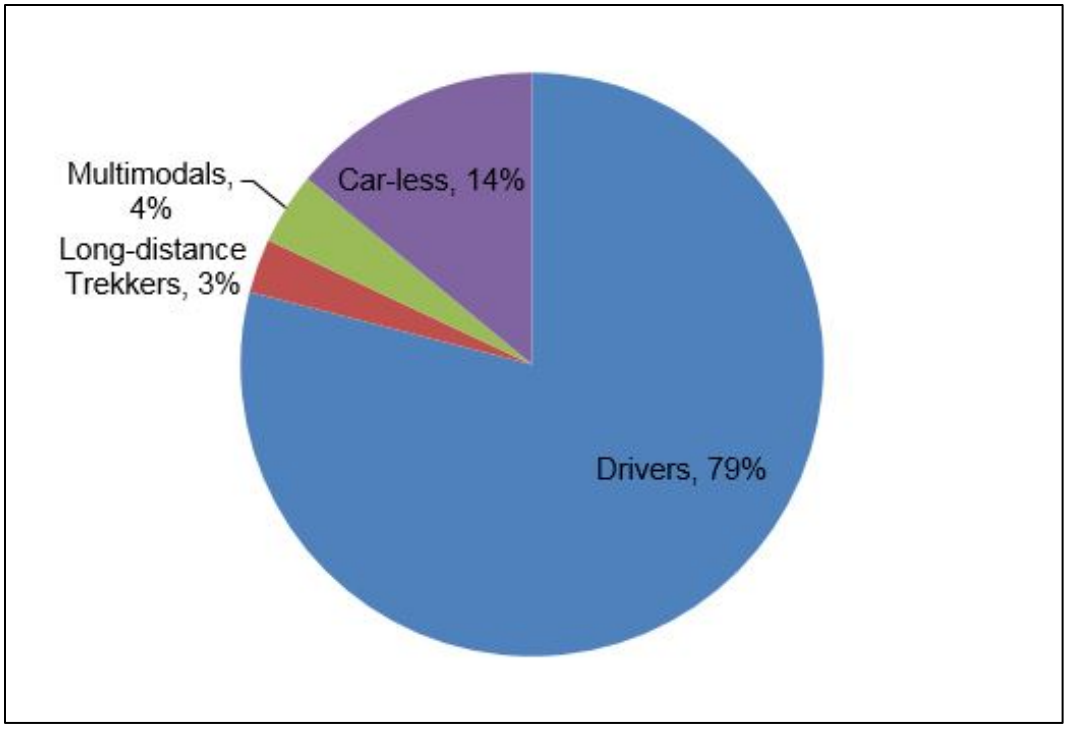
- However, any “back-to-the-city” movement since 2000 was swamped by what might best be described as a much larger “out-to-the-suburbs” movement (though again, our focus here is on residential location and not migration). The increase in youth living in urban areas was dwarfed by the growing numbers of young adults living in suburban neighborhoods, and in particular the generally far-flung New Development neighborhoods.

Youth Traveler Types

- Analysis of travel behavior shows that youth travelers (in this case aged 16-36) can be grouped into one of four different traveler types—Drivers, Long-distance Trekkers, Multimodals, and the Car-less.

- The names of these four traveler types reflect the predominant travel behavior patterns of each group.
  - Drivers make most of their trips by car and have extensive mobility.
  - Long-Distance Trekkers travel the most miles but make no more daily trips than Drivers.
  - Multimodals use a mix of modes and generally enjoy the highest levels of access.
  - The Carless don’t travel by automobile, have little mobility, and lower levels of access than those in any of the other three groups.

- As Figure 4 shows, Drivers and Long-Distance Trekkers rely on private vehicles for their mobility and comprise 82 percent of all youth traveler types. High accessibility Multimodals comprise only four percent of young travelers, while the low-accessibility Car-less comprise 14 percent of young travelers.



Source: 2009 NHTS, weighted values.

Figure 4. Chart. Prevalence of traveler types (2009).

Note: Population estimates based on the weighted values from the NHTS.

Travel Behavior

- As Figure 5 shows, while we observe travel behavior differences across five of the seven neighborhood types (New Development, Patchwork Suburban, Established Suburbs, Urban Residential, and Mixed Use), these variations are relatively, and to some extent, surprisingly modest.

- On the other hand, travel patterns in Rural areas and, in particular, Old Urban neighborhoods vary substantially from the patterns seen in the three suburban and two urban neighborhood types listed above.

- With the exception of Old Urban Neighborhoods, private vehicle travel (driving alone and carpooling) dominates personal travel for all age groups analyzed (teens, young adults, and adults) in the six other neighborhood types.

- Travel in Old Urban neighborhoods is decidedly different than any of the other urban, suburban, or rural neighborhoods. Residents of Old Urban neighborhoods make fewer trips, travel fewer miles, have lower rates of automobile access and licensing, are less likely to drive alone, and are much more likely to walk and take travel by public transit than are the residents of any other

neighborhood type. Further, teen and young adult residents of Old Urban neighborhoods are less likely to be Drivers and more likely to be members of the Car-less traveler type.

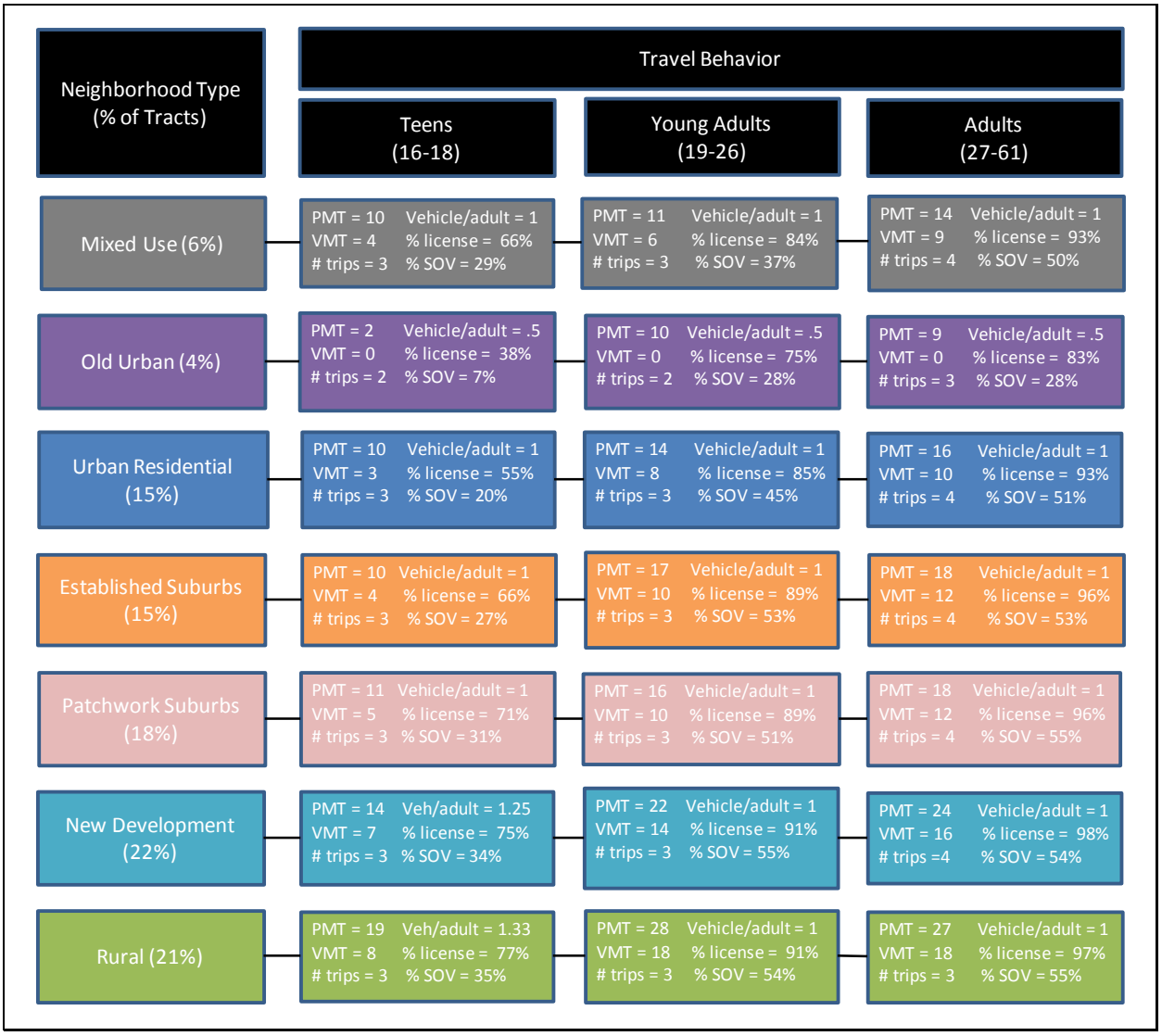


Figure 5. Chart. Travel behavior by age group and neighborhood type.

Note: PMT = Personal Miles Traveled; VMT = Vehicle Miles Traveled
Median number of PMT, VMT, and trips

Implications for Policy

The findings of this detailed, and in many ways unique, analysis reveal the folly of excessive aggregation in seeking to either explain travel behavior or make transportation policy. Are young people more likely than older adults to live in central cities? Yes. But the number of young adults living in new suburbs has grown far faster since 2000 than the number in older urban areas. Are teens and young adults today driving less and traveling more by alternative modes than either older adults or youth of earlier generations? Yes. But the vast majority of young travelers travel almost exclusively by automobile and there are 3.5 Car-less youth who barely travel at all for each Multimodal young person who enjoys high levels of accessibility. Are there urban neighborhoods where travel by foot and public transit is greater than travel by car? Yes, but these account for just four percent of all U.S. neighborhoods and 9 out of 10 of them are in the six largest U.S. metropolitan areas, more than 7 out of 10 are in the two largest metropolitan areas (Los Angeles and New York), and fully half are in the Big Apple alone; in all other neighborhood types, private vehicle travel dominates.

Such geographically and demographically varied patterns in residential location and travel behavior call into question one-geography-fits-all transportation policies premised on homogeneous characterizations of travelers. Public transit use is concentrated among the lowest income households and in the densest, most urban neighborhoods, yet public policies favor widening the geographic scope of public investments in transit into neighborhoods where cars are king and transit use is sparse (Taylor & Morris, 2015). Cities around the U.S. enforce largely undifferentiated minimum parking requirements in even the densest, least car-oriented neighborhoods, driving up development costs and subsidizing car travel in the process (Shoup, 2005). Finally, broad proclamations about the era of driving and roadbuilding fading into the sunset (Davis & Baxandall, 2013; Baxandall, 2013; Dutzik & Baxandall, 2013) may well be apt for certain types of travelers and certain types of neighborhoods, but our analysis shows that for the vast majority of both U.S. neighborhoods and young travelers, a eulogy for cars and suburbs is likely premature.

I. INTRODUCTION—YOUTH, RESIDENTIAL LOCATION AND TRAVEL BEHAVIOR

Millennials and Travel Behavior—Are the times they are a changin'?

Millennials are the talk of the town these days. They have replaced GenXers as the generational darlings of the media—from their collective obsession with mobile communications devices and social media, to their perceived tendencies toward both tolerance and entitlement, to their generally blasé attitudes towards politics, to their enduring infatuation with tattoos—and are seen as distinct in many ways from the generations before them (see for example the Council of Economic Advisers (2014), Pew Social & Demographic Trends Project (2014), and Pew Research Center (2015). These studies find Millennials to be more culturally and ethnically diverse, urban, educated, and liberal than older generations. They are also more likely to embrace multiple modes of self-expression and, having entered the work force during the Great Recession, are more likely to have experienced unemployment and its long-term consequences (Pew Social & Demographic Trends Project,2010).

Among the most important and commented on characteristics of Millennials is in their travel behavior. The data show, for example, that youth have experienced a sharp decline in licensing rates (Davis, Dutzik, & Baxandall, 2012; McDonald, 2015; Shults & Williams, 2013; Sivak & Schoettle, 2011, 2012; Tefft, Williams, & Grabowski, 2013). In 1983 over 87 percent of 19-year-olds had a driver's license, compared to less than 70 percent in 2010 (Sivak & Schoettle, 2012). They have also reduced their vehicle miles travelled (Davis et al., 2012; McDonald, 2015; Shults & Williams, 2013) and increased their reliance on modes other than the automobile (Delbosc & Currie, 2014; Dutzik, Inglis, & Baxandall, 2014; Kuhnimhof et al., 2012; Kuhnimhof, Zumkeller, & Chlond, 2013; Polzin, Chu, & Godfrey, 2014).

Recent data showing a decline in teen licensing and driving have garnered considerable attention from the media. The major news outlets have published articles announcing that "Millennials Reject Car Culture," "Young Americans Lead Trend to Less Driving," "Millennials Changing U.S. Driving Habits" (Becker & Gerstenzang, 2013; Rouan, 2013; Schwartz, 2013). These headlines often imply a fundamental change in the travel behavior of youth, one that many pundits argue portends a long-term decline in driving as youth age into middle age.

Despite widespread agreement about the existence of generational differences in travel, the reasons behind them have been subject to considerable speculation and debate. Among the theories proffered include: the lingering effects of the Great Recession, the ubiquity of information and communications technology use among young people, the barriers to driving presented by increasingly stringent, graduated driver's licensing regulations, and the growing disdain among Millennials for suburban, auto-oriented lifestyles in favor of greener urban living. Studies that extend beyond simple descriptive statistics suggest that changes in travel behavior can be explained by life cycle and income, changing attitudes and reliance on virtual mobility, and the general decline in travel among all age groups (Blumenberg et al., 2012; McDonald, 2015; Tefft et al., 2013).

Millennials, Residential Location, and Travel Behavior

Among studies of youth travel, however, geography in general, and the role of urban form in particular, have received relatively little attention. This paucity of research persists despite recent debate regarding the residential location of youth. Some researchers have argued that young adults are increasingly likely to move to dense central-city neighborhoods where origins and destinations are more proximate and travel by alternative modes (i.e. transit, bike, and walk) more common (Cortright, 2015). Others contend that while Millennials are moving to the suburbs at a lower rate than youth of previous generations, but that they are still attracted to them (Casselman, 2015).

Data from the Current Population Survey on geographic mobility show some merit to both of these arguments. In general, young adults are almost three times as likely to move as older adults. In 2013-14, 22 percent of young adults (ages 20 to 34) moved compared to only 8 percent of adults ages 35 to 64. Almost two-thirds of all moves among young and older adults occur within metropolitan areas. Most movers stay in the same neighborhood type. In other words, if they live in the central city, they are likely to move to another home in a central city. Among those individuals who change neighborhood type, however, a majority move to neighborhoods in the suburbs. Yet the data in Figure 6 show that over time youth are slightly more likely to move to central-city neighborhoods than older adults. Consequently, as Figure 7 shows, young adults are the most likely age group to live in the central city. Forty percent of youth between the ages of 25 and 34 live in central city compared to 31 percent of adults ages 35 to 64.

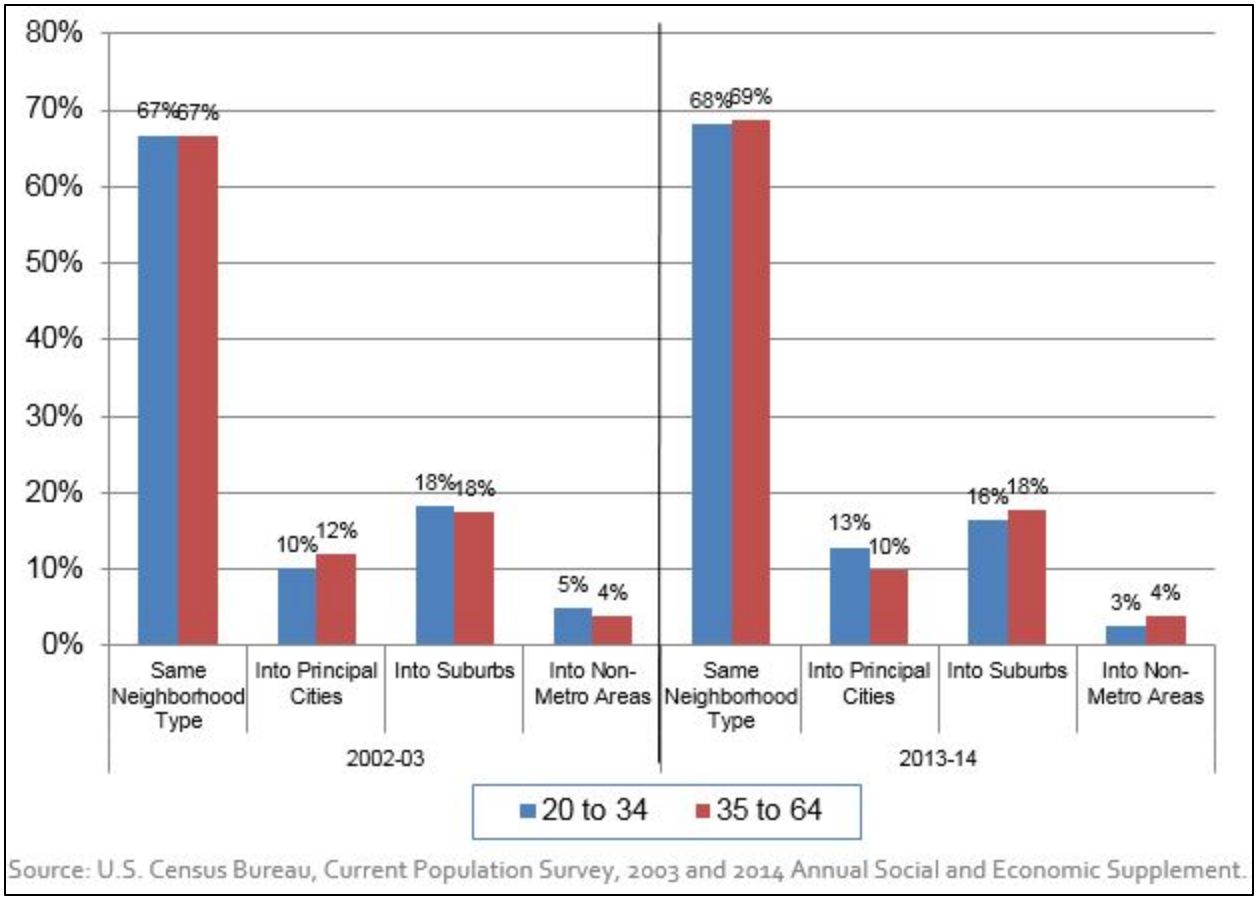


Figure 6. Chart. Changes in metropolitan mobility, 2002-3 and 2013-14.

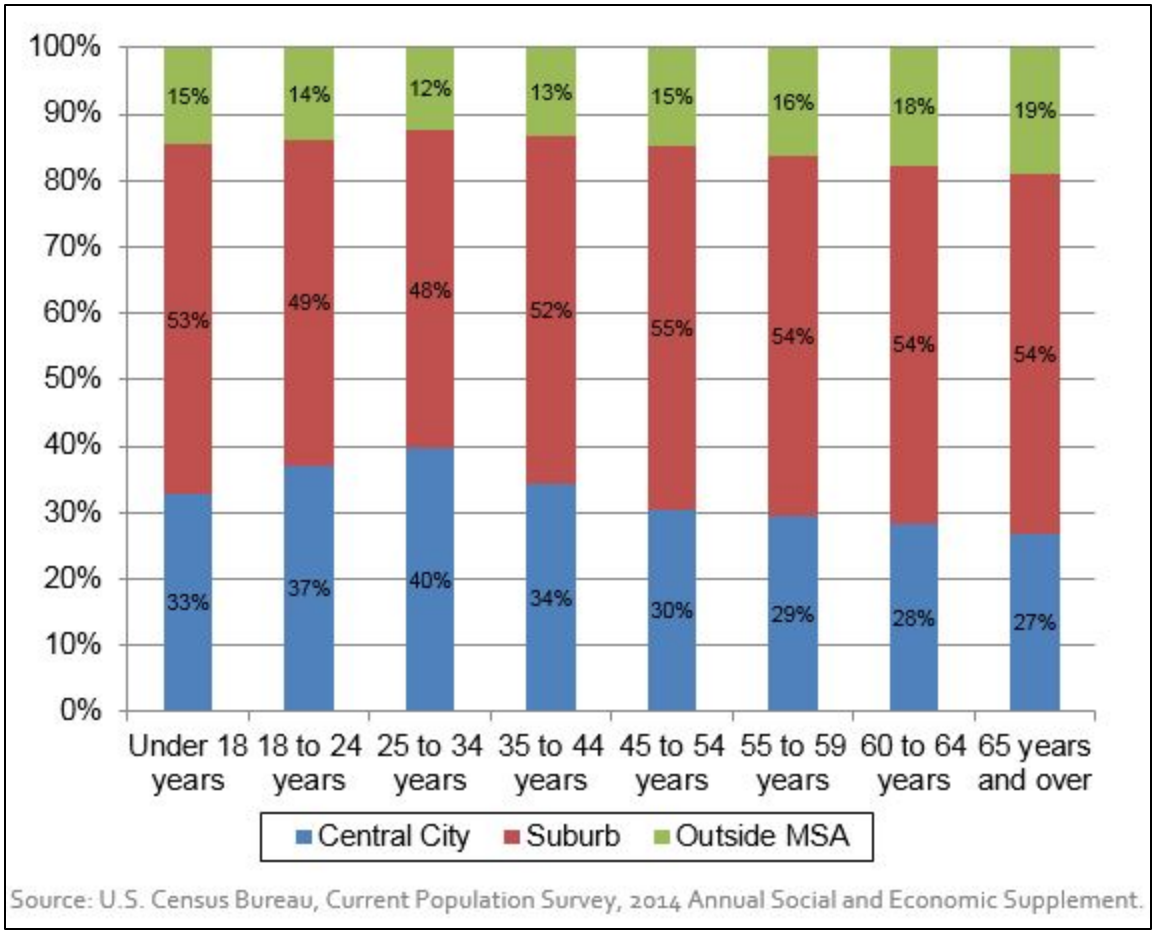


Figure 7. Chart. Residential location by age.

Residential Location and Youth Travel Behavior

These changes in geographic location likely have meaningful effects on the travel behavior of youth. A large number of studies have found that land use and urban form characteristics influence travel behavior (see the literature reviews by the Committee for the Study on the Relationships Among Development Patterns, Vehicle Miles Traveled, and Energy Consumption, 2009; Ewing & Cervero, 2010), though often to a relatively modest degree. It does so in at least three ways: (1) higher development density and more heterogeneous mix of land uses increases proximity to activity sites and promotes travel to them, (2) the relative utility of private vehicle use declines where frequent congestion and high parking costs increase auto access costs, and (3) dense environments increase the relative utility of walking and transit use (Chatman, 2008). For example, living in dense urban areas where origins and destinations are proximate and public transit service is ample pushes origins and destinations closer together, slows auto speeds and increases parking costs, and provides more opportunities to reduce vehicle miles of travel through increased walking and transit use.

Thus far, studies of youth have largely centered on the relationship between residential density and travel. For example, Heck & Nathaniel (2011) find that high school seniors in California who live in urban areas are less likely to have drivers' licenses and spend less time driving compared to youth in suburban and rural areas. Similarly, Trowbridge & McDonald (2008) show that teens in sprawling counties are more than twice as likely to travel more than 20 miles a day compared to teens in more compact counties. Finally, Blumenberg et al. (2012) found that density is negatively related to personal miles travelled for all population groups, including young adults.

This study aims to close this gap in the travel behavior literature by using individual data from the 2001 and 2009 National Household Travel Surveys and associated neighborhood-level data from the Environmental Protection Agency (EPA) Smart Location Database[1] and the Decennial U.S. Census to examine geographic variation in the travel behavior of youth relative to other age groups. In conducting this analysis we employ a variety of methods (summarized in Chapter II) to examine the following:

- The composition, character, and distribution of neighborhood types across the entire U.S.;
- Changes in the location of young adults across these neighborhood types over time and relative to other age groups;
- The composition, character, and distribution of types of youth travelers in the U.S., as well as the relationships between neighborhood types and youth traveler types;
- The relationship between neighborhood type and travel behavior (measured by person miles of travel, vehicle miles of travel, trips, access to automobiles, and travel mode) by age group; and
- The relationship between living in a particular neighborhood type and the likelihood of being a certain type of youth traveler.

Through our analysis we define and analyze seven distinct neighborhood types and four distinct young traveler types in the U.S.:

Neighborhoods

1. **Mixed use (urban)**: downtowns and outlying commercial & industrial districts
2. **Old urban**: very high-density, very transit-rich neighborhoods
3. **Urban residential**: residential neighborhoods in mostly central city areas
4. **Established suburbs**: older, mostly residential suburban neighborhoods
5. **Patchwork (suburban)**: mix of residential and commercial land uses in suburban settings
6. **New development**: mostly new, low-density suburban development often near the fringes of metropolitan areas
7. **Rural**: most types of non-urban and non-suburban development

Young Travelers

1. **Drivers**: Good accessibility (measured in terms of trips per day), most trips by car, rarely use transit

[1] See http://www2.epa.gov/smart-growth/smart-location-mapping for a description of these data.

2. **Long-Distance Trekkers**: Good accessibility, drive very long distances, rarely use transit
3. **Multimodals**: Excellent accessibility, travel by a variety of modes, including cars
4. **Car-less**: Poor accessibility, travel mostly by foot (primarily) and public transit (secondarily)

We then analyze the incidence and distribution of each of the neighborhood and traveler types, and the degree to which two interact to better understand how the characteristics of places and people combine to influence the travel choices of behaviors of teens and young adults in the chapters that follow:

- **Chapter II** outlines our specific research questions, reviews some of the previous research that informed our analysis, outlines our research approach, and describes our data analyzed. However, the very broad scope of the analyses in this report required numerous and diverse methodological approaches; thus we save the detailed discussion of our methodologies for each of the principal analytical chapters.
- **Chapter III** includes the factor and cluster analyses used to develop the seven neighborhood types and analysis of the characteristics of and differences among the various neighborhoods, as well as their incidence. Chapters IV, V, and VI build on this neighborhood analysis to conduct separate travel behavior analyses.
- **Chapter IV** describes and analyzes the residential location patterns of youth and older adults across the seven neighborhood types.
- **Chapter V** presents the latent class analysis used to develop the four youth traveler types and then compares and contrasts the characteristics and incidence of these four types of travelers, as well as the incidence of each of the traveler types across the neighborhoods types developed in Chapter III.
- **Chapter VI** analyzes the influence of neighborhood types on the travel behavior of teens and young adults.
- **Chapter VII** summarizes the findings of the four analytical chapters (III through VI).
- Finally, a series of **appendices** are included to provide detailed supporting data and analysis on the work conducted for each of the four analytical chapters.

Sources

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II. RESEARCH DESIGN

Introduction

As we discuss in the introduction, our analysis of travel behavior and geographic location includes four different empirical components in which we apply a diverse set of methodological approaches. Much of the detailed description of our analysis resides in each of the individual chapters. However, in this chapter we review all of the data sources used in our subsequent analyses. We then discuss our approach to identifying young adults or Millennials. Finally, we conclude this chapter by summarizing the various methodological approaches used in each analysis, which we then describe in greater detail in the four subsequent empirical chapters.

Data

Table 2 summarizes the data used for this project. The analysis of travelers, changes in residential location by age, and travel behavior draw from the two most recent versions of the National Household Travel Survey (NHTS). The surveys are commissioned periodically by the Federal Highway Administration and include a detailed travel diary over a 24-hour period (Federal Highway Administration, 2009). Respondents record information about automobiles in the household as well as driver's licensing.[2] They also record each trip they make, including the purpose of the trip as well as travel mode, duration, and distance. In addition to travel from a single day, the NHTS also includes questions about a limited number of longer-term travel behaviors, such as frequency of public transit use and annual miles driven.

The NHTS sample includes respondents from all fifty States and the confidential data link individual respondents to the census tract in which they live. These data, therefore, enable analysis of travel patterns in various geographic settings and the broad sampling ensures that the findings are more generalizable than similar studies conducted in a single metropolitan region or State. In addition, the NHTS provides sample weights to match the characteristics of the U.S. population in each survey year (Federal Highway Administration, 2011). Respondents provided detailed personal information on household income, race, life-cycle characteristics, and other characteristics. Finally, the survey was conducted in a broadly consistent manner in 2001 and 2009, which facilitates analysis of change over time. For more information about the national travel surveys, see Appendix IIa.

2 Technically the NHTS does not collect data on licensing. Instead, the head of each household identifies whether or not each member is a "driver". To avoid confusion with the "Driver" traveler type identified in the Traveler Type analysis, we refer to the NHTS driver status as drivers licensing.

Table 2. Data sources and age groups.

Analysis Type	Data Sources	Age Group
Neighborhood Typology		
	Smart Location Database	Not applicable
	2010 Decennial U.S. Census	Not applicable
Traveler Types		
	2009 National Household Travel Survey	Young people: 16-36 year olds
Residential Location		
	2001 National Household Travel Survey	Younger adults (20-34), Older adults (35 to 64)
	2009 National Household Travel Survey	
	1990, 2000, and 2010 U.S. Census	
Travel Behavior Analysis		
	2009 National Household Travel Survey	• Teens (16-18), Young Adults (19-26), Adults (27-61) • Traveler types: Young People (16-36)

To develop a typology of U.S. neighborhoods, we drew on data from the Smart Location Database (SLD) and the 2010 Decennial U.S. Census. The SLD was created by staff of the U.S. Environmental Protection Agency in response to a meta-analysis published in the *Journal of the American Planning Association* showing the effects of particular built environment characteristics on travel behavior (Ewing & Cervero, 2010).[3] The database includes "more than 90 attributes summarizing characteristics such as housing density, diversity of land use, neighborhood design, destination accessibility, transit service, employment, and demographics." The SLD data are summarized at the census block group level and include data from the following sources: 2010 U.S. Census, American Community Survey, Longitudinal Employer-Household Dynamics, NAVTEQ highway/streets data, protected areas database, and local transit service data shared as part of the General Transit Feed Specification (GTFS). As we explain in Chapter IV, we transformed many of these variables for use in our analysis. Additionally, we aggregated the data from the block group to the census tract. Finally, we supplemented these data with additional data from the 2010 Decennial Census on housing tenure, age of the housing stock, and resident longevity.

Age

The term "Millennial" to refer to the current generation of young adults was initially coined by Howe & Strauss (2000), and quickly supplanted the term "Generation Y" in popular culture. Howe & Strauss

[3] See the following website for a description of and access to the SLD: http://www2.epa.gov/smart-growth/smart-location-mapping#_edn2.

(2000) classify Millennials as those individuals born after 1982. However, there is no shared definition of a "Millennial" or "young adult" and, therefore, many authors utilize slightly different age groups depending on data availability and the specific research questions that they address.[4] For similar reasons there is variation in the age groups used in this study (see Table 2 for a summary of age groups by analysis type).

For our study of traveler types we focus on young people ages 16 to 36, a group born between 1973 and 1993. Some researchers date the start of the millennial generation to those individuals born after 1980 (see for example Pew Social & Demographic Trends Project, 2014). While the 16 to 36 age grouping includes some individuals who might be part of an earlier generation, it encompasses a group of young adults who are making major life transitions from adolescence to emerging adulthood to adulthood. The rationale is that the gradual assumption of adult roles will influence both residential location decisions as well as travel behavior.

We use the 1990, 2000, and 2010 Census data to examine the residential location of younger adults (20 to 34) relative to older adults (35 to 64) over time. This age grouping corresponds to the age categories available in the Decennial Census, the most reliable source of census tract level population data. We then use these same age categories to compare findings between data from the Decennial Census and the NHTS and to examine the residential location of youth controlling for other characteristics that determine residential location.

Finally, the analysis of travel behavior outcomes focuses on characterizing differences in travel by age. Therefore, in this part of our analysis we include models for teens (ages 16 to 18), young adults (ages 19 to 26) and older adults (ages 27 to 61). These age categories were developed as part of the principal investigators' previous study of Millennials and travel (Blumenberg et al., 2012). Using average daily personal miles traveled (PMT) from the 2001 and 2009 NHTS, the researchers employed an iterative cutoff-search to minimize the root mean square error (RMSE) of regression line-fits for a number of age-based subsamples. Despite changes in absolute PMT between the two NHTS years, the cut points between youth and adults remained relatively stable over time. In this current study, we use the same cut point between youth and older adults; however, we separate young adults into two categories to capture young teens (16 to 18) who might be more likely to live with their parents from older teens and young adults who are beginning to assume adult roles and make independent residential location decisions.

[4] See Bump (2014) for a discussion of this issue in *The Atlantic*.

Summary of Analytical Approaches

As shows, we apply a diverse set of approaches depending on the analysis. We begin our study by using factor and cluster analysis to develop a set of distinct neighborhood types—mixed use, old urban, residential urban, established suburbs, patchwork, new development, and rural. In Chapter IV we describe these neighborhoods and their prevalence.[5] Based on the neighborhood typology, in Chapter V we examine the residential location of youth. We first use descriptive statistics to assess whether youth are more or less likely to live in particular types of neighborhoods. We then use multinomial logistic regression to examine whether young adults live in different neighborhood than older adults and the determinants of residential location among youth.

No single measure (e.g. personal miles traveled, commute mode) can capture individual's diverse travel patterns. To address this issue, in Chapter VI we use latent class analysis to identify traveler types based on a broad cross-section of travel variables including number of trips, miles of travel, share of personal miles by non-automobile modes, annual miles driven, use of transit in the past month, licensed driver, and automobiles per adults in the household. This analysis resulted in four different youth traveler types—Drivers, Long-Distance Trekkers, Multimodals, and Car-less. We then use descriptive statistics to describe the travel behavior of each traveler type, compare travel behavior across traveler types, identify the prevalence of each traveler type, and analyze variation in traveler type by age.

In the concluding empirical section of the report, we use regression analysis to predict 10 different travel- or transportation-related outcome measures. These can be loosely grouped into three categories (a) individual travel/transportation characteristics (personal miles traveled, vehicle miles traveled, number of trips, travel mode, presence of a driver's license), (b) household characteristics (vehicles per household) and (c) composite travel behavior (traveler type). The model form and the associated independent variables vary by the outcome measure.

[5] See Appendix A for a table of neighborhood types by Metropolitan Area.

Table 3. Research approach by analysis type.

Analysis Type	Methodological Approach	Outcomes/Dependent Variables
a. Methods Used to Group Data		
Neighborhood Type		
	Factor Analysis Cluster Analysis	7 Neighborhood Types: Mixed Use, Old Urban, Residential Urban, Established Suburbs, Patchwork, New Development, Rural
Traveler Type		
	Latent Class Model	4 Traveler Types: Driver, Long-Distance Trekker, Multimodal, Car-less
b. Methods Used to Predict Outcomes		
Residential Location		
	Multinomial Logistic Regression	Neighborhood Type
Travel Behavior		
	Log-linear	Person Miles Traveled (PMT) and Vehicle Miles Traveled (VMT)
	Tobit Regression	Vehicles per household adult
	Poisson	Trips on survey day
	Logistic Regression	Driver's license, single occupancy vehicle (SOV), carpool, transit, walk
	Multinomial Logistic Regression	Traveler Type

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III. NEIGHBORHOOD TYPES

Introduction

Where people live, work, and recreate, and how they travel, are intimately related to the built environment. While these relationships are complex and nuanced, they are important to people deciding where to live, work, and shop, and to business owners deciding where to locate. They are also important to public policymakers who plan and control land uses and build and operate transportation systems.

The characteristics of the built environment can be described in terms of measures such as population or employment density; the form and scale of built environment; the prevalence of specific facilities, amenities, or businesses; or the diversity of such facilities, amenities, and businesses. But rather than considering each of these characteristics separately, household decision-makers are likely influenced by how the confluence of these characteristics combines to create to an overall sense of place. A neighborhood's overall character, or type, and even its boundaries are not a completely objective determination. Nevertheless, one can describe many salient neighborhood characteristics systematically and empirically. This chapter does just that; it describes our use of quantitative methods to develop a typology of neighborhoods. In subsequent chapters, these neighborhood types provide a framework for thinking about household and individual decisions regarding residential location choice and travel behavior.

Background

A number of previous studies have attempted to quantify characteristics of the built environment, and other studies have extended such efforts to classify neighborhoods into distinct types.

Describing the Built Environment

Owing perhaps to a collective fondness for alliteration, many planners use words beginning with D to refer to characteristics of the built-environment. This convention began with Cervero and Kockleman (1997), who identified 3 Ds: density, diversity, and design. Ewing & Cervero (2010) added two more: destination accessibility and distance to transit. These D variables are broadly defined and have been measured in different ways.

Of the five D variables, density is the most straightforward to measure. Cervero and Kockleman (1997) describe density in terms of:

- Residents per developed acre
- Employees per developed acre
- Accessibility measured using the gravity model (this was given its own D in Ewing & Cervero (2010))

Bhat & Gossen (2004) also propose other, less direct measures of density including fractions of detached and non-detached dwelling units, and neighborhood classifications such as central business district, urban, suburban, and rural.

The second D, diversity, describes the degree of mixing of various land uses within a zone. Cervero and Kockleman (1997) quantify diversity by a value they call land-use entropy:

$$\frac{\sum_j p_j \ln(p_j)}{\ln(J)}$$

where p_j = proportion of land-use category j
J = number of land-use categories

Figure 8. Equation. Cervero and Kocklement land-use entropy.

Bhat and Gossen (2004) propose a different measure for land-use mix diversity:

$$1 - \left\{ \frac{\sum_j \left| p_j - \frac{1}{J} \right|}{1 - (1/J)} \right\}$$

Figure 9. Equation. Bhat and Gossen land-use mix diversity.

For either measure, a value of zero indicates that there is only one land use type; a value of one means there is an equal distribution of all land use types. Note that the entropy value is contingent on how analysts define land use types. Areas with an entropy score of one—an even distribution of land uses—often oversupplies land uses that serve residents (e.g., a self-contained neighborhood does not need as much space devoted to retail as it does space devoted to residential).

Cervero and Kockleman (1997) include intersection density, the proportion of 4-way intersections, speed limits, street widths, and presence of sidewalks among the variables that describe the relationship between design elements of a neighborhood and travel behavior.

Handy & Niemeier (1997) identify three types of accessibility measures: cumulative opportunity measures, gravity-based measures, and utility-based measures. El-Geneidy and Levinson (2006) propose a fourth type of accessibility measure based on observed travel flows between origins and destinations. Of these measures, cumulative opportunity measures are the simplest to compute. Cervero and Kockleman (1997) use a gravity-based measure of job accessibility, which are most commonly used in travel demand forecasting.

Neighborhood Classification

A number of previous studies employ quantitative analytical methods to describe and classify neighborhood types, and several methodological issues associated with classifying neighborhoods have been addressed in previous studies. Among these is the definition of a neighborhood. Recognizing that neighborhood boundaries may be somewhat subjective, a number of researchers have established a standard of using of census tracts as proxies for neighborhoods, both because the general scale of tracts and neighborhoods are thought to coincide and out of analytical convenience (Mikelbank 2011; Chow 1998; Lin and Long 2008; Vicino 2008; Leigh and Lee 2005).

There exists an array of statistical techniques for systematically grouping things into categories using multiple factors. Among these, cluster analysis is a useful classification tool that uses multidimensional data. With respect to classifying neighborhoods, Lin and Long (2008) perform a cluster analysis directly on a set of 64 variables, including variables describing both the built environment and demographic characteristics of neighborhood residents, such as race and income. They apply their analysis to the entire United States and identify ten distinct neighborhood types: Urban non-Hispanic Black dominant, Rural, Non-Black Hispanic dominant, natural scenic, Suburban young, Suburban retired, Suburban mid-income working class, Urban elite, Low income minority, and Suburban mid-age wealthy.

Classifying neighborhoods in terms of both their physical characteristics and the socio-economics of the people who live in them is useful for descriptive purposes, as Lin and Long (2008) did, but doing so greatly complicates understanding of cause and effect. Further, given the very large number of variables that can be used to describe neighborhoods, their inter-relationships with one another, and the requirement that all variables in a cluster analysis be normalized to a similar scale, many neighborhood classification studies use another statistical technique called factor analysis as a first stage to reduce a large number of descriptive variables to a smaller number of factors, and then use the resulting factors as inputs to a cluster analysis (Chow 1998; Vicino 2008; Li and Chuang 2009; Song and Knaap 2007; Song and Quercia 2008; Shay and Khattak 2007).

Song and Knaap (2007) employ factor analysis followed by cluster analysis to classify neighborhoods in the Portland, Oregon metropolitan area. They use factor analysis to reduce a set of 21 variables, including characteristics of the street network, plot density, and land use diversity, to a set of eight factors: street design, density, commercial use, transit, housing size, mixed land use, natural environment, and multi-family use. From these factors, they use cluster analysis to identify six neighborhood types: Sporadic rural development; bundled rural development; outer ring suburbs; downtown, inner and middle ring suburban redevelopments/infill; Composite greenfields; and partially clustered greenfields.

Shay and Khattak (2007) use factor analysis and then cluster analysis to classify neighborhoods in Charlotte, North Carolina metropolitan region. They create a set of five factors (Walkability, Accessibility, Agglomeration, Industry, and Property Value) from a set of twenty-five variables including typical measures of built environment characteristics such as density and diversity as well as less

common variables such as acres of tree canopy, median distance to a supermarket, and median age of single-family residential homes. From these five factors, they identify seven clusters, which happen to arrange themselves spatially into a pattern that suggests concentric zones, as suggested by classical urban geography theories (Hoyt 1939; Burgess 1925): Central City, Urban, Inner Suburbs, Middle Suburbs, Outer Suburbs, Mixed Rural, and Rural.

We describe below our effort to combine the nationwide geographic analysis employed by Lin and Long (2008) with a focus on the physical characteristics of neighborhoods only. We use factor analysis and cluster analysis in concert like Song & Knapp (2007) and Shay & Khattak (2007) to characterize physical and transportation system characteristics of nearly ever census tract in the U.S. into a set of similar neighborhood/district types. Our goal with this exercise is to be able to separate land use/urban form and socio-economic factors in describing and understanding travel behavior.

Data and Methodology

We combine in our analysis data from three sources, which apply to census tracts across the U.S.: (1) data taken directly from the Environmental Protection Agency (EPA) Smart Location Database, (2) data derived from the EPA Smart Location Database, and (3) 2010 Decennial United States Census data. The variables used in our factor analysis and their sources are summarized in Table 4. Many of the variables we selected were derived from the EPA's Smart Location Database (Ramsey and Bell 2014), which compiles data at the census block group level from a variety of sources, with a strong emphasis on variables related to Ewing and Cervero's (2010) 5 D variables. We supplemented variables from the Smart Location Database with data from the 2010 United States Census. These variables are described in greater detail in Appendix IIIa.

We reduced the initial set of 20 variables listed in Table 4 to a set of five factors using the "psych package" for the statistical analysis software R (Revelle 2014). Factor analysis requires an *a priori* specification of the desired number of factors. We tested solutions with five to eight factors and selected the number of factors within this range with the clearest interpretability. Following the factor analysis, we conducted a cluster analysis using the "fastcluster package" in R (Müllner 2013), including each of the five factor scores for most census tracts in the United States (some tracts were omitted due to missing data).

Table 4. Variables included in neighborhood classification analysis.

Variable description	Variable name	Source
Number of jobs within a 45-minute drive	Job access	(1)
Share of total CBSA employment	Job share	(2)
Percent of total activity represented by employment	Percent jobs	(2)
Percent of total activity represented by office employment	Percent office	(2)
Percent of total activity represented by retail employment	Percent retail	(2)
Jobs-housing balance*	Job-housing balance	(2)
Housing density (log-transformed)	Housing density	(2)
Employment density (log-transformed)	Job density	(2)
Activity density (homes + jobs per acre) (log-transformed)	Activity density	(2)
Total road network density (log-transformed)	Road density	(2)
Pedestrian-oriented road network density (log transformed)	Pedestrian density	(2)
Car-oriented road network density (log-transformed)	Car network density	(2)
Intersection density (log-transformed)	Intersection density	(2)
Transit service density index (log-transformed)	Transit supply index	(2)
Share of homes that are single-family homes	Percent SFR	(3)
Share of occupied homes that are rentals	Percent rented	(3)
Share of occupied homes currently occupied for < 5 years	Short-term homes	(3)
Share of occupied homes currently occupied for > 20 years	Long-term homes	(3)
Share of homes less than ten years old	New homes	(3)
Share of homes more than forty years old	Old homes	(3)

Sources:
(1) EPA Smart Location Database
(2) Derived from the EPA Smart Location Database
(3) 2010 Decennial United States Census
Notes:
* This value is computed as 1 - 2|(Percent jobs—0.5)|. A jobs-housing balance value of 1 indicates that there are equal numbers of homes and jobs. A value of 0 indicates that there are either no jobs or no homes in the tract.

A number of so-called "stopping rules" are available to determine the appropriate number of clusters for a cluster analysis. We computed statistics for 14 different stopping criteria using the R package "clusterCrit" (Desgraupes 2014) and selected the number of clusters that the greatest number of criteria determined to be optimal.

Based on an initial factor analysis and subsequent cluster analysis, we identified ten census tracts (out of more than 73,000) that had very low populations and factor scores that were clearly outliers. Several included, for example, large areas underwater. Since factor scores are computed to have a mean of zero and a standard deviation of one, these few outliers had a large impact on the factor scores for all observations. Therefore, we removed these ten census tracts from the sample and re-ran the analysis

without them. As noted above, we excluded other census tracks from the analysis due to missing data. Ultimately, our analysis includes a sample of 72,183 census tracts, which represents 99 percent of the 73,057 census tracts in the United States.

Table 5. Standardized factor loadings.

Variable name	Factor 1: Dense	Factor 2: Diverse	Factor 3: Transient	Factor 4: Established	Factor 5: Accessible
Intersection density	0.99				
Pedestrian density	0.99				
Road density	0.99				
Housing density	0.88				0.21
Activity density	0.85				0.24
Job density	0.69	0.38			0.20
Transit supply index	0.52				0.23
Job access	0.30				0.42
Car network density	-0.29	0.21			
Percent jobs		0.98			
Job-housing balance		0.80			
Percent office		0.57			
Percent retail		0.48			
Job share		0.32			
Percent rented			0.97		
Percent SFR			-0.73		
Short-term homes			0.70	-0.40	
Long-term homes			-0.38	0.67	
Old homes			0.20	0.73	
New homes				-0.74	
Note: Loadings with a magnitude of less than 0.20 are not shown.					

Results

The results of the final factor analysis are shown in Table 5. We determined the five-factor solution to be the most interpretable; the five factors generally indicate the degrees to which a neighborhood is dense, diverse, transient, established, and accessible.

The distribution of each factor among the census tracts in our sample is shown in Figure 10. The distribution of the density variables across all census tracts is highly asymmetric, since a small number of tracts are extremely dense, relative to most of the country. Thus, the two factors that are most closely related to the density variables –density and diversity– have distributions with very long tails.

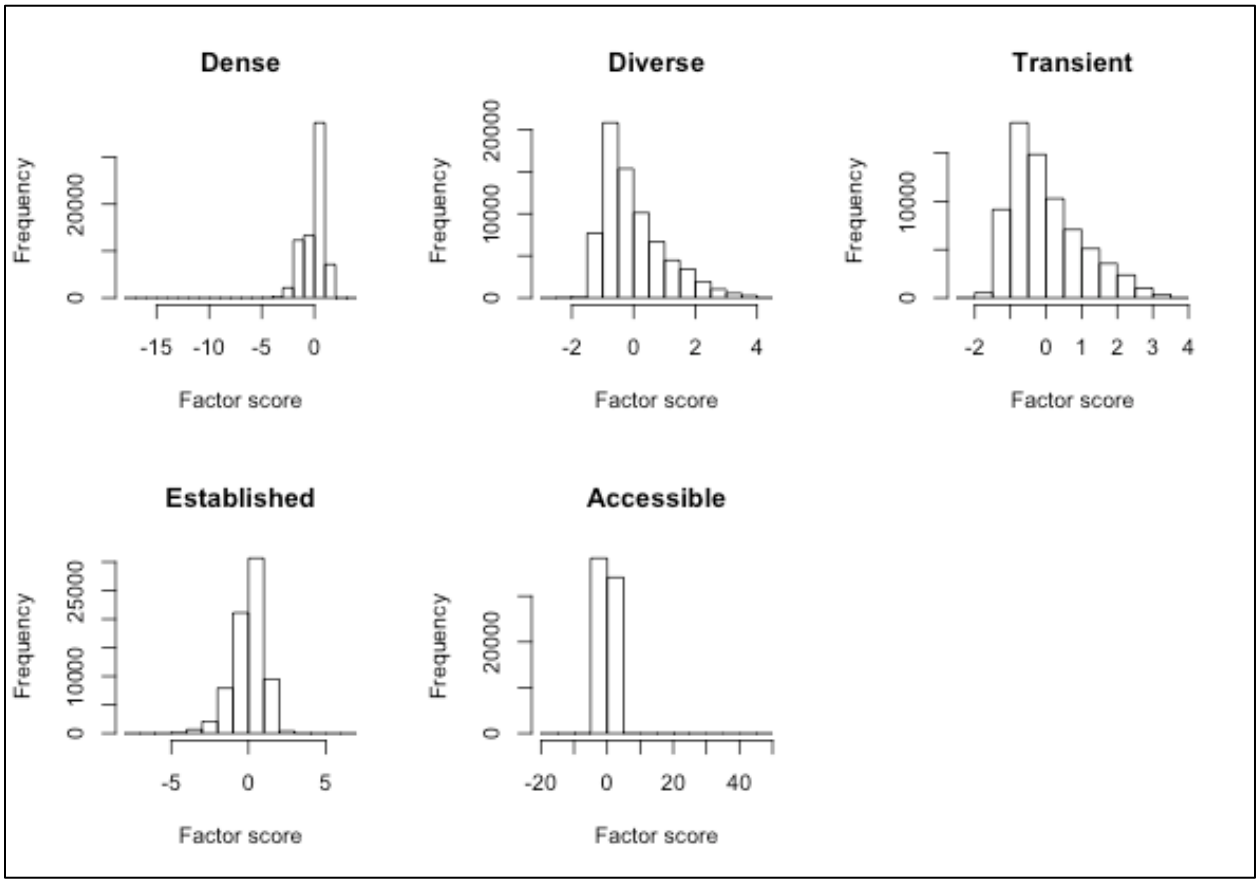


Figure 10. Graph. Distribution of factor scores between census tracts.

We used the standardized factor scores for each census tract to conduct the cluster analysis. Based on multiple stopping criteria (the Ball=Hall index, the Det_Ratio index, and the Ksq_DetW index) (Desgraupes 2014), we determined seven clusters to be optimal. The dendrogram in Figure 11 illustrates how these seven clusters relate to one another. Reading the dendrogram from left (the start of the cluster development process) to right (the conclusion of the process), the later any two clusters branch off from one another, the more similar they are. To test the consistency of the clusters over space and to test whether their salient characteristics were consistent over space, members of the research team independently characterized each of the seven neighborhood types based on the spatial distribution of the clusters within parts of cities with which they were familiar (Anchorage, Honolulu, Long Beach, Los Angeles, New York, Pittsburgh, Provo, Salt Lake City, San Francisco, and Santa Clarita). This exercise suggested consistency in neighborhood types across areas, which allowed us to attach names that broadly (if incompletely) characterize seven neighborhood types: Rural, New development, Patchwork, Established suburbs, Urban residential, Old urban, and Mixed-use.

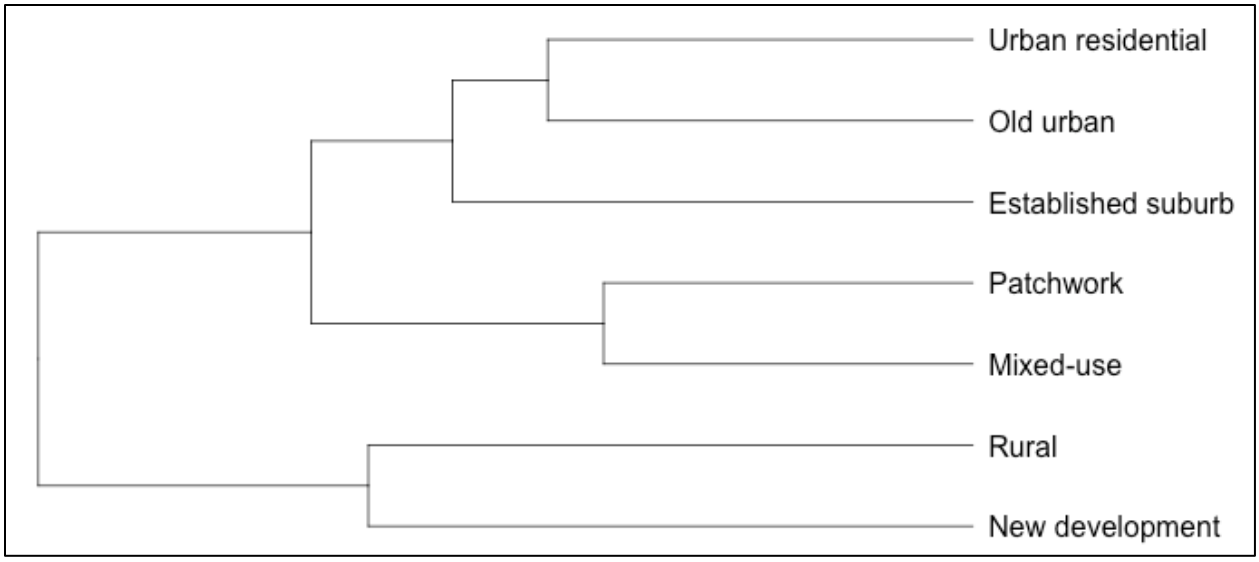


Figure 11. Graph. Dendrogram results of cluster analysis.

Table 6. Average built environment characteristics by neighborhood type.

Type	Homes per acre	Jobs-housing balance	Percent rental homes	Percent of homes > 40 years old	Jobs within a 45-minute drive (in thousands)	Transit supply index
All Neighborhoods	3.5	0.4	34%	46%	118	0.5
Rural	0.1	0.3	19%	42%	14	0.0
New development	1.4	0.2	19%	17%	68	0.0
Patchwork	1.7	0.7	35%	46%	94	0.1
Established suburbs	4.1	0.3	25%	74%	186	0.6
Residential urban	5.9	0.3	58%	56%	147	0.8
Old urban	27.5	0.3	76%	74%	533	4.2
Mixed-use	5.2	0.7	65%	49%	181	1.1

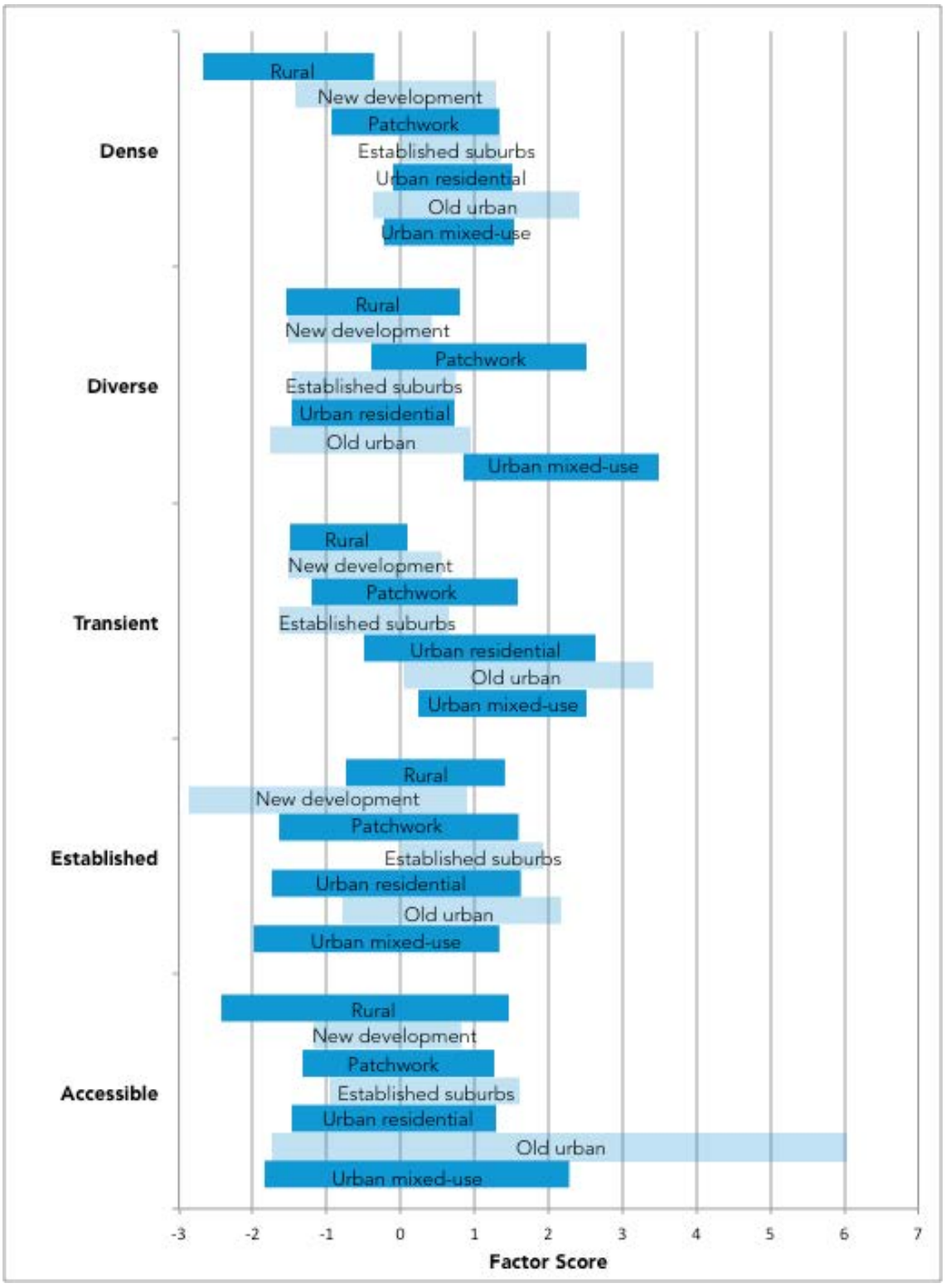


Figure 12. Chart. Variation in factor scores within and among neighborhood types.

Table 6 shows how the seven neighborhood types vary in terms of each of the selected built environment characteristics. Figure 12 shows how the factor scores vary among neighborhood types. The Patchwork and Mixed-use neighborhood types, for example, have similar high scores on the jobs-housing balance index, which is likely why these two types are shown to be similar in the dendrogram in Figure 11; however, the housing density is much higher in Mixed-use neighborhoods than in Patchwork neighborhoods. Likewise, the age of the housing in Old Urban neighborhoods is similar to that in Established Suburbs, but the housing density in Old Urban neighborhoods is nearly seven times that of Established Suburbs.

Source: Google Earth, Google Maps

Figure 13. Photo. Characteristic images of each neighborhood type.

Although neighborhoods are not homogenous even within each type, Figure 13 illustrates each neighborhood type in terms of a characteristic image. These images give an overall sense of the qualitative differences among neighborhoods types.

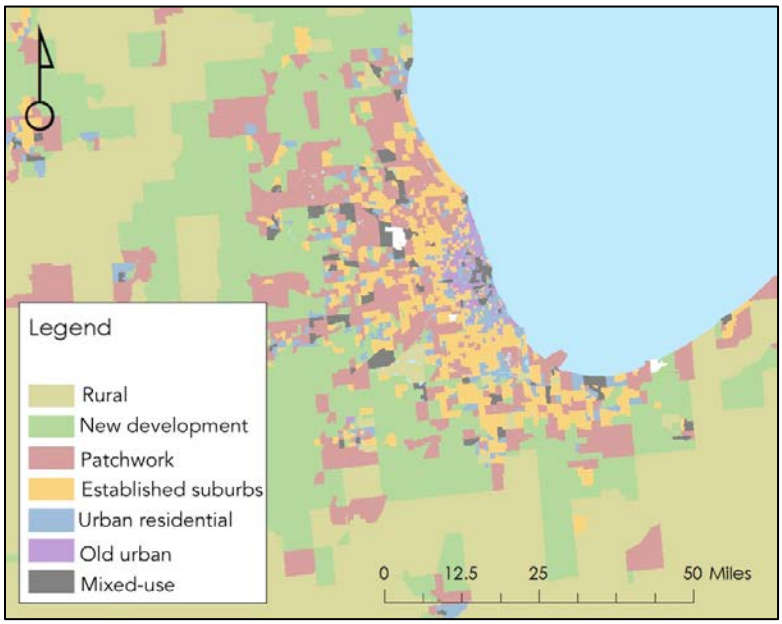


Figure 14. Chart. Spatial arrangement of neighborhood types in Chicago.

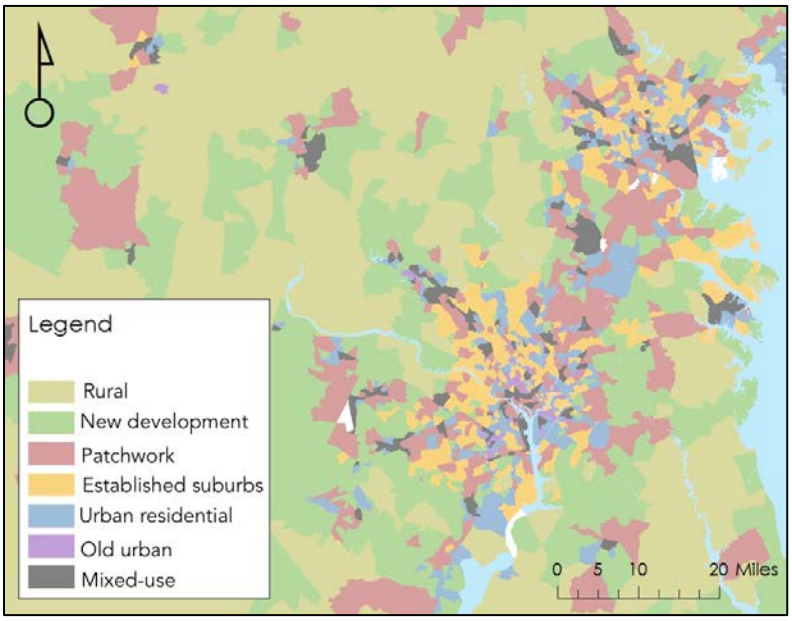


Figure 15. Chart. Spatial arrangement of neighborhood types in Washington DC and Baltimore.

In many cities, the neighborhood types arrange themselves in ways that evoke the familiar concentric ring patterns described by classical urban geography theories by scholars such as Burgess (1925) and Hoyt (1939). Figures 14 through 17 illustrate these patterns in Chicago, Washington DC-Baltimore, Los Angeles, and Philadelphia.

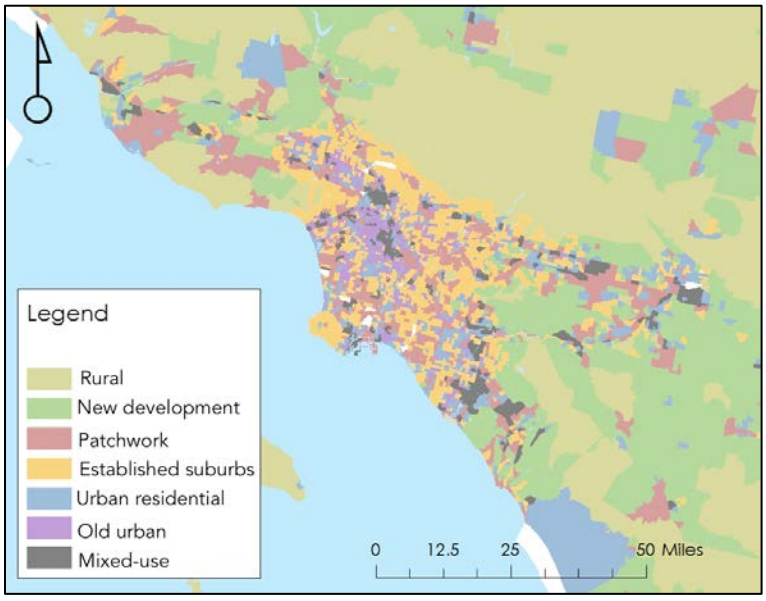


Figure 16. Chart. Spatial arrangement of neighborhood types in Los Angeles.

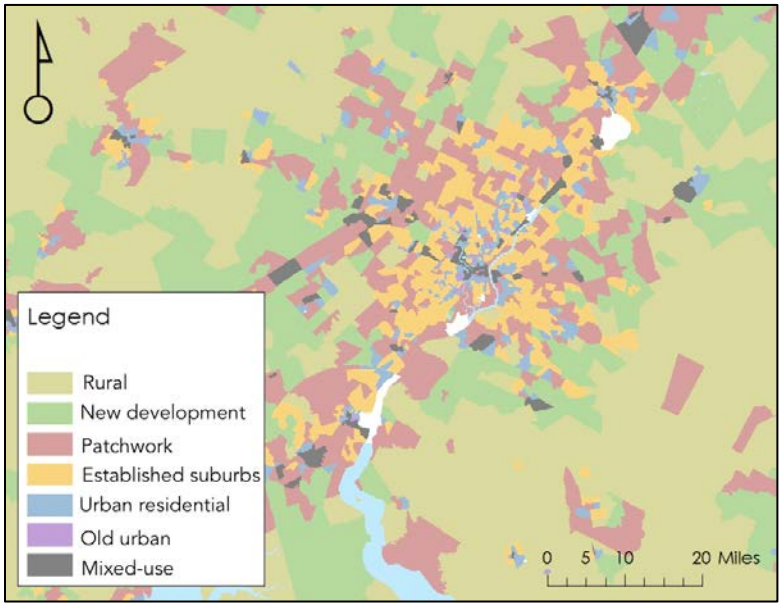


Figure 17. Chart. Spatial arrangement of neighborhood types in Philadelphia.

While all of the cities shown above have a cluster of Mixed-use neighborhoods at the city center, this neighborhood type is not confined to downtowns. There are also mixed-use neighborhoods in commercial centers located closer to the edges of each city. Likewise, there are several Rural

neighborhoods surrounded on all sides by Established Suburban neighborhoods or even adjacent to Urban neighborhoods. Nevertheless, moving from the center of each city to the outskirts, there is a distinct, if varied, progression from Mixed-use to Old Urban to Urban Residential to Established Suburb to Patchwork to New Development to Rural.

Prevalence of Neighborhood Types

Figure 18 shows the percentage of the United States population that lives in each neighborhood type, as well as the percentage of census tracts that is classified in each neighborhood type. New Development neighborhoods are the most prevalent, representing 22 percent of all census tracts and 27 percent of the population.

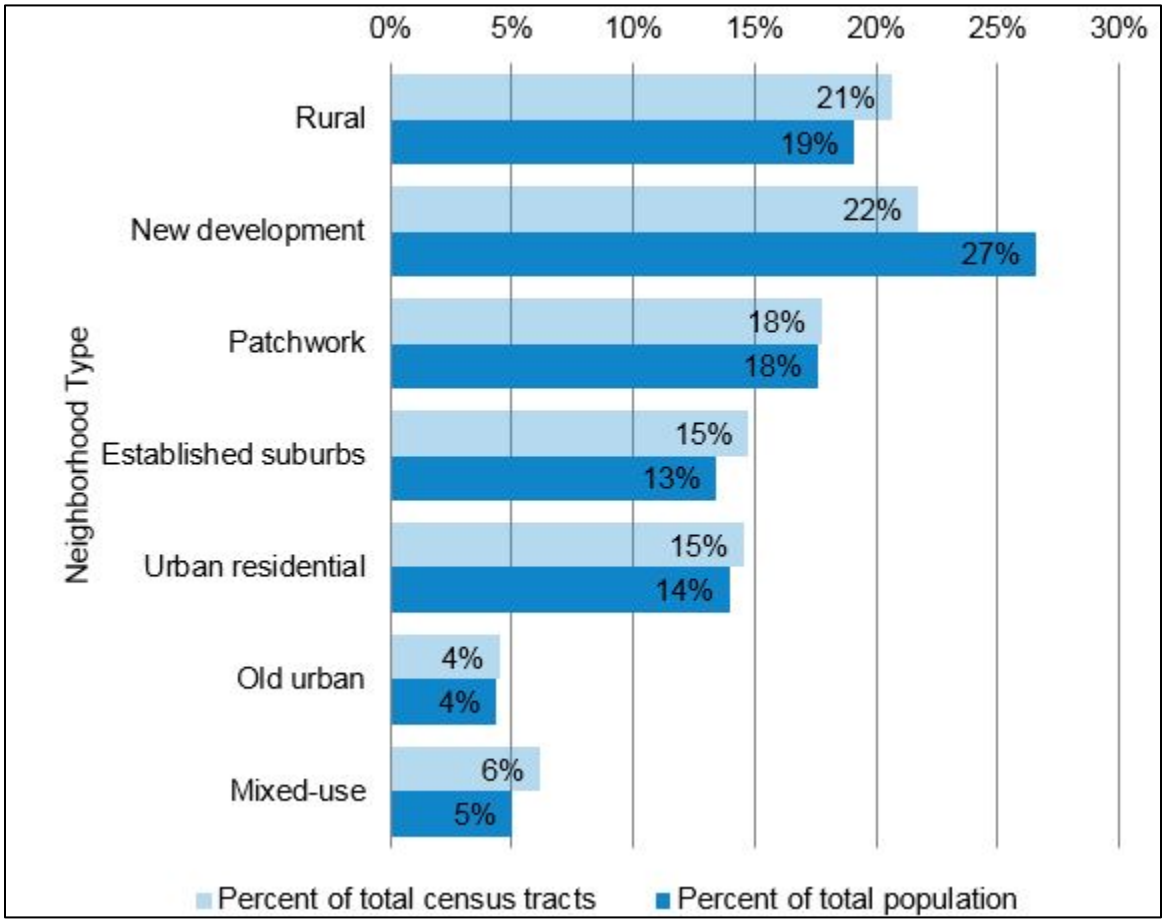


Figure 18. Chart. Share of population and census tracts within each neighborhood type.

Within given areas, the distribution of neighborhood types will certainly vary from the averages shown in Figure 18. Appendix IIIc lists the share of neighborhoods classified in each neighborhood type for each of the 943 core-based statistical areas (CBSAs, a designation that can refer to a metropolitan or micropolitan statistical area).

As shown in Table 7, 80 percent of all neighborhoods classified in the Rural neighborhood type are located outside of any CBSA. In CBSAs with the greatest number of Rural neighborhoods, these neighborhoods represent a relatively small share of the total CBSA neighborhoods. For example, in the New York City MSA, there are 161 Rural neighborhoods, more than in any other CBSA. However, these represent only four percent of the total neighborhoods. No CBSA contains more than one percent of the total Rural neighborhoods in the United States.

Table 7. Top ten CBSAs by number of rural neighborhoods.

CBSA	Percent rural tracts	Number of rural tracts	Share of national rural tracts	Share of national population
Non-CBSA	80%	4,422	30%	6%
New York-Northern New Jersey-Long Island, NY-NJ-PA	4%	161	1%	6%
Pittsburgh, PA	22%	156	1%	1%
Boston-Cambridge-Quincy, MA-NH	13%	126	<1%	1%
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	8%	113	<1%	2%
Washington-Arlington-Alexandria, DC-VA-MD-WV	7%	100	<1%	2%
St. Louis, MO-IL	13%	83	<1%	1%
Detroit-Warren-Livonia, MI	6%	80	<1%	1%
Cincinnati-Middletown, OH-KY-IN	15%	75	<1%	1%
Baltimore-Towson, MD	11%	74	<1%	1%
Total	N/A	5,384	36%	22%

Unlike rural neighborhoods, New Development neighborhoods tend to be heavily concentrated in large, relatively new, and fast growing metropolitan areas, particularly in the Sunbelt. Table 8 shows that over half of all neighborhoods in Phoenix are New Development neighborhoods, and these account for three percent of the total New Development neighborhoods in the United States, the largest contribution of any CBSA in the country.

Table 8. Top ten CBSAs by number of new development neighborhoods.

CBSA	Percent New Development tracts	Number of New Development tracts	Share of national New Development tracts	Share of national population
Phoenix-Mesa-Glendale, AZ	53%	524	3%	1%
Dallas-Fort Worth-Arlington, TX	38%	495	3%	2%
Atlanta-Marietta, GA	45%	428	3%	2%
Miami-Fort Lauderdale, FL	35%	420	3%	2%
Riverside-San Bernardino, CA	48%	391	2%	1%
Washington-Arlington, DC-VA-MD	29%	386	2%	2%
Chicago-Joliet, IL-IN-WI	17%	385	2%	3%
Houston-Sugar Land, TX	35%	377	2%	2%
Tampa-St. Petersburg, FL	46%	337	2%	1%
Seattle-Tacoma-Bellevue, WA	38%	275	2%	1%
Total	N/A	4,018	26%	17%

Table 9. Top ten CBSAs by number of patchwork neighborhoods.

CBSA	Percent Patchwork tracts	Number of Patchwork tracts	Share of national Patchwork tracts	Share of national population
Non-CBSA	13%	746	6%	6%
New York-Northern New Jersey-Long Island, NY-NJ-PA	12%	518	4%	6%
Chicago-Joliet-Naperville, IL-IN-WI	17%	379	3%	3%
Los Angeles-Long Beach-Santa Ana, CA	11%	321	2%	4%
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	20%	290	2%	2%
Detroit-Warren-Livonia, MI	17%	222	2%	1%
Washington-Arlington-Alexandria, DC-VA-MD-WV	16%	211	2%	2%
Dallas-Fort Worth-Arlington, TX	15%	198	2%	2%
Boston-Cambridge-Quincy, MA-NH	19%	192	1%	2%
Houston-Sugar Land-Baytown, TX	17%	185	1%	2%
Total	N/A	3,262	25%	30%

Table 9 shows that 13 percent of all neighborhoods outside of any CBSA are classified as Patchwork. Together, Rural and Patchwork neighborhoods represent 93 percent of all non-CBSA neighborhoods.

Together, areas outside of CBSAs and the nine CBSAs listed in Table 9 contain 25 percent of all Patchwork neighborhoods in the country, with the other 75 percent found in the remaining 934 CBSAs in the United States.

As shown in Table 10, this concentration of particular neighborhood types in certain large metropolitan areas is particularly pronounced for Established Suburban neighborhoods. The ten cities listed in Table 10 host almost half of the total Established Suburban neighborhoods nationally.

Table 10. Top ten CBSAs by number of established suburban neighborhoods.

CBSA	Percent Established Suburban tracts	Number of Established Suburban tracts	Share of national Established Suburban tracts	Share of national population
New York-Northern New Jersey-Long Island, NY-NJ-PA	32%	1,418	13%	6%
Los Angeles-Long Beach-Santa Ana, CA	32%	939	9%	4%
Chicago-Joliet-Naperville, IL-IN-WI	29%	640	6%	3%
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	36%	527	5%	2%
Detroit-Warren-Livonia, MI	39%	502	5%	1%
San Francisco-Oakland-Fremont, CA	31%	302	3%	1%
Pittsburgh, PA	36%	257	2%	1%
Boston-Cambridge-Quincy, MA-NH	24%	235	2%	2%
Washington-Arlington-Alexandria, DC-VA-MD-WV	17%	229	2%	2%
Cleveland-Elyria-Mentor, OH	34%	217	2%	1%
Total	N/A	5,266	49%	23%

In contrast, Table 11 shows that the top ten CBSAs in terms of the number of Urban Residential neighborhoods contribute only 27 percent of the national total, indicating a more even distribution among all CBSAs than is observed for the Established Suburban, and one that is typical of the Rural, New Development, and Patchwork neighborhood types.

Table 11. Top ten CBSAs by number of urban residential neighborhoods.

CBSA	Percent Urban Residential tracts	Number of Urban Residential tracts	Share of national Urban Residential tracts	Share of national population
Los Angeles-Long Beach-Santa Ana, CA	18%	513	5%	4%
Chicago-Joliet-Naperville, IL-IN-WI	17%	367	3%	3%
New York-Northern New Jersey-Long Island, NY-NJ-PA	7%	301	3%	6%
Dallas-Fort Worth-Arlington, TX	22%	295	3%	2%
Miami-Fort Lauderdale-Pompano Beach, FL	22%	264	3%	2%
Philadelphia-Camden-Wilmington	17%	244	2%	2%
San Francisco-Oakland-Fremont	23%	227	2%	1%
Washington-Arlington-Alexandria	17%	226	2%	2%
Houston-Sugar Land-Baytown, TX	21%	226	2%	2%
San Diego-Carlsbad-San Marcos	35%	222	2%	1%
Total	N/A	2,885	27%	25%

As shown in Table 12, Old Urban neighborhoods depart dramatically from the even distribution described above. This neighborhood type represents four percent of the United States population and four percent of all census tracts, and it is highly concentrated in a relatively small number of cities. Ninety-four percent of all Old Urban neighborhoods in the country are located in just ten MSAs. The New York MSA alone accounts for half of all Old Urban neighborhoods, and almost three quarters of all Old Urban neighborhoods are in either New York or Los Angeles. Only 60 out of the 943 CBSAs in the United States (about six percent) contain any Old Urban neighborhoods.

The Mixed-use neighborhood type includes the central business districts as well as more outlying commercial and industrial centers of the cities where it appears. Fifty-eight percent of all CBSAs, as well as a number of small communities located outside of any CBSA, have at least one Mixed-use neighborhood.

No individual CBSA contributes more than five percent of all Mixed-use neighborhoods. Nevertheless, those cities with the largest number of Mixed-use neighborhoods are large MSAs such as New York, Los Angeles, and Chicago (see Table 13).

Table 12. Top ten CBSAs by number of old urban neighborhoods.

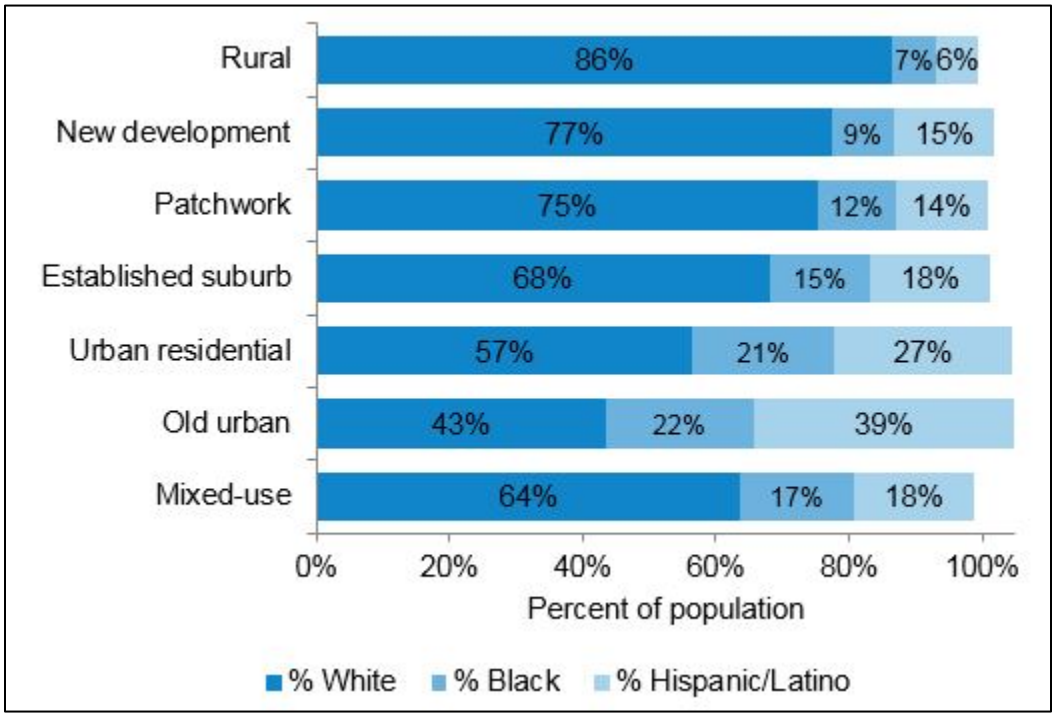
CBSA	Percent Old Urban tracts	Number of Old Urban tracts	Share of national Old Urban tracts	Share of national population
New York-Northern New Jersey-Long Island, NY-NJ-PA	36%	1,630	50%	6%
Los Angeles-Long Beach-Santa Ana	24%	712	22%	4%
Chicago-Joliet-Naperville, IL-IN-WI	13%	279	9%	3%
San Francisco-Oakland-Fremont, CA	11%	108	3%	1%
Boston-Cambridge-Quincy, MA-NH	9%	92	3%	2%
Washington-Arlington-Alexandria	7%	91	3%	2%
Philadelphia-Camden-Wilmington,	3%	40	1%	2%
Miami-Fort Lauderdale-Pompano Beach, FL	3%	37	1%	2%
Honolulu, HI	12%	29	1%	>1%
San Diego-Carlsbad-San Marcos, CA	4%	25	1%	1%
Total	N/A	3,043	94%	23%

Table 13. Top ten CBSAs by number of mixed-use urban neighborhoods.

CBSA	Percent Mixed-use tracts	Number of Mixed-use tracts	Share of national Mixed-use tracts	Share of national population
New York-Northern New Jersey-Long Island, NY-NJ-PA	5%	232	5%	6%
Los Angeles-Long Beach-Santa Ana	6%	165	4%	4%
Dallas-Fort Worth-Arlington, TX	10%	137	3%	2%
Washington-Arlington-Alexandria	8%	103	2%	2%
Chicago-Joliet-Naperville, IL-IN-WI	4%	96	2%	3%
Houston-Sugar Land-Baytown, TX	9%	96	2%	2%
Atlanta-Sandy Springs-Marietta, GA	10%	91	2%	2%
Miami-Fort Lauderdale, FL	7%	83	2%	2%
Phoenix-Mesa-Glendale, AZ	8%	81	2%	1%
San Francisco-Oakland-Fremont, CA	8%	80	2%	1%
Total	N/A	1,164	26%	25%

Demographic Characteristics by Neighborhood Type

Each of the seven neighborhood types is unique in its socioeconomic makeup, though recall that socioeconomics played no role in how the neighborhoods were identified (unlike some similar previous studies described in the literature review). This section reports on averages for neighborhood types across the country; not all neighborhoods of a particular type will conform to these averages, as outliers at both ends of the spectrum will exist among each of the neighborhood types.[6]



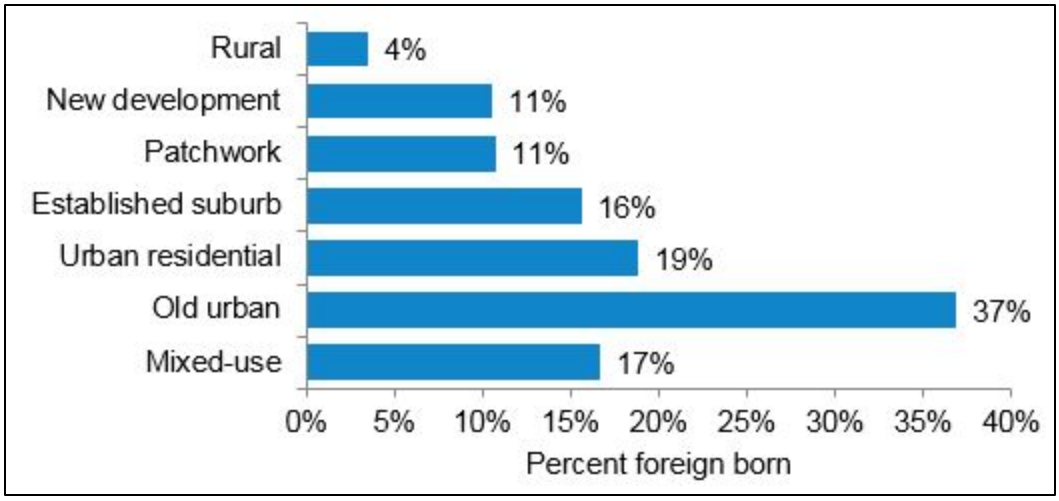
Source: 2010 U.S. Census

Figure 19. Chart. Neighborhood racial/ethnic compositions.

Note: Some neighborhoods may not sum to 100% due to rounding, omitted races, or overlap between Hispanic ethnicity and the white and black racial categories.

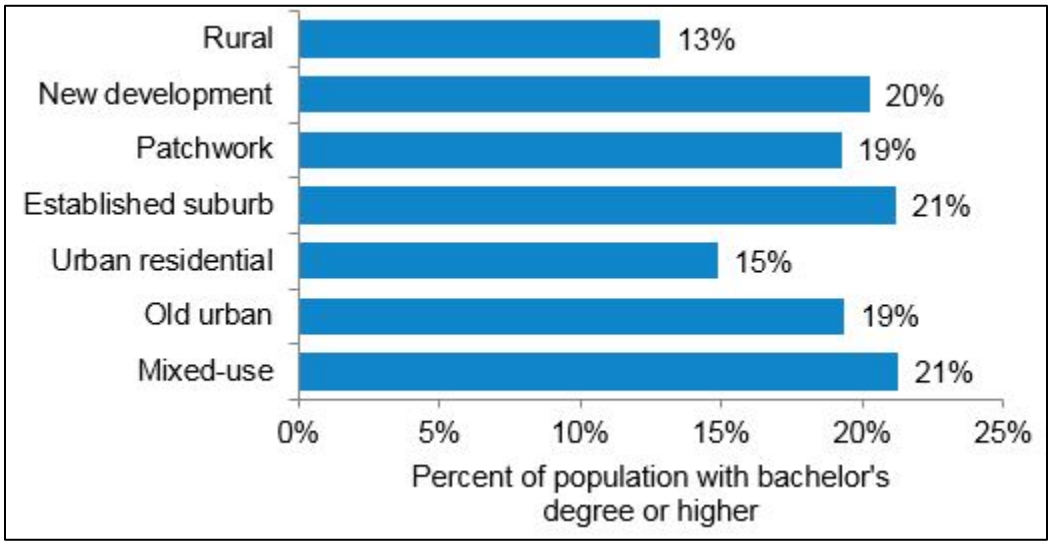
Unsurprisingly, rural neighborhoods have the highest percentage of non-Hispanic white residents, while urban neighborhoods have the lowest (see Figure 19). Of the urban neighborhoods (Mixed use, Old urban, and Urban residential), 43 percent of old urban neighborhoods are white, while Latino/Hispanic residents account for 39 percent. The disproportionate representation of Latino/Hispanic residents in old urban neighborhoods mirrors the likewise disproportionate proportion of foreign-born residents (39 percent) in those neighborhoods. Exhibiting trends similar to the racial/ethnic diversity within the neighborhood types, urban neighborhoods are home to the highest percentage of foreign-born residents (average of 24 percent across urban neighborhoods), followed by suburban (12 percent on average) and rural (4 percent) (see Figure 20).

[6]See Appendix IIId for tables on the characteristics of residents by neighborhood type and age–16-18, 19-26, and 27-61 year olds.



Source: 2010 5-Year American Community Survey

Figure 20. Chart. Percentage foreign born by neighborhood type.



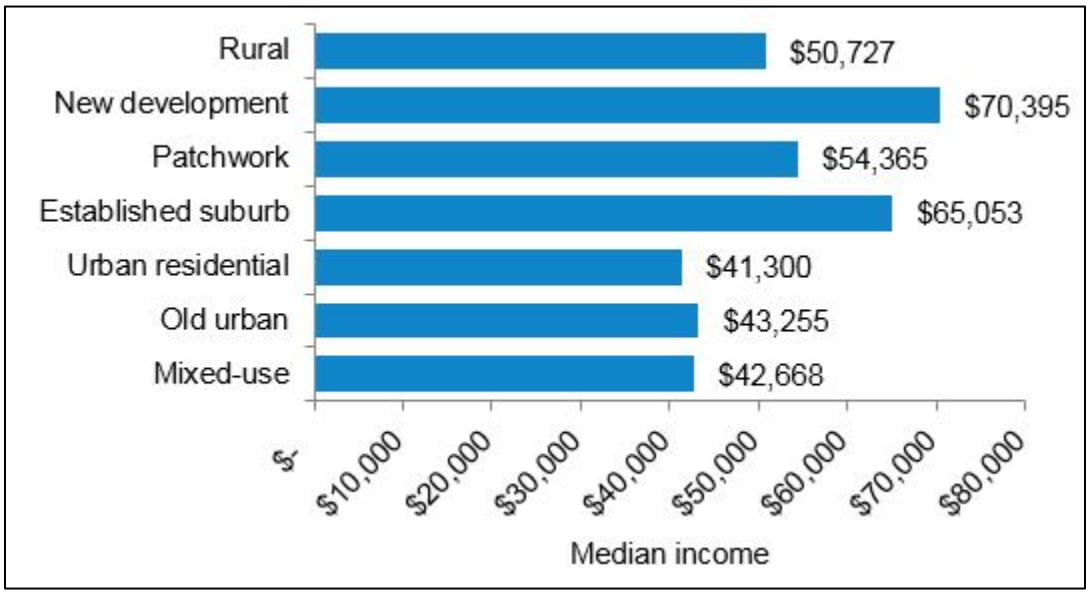
Source: 2010 5-Year American Community Survey

Figure 21. Chart. Educational attainment by neighborhood type.

Across the seven neighborhood types, two of the neighborhood types share similarly (low) average educational attainment levels, while the other five types have surprisingly similar average levels of educational attainment. Rural neighborhoods have the lowest percentage of people holding a bachelor's degree or higher (13 percent) followed closely by urban residential neighborhoods (15 percent) (see Figure 21). This similarity is notable as the two neighborhood types are dissimilar on most other physical and socioeconomic characteristics. About 20 percent of residents in the remaining urban neighborhoods (mixed-use and old urban) and three suburban neighborhood types hold bachelor's degrees or higher.

Urban neighborhoods have the lowest median incomes of any neighborhood type (about $42,000), while suburban neighborhoods (Established suburbs, Patchwork, New Development) have among the

highest median incomes (see Figure 22). However, while urban neighborhoods have a relatively low range of median incomes, new development neighborhoods have much higher median incomes (about $70,400) compared to patchwork neighborhoods (about $54,400).

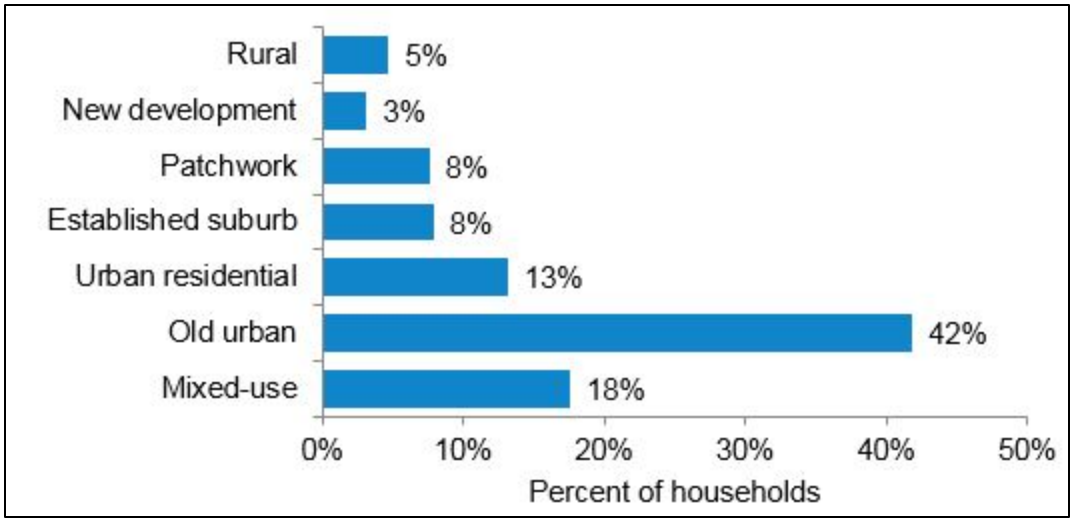


Source: 2010 5-Year American Community Survey

Figure 22. Chart. Median income by neighborhood.

Vehicle ownership is of particular interest to travel behavior researchers and has long been observed as a rough proxy for income (Dargay, 2001). But income is not the only factor explaining auto ownership; there are dramatic differences in auto ownership by neighborhood type, even across neighborhoods with similar average incomes, which suggest that the built environment may also importantly influence vehicle ownership rates.

For example, despite the three types of urban neighborhoods having similar median incomes, 42 percent of old urban residents do not own cars. This is dramatically higher than either mixed-use or urban residential residents, of whom 18 and 13 percent do not own vehicles, respectively (see Figure 23). Much of this trend is likely explained by the high proportion of old urban neighborhoods in Manhattan, which is home to 50 percent of all old urban neighborhoods in the country (see Table 12).



Source: 2010 5-Year American Community Survey

Figure 23. Chart. Percentage of households owning zero vehicles.

Conclusion

We describe in this chapter our process for using factor analysis followed by cluster analysis to characterize nearly every census tract in the U.S. in terms of built environment and transportation system characteristics into one of seven basic neighborhood types. We then describe how these neighborhood types compare and contrast with one another, how they are distributed across and among metropolitan areas, and how the socio-economic characteristics of residents differ, on average.

We characterized (nearly) all of the census tracts in the U.S. and identified seven principal neighborhood types. However, the population is not evenly distributed across the neighborhood types; quite the contrary. For example, only five percent of the population lives in Mixed Use neighborhoods while 27 percent live in New Development neighborhoods. Further, the distribution of neighborhoods within a given metropolitan area and among them is far from uniform. U.S. cities and the neighborhoods in them really are very different from one another, particularly among the largest metropolitan areas. For example, while the three largest U.S. metropolitan areas (New York, Los Angeles, and Chicago) collectively account for 13.5 percent of the American population, those three areas are home to 28 percent of the nation's Established Suburbs.

Likewise, over one-third (36%) of metropolitan New York is comprised of Old Urban neighborhoods; those neighborhoods in New York account for fully half of all Old Urban neighborhoods in the entire U.S. Further, nearly one-quarter (24%) of neighborhoods in Los Angeles are Old Urban, and LA accounts for an additional 22 percent of all Old Urban neighborhoods—which means that the two largest U.S. metropolitan areas together account for nearly three-fourths of all Old Urban neighborhoods in the U.S. While the factor and then cluster analyses employed to identify the seven types of American neighborhoods analyzed here rest almost exclusively on the physical characteristics of census tracts—in

terms of the built environment and transportation infrastructure—these neighborhoods vary systematically and widely across an array of socio-economic factors (that were not used to determine neighborhood types).

For example, African-American and Latino residents are disproportionately concentrated in the three urban neighborhood types, and in particular in the Old Urban neighborhoods discussed above. Similarly, Urban Residential and Rural districts have considerably lower average levels of educational attainment than do the other five neighborhoods types, which all have higher proportions of those with Bachelor's degrees or more by about six percentage points. Finally, two suburban neighborhood types Established Suburbs and New Development have considerably higher average incomes than all others.

With the entire U.S. now characterized in terms of these seven neighborhood types, we now turn to a series of analyses to determine how travel in these neighborhoods, particularly among teens and young adults, varies.

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IV. MILLENNIALS: ARE THEY FLOCKING TO THE CITY, OR TO THE ‘BURBS?

Introduction

The previous chapters introduced seven types of neighborhoods in the United States: Rural, New Development, Patchwork, Established Suburb, Urban Residential, Old Urban, and Mixed-Use. In this chapter we use these neighborhood types to answer a number of currently debated questions about the residentional location of youth (age 20 to 34) today and over time.

In the first section, we analyze the residential location of youth in 2010 and use multivariate statistical analysis to determine whether youth live in different neighborhoods than adults (ages 35 to 64). In the second section, we explore life stage and socioeconomic factors that shape youth residential location, assessing, for example, how neighborhood location changes when youth move out of the parental home, get married, or have a child.

In the final two sections we analyze the so-called back-to-the-city movement. First, is a back-to-the-city movement underway at a national level? To tip our hand up front, we find that it is not; consistent with the findings of other studies, suburban population growth among youth actually outpaced urban growth during our study period and accelerated growth growth of youth in urban neighborhoods in recent years is only sporadically supported in select metropolitan areas. We then restrict our analysis to the 25 largest metropolitan areas to test whether we are witnessing a back-to-big-cities movement. In these large American cities we find a simliar story to what we found with all cities: while there was indeed population growth among urban youth, the growth in suburban areas—particularly the most sprawling and auto-oriented New Developments—outpaced urban growth. In the final section, we analyze each of the 25 largest metropolitan areas in turn to show the patterns of population growth across neighborhoods. While three particular metropolitan areas did experience higher levels of population growth among youth vis-à-vis suburbs, many more metropolitan areas experienced the reverse—where suburban population growth outpaced urban growth, and still more exhibited mixed patterns of growth that were neither clearly urban-focued nor clearly suburban-focused.

Where do Youth Live?

Recent popular media and scholarly articles hailed the Back-to-the-City Movement—the return of American youth to cities, a new thirst for urban living, and rejection of suburban lifestyles (Hyra, 2014; Maney, 2015; Roberts, 2011). Frey (2013) finds that between 2010 and 2012, the largest American cities grew faster than their surrounding suburbs compared to the 2000s. Despite these findings and claims of a growth of the urban youth populations, others challenge that the Movement is more wishful thinking rather than hard fact; Cox (2011) finds that metropolitan areas of 1 million or more residents “ of growth in the 2000s than in the 1990s”. So where do youth live today, are they living in cities at higher rates compared to adults, and are the number of youth in cities growing faster now than in the past?

Belden Russonello & Stewart LLC (2011) find that young single adults (those under 35 and never married), live in cities at higher rates (31 percent) than do other adults (24 percent). Previous research

suggests that youth today have different residential location patterns than did prior generations at similar ages. Millennials are more likely to live in cities (39 percent) compared to earlier generations (Belden Russonello Strategists, 2013). In addition, youth are less likely to live in rural areas (14 percent) than older generations were at comparable ages (29 and 36 percent of the Boomers and Silent Generations respectively) (Pew Social & Demographic Trends Project, 2010). The Pew Social & Demographic Trends Project (2010) attributes the location patterns of young adults to wider changes in American geography, which have shifted from rural to suburban and city living. Thirty-two percent of Millennials live in central cities, well over the 23 percent of the Silent generation who lived in central cities at comparable ages (Pew Social & Demographic Trends Project, 2010).

Analytical Approach

Throughout this analysis we draw on two sources of data: the U.S. Census (1990, 2000, and 2010) and the 2001 and 2009 National Household Travel Surveys (NHTS). The Census data provide population counts at the census tract level. Because the Census is not a survey (i.e. it has complete coverage of the population), all analyses employing the Census do not report confidence intervals. Unlike the Census, the NHTS includes individual and household-level data, which we use to analyze the relationship between socioeconomic factors and residential location. Throughout the chapter we compare youth (ages 20 to 34) to the adult population (ages 35 to 64).[7] We then examine various independent socioeconomic factors thought to explain some of the variation in residential location between these two age groups.

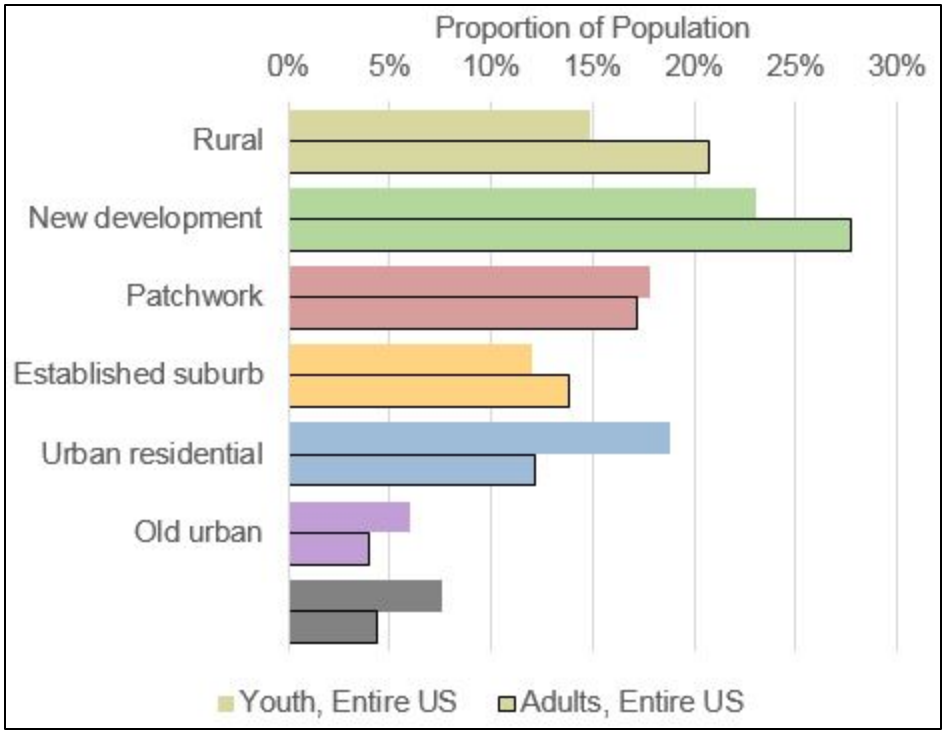
As we discuss in Chapter III, we developed the seven neighborhood types using data from the 2010 Census and the 2014 Smart Location Database (SLD); therefore, it is possible that these neighborhoods would have been otherwise categorized in 1990 or 2000 as the built environment characteristics used to define neighborhoods, such as road network density may have changed over this period of time. In particular, many New Development neighborhoods may have been classified as Rural neighborhoods during these earlier years. In these cases, dramatic population growth may occur because of increased housing opportunities in areas where previously none existed.

Descriptive Results

Nationwide

America today, for better or worse, is a nation of suburbs. Nationwide, just over half of all youth lived in suburban neighborhoods (53 percent), a third lived in urban neighborhoods, and 15 percent lived in rural neighborhoods in 2010 (see Figure 24). But while most youth live in suburban neighborhoods, they reside in urban neighborhoods in higher proportions than their older adult counterparts. Conversely, relative to adults (age 35 to 64), a lower proportion of youth lived in rural and suburban neighborhoods (except in Patchwork suburban neighborhoods) (see Figure 24).

7 The upper age boundary in this section of the analysis (64) is higher than the previous section (61) due to the Census' categorical age definitions.



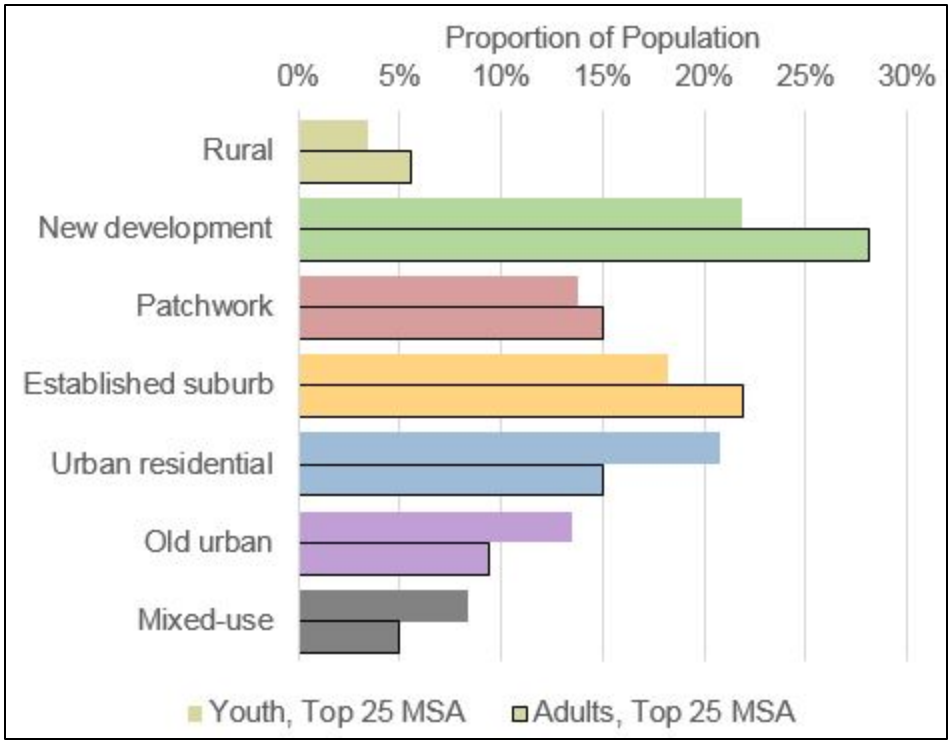
Source: U.S. Census, 2010.

Figure 24. Chart. Residential location nationwide, U.S. Census, 2010.

Note: Youth, ages 20-34; Adults, ages 35-64. Error bars are not included as reported changes are based on U.S. Census rather than sample data.

Youth in the Largest Metropolitan Areas

Figure 25 presents the results of a similar analysis but restricted to the 25 largest metropolitan statistical areas (MSAs) (see Appendix IVa for a list of the largest MSAs). As in the nationwide analysis, just over half of youth in the largest U.S. metropolitan areas lived in suburban neighborhoods (54 percent). Even in these large metropolitan areas, a larger share of youth lived in suburban neighborhoods than lived in urban ones. Nevertheless, the share of youth in urban areas was higher in the largest metropolitan areas compared to the nation as a whole (43 v. 33 percent). Likewise, the share of youth in the rural parts of the largest metropolitan areas was lower than it was nationwide (3 v. 15 percent). Finally, within large metropolitan areas, youth exhibited a clear pattern of being more urban and less suburban than adults.



Source: U.S. Census, 2010

Figure 25. Chart. Residential location in the largest 25 metropolitan areas, U.S. Census, 2010.

Note: Youth, ages 20-34; Adults, ages 35-64. Error bars are not included as reported changes are based on U.S. Census rather than sample data.

Of course, youth differ in many ways from adults, which may affect their residential location decisions. As Table 14 indicates, a lower percentage of youth identify as white compared to adults, and youth have lower educational attainment and median income (32 percent hold a Bachelor's degree and earn $52,500 respectively) compared to adults (39 percent and $62,500 respectively). One of the most striking distinctions between youth and adults is the percentage living with parents and children. Over one-third of youth (between the ages of 20 and 34) live with parents, while less than two percent of adults do. Similarly, less than 19 percent of youth live with children compared to about 44 percent of adults.

Moreover, youth and adults have different transportation resources at their disposal. Although youth have the same median number of vehicles compared to the adults (2), and the vast majority of households own cars, 27 percent more youth own no vehicles (6.2 percent) compared to the adults (4.9 percent). Vehicle ownership is linked to income and employment and may also reflect neighborhood location decisions. For example, households with fewer cars may choose to live in urban neighborhoods where transit is more frequent (Glaeser, Kahn, & Rappaport, 2008). Conversely, a household living in an urban neighborhood with excellent transit alternatives may choose to reduce the number of cars in their household (Glaeser et al., 2008).

Table 14. Socioeconomic characteristics of youth vs. adult population, 2009.

Variable	Youth[1]	Adults[2]
Personal Characteristics	N/A	N/A
% Female	50.8%	49.8%
Race/ethnicity	N/A	N/A
Non-Hispanic White	62.4%	70.0%
Non-Hispanic Black	11.0%	11.8%
Hispanic	6.9%	5.2%
Non-Hispanic Other	19.8%	13.0%
% Live with Parents	34.0%	1.5%
% Live with Kids	18.5%	43.8%
Bachelor's Degree or Higher	31.6%	38.9%
Median Household Income	$52,500	$62,500
Median Number of Household Vehicles	2.0	2.0
% of Households with Zero Vehicles	6.2%	4.9%

Source: National Household Travel Survey, 2009
(1) Youth are ages 20-34
(2) Ages 35-64

Do Youth and Adults Live in Different Neighborhoods?

Do the higher proportions of youth living in urban areas vis-à-vis adults reflect generational differences in living preferences, or simply life stage differences whereby young across generations are more likely to live in cities as young adults, and in suburbs as they grow older and have children of their own? Put another way, when controlling for socioeconomic and life stage differences, do youth live in different neighborhoods than adults?

Studies of housing and neighborhood choice find that neighborhood selection is a "complex interplay of income, socioeconomic status, and preferences" (Clark & Ledwith, 2007, p. 148). Life stage affects housing and neighborhood preferences; for example, households with children opt for neighborhoods with high-quality schools (McAuley & Nutty, 1982). Households in later life stages, as marked by age, being married, and the presence of children, have higher mobility thresholds and are comparatively less likely to move than are young single adults (McAuley & Nutty, 1982; Weisbrod, Lerman, & Ben-Akiva, 1980). Importantly for our household-level analysis, "household composition considerations overwhelm all other tradeoffs among housing cost, taxes, transportation access, and crime level"; households with children are more likely to choose single family houses than those without children (Weisbrod et al., 1980, p. 7). In addition, homeowners have higher transaction costs of moving and are less likely to move, or even want to move, compared to renters (Böheim & Taylor, 2002).

Analytical Approach

To answer these questions, we needed disaggregated data that included personal and household characteristics of individual respondents. We thus used the 2009 National Household Travel Survey (NHTS) because it includes a representative sample of individuals across the entire United States and provides detailed information about each respondent. Using the NHTS, we estimated a multinomial logistic regression model with neighborhood type as the dependent variable. The key explanatory variable of interest was a dichotomous variable for age: youth (ages 20 to 34) versus adults (ages 35 to 65). Table 15 lists explanatory variables that served as controls and are all measured at the household level:

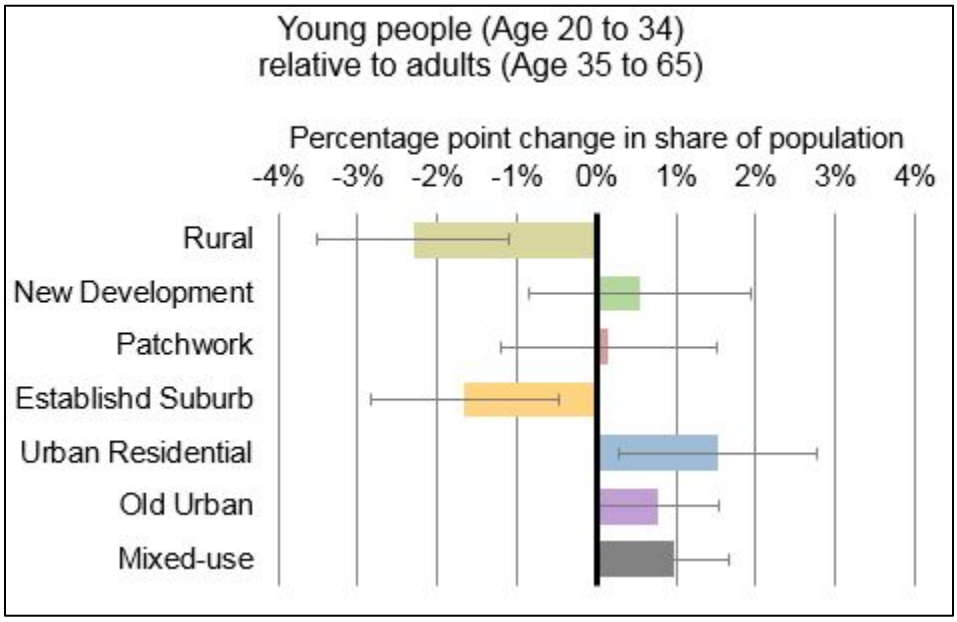
Table 15. Control variables in multinomial logistic regression model.

Variable	Definition
Education	Level of educational attainment; Highest level of education attained by anyone in the household used if respondent under age 27 (< HS, HS only, Some college, College degree, Advanced degree)
Household income	ln of income
Race/ethnicity of household head	Non-Hispanic white, Non-Hispanic black, Hispanic, Non-Hispanic Other
# of workers in household	0, 1, 2, or more
Household size	1, 2, 3, 4, or 5 or more
Child under 18 in household	Yes/no
Young person lives with his or her parents	Yes/no
Metropolitan area status[8]	Inside a metropolitan area (yes/no)

Figure 26 depicts the results of that analysis graphically (Full model results are available in Appendix IVe). The bars to the left of the axis indicate that, controlling for other factors thought to influence residential location decisions, youth were less likely than adults to live in Rural neighborhoods or in Established Suburban neighborhoods. Likewise, the bars to the right of the axis indicate that youth were more likely than otherwise similar adults to reside in urban neighborhoods, specifically Urban

8 In general, there is a positive relationship between metropolitan area size and the odds that all seven neighborhood types are present in the area. Put another way, not all neighborhood types appear in small or outside of metropolitan areas. Therefore, we included metropolitan area size as an explanatory variable to reflect the likely neighborhood choice set available to each NHTS respondent. We also estimated a separate model in which we excluded metropolitan area size to control for possible endogeneity effects of including metropolitan area size in predicting residential neighborhood type. This second model explained less of the variance in residential location than the one reported above that includes metropolitan area size, but the signs and magnitude of the results were broadly consistent across both models.

Residential, Old Urban, and Mixed-use neighborhoods. So, in general, we do see a pattern whereby young adults (ages 20 to 34) are more likely than older adults (ages 35 to 65) to reside in urban than in suburban or rural neighborhoods, though the effects are mixed across various neighborhood types.



Source: 2009 NHTS, weighted values.

Figure 26. Chart. Independent relationship—age vs. residential location.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe.

What Factors Shape Where Youth Live?

In the previous section we showed that youth are more likely than otherwise similar adults to live in urban neighborhoods. In this section we consider the factors that influence where youth live.

One strand of research seeking to answer that question focuses on residential location *preferences* of youth as ascertained by large surveys. For example, The Urban Land Institute surveyed a nationally representative sample of 1,200 adults and found that, relative to other generations, Millennials had stronger preferences for living in mixed-use areas with diverse housing options (Belden Russonello Strategists, 2013). Moreover, more than half of Millennials (55%) reported that when making residential location decisions, they preferred to have convenient access to public transportation (Belden Russonello Strategists, 2013). A separate survey, conducted by National Association of Realtors, found that Millennials favor suburban town centers and urban downtowns (National Association of Realtors, 2013). The second strand of research on this question focuses on how social and economic forces shape where youth live, many of which were in flux during the research period. For example, when a young person leaves their parents' home their residential location obviously changes. Residential location often

changes again when a young person gets married or has a child. The trends in each of these three adult role changes (living independently, marrying, and childbearing) were in flux during our analysis period. For example, in the late 2000s youth were less likely to form independent households than young adults of earlier generations (Bell, Burtless, Gornick, & Smeeding, 2007). Moreover, men and women in recent years are getting married later (Fry, 2012, 2013) and, somewhat less successfully, delaying childbirth (Hymowitz, Carroll, Wilcox, & Kaye, 2013).

These changes were caused by a mix of factors. First, economic forces, particularly the Great Recession, reduced the employment opportunities and earnings for many youth. Parker (2012) and Wang, Morin, & Taylor (2009) find that economic hardship is the largest driver for young adults[9] to "boomerang" or move back in with parents. A larger share of unemployed youth live with their parents than employed youth (45% v. 29%) (Fry, 2013), and elevated rates of youth unemployment during the Great Recession increased the number of youth living at home. In 2009, over 13 percent of parents with grown children said that at least one of their children moved back home within the past year (Wang et al., 2009). Economic insecurity leads to falling incomes and employment levels delay independent household formation as young adults postpone household formation to save costs (Bell et al., 2007). Youth in the 2010s also stayed in school longer, in part due to economic pressures (Furstenberg Jr, 2010) and in part due to the steady increase in educational attainment among women (Goldin, Katz, & Kuziemko, 2006).

Analytical Approach

In this analysis we add to the recent research on residential preferences to examine how various factors discussed in the literature—namely adult roles, household income, employment, educational attainment, and race/ethnicity—collectively shape residential location.

To answer these questions we first analyze descriptive data, the full results of which are available in Appendix IVb. We focus our discussion here on whether the associations uncovered in our descriptive analysis persist when controlling for other personal characteristics that may also shape residential location.

To model the independent relationships between residential location and personal characteristics, we estimated another multinomial logistic regression model with neighborhood type as the dependent variable. Because we are specifically interested in what affects youth's residential location rather than the comparison between youth and adults, we restricted the analysis to youth (ages 20 to 34) and included an explanatory variable corresponding to each of the aforementioned research questions (see Table 16).

[9] Parker (2012) looks at young adults aged 25-34; Wang et al. (2009) find that 10 percent of adults ages 18-34 cited economic hardship as the primary reason for moving back home.

Table 16. Variables in multinomial logistic regression—Factors that shape where youth (ages 20-34) live.

Variables	Definition
Four Adults Roles	N/A
Living independently	Live outside the parental home (yes/no)
Getting married	Married (yes/no)
Having a child	Children of their own (yes/no)
Securing a job	Employed (yes/no)
Education	Respondent's level of educational attainment; Highest level of education attained by anyone in the household used if respondent under age 27 (< HS, HS only, Some college, College degree, Advanced degree)
Household Income	Income quintile
Race/ethnicity	Non-Hispanic white, Non-Hispanic black, Non-Hispanic Asian, Hispanic, Non-Hispanic Other

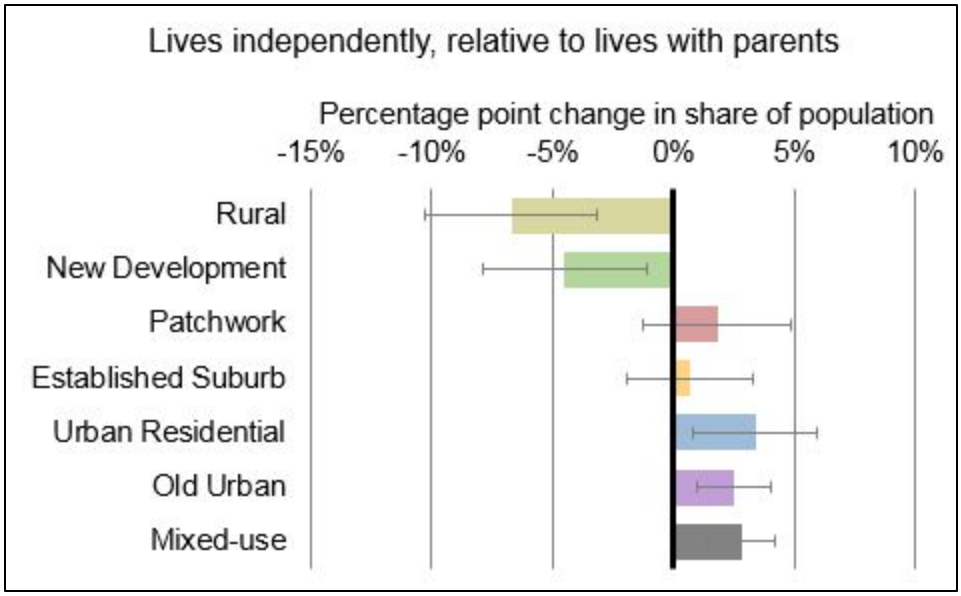
To facilitate model interpretation, we again present the results graphically in two sections (as with the descriptive results, the full multivariate model results are available in Appendix IVe). In the first section, we group the results by explanatory variable. In the second, we group the results by neighborhood type. In both cases, the graphs report the estimated change in the share of youth that live in each neighborhood type everything else equal, relative to the base category (e.g. not employed, middle income, non-Hispanic White). Bars to the right of the axis indicate that youth with that characteristic were more likely to live in the specified neighborhood type, whereas bars to the left indicate that those youth were less likely to live in that neighborhood type. Each bar includes a 95 percent confidence interval, which can be used to assess the amount of uncertainty about the estimate and to determine statistical significance.

Multivariate Results, by Explanatory Factor

How does taking on adult roles shape where youth live?

Living independently

Youth who leave the parental nest and establish their own households were more likely, everything else equal, to live in urban neighborhoods than were youth who still live with mom and/or dad (see Figure 27). Conversely, youth who still live in the parental home were relatively more likely to live in Rural or New Development neighborhoods.



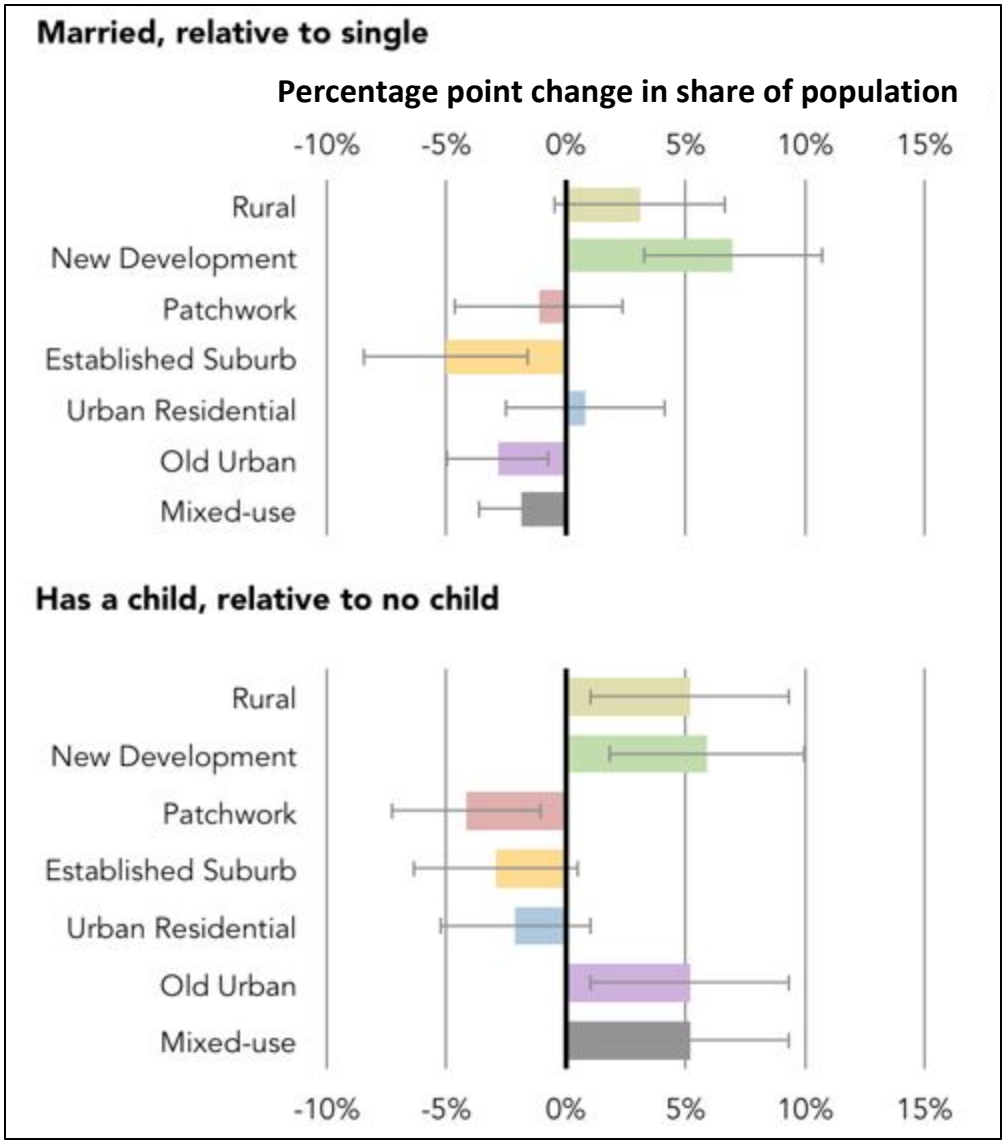
Source: 2009 NHTS, weighted values.

Figure 27. Chart. Independent relationship—youth living on their own vs. residential location.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe. Youth, ages 20-34.

Starting a family

All else equal, family-oriented youth—that is, those who were married and/or had children of their own—were relatively more likely to live in Rural areas or in New Developments and relatively less likely to live in Established Suburbs or Patchwork areas compared to single youth and those without children (see Table 18). As Figure 28 shows, in general being married and having a child had similar effects on neighborhood location. Notably, these similarities diverged for Old Urban and Mixed-use neighborhoods; while married youth were less likely to live in those neighborhoods, youth with children were more likely to do so.



Source: 2009 NHTS, weighted values.

Figure 28. Chart. Independent relationship—married or having children vs. youth residential location.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe. Youth, ages 20-34.

Employment

Unlike the other adult roles, there was no statistically significant relationship between being employed and living in a particular type of neighborhood. The results in Figure 29 are, however, suggestive. Youth with a job were slightly more likely, everything else equal, to live in Patchwork or Established Suburban neighborhoods.

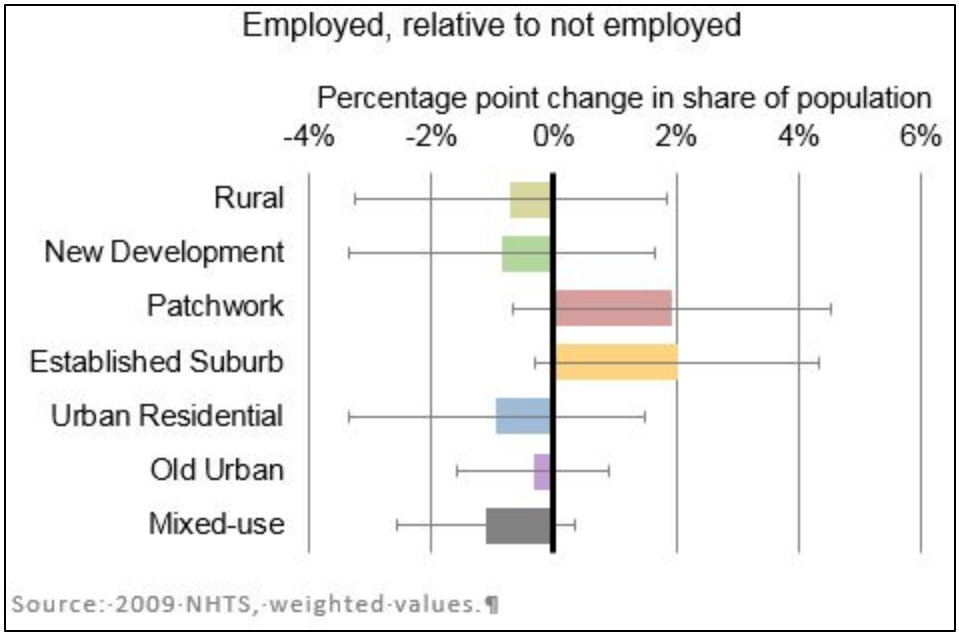


Figure 29. Chart. Independent relationship—employed vs. youth residential location.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe. Youth, ages 20-34.

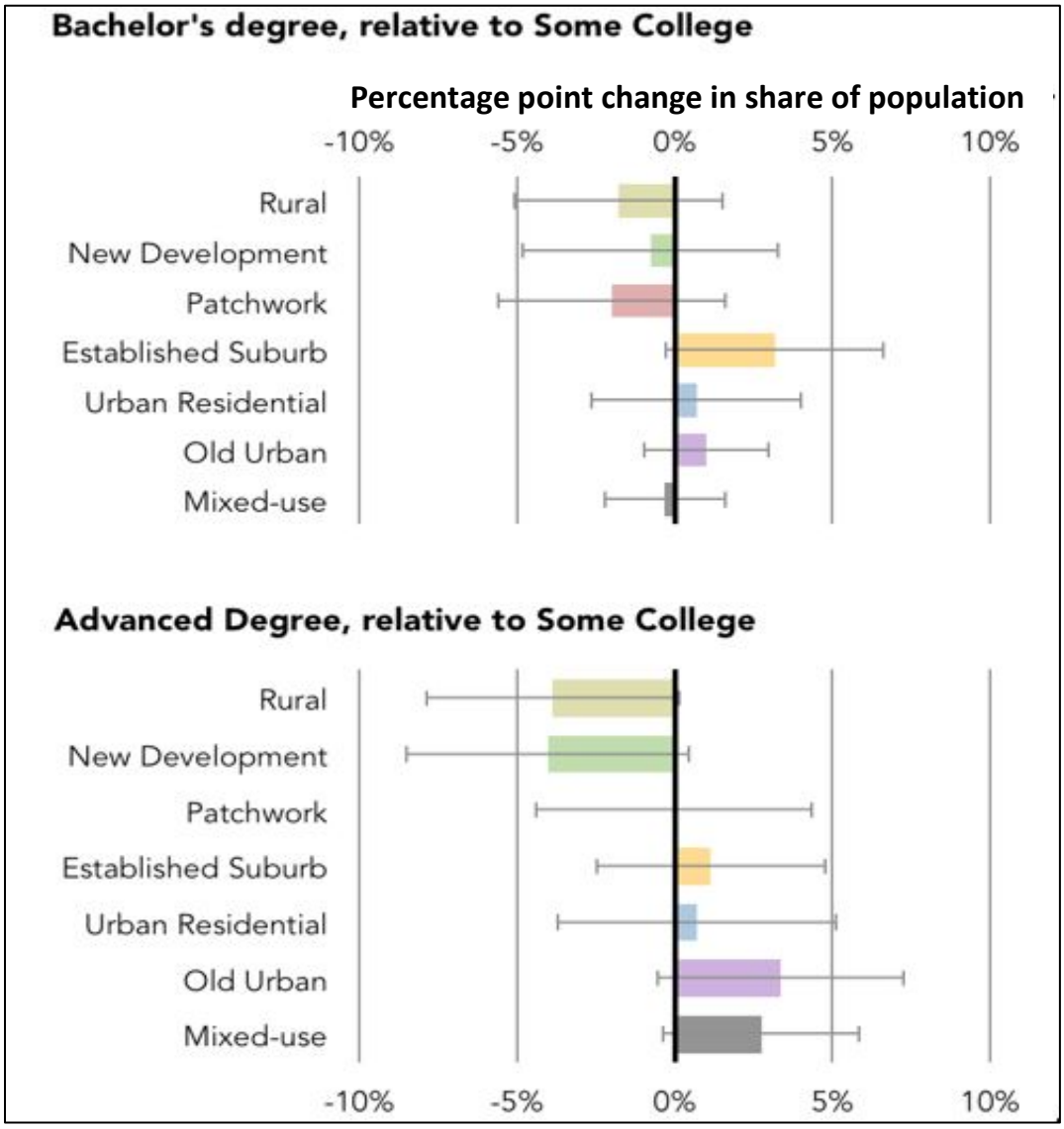
How does educational attainment shape where youth live?

Figure 30 and Figure 31 present the results of the analysis for educational attainment. Because an individual's highest level of educational attainment is typically reached between her mid-teens and late-twenties, we have no way of differentiating, say a twenty-year-old who has concluded all education with an Associate Arts degree and one who has completed two years of college on her way to becoming a medical doctor. As such, we chose to analyze the highest level of education attained by any member of the household. The base category is the most prevalent category—some college (but no Bachelor's degree).

In general there were few statistically significant differences in the neighborhood location of youth by educational attainment. For example, there was no difference in the residential location of youth who graduated from college (but did not earn an advanced degree) and those who attended college, but did not graduate.

Youth living in households with considerably more or less education (than some college or a bachelor's degree) did, everything else equal, tend to live in different neighborhoods than youth with some college or a bachelor's degree. The lower portion of Figure 30 depicts the case at the high end of the educational attainment spectrum. Youth with an advanced degree (i.e. beyond a bachelor's degree)

were less likely than those with some college to live in Rural areas or New Developments. In turn, they were more likely, everything else equal, to live in Old Urban and Mixed-use neighborhoods. This supports findings elsewhere suggesting that highly educated youth are choosing to locate in more urban locations (Cortright, 2014).

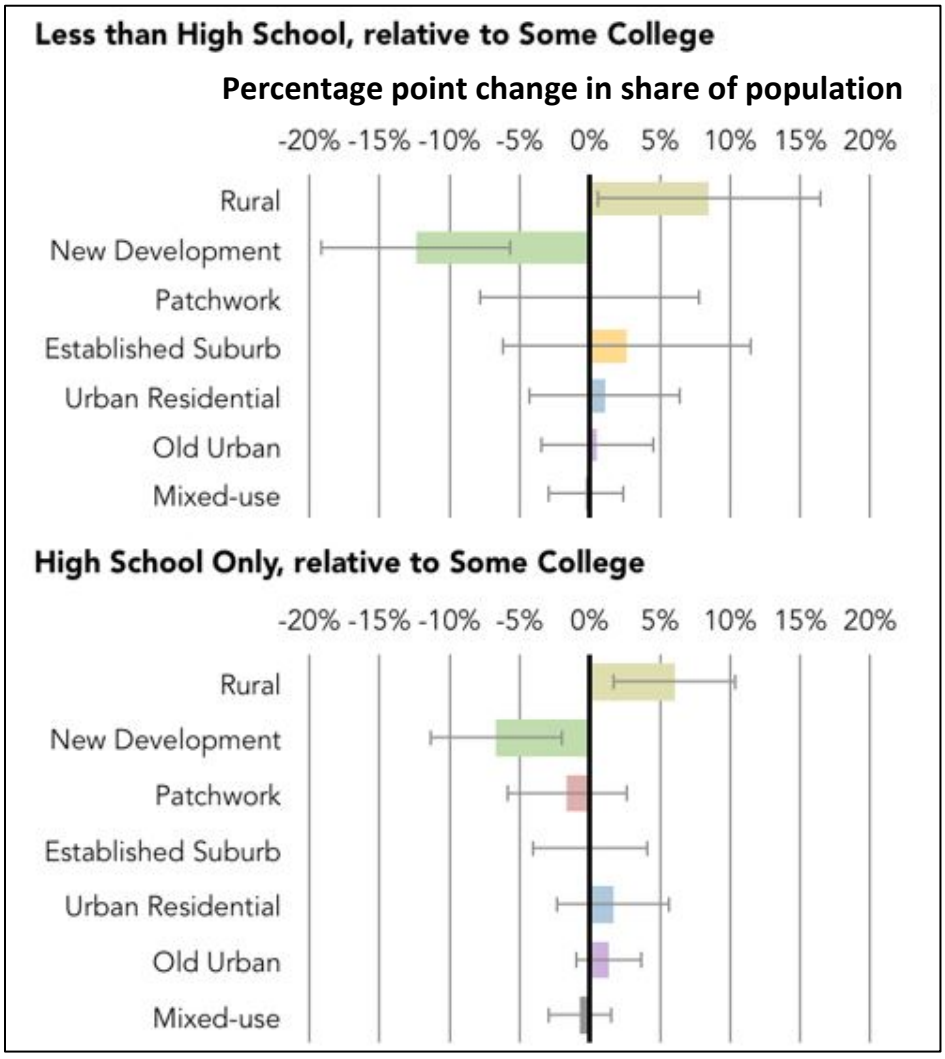


Source: 2009 NHTS, weighted values.

Figure 30. Chart. Independent relationship—holding a graduate degree vs. youth residential location.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe. Youth, age 20-34.

Figure 31 depicts the case at the other end of the spectrum. Youth with very limited educational attainment (less than a high school degree or only a high school degree) were more likely than were better educated youth (some college) to live in Rural areas and less likely to live in New Developments (see Figure 31).



Source: 2009 NHTS, weighted values.

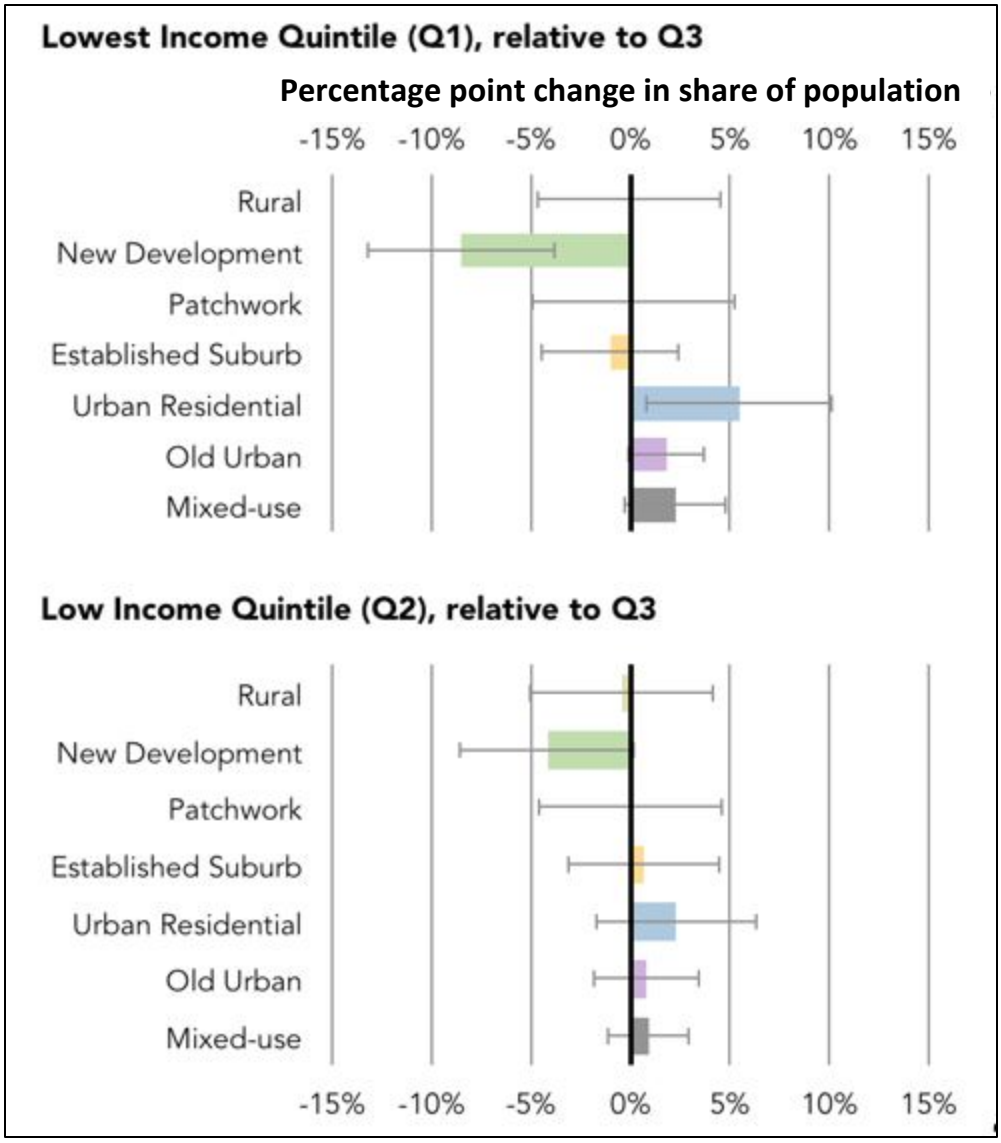
Figure 31. Chart. Independent relationship—having limited educational attainment vs. youth residential location.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe.

How does household income shape where youth live?

Figure 32 and Figure 33 depict the results by household income quintile. Low-income youth were much less likely than their otherwise similar peers to live in New Developments and were slightly more likely to live in Urban Residential, Old Urban, and Mixed-use neighborhoods.

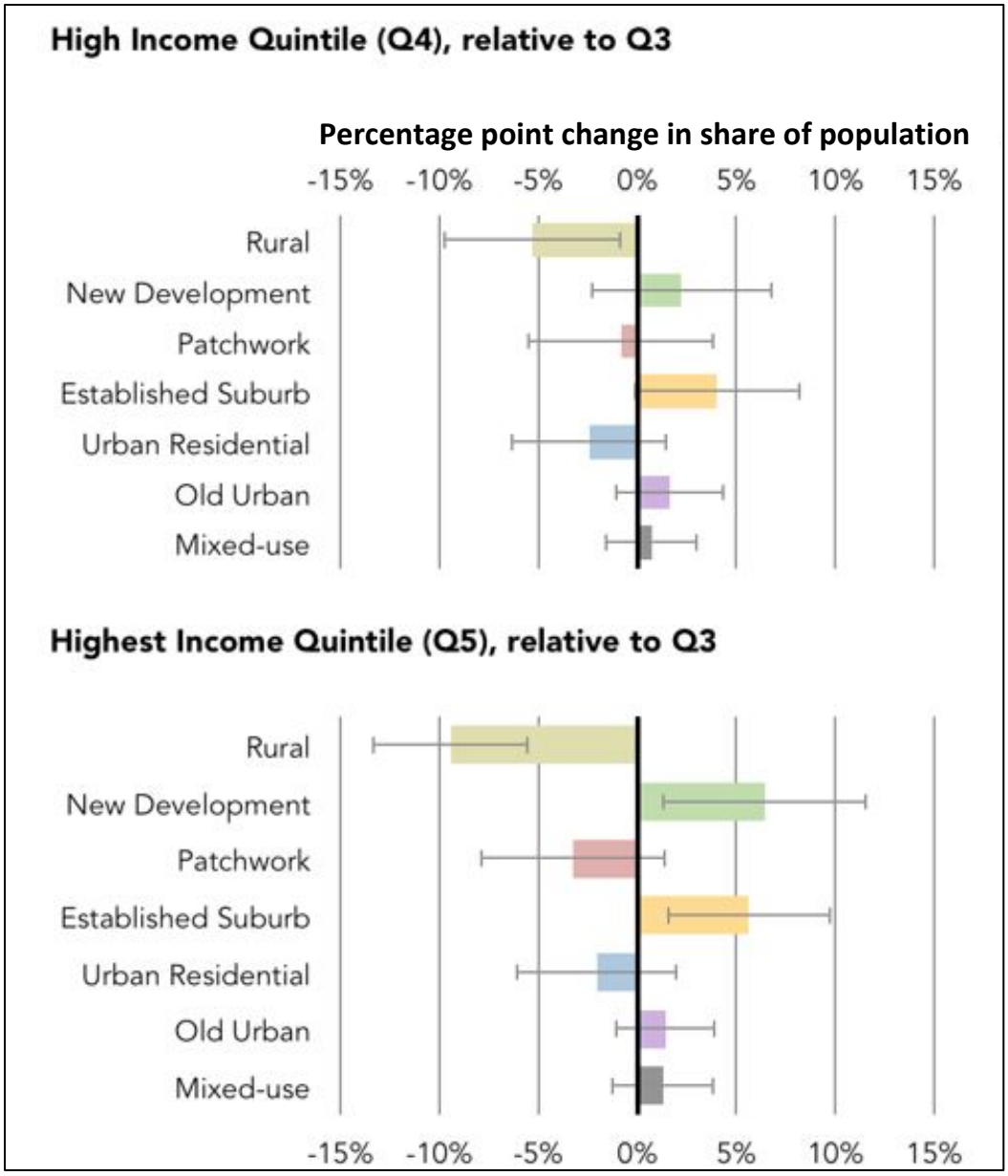
At the other end of the income spectrum, high-income youth, and to a greater extent those in the highest income quintile, were less likely than otherwise similar youth to live in Rural neighborhoods. These well-off youth were, in turn, relatively more likely to live in New Development and Established Suburban neighborhoods.



Source: 2009 NHTS, weighted values.

Figure 32. Chart. Independent relationship—low household income vs. youth residential location.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe. Youth, ages 20-34.



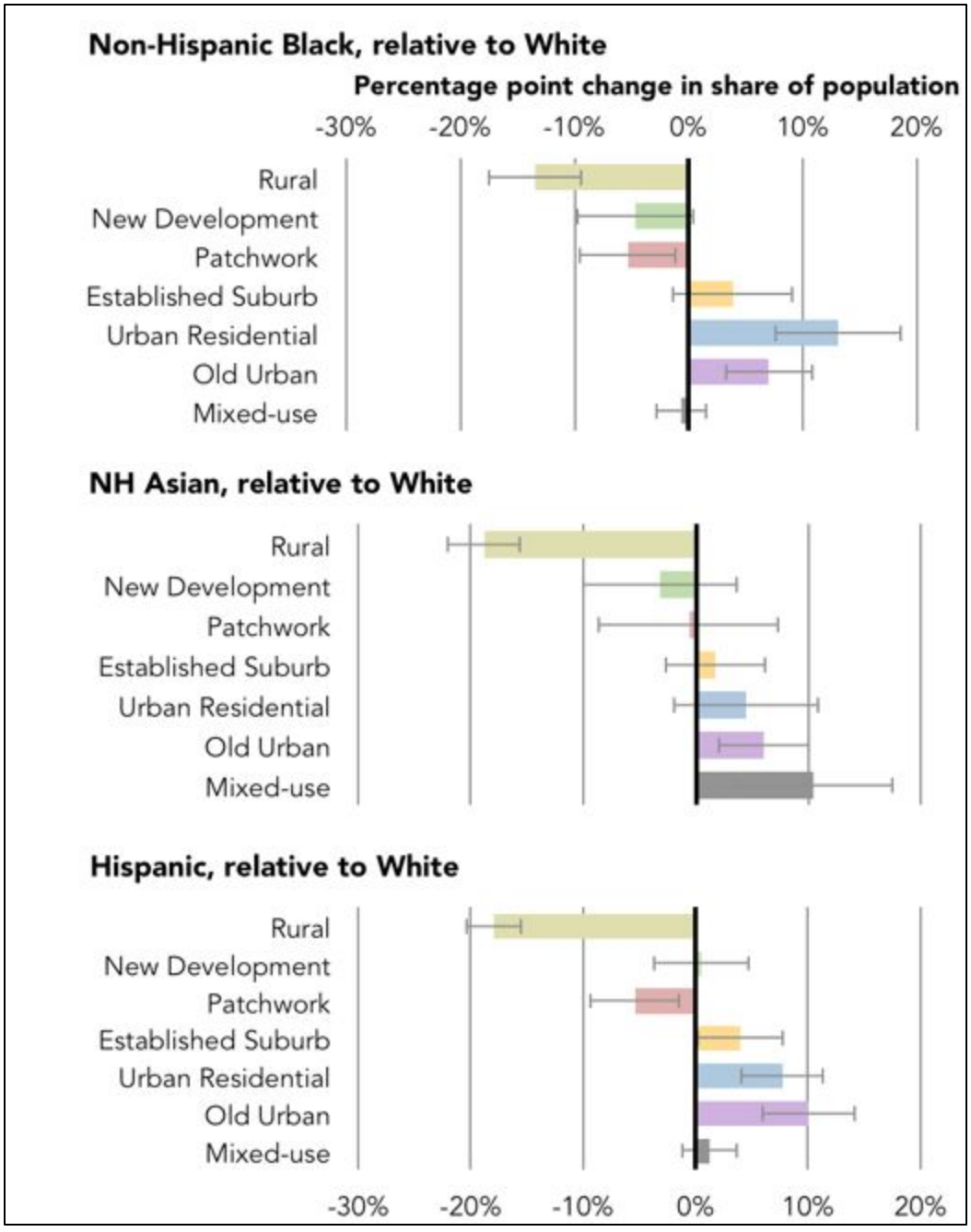
Source: 2009 NHTS, weighted values.

Figure 33. Chart. Independent relationship—high household income vs. youth residential location.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe. Youth, ages 20-34.

How does racial/ethnic background shape where youth live?

Figure 34 depicts the relationship between race/ethnicity and residential location, while controlling for other factors like household income, educational attainment, and adult roles. All comparisons are relative to non-Hispanic white youth. Everything else equal, minority youth were much less likely than white youth to live in Rural neighborhoods. Minority youth were, in turn, typically more likely to live in urban neighborhoods. Black and Hispanic youth in particular were more likely than white youth to live in Urban Residential and Old Urban neighborhoods, while Asian youth were more likely, relative to otherwise similar whites, to live in Mixed-use urban neighborhoods.



Source: 2009 NHTS, weighted values.

Figure 34. Chart. Independent relationship—race/ethnicity vs. youth residential location.

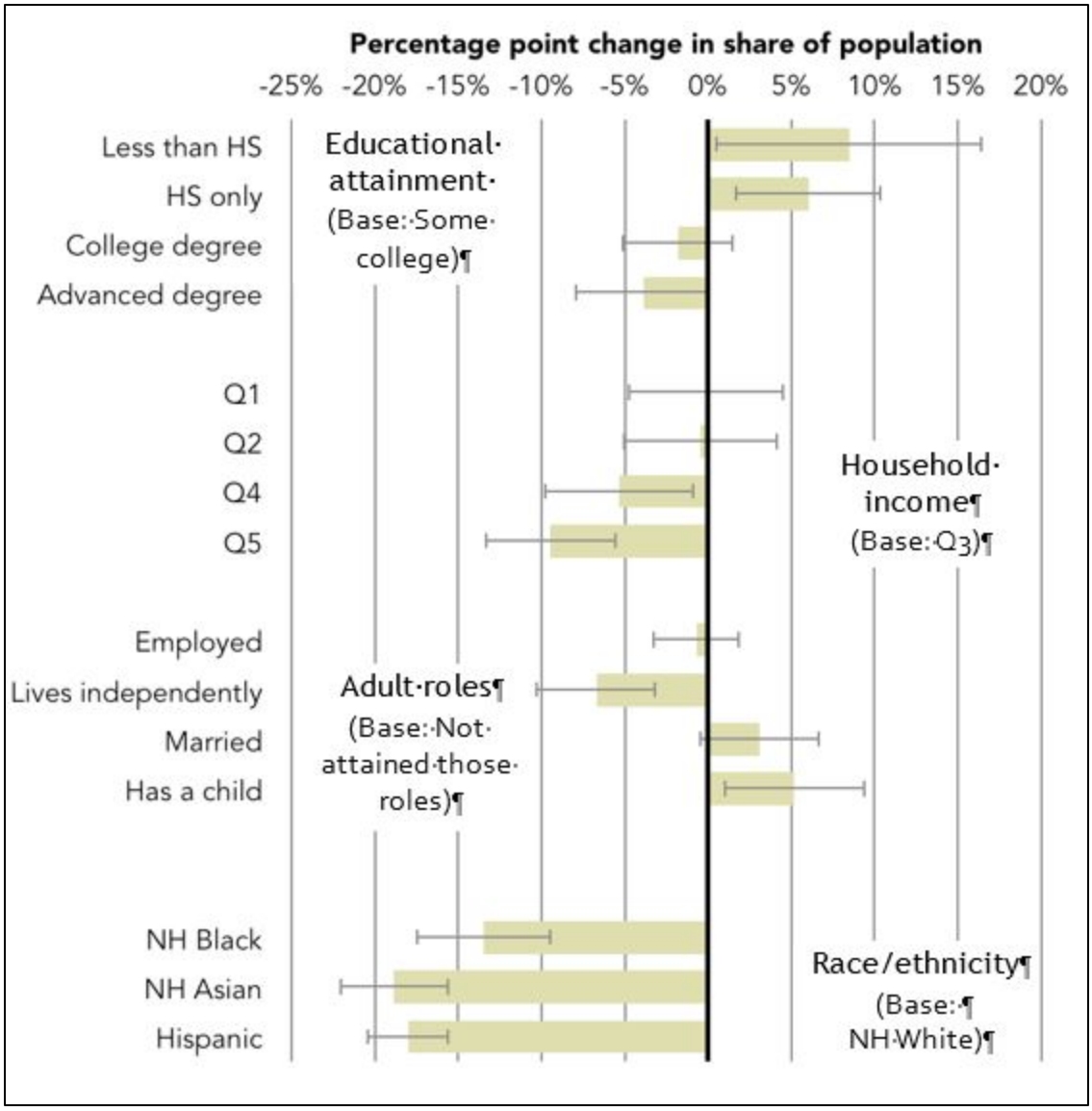
Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe. Youth, ages 20-34.

Synthesis of Results by Neighborhood Type

While the previous analysis grouped the results by explanatory variable, the following section presents the results for all of the explanatory variables in a single figure grouped by neighborhood type. This allows the reader to quickly compare the magnitude of the various results for any given type of neighborhood.

Rural

As Figure 35 indicates, youth were more likely to live in Rural neighborhoods if they had low levels of educational attainment, were married, had a child, or were white. By contrast, youth were less likely to reside in Rural neighborhoods if they had a college or advanced degree, had high household incomes, lived independently, or especially if they were a racial/ethnic minority.



Source: 2009 NHTS, weighted values.

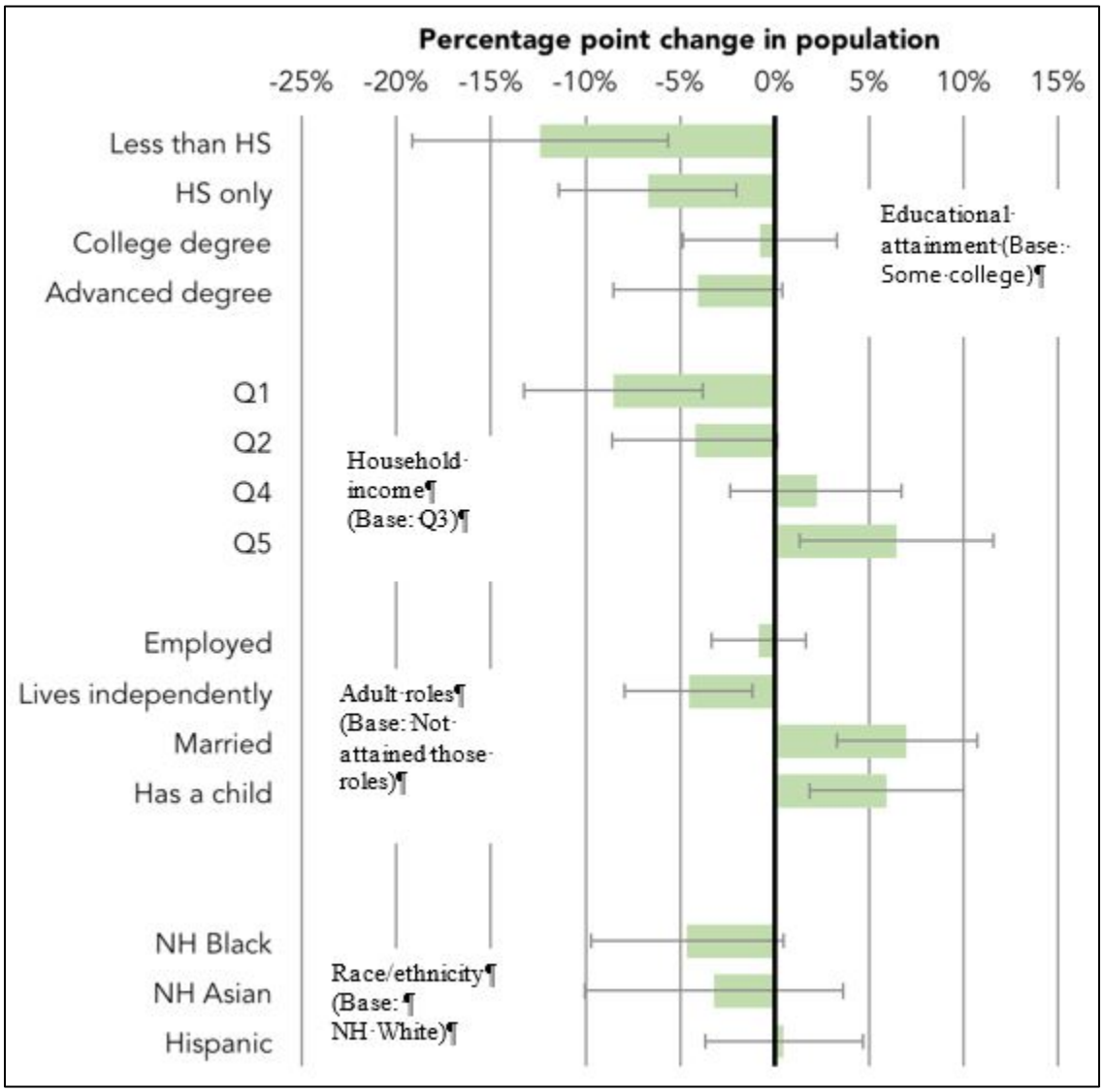
Figure 35. Chart. Rural neighborhood types, ages 20 to 34.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe.

New Development

Figure 36 depicts the factors that shape whether youth live in New Developments. Youth were most likely to live in New Developments if they had some college education or a Bachelor's degree. By contrast, youth with more limited education and those who earned an advanced degree were relatively less likely to live in New Developments. The relationship between household income and the propensity to live in a New Development proved linear; the likelihood of living in a New Development increased steadily with household income. Youth who were married or had a child were more likely than

otherwise similar youth to live in New Developments, while those living independently (but without a spouse or a child) were less likely to live in New Developments. Finally Black and Asian minorities were less likely than white and Hispanic youth to live in New Developments.



Source: 2009 NHTS, weighted values.

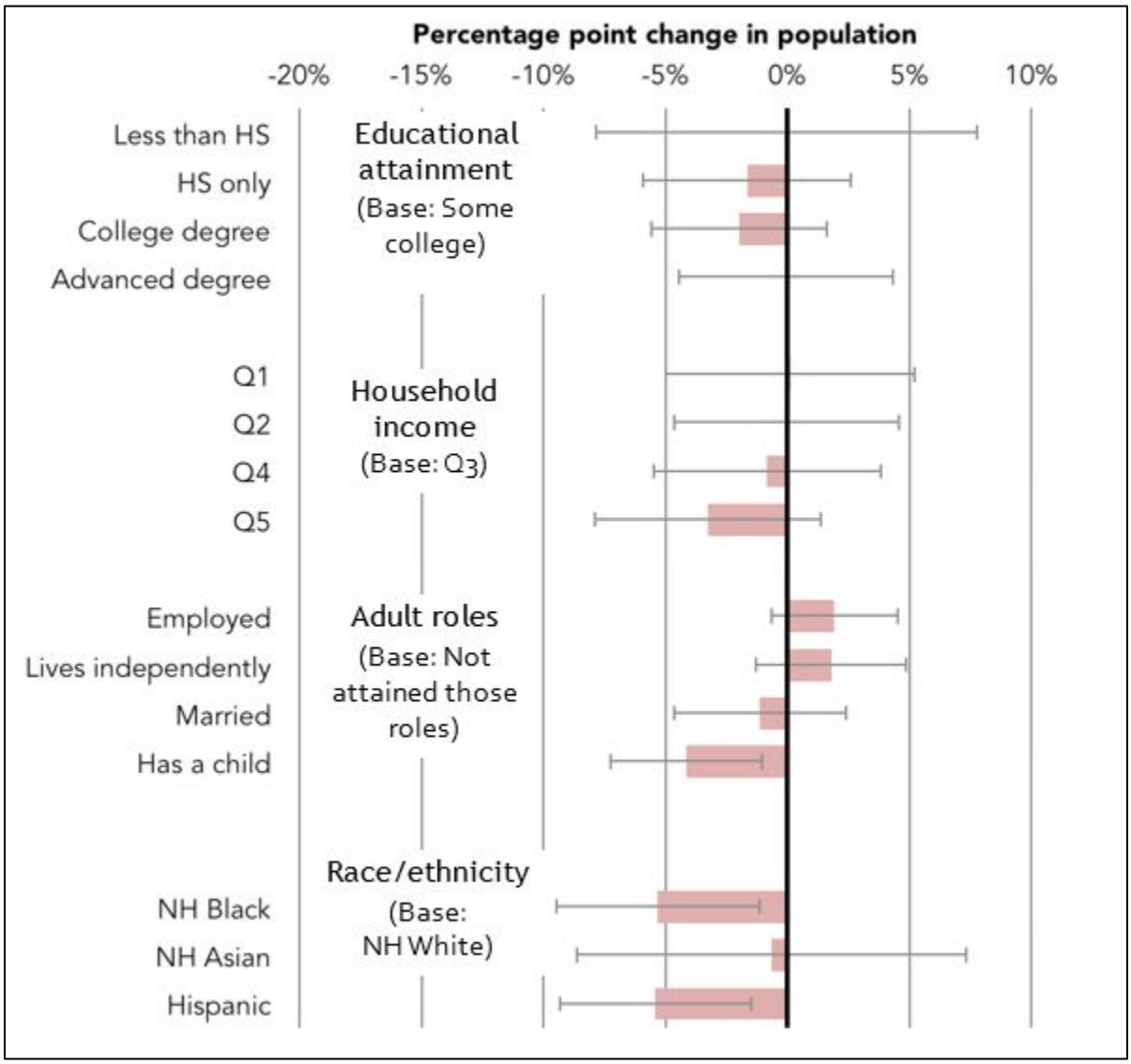
Figure 36. Chart. New Developments, ages 20 to 34.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe.

Patchwork

As Figure 37 demonstrates, the relationship between personal characteristics and residential location was less strong for Patchwork neighborhoods than for Rural or New Development neighborhoods. For

most variables, there was no meaningful relationship with neighborhood type when controlling for other factors. The sole exception was that Black and Hispanic youth were less likely than their otherwise similar white peers to live in Patchwork neighborhoods.



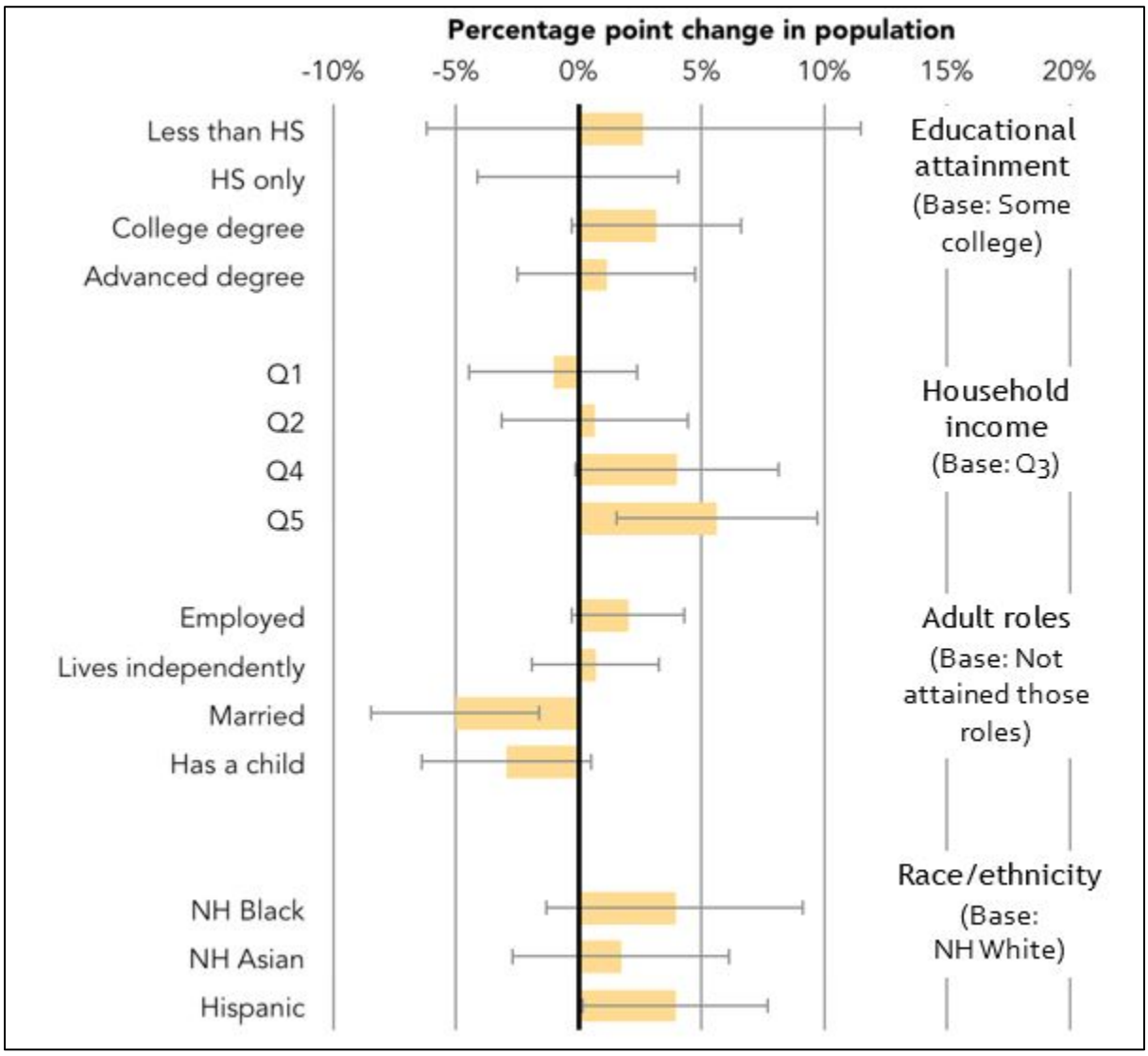
Source: 2009 NHTS, weighted values.

Figure 37. Chart. Patchwork neighborhoods, ages 20 to 34.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe.

Established Suburb

Everything else equal, youth were more likely to live in Established Suburbs if they were employed or had high household incomes (see Figure 38). Being married or having children decreased a young person's propensity to live in an Established Suburb. Finally, racial/ethnic minorities were slightly more likely than otherwise similar white youth to live in Established Suburban neighborhoods.



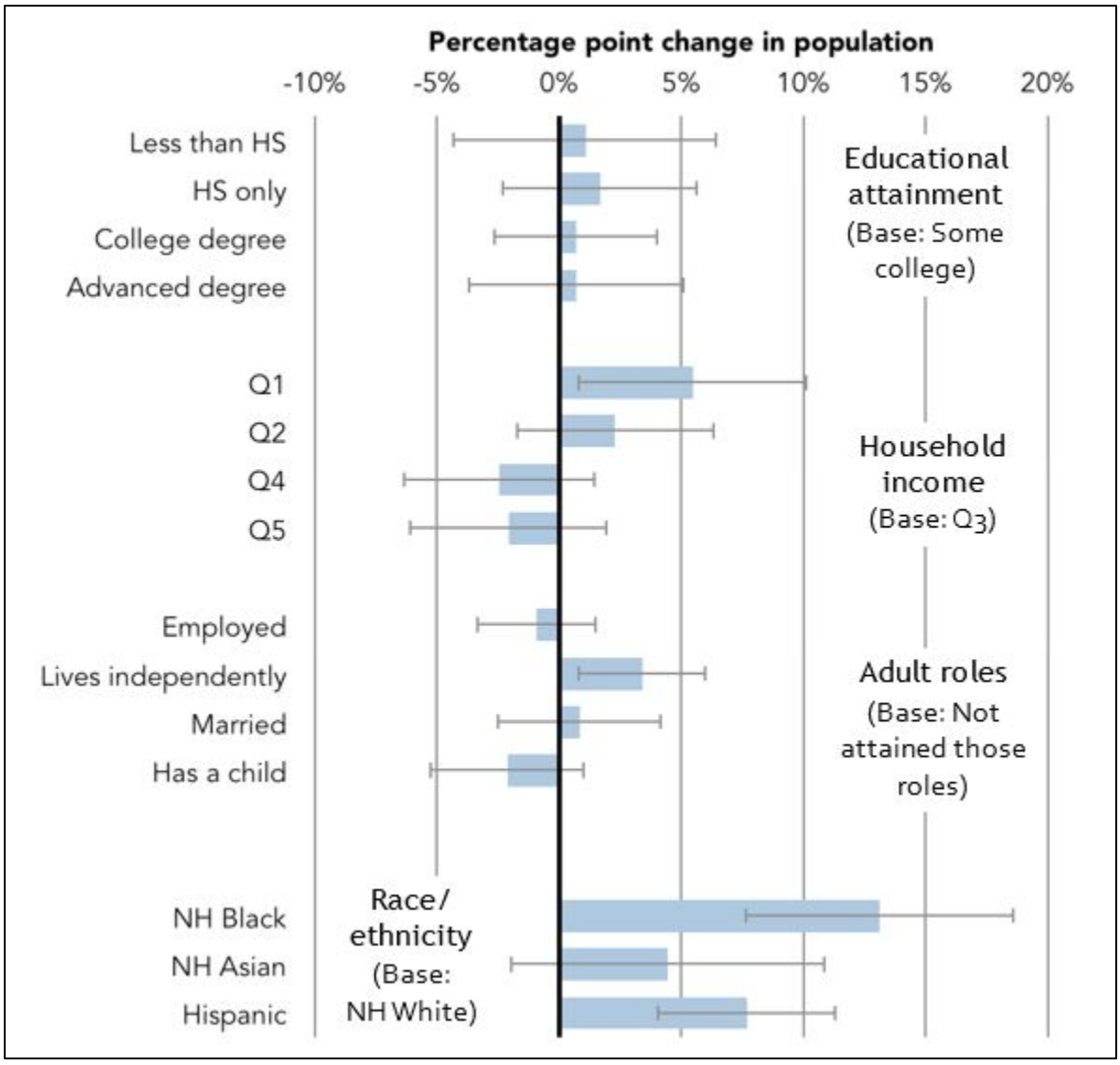
Source: 2009 NHTS, weighted values.

Figure 38. Chart. Established Suburbs, ages 20 to 34.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe.

Urban Residential

Controlling for other factors, youth were more likely to live in Urban Residential neighborhoods if they had low household incomes or were a racial/ethnic minority (see Figure 39). Youth were also more likely to live in this neighborhood type if they were living independently outside of the parental home.



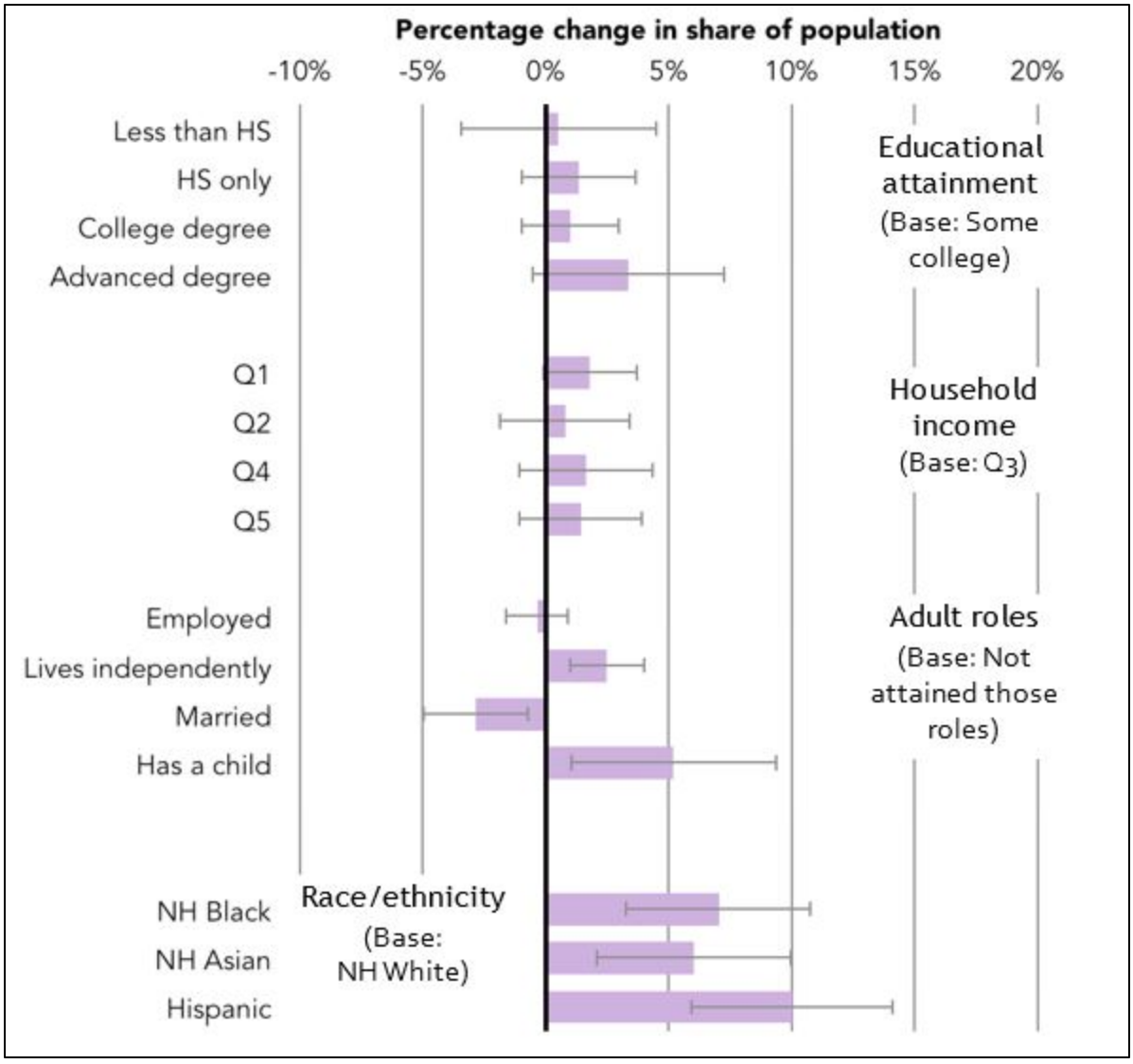
Source: 2009 NHTS, weighted values.

Figure 39. Chart. Urban Residential neighborhoods, ages 20 to 34.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe.

Old Urban

Neither education nor income is statistically significantly related to residing in Old urban neighborhoods, in contrast to adult roles and race/ethnicity, which are (see Figure 40). Youth living independently and living with a child were more likely to live in Old Urban neighborhoods, while married youth were less likely—suggesting that single parenthood may be more likely in Old Urban neighborhoods than elsewhere. Finally, racial/ethnic minorities—Black, Asian, and Hispanic—were overrepresented in Old Urban neighborhoods, even when controlling for other factors.



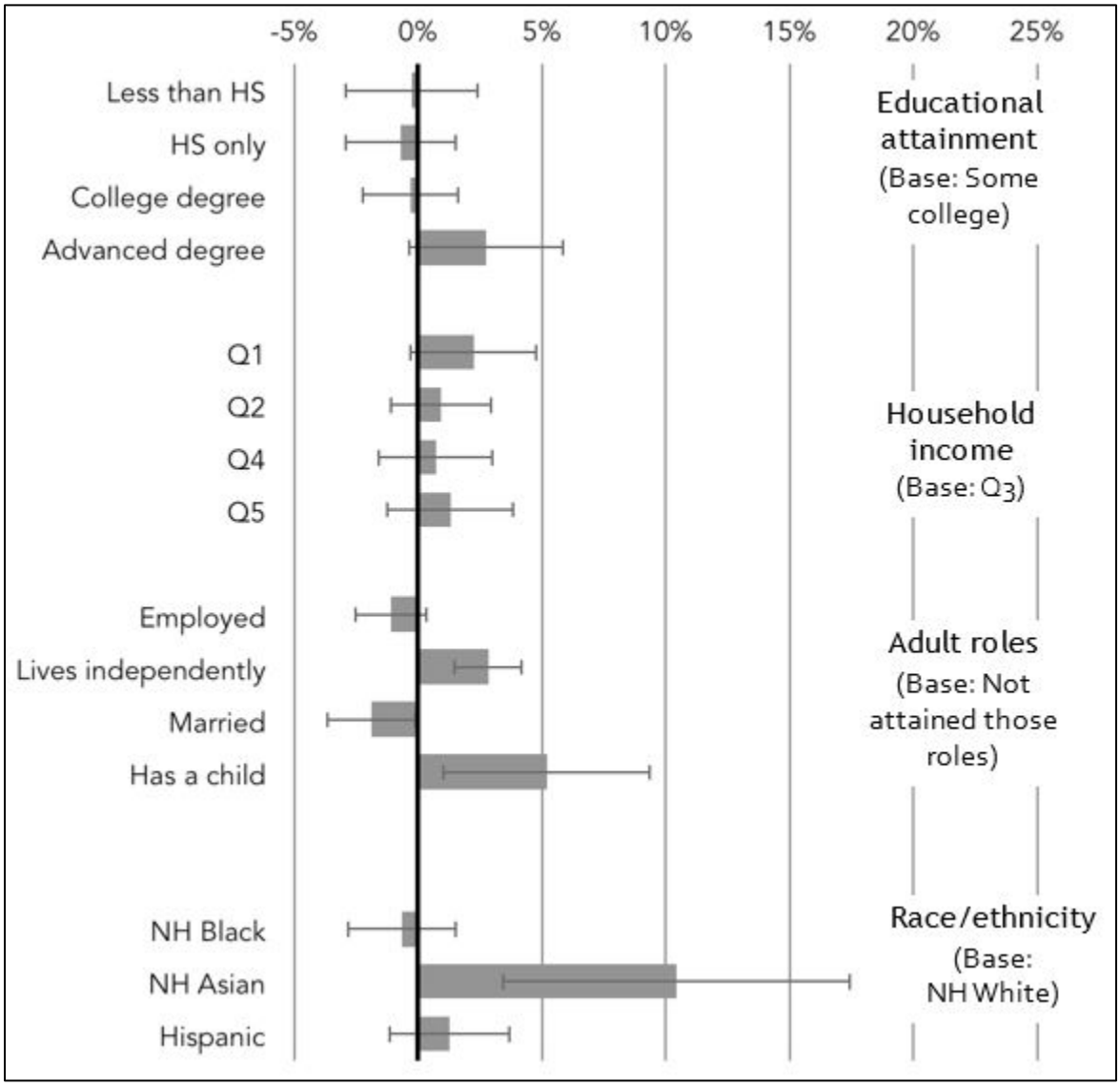
Source: 2009 NHTS, weighted values.

Figure 40. Chart. Old Urban neighborhoods, ages 20 to 34.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix # IVe.

Mixed-use

Similar to the patterns observed with Old Urban neighborhoods, education and income levels are not strongly associated with living in Mixed Use neighborhoods, while living independently and having a child increased the odds of Mixed-Use living, and being married reduced the odds (see Figure 41). Finally, and like Old Urban neighborhoods, Asian youth were more likely than otherwise similar white youth to live in Mixed-use neighborhoods, while unlike Old Urban Black and Hispanic youth were not.



Source: 2009 NHTS, weighted values.

Figure 41. Chart. Mixed-use neighborhoods, ages 20 to 34.

Note: Results of a multivariate regression analysis with neighborhood type as the dependent variable. Model controls statistically for other household characteristics. Full model results are available in Appendix IVe.

Sidebar: Do Youth Live Near Transit?

The Back to the City Movement is often paired with a corollary story about transportation: youth eschewing or wanting to eschew cars for a multi-modal lifestyle that relies on car-free and car-light travel (e.g. Ball (2014); Malcolm (2014)).[10] Surveys show that youth (adults under the age of 30) are the most enthusiastic about public transit (RSG, 2014) and are also the most likely to use transit despite having been raised in environments where automobile travel is the norm (RSG, 2014). Millennials see many benefits to using public transit including the ability to engage in digital socializing while traveling, connecting with their communities, and working (American Public Transportation Association, 2013). Finally, public transit and transit-oriented development, the story goes, are central to more urbanized lifestyles.

To explore this issue, we examine the relative access youth have to public transit service. This analysis uses the transit supply index described in Appendix IIIb to develop service quality rankings that are used to examine whether youth live near transit of varying levels of service.

This analysis provides a cross-sectional analysis of youth living near transit service. Transit supply, recorded at the census tract level, is a measure of transit frequency and is divided here into the top 50th, 75th, and 95th percentiles nation-wide. We then calculate transit access among youth (ages 20 to 34) and compare it to that of adults (ages 35 to 64).

Given this relative division of transit service levels based on transit frequency, we label the transit service as "Excellent" (95th percentile or higher), "Good" (75th to 94th percentile), "Moderate" (50th to 74th percentile), "Minimal" (1st to 49th percentile), and "No" service (0th percentile). Table 17 shows the average mean commute time (in minutes) and the transit mode share for the commute for each of these five transit service levels nationwide. Transit mode share is highest in neighborhoods with "excellent" transit service, reflecting transit investments in areas where residents are likely to use transit as well as the propensity for carless households to move into transit-rich neighborhoods where they can travel without relying on automobiles. In neighborhoods with "excellent transit service," about one-third of workers commute by public transit. However, transit use quickly declines across the other neighborhood types. For example, in neighborhoods that we characterize as having "good" transit service, only 11 percent of residents commute by transit.

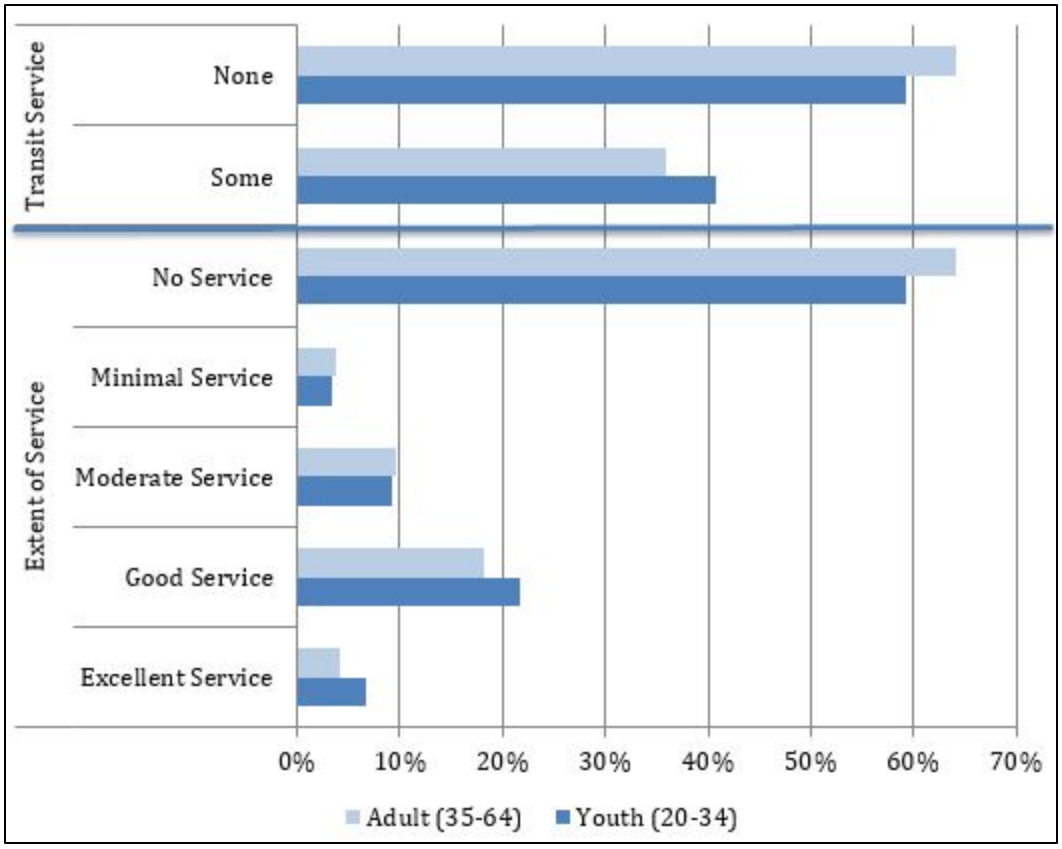
[10] Recent articles suggest that Millennial demand for automobiles has increased in the years following the recession (Thompson, 2015).

Table 17. Commute characteristics by transit service level.

Transit Service Level	Mean Commute Time (minutes)	Transit Mode Share
Excellent (95th percentile or higher)	31.0	33%
Good (75th-94th percentile)	26.7	11%
Moderate (50th-74th percentile)	25.6	4%
Minimal (1st-49th percentile)	26.5	3%
No Service (0th percentile)	23.9	2%
Overall	25.0	5%

Source: 5-year American Community Survey, 2009-2013.

So do youth tend to live near public transit? In comparison with adults, the answer is "yes." In absolute terms, the answer is "for the most part, no." Figure 42 displays the results of this analysis. In general youth enjoy greater residential access to public transit compared to adults. Nevertheless, only about 40 percent of youth have access to any transit at all and just seven percent have access to the best transit in the country. Excellent transit service is typically concentrated in the largest and most densely settled U.S. cities such as Boston, Honolulu, Los Angeles, San Francisco, and New York (see Appendix IIIb).



Source: U.S. Census Bureau (2010).

Figure 42. Chart. Relative transit access.

Note: The service categories correspond to the following percentiles and thresholds in the transit supply index: Excellent (95th percentile or higher), Good (75th-94th percentile), Moderate (50th-74th percentile), and Minimal (1-49thpercentile). Error bars are not included as reported changes are based on U.S. Census rather than sample data.

Are Youth Moving Back to the City?

The Back-to-the-City Movement has captured both popular and media attention; however, findings on youth migration are decidedly mixed. Frey (2014) finds that 19 of 51 major American metropolitan areas experienced more rapid population growth in the primary city compared to the suburbs. Similarly, Cortright (2015) finds that young adults are increasingly likely to move to dense central-city neighborhoods where origins and destinations are more proximate and travel by alternative modes (i.e. transit, bike, and walk) more common. Both of these studies support the notion of youth moving back to cities at faster rates than previously. In contrast, Cox (2011) finds that a smaller share of population growth occurred in cities in the 2000s compared to the 1990s. This finding is supported by Casselman (2015), who contends that while Millennials are moving to the suburbs at a lower rate than youth of previous generations, they still are attracted to the suburbs.

Despite an increased interest in youth's movement back to cities, little attention has been given to more fine-grained urban form and particular neighborhood types. Urban form is important to consider for travel behavior, and large number of studies have found that land use and urban form characteristics influence travel behavior (Committee for the Study on the Relationships Among Development Patterns, Vehicle Miles Traveled, and Energy Consumption, 2009; Ewing & Cervero, 2010), though often to a relatively modest degree. In this section, we take a closer look at small-scale urban form, and in particular, neighborhood type to ask if youth are moving back to the city more than adults and more than in the past?

Analytical Approach

This analysis relies on 1990, 2000, and 2010 U.S. Census data and 2001 to 2009 NHTS data to examine both the relative proportions of youth and absolute number of youth in each neighborhood type over time. We present results for both the nation, as well as the trends in the 25 largest MSAs (see Appendix IVa for a list of these).

Results

Nationwide population values from the U.S. Census

In absolute terms, there were four million more youth living in urban neighborhoods in 2010 than in 2000. At the same time, however, the number of suburban youth increased by 14 million, dwarfing growth in urban youth. Not only did the growth of suburban youth during the first decade of the 21st century substantially exceed that of urban youth, the increase in the newest and most sprawling of the suburban neighborhood types—New Developments—outpaced growth in all three urban

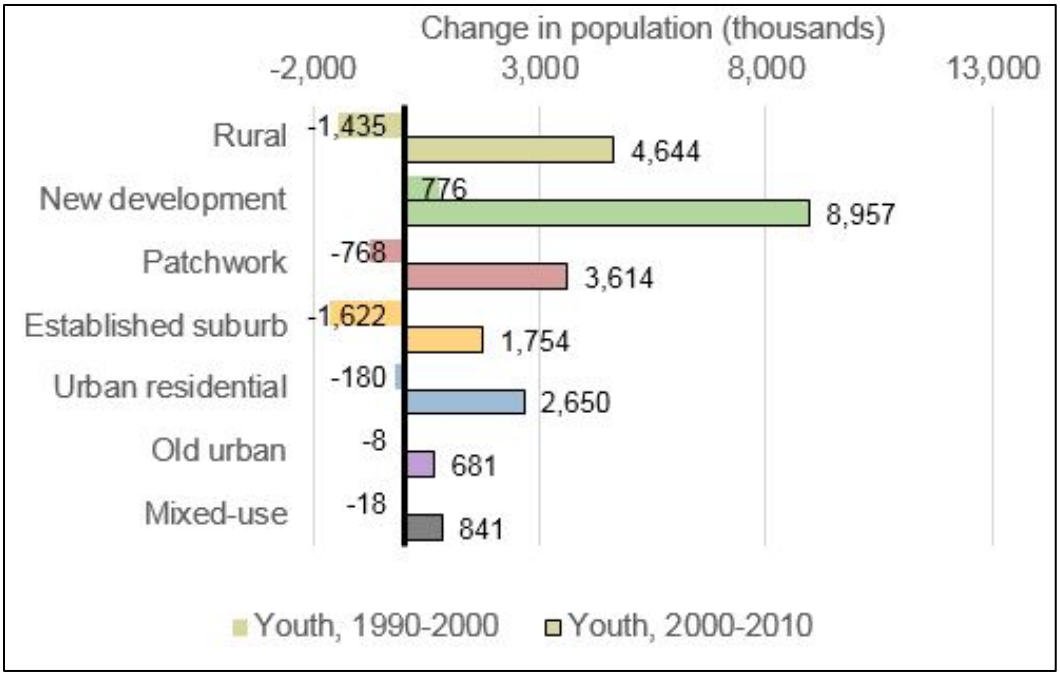
neighborhoods *combined*. We observed a similar pattern among adults with growth in urban areas outstripped by a bloom in suburban population.[11]

In stark contrast to the pattern of growth during the 2000s, the number of youth in six of the seven neighborhood types, as well as the total number and share of youth across the country, declined during the 1990s (see Table 18; Figure 43). The one exception? The number of those aged 20 to 34 living in New Developments increased between 1990 and 2000.

Table 18. Share and number of youth (ages 20-34) in the US, 1990-2010.

Population	1990	2000	2010
Youth (20-34)	62,196,244	58,855,725	62,649,947
	25.0%	20.9%	20.3%
Adults (35-64)	83,949,912	107,101,163	122,560,051
	33.8%	38.1%	39.7%
Total	248,709,872	281,421,906	308,745,538

Source: U.S. Census, 1990, 200, 2010.



Source: U.S. Census, 1990-2010.

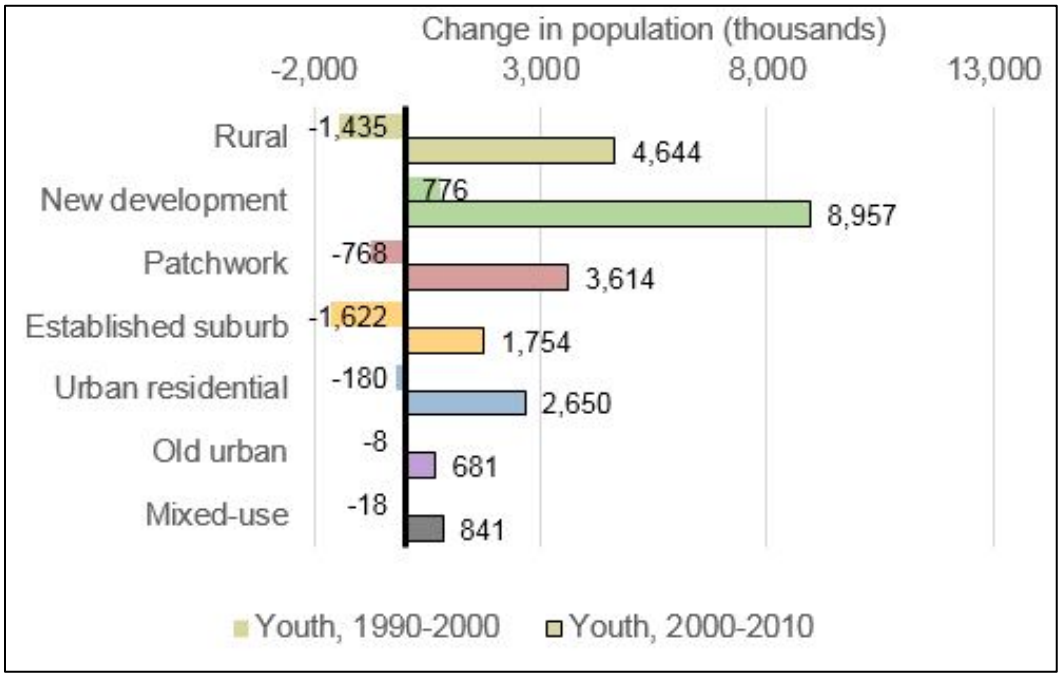
Figure 43. Chart. Change in youth population 1990 to 2000 and 2000 to 2010, entire U.S.

Note: Youth, ages 20-34. Error bars are not included as reported changes are based on U.S. Census rather than sample data.

[11] The adult suburban population grew by about 3.3 million from 1990 and 2000 and over triple that number (11.2 million) between 2000 and 2010. Comparatively, the number of adults in urban neighborhoods grew by only 810,000 and 2 million across the two respective decades.

Nationwide proportional values from the U.S. Census

The dramatic growth of New Developments reshaped the *distribution* of youth by neighborhood type (see Figure 44). The share of youth living in New Developments increased by five percentage points in 1990s and again in the 2000s. These increases were counterbalanced by decreases in the other six types of neighborhoods, particularly Established Suburbs. These patterns are remarkably similar for adults (ages 35 to 64, not pictured) and held when checked using NHTS data. The 2001 to 2009 NHTS reveal patterns similar to the U.S. Census, albeit on a slightly larger magnitude (see Appendix IVc for NHTS results).



Source: U.S. Census, 1990-2010.

Figure 44. Chart. Changing share of youth—U.S. neighborhoods, 1990-2010.

Note: Youth, ages 20-34. Error bars are not included as reported changes are based on U.S. Census rather than sample data.

Is the back to the city movement a big city phenomenon?

While the empirical evidence presented here for the nation as a whole point to an "Out-to-the-Newest-Suburbs" movement rather than a "Back-to-the-City" movement¸ there may well be a "Back-to-the-Big-City" movement occurring in parallel to the broader national trends outlined here. In other words, youth may be drawn to certain cities—Boston, Los Angeles, Miami, New York, San Francisco, Seattle, Washington, DC, etc.—and not to other, smaller, places—Fresno, Tulsa, Syracuse, Trenton, etc. To assess this possibility, we restricted our analysis to the 25 largest metropolitan areas ranging in population from about 2.3 million in San Antonio, to 20.1 million in New York (U.S. Census Bureau, 2008-2013). This analysis reveals that large cities are not unique in attracting youth to urban neighborhoods compared to the rest of the country. Indeed we see a similar pattern of neighborhood youth population

growth in the largest MSAs as we saw with the country as a whole: while the absolute number of youth grew in the three types of urban neighborhoods between 1990 and 2010 (an increase of nearly 400,000 youth), the growth in New Development neighborhoods alone (1.4 million) is more than triple the combined growth in urban neighborhoods. Similarly, while the proportion of youth living in urban neighborhoods inched up by 1.4 percentage points between 1990 and 2010, the proportion of youth in New Development neighborhoods alone grew by 5 percentage points.

Where are Youth Moving Back-to-the-City?

To understand how cities across the U.S. are changing, we took a closer look at how both the proportion and absolute population of youth changed between 1990 and 2010 within each type of neighborhood in the largest MSAs around the country. We identified three distinct patterns of change, outlined in Table 19. Some metropolitan areas did indeed experience a marked increase in urban youth. We call these cities "urban growth" cities. At the other end of the spectrum, many metropolitan areas experienced a rapid growth of youth in the suburbs; we refer to those areas as "suburban growth" cities. Finally, many metropolitan areas exhibited no distinct urban or suburban shifts in youth population, which we describe as "mixed urban and suburban shifts." We discuss these areas in turn below.

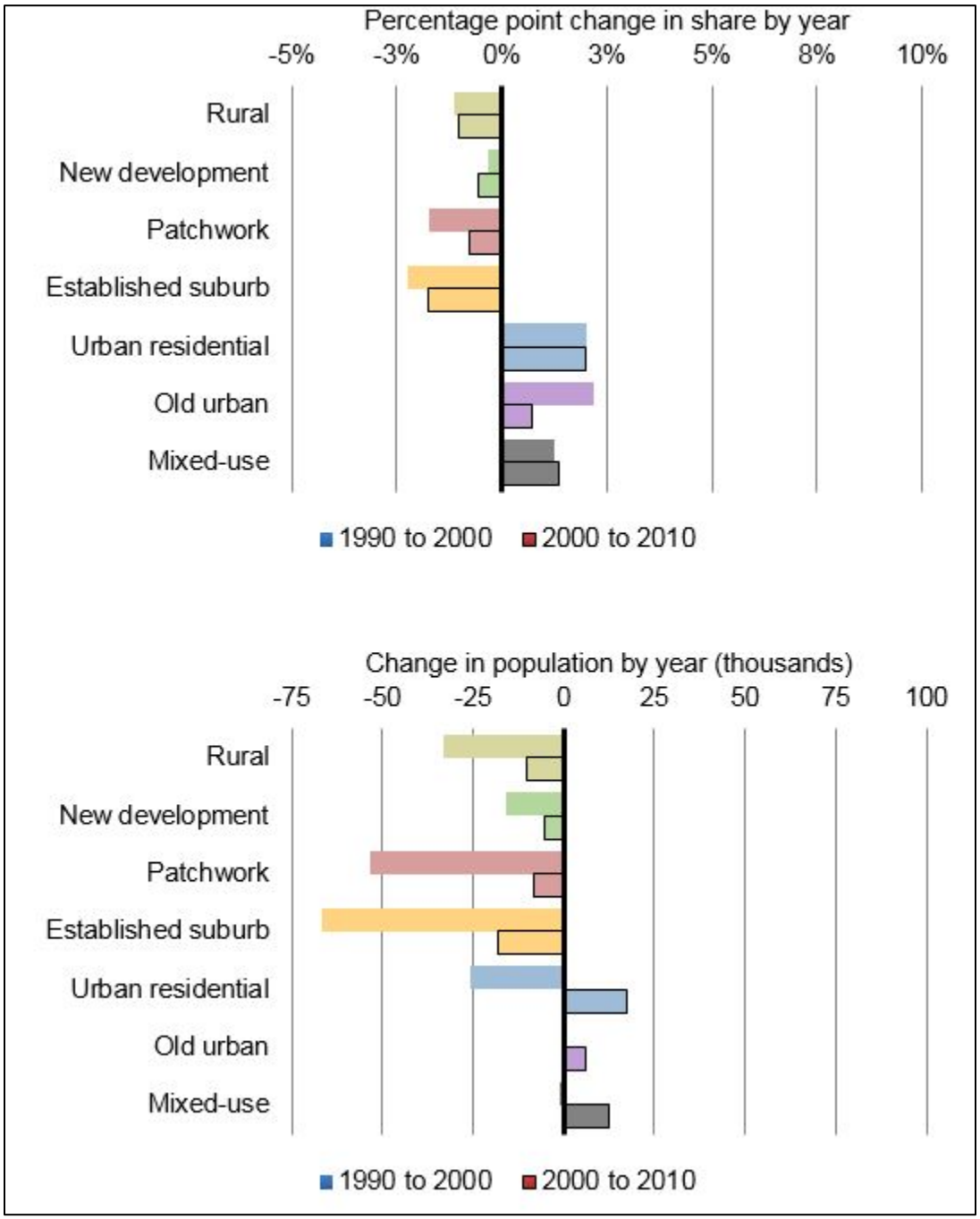
The figures below present both the percentage point change in the share of youth in each neighborhood type from 1990 to 2000 and again from 2000 to 2010, as well as absolute population changes over the same time periods. The cities we have identified below are not a complete list of those in each of our urban/suburban/mixed categories, but rather they typify the type of growth we discuss; population changes for each of the MSAs listed in Table 19 can be found in Appendix IVd.

Table 19. Classifying youth population changes in metropolitan areas.

Area	Definition	Examples
Urban growth	The share and population of youth in urban neighborhoods increased between 1990 and 2010	Boston, New York City, and Pittsburgh
Mixed Urban and Suburban shifts	Mixed population and population changes across neighborhoods that do not present a clear case for either urban or suburban growth.	Baltimore, Chicago, Denver, Detroit, Los Angeles, Miami, Minneapolis/St. Paul, Philadelphia, Portland, San Diego, San Francisco, Seattle, St. Louis, Washington, D.C.
Suburban growth	The share and population of youth in suburban neighborhoods increased between 1990 and 2010.	Atlanta, Charlotte, Dallas, Houston, Phoenix, Riverside, San Antonio, and Tampa

Urban Growth

We identified three metropolitan areas where the share of youth in urban neighborhoods increased between 1990 and 2010: Boston, New York City, and Pittsburgh. All three are older northeastern metropolitan areas with vibrant central cities. Figure 45 depicts the case of Boston—an area that experienced unambiguous growth in all three urban neighborhood types and a decline in its youth population in the rural and three types of suburban neighborhoods. Boston experienced a larger growth of youth in urban areas between 2000 and 2010 than in the 1990s. At the same time, Boston's adult suburban population increased by nearly three times as many people (85,000) compared to its urban population (38,000). In New York City, we also saw near ubiquitous growth in urban youth—both in absolute numbers and proportionally (see Appendix IVd). However, like Boston, the adult suburban population grew more (267,000) between 2000 and 2010 than did the urban population (241,000). The contrast between youth and adult population growth in these select urban areas suggests that, in the few instances where it is happening, the back-to-the-city movement is uniquely centered on the residential location decisions of youth.



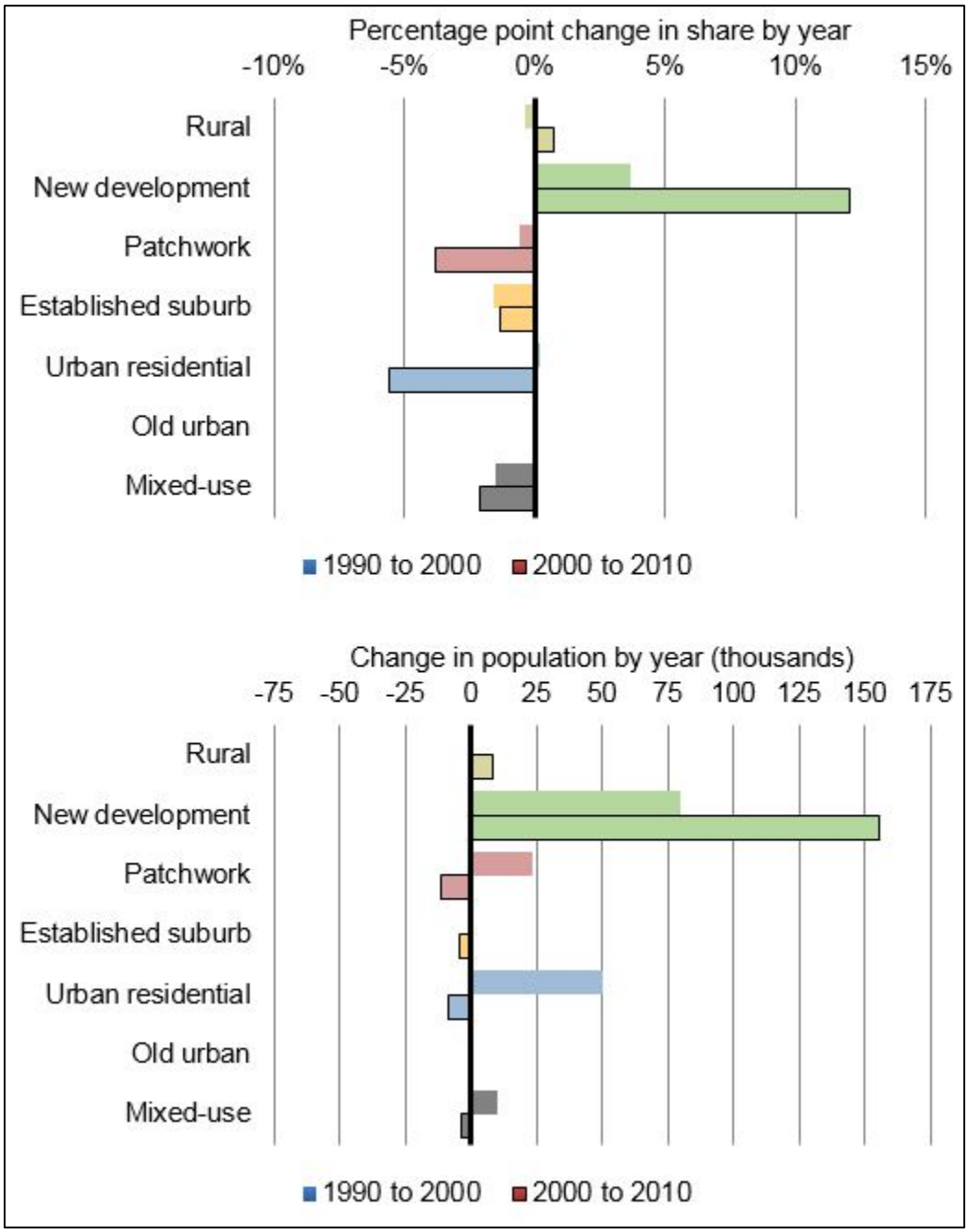
Source: U.S. Census, 1990-2010.

Figure 45. Chart. Youth (ages 20-34) population trends in Boston.

Note: Error bars are not included as reported changes are based on U.S. Census rather than sample data.

Suburban Growth

In stark contrast to the growth patterns in these three northeastern cities, many metropolitan areas—particularly those in the Sunbelt (in the South and West)—experienced dramatic suburban growth vis-à-vis their urban areas. Reflecting wider national trends revealed previously in this paper, the share of youth in New Development neighborhoods within these suburban growth cities exploded between 1990 and 2010. New Development neighborhoods, as their name suggests, are typically newly built suburban fringe developments that mostly did not exist prior to the two-decade period examined here. The absolute increase in housing availability in these generally new neighborhoods surely explains part of the dramatic influx of youth into them. In Phoenix, a prototypical suburban growth city, the share of youth in New Development neighborhoods increased by 12 percentage points (156,000 people) between 2000 and 2010 alone (see Figure 46). Houston experienced the largest absolute rise in youth population in New Development neighborhoods, with 178,000 more youth living in New Developments in 2010 than in 2000 (see Appendix IVd). Importantly, in some suburban growth cities, including Phoenix and Dallas, the number of youth in urban neighborhoods increased; however, these increases were offset by the growth in the number of New Development suburban neighborhoods and thus the proportion of youth in urban neighborhoods declined across nearly every suburban growth city.



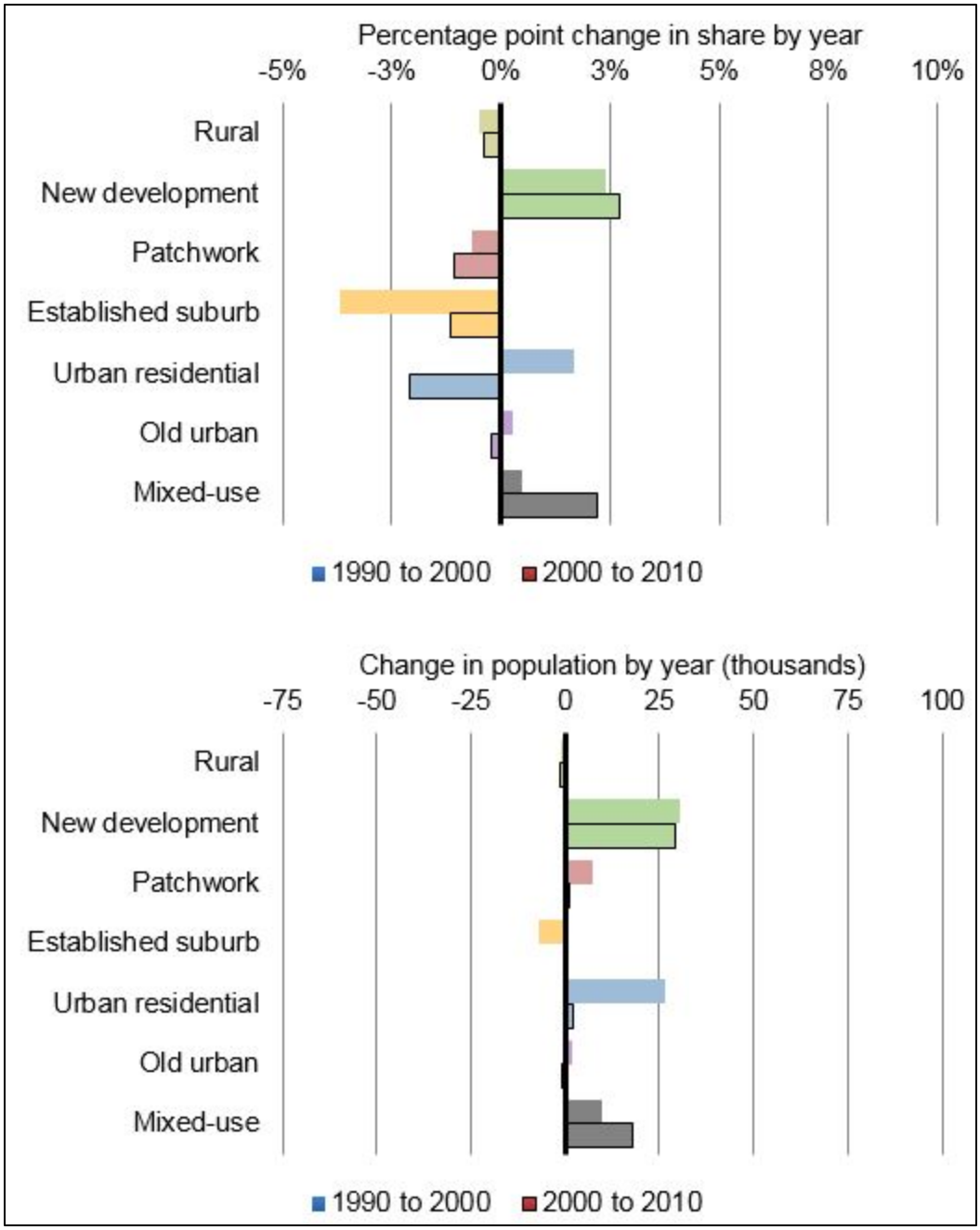
Source: U.S. Census, 1990-2010.

Figure 46. Chart. Youth (ages 20-34) population trends in Phoenix.

Note: Error bars are not included as reported changes are based on U.S. Census rather than sample data.

Mixed Urban and Suburban Shifts

In contrast to places like Boston, with unambiguous youth urban population growth, and Phoenix, with equally unambiguous suburban population growth, most MSAs have less clear-cut patterns of youth residential location. Cities in this middle category span nearly every regions of the country—including the east (Washington, DC), Midwest (Chicago and Minneapolis/St. Paul), and West (Los Angeles, San Francisco, and Seattle). In many of these metropolitan areas, while increasing shares of youth are living in urban neighborhoods—most often in Mixed-Use neighborhoods—a corresponding and typically larger increase in share of youth in seen in suburban—usually New Development—neighborhoods. For example, while the population of youth in Denver increased substantially (about 57,000 people or 3 percentage points) between 1990 and 2010, growth in New Developments greatly surpassed the urban increase (60,000 people and or 5 percentage points) (see Figure 47). Therefore, while more youth are living in urban neighborhoods than in previous years, even more are now living in suburban, and in particular, New Development, neighborhoods.



Source: U.S. Census, 1990-2010.

Figure 47. Chart. Youth (ages 20-34) population trends in Denver.

Note: Error bars are not included as reported changes are based on U.S. Census rather than sample data.

Conclusion

Characterizing all neighborhoods in the U.S. as rural, one of three types of suburban, or one of three types of urban neighborhoods allows us to examine the residential location of young adults with far more precision than most previous studies that rely on much cruder central city vs. suburban vs. non-metropolitan area distinctions. We can, for example, differentiate those living in dense, transit-oriented (Old Urban) neighborhoods, from less dense and transit focused (Urban Residential) neighborhoods, or those living in older, inner-ring (Established Suburban) areas from those living in the newest and most often far-flung (New Development) suburbs. This neighborhood typology has allowed us to investigate reports of a "Back-to-the-City" movement among America's youth, in which large numbers of young adults are rejecting suburban, car-centered lifestyles in favor of more urban, multi-modal lifestyles. While we examine the links between youth, residential location, and travel in a later chapter, our focus here is on the residential location of youth vis-à-vis older adults.

The analysis presented in this chapter shows that a higher proportion of youth than adults does indeed live in urban neighborhoods today. We also show that socioeconomic and life stage factors affect youth's propensity to live in particular neighborhood types; living independently from one's parents and having a low-income both increased propensity of young adults to live in urban neighborhoods. Other factors, such as being married, decreased likelihood of youth living in urban neighborhoods. While a higher share of youth are living in cities compared to adults, the story of youth moving *en masse* to urban neighborhoods is not supported by our data. The number of youth in urban neighborhoods increased in many cities between 1990 and 2010; but this growth, along with the increased share of youth living in urban neighborhoods, was surpassed in most cities by growth in suburban—and in particular, New Development—neighborhoods.

So while we do see some evidence of a "Back-to-the-City" trend among young adults in our data, the trends are relatively modest and are most evident in just a few cities like Boston, New York, and Pittsburgh. Nationwide, evidence for a "Back-to-the-City" movement is overwhelmed by what can only be described as a much larger "Out-to-the-Newest-Suburbs" movement, whereby the absolute and relative increases in the numbers of young adults living in suburbs generally, and New Development suburbs in particular, are the dominant youth residential location trend in the U.S. between 1990 and 2000.

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V. IDENTIFYING THE TRAVELER TYPES

Introduction

In Chapter 6 we explore the relationship between neighborhood type and travel, analyzing personal and vehicle miles of travel, number of trips, access to automobiles, licensing, and travel mode in turn. Each of these measures is an important indicator of specific aspects of travel. Yet no single variable can capture the rich variety of travel patterns. Person miles of travel is an important measure of mobility, but one that takes on very different meaning between a young person living and working in Manhattan in the northeast versus the Navajo Nation in the southwest. Likewise, heavy reliance on public transit by a young adult who also has a license and car available for her use connotes something very different than the same level of transit reliance by someone with no option to drive. There are, in other words, different types of travelers, even if they exhibit similar travel patterns along a single dimension of transportation.

Thus, the aim of this chapter is to capture some of the multiple facets of travel in a single metric. To do this, we employ a statistical technique known as latent class analysis to identify four distinct traveler types—Drivers, Long-distance Trekkers, Multimodals, and the Car-less. The chapter opens by describing various methods for identifying groups in data before then introducing the survey data used here and the specific variables used to identify the traveler types. We then describe the characteristics and prevalence of each traveler type.

The traveler types are then used in the next chapter, Chapter VI, to explore the link between neighborhood types and travel using both descriptive statistics and multinomial logistic regression models.

Part 1: Identifying Traveler Types

Identifying Groups in Data

This research primarily aims to identify distinct traveler types in which individuals in each type share similar travel characteristics. There are many ways to identify groups in data; therefore, a critical early step in the project was to select an appropriate grouping method.

The most straightforward approach to group data is to manually categorize groups, using an established rule of thumb or by identifying cut-off points in the data (e.g. income quintiles). For example, Buehler and Hamre (2014), classified individuals as multimodal if they walked, biked, or used public transit at any point in the previous week.[12]

A variety of more sophisticated statistical techniques are also available to identify groups in data. For many years, cluster analysis (either hierarchical or k-means) was the standard statistical tool for

12 The authors tested a variety of cut-off points for multimodality; the description in the text is illustrative.

identifying groups using data (Eshghi, Haughton, Legrand, Skaletsky, & Woolford, 2011). Cluster analysis identifies groups based on the distance between cases and among possible groupings, resulting in relatively homogenous and mutually exclusive categories (Schreiber & Pekarik, 2014).

Cluster analysis has a number of shortcomings. Most troublingly, there are few statistical guidelines for determining the appropriate number of clusters (Eshghi et al., 2011). Clusters are sensitive to outliers and the same clustering structure cannot be applied to other data (Schreiber & Pekarik, 2014). Finally, cluster analysis requires interval level data (k-means clustering) or dichotomous data (hierarchical clustering), and cannot incorporate count or categorical variables. These shortcomings pose a problem for identifying traveler types because many of the potential indicator variables are count or categorical (e.g. number of trips on the survey day or frequency of using transit: never/sometimes/once a week or more).

To address the shortcomings of cluster analysis, scholars developed a new approach for identifying groups known as latent class (LC) models. LC models are known by various names in different fields: finite mixture models, Bayesian classification, latent class cluster analysis, latent profile analysis, and others (Lanza, Collins, Lemmon, & Schafer, 2007; Magidson & Vermunt, 2002; Schreiber & Pekarik, 2014). Like cluster analysis, LC models identify homogenous groups in data, but the approach to identifying those groups is different. As Eshghi et al. (2011) explain, "[LC models are] a method for analyzing the relationships among manifest data when some variables are unobserved. The unobserved variables are categorical, allowing the original data set to be segmented into a number of exclusive and exhaustive subsets: the latent classes" (p. 274).

There are three key advantages of latent class models over traditional clustering models. First, selecting a model is less subjective than for cluster analysis because the modeler can compare the statistical fit of LC models (Schreiber & Pekarik, 2014). Second, rather than assign each case to a group, the LC output produces membership probabilities (Schreiber & Pekarik, 2014), which is useful for identifying cases that fit the group structure poorly. Third, relative to traditional clustering, LC models can work with a wider variety of data types and impose fewer restrictions on the scale and variance of the indicator variables (Magidson & Vermunt, 2002). Given these distinct advantages, particularly given the data used in this study, a LC model was used to identify the traveler types.

Data

The data used to identify the traveler types were obtained from the 2009 United States National Household Travel Survey (NHTS). These data are described in detail in Chapter II and Appendix IIa.

The national sample size varies, with larger samples in more recent years. In each period, the NHTS included thousands of young people in our age range of interest (16 to 36)[13] (see Table 20). Moving from

13 The age range analyzed here differs slightly than other chapters. This in part reflects greater flexibility in using the NHTS data over the Census data, which reports age in ranges (e.g. ages 20 to 25). The

left to right, Table 20 depicts how the sample size shrinks as respondents are excluded for various reasons. Some were excluded because information was missing about one or more travel variables (particularly annual miles driven) or personal information (such as household income or race). Others were excluded if they traveled over 400 miles or flew in an airplane on the survey day.[14]

Table 20. Sample size, 2009 NHTS.

Age 16-36	with complete travel info	and complete personal info	and traveled <400 miles	and did not fly
43,541	32,076	30,615	30,427	28,980

Source: 2009 NHTS.

Identifying the Classes

Selecting indicator variables

We wanted the traveler types to encompass the multifaceted nature of travel behavior. We therefore selected seven travel variables that together provided information about:

- short, medium, and long-term travel behavior;
- the extent of automobility;
- the use of alternative modes (during the survey day and over a longer duration);
- mobility (miles of travel); and
- access to opportunities.

Table 21 provides information on average values for each travel variable for young adults (16 to 36) in the United States in 2009. On the survey day, the average young adult in 2009 made just over four trips and traveled 35 miles, primarily in an automobile. The vast majority of young adults was licensed to drive, had access to a private vehicle in the home, and drove about ten thousand miles annually. What is more, nearly eight in ten young adults did not use public transit at any time in the previous month. As we shall see, however, these average values mask substantial variation. For more information about the measurement of each indicator variable, see Appendix Va.

extended age range also allowed us to examine how traveler type varies over the life course (see Figure 57).

14 The focus of this analysis is on typical travel behavior and we explored numerous cutoff points for exclusion. Removing respondents who flew removes an additional 130 cases (51 in 2009).

Table 21. Travel variables average.

Travel Variable	Point estimate	Range (95% confidence interval)
Travel on the survey day		
Number of trips (Mean)	4.2	[4.1 to 4.3]
Miles of travel by any mode (Mean)	35.3	[34.0 to 36.6]
Share of miles by a non-automobile mode (%)	15%	[14 to 16]
Medium and long-term travel		
Annual miles driven (Mean)	10,400	[10,000 to 10,9000]
Transit use in the past month (%)		
Never	79%	[77 to 80]
Sometimes	12%	[11 to 13]
Once a week or more	9%	[8 to 10]
Licensed driver (%)	83%	[82 to 85]
Automobiles per adult in the household (%)		
None	5%	[4 to 6]
Less than one	26%	[24 to 27]
One or more	70%	[68 to 71]

Source: 2009 NHTS, weighted values.
Note: Percentages are rounded to the nearest whole number and annual miles driven figures are rounded to the nearest hundred.

How many traveler types?

We used the statistical package Mplus (version 7.2) to identify the traveler types. Mplus does not automatically determine the optimal number of classes or types, so the researcher must repeat the analysis iteratively, first with a two-class solution and then again with an additional class each time. The researcher then uses a number of guidelines to select the optimal model (Lanza et al., 2007). Table 22 lists the statistical criteria used to guide model selection. Columns 1 and 2 list the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). Lower AIC and BIC values are preferred and, by this measure, a five-class model is best.

The entropy score is listed in column 3. Rather than assign each case to a particular class, LC models calculate the probability of being a member of each class, with values ranging from 0 to 100. Ideally, each case aligns closely with one class—with predicted probabilities close to 100 for that class and close to zero for the other class(es). The entropy score combines the predicted probability data into a single measure, where a higher value is preferred. Based on the entropy score alone, a model with three classes is preferred, although all of the models have a satisfactorily high entropy value.

Table 22. Latent class model selection.

Number of classes	(1) AIC	(2) BIC	(3) Entropy
2	2,543,404	2,543,662	0.978
3	2,459,350	2,459,719	0.985
4	2,387,887	2,388,367	0.982
5	2,373,012	2,373,602	0.970

In addition to statistical criteria, researchers must make subjective decisions based on model interpretability. Lanza et al. (2007) explain that the classes should be relatively homogenous and that it should be, "possible to assign a meaningful label to each [one]" (p. 5). Figure 48 illustrates the breakdown of classes as the number of classes increases from two to five. Each traveler type was interpretable and has been assigned a corresponding label. (For more details about travel behavior in each class, see Table 9 in Appendix Va.)

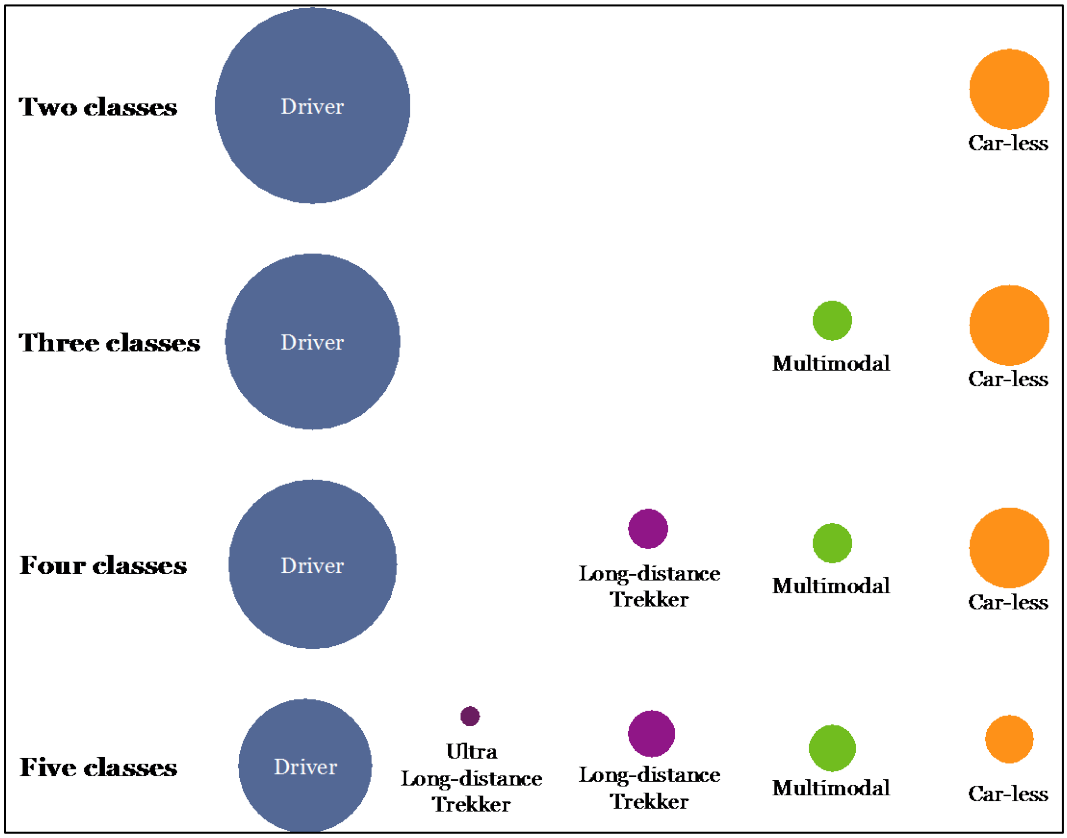


Figure 48. Graphic. How many classes?

Lanza's (2007) final requirement is that, "no class should be trivial in size" (p. 5). While increasing the number of classes makes each group more homogenous, too many classes can be cumbersome to interpret and, most importantly, small sample sizes within one or more classes can limit the statistical power of subsequent analysis. The Ultra-Long-distance Trekkers in the five-class solution represent just

one percent of all young adults. Including such a small class would constrain subsequent statistical analysis. For that reason, a four-class solution was selected for further analysis.

Emphasizing long-term travel

The results above reflect the second latent class model developed for the project. Initially, each indicator variable was given equal weight and a five-class solution minimized the AIC and BIC. The five classes were named to reflect the dominant travel characteristic of each type: Drivers, Long-distance Trekkers, Multimodals, Urbanistas, and Car-less. This five-class solution was problematic, however, because it tended to overemphasize the vagaries of travel on the survey day and underemphasize travel patterns over longer periods. For instance, the Long-distance Trekkers had very high mobility on the survey day (150 miles), but traveled only ten percent more miles than Drivers over the course of the year. Similarly, young people were categorized as Multimodals if they used transit on the survey day, even if they never used transit over the past month and drove several thousand miles annually. In both cases, young adults were being categorized by their atypical behavior on the survey day rather than by their long-term travel patterns.

To rectify this problem we double-weighted two long-term travel variables (annual miles driven and frequency of public transit use) vis-à-vis the survey day variables on the logic that these longer term indicators of travel better reflect the typical patterns of travelers. The resulting four-class solution was similar in many respects to the first solution—it still contained the Driver, Long-distance Trekker, Multimodal, and Car-less types. With more emphasis on long-term behavior, young adults were no longer categorized by their atypical behavior on the survey day. For example, in the new solution Long-Distance Trekkers not only drove more than Drivers on the survey day, they also drove more than five times as many miles annually. Similarly, respondents who used transit on the survey day, but who normally did not use transit at all and drove thousands of miles over the year were categorized as a Driver.

Part 2: Describing the Traveler Types

Having classified young adult travelers in the U.S. into one of four mutually exclusive traveler types—Drivers, Long-distance Trekkers, Multimodals, and Car-less—we describe here the distinct travel patterns of each type. In a nutshell, Drivers, the most common traveler type, made nearly all of their trips by automobile. Trekkers are similar to Drivers in many respects, but traveled many more miles each day on average to complete the same number of trips. Multimodals make half of their trips by walking, biking, or riding transit, but were able to engage in more activities outside the home than Drivers because they made more trips on average. Finally, Car-less young adults traveled exclusively by non-automobile modes and had very limited mobility and trip-making overall.

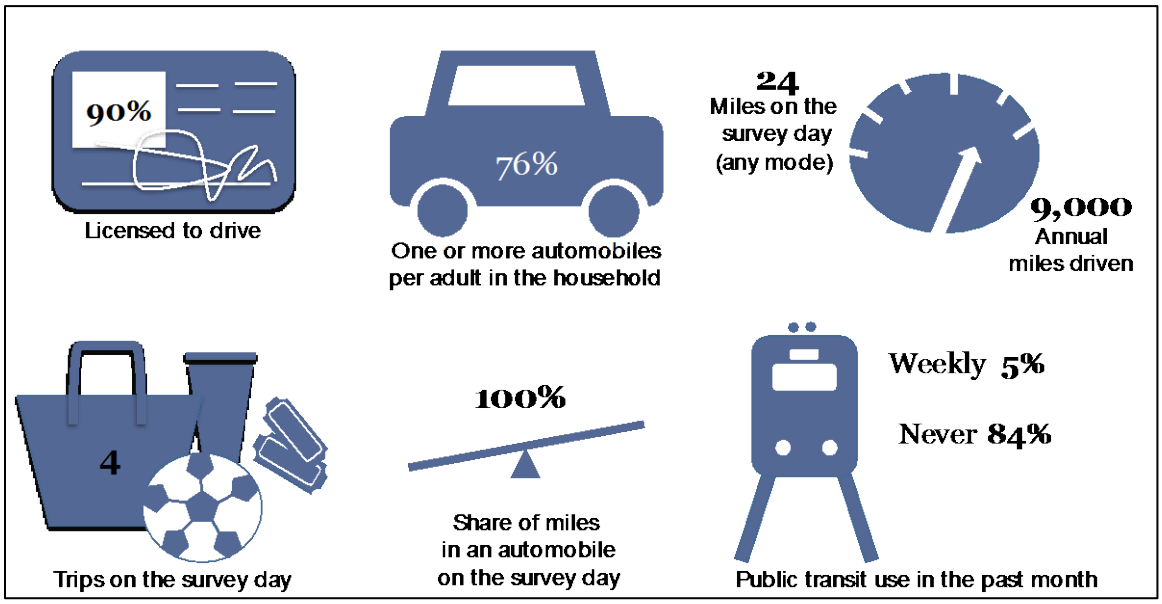
The following section characterizes the members of each traveler type in terms of their travel behavior, with special emphasis on the seven indicator variables that were used to identify the traveler types. In

addition to the summary overview presented here, more information about each of the traveler types can be found in Table 9 in Appendix Va.

The Four Traveler Types

Drivers

Figure 49 characterizes the travel behavior of a typical Driver in 2009. Automobiles featured very prominently in the lives of Drivers. For example, the typical Driver traveled exclusively by automobile on the survey day. Fully nine in ten Drivers were licensed to drive and those who were not still made all of their trips in an automobile as passengers. Drivers had ready access to automobiles; three quarters of them had at least one motor vehicle per adult in their household. Access to automobiles enabled extensive mobility—the typical Driver traveled 24 miles and made four trips on the survey day. Drivers rarely traveled by other modes; the vast majority of Drivers report that they never used public transportation in the past month and the typical Driver made just two walk trips over the past week.



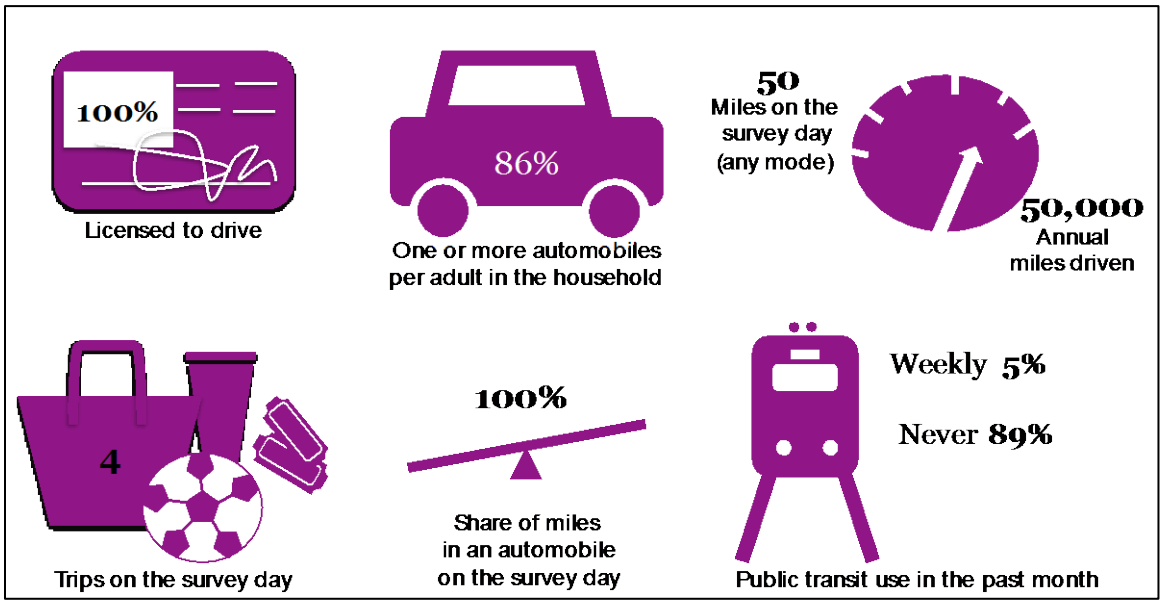
Source: 2009 NHTS, weighted values.

Figure 49. Graphic. Travel patterns of drivers in 2009 (ages 16 to 36).

Note: Estimates are based on the NHTS survey weights and are therefore nationally representative. Miles of travel and trip making are reported as median values. All other values are percentages and reflect the share of all young adults ages 16 to 36.

Long-distance Trekkers

The Trekkers get their name from their extensive travel over the survey day and over the course of the year (see Figure 50). The typical Trekker traveled 50 miles—twice as many as Drivers—but averaged the same number of trips per day (4 trips) as Drivers. In other words, Trekkers had higher mobility than Drivers because their average trip length was high, not because they made more trips and engaged in more activities outside the home. The typical (i.e. median) Trekker not only traveled a great distance on the survey day, he or she also drove vast distances over the course of a year—50,000 miles. Long-distance Trekkers were similar to the Drivers in the sense that virtually all of their travel was by automobile, all of them were licensed to drive, and automobiles were widely accessible in their homes. Finally, nearly nine in ten Trekkers never used public transit in the past month.



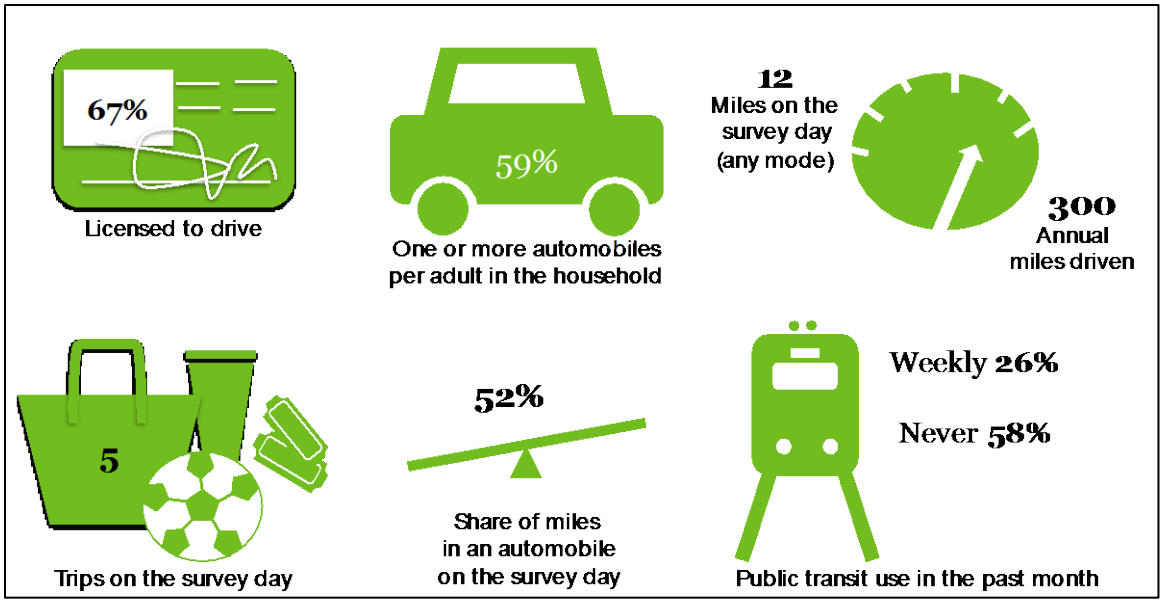
Source: 2009 NHTS, weighted values.

Figure 50. Graphic. Travel patterns of long-distance trekkers (ages 16 to 36).

Note: Estimates are based on the NHTS survey weights and are therefore nationally representative. Miles of travel and trip making are reported as median values. All other values are percentages and reflect the share of all young adults ages 16 to 36.

Multimodals

The Multimodals differed from the Drivers and Trekkers in that they used a mix of modes on the survey day (see Figure 51), and nearly half of their miles traveled (and 64% of their trips) were by walking, biking, or using public transit.



Source: 2009 NHTS, weighted values.

Figure 51. Graphic. Travel patterns of multimodals (ages 16 to 36).

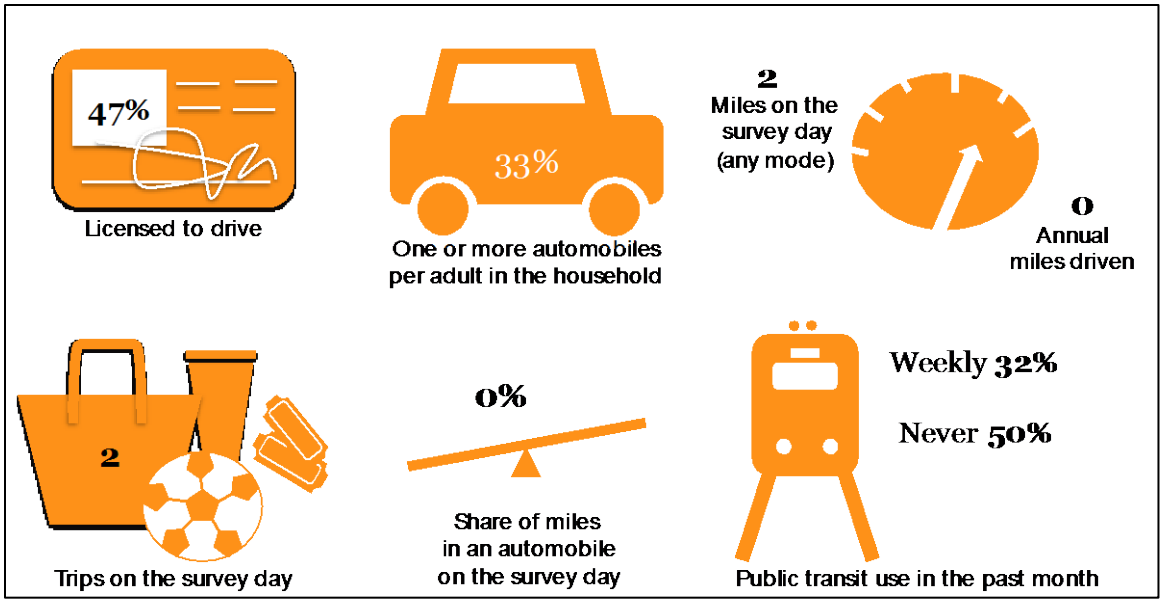
Note: Estimates are based on the NHTS survey weights and are therefore nationally representative. Miles of travel and trip making are reported as median values. All other values are percentages and reflect the share of all young adults ages 16 to 36.

Relative to the Drivers, Multimodals were less likely to have a driver's license and had more limited access to an automobile in their household, and because automobiles enable faster travel and longer trips, Multimodals traveled half as many miles as Drivers on a typical day. Their limited mobility did not, however, appear to limit their activity participation. The typical Multimodal made five trips on the survey day, one more than Drivers. Finally, although a quarter of Multimodals used transit at least once a week, the majority never used public transit.

Car-less

Car-less young people made all of their trips on the survey day by non-automobile modes (see Figure 52). Walking, biking, and riding transit are typically slower than traveling by automobile, so it is no surprise that Car-Less young people had lower mobility than the other travel types. The typical Car-less young adult traveled just two miles on the survey day, just 1/12th the mobility of the typical Driver.

Of course, limited mobility is not in and of itself a problem as long as young adults also have adequate access to opportunities, which are approximated here by the number of trips on the survey day. Unfortunately, the typical Car-less young person made just two trips on average, or about half or less as many as the other traveler types. This almost certainly means that Car-less young adults participated in considerably fewer activities outside the home than other young people.



Source: 2009 NHTS, weighted values.

Figure 52. Graphic. Travel patterns of car-less young adults (ages 16 to 36).

Note: Estimates are based on the NHTS survey weights and are therefore nationally representative. Miles of travel and trip making are reported as median values. All other values are percentages and reflect the share of all young adults ages 16 to 36.

Young people in this traveler type had fewer mobility options than the other types. A lower share of Car-less young people had a license, a quarter of them lived in households without any automobiles, and another 43 percent lived in households where adults outnumber automobiles.

Comparing the Traveler Types

To facilitate comparisons and highlight the differences among the traveler types, Figure 53 and Figure 54 present information on the travel patterns of young adults by traveler type, focusing on short- and long-term travel patterns respectively.

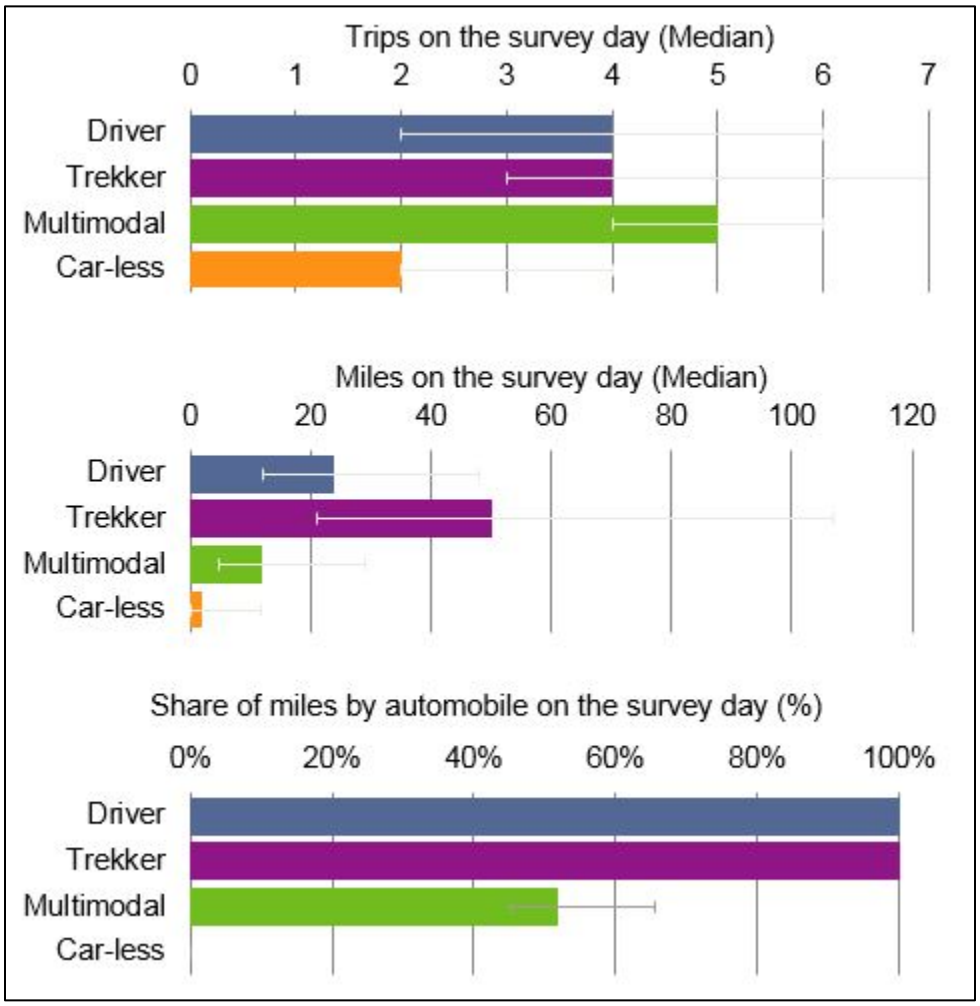
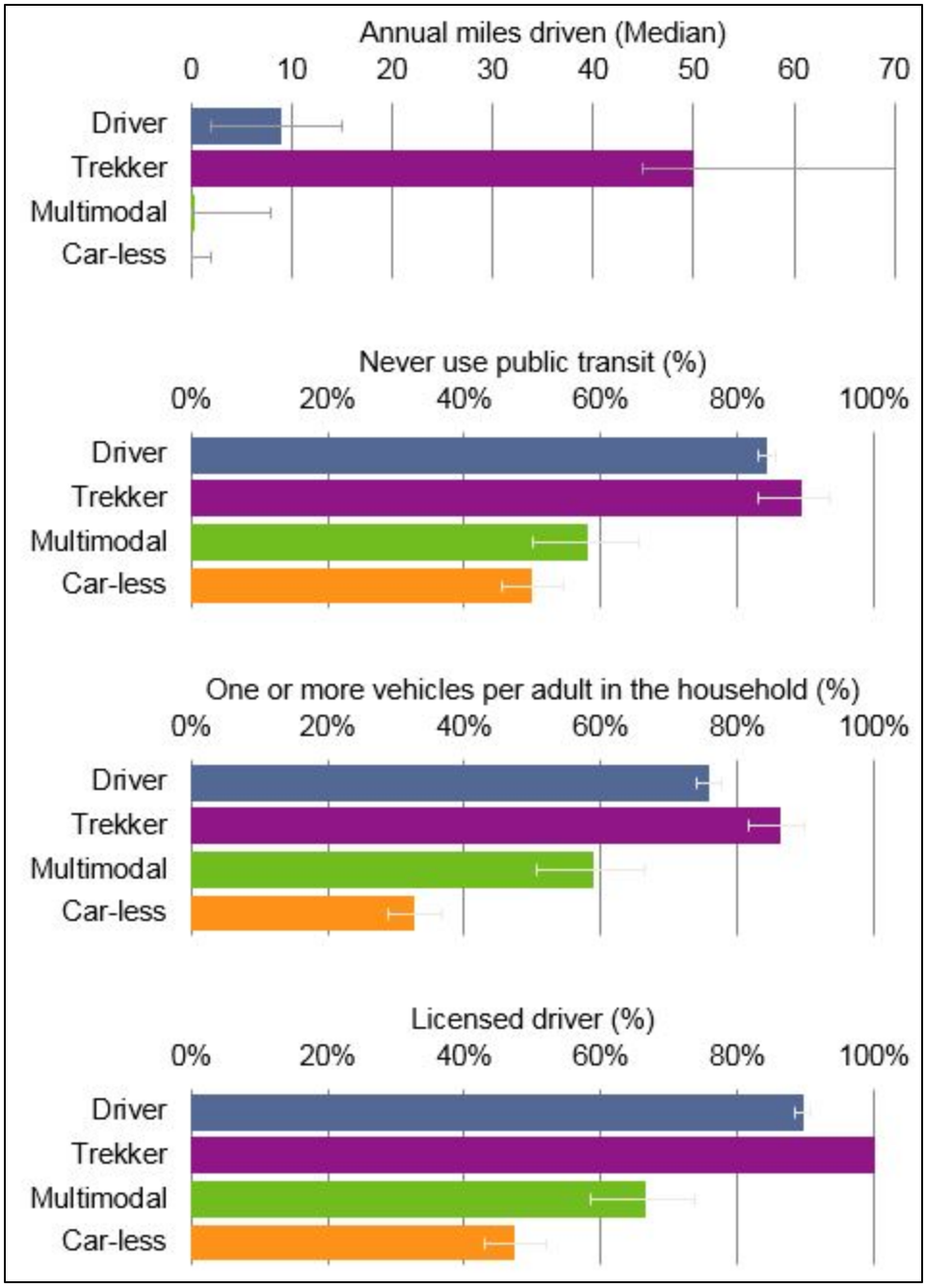


Figure 53. Chart. Survey by traveler type, young adults (ages 16 to 36).



Source: 2009 NHTS, weighted values.

Figure 54. Chart. Medium- and long-term travel patterns by traveler type, young adults (ages 16 to 36).

Note: Error bars reflect the 25th and 75th percentile for annual miles driven and the 95 percent confidence interval for the remaining values.

A Closer Look at Travel Mode

In characterizing the travel patterns of each type, the preceding section focused exclusively on the seven indicator variables used to identify each type. The next section, by contrast, enriches the description with data that were not used to identify the types.

Travel mode on the survey day

Table 23 provides information about the travel mode of each traveler type. Drivers and Trekkers made 88 percent of their trips by an automobile in 2009, predominantly as the driver of the vehicle. Recall that the typical Driver made 100 percent of their *miles* by automobile on the survey day, indicating that their trips by other modes were very short on average. Roughly five percent of Drivers' and Trekkers' trips were by walking.

Table 23. Share of trips by travel mode on the survey day in 2009, by traveler type (ages 16 to 36).

Trip mode	Driver	Trekker	Multimodal	Car-less
Drove	71%	80%	20%	4%
Passenger	17	8	16	5
Rode Transit	0	1	12	25
Walked	6	4	27	55
Biked	0	1	2	5
Other	5	6	23	7
Total	100%	100%	100%	100%

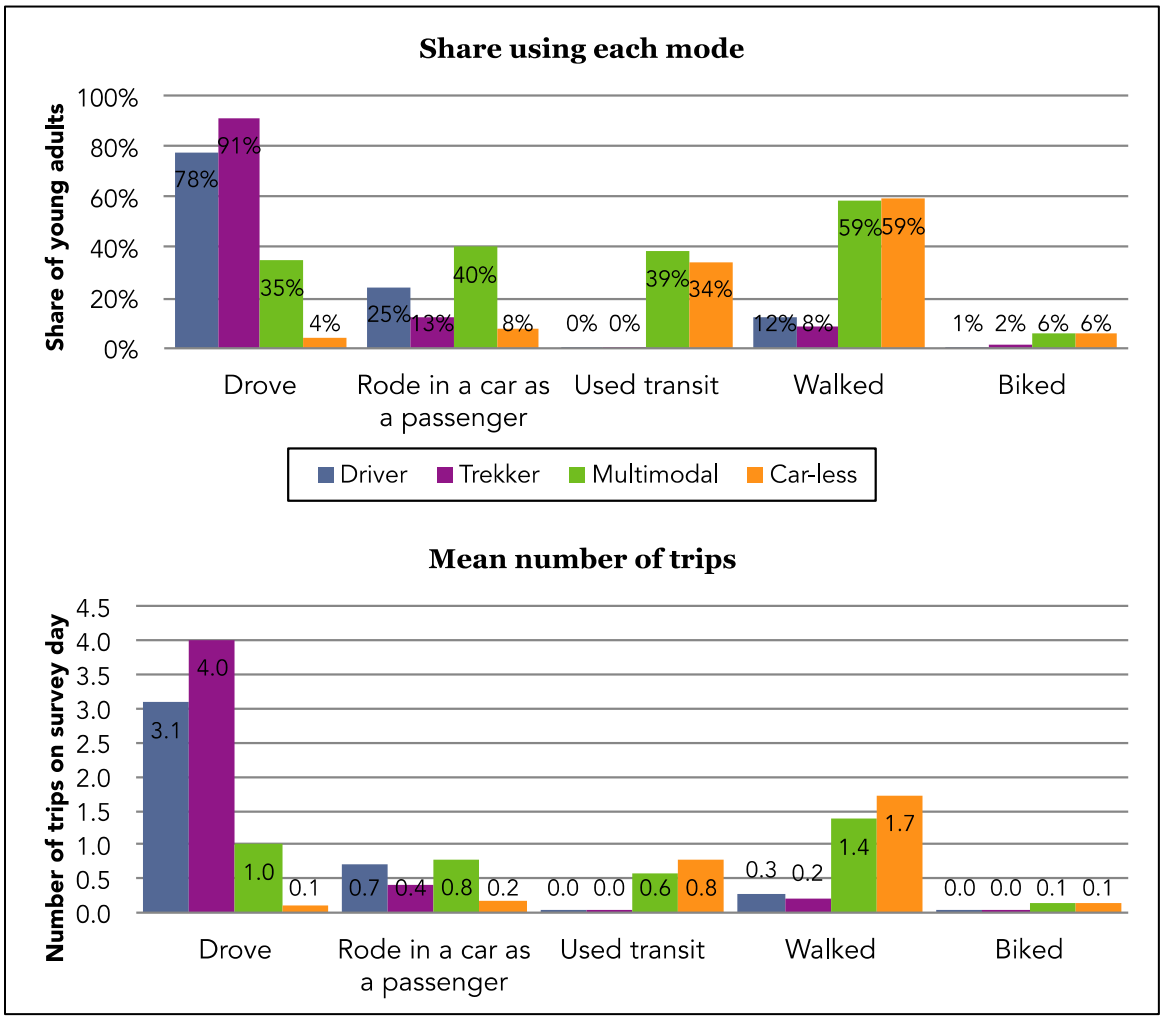
Source: 2009 NHTS, weighted values.
Note: Average share of trips by each mode on the survey day. Other modes include motorcycle, golf cart, taxi, and ferry.

Multimodals display a more even distribution of the modes. The average Multimodal young adult made a 36 percent of their trips in a private vehicle: 20 percent as the driver of the vehicle and 16 percent as a passenger. Just over a quarter of the trips made by Multimodals were by walking and a large number of their trips were by "Other" modes, which includes motorcycles and taxis.[15]

Among Car-less young adults, the most common mode of travel was walking—they walked for more than half of their trips in 2009. Public transit accounted for another quarter of their trips. Finally, automobiles accounted for just one in ten trips by Car-less young adults, and those were split evenly between trips as passengers and trips as drivers.

15 21st century transportation options (i.e. transportation network companies) were not widely available during the 2009 survey. Uber began service in 2010 and Lyft and Sidecar followed in 2012.

Figure 55 presents a different view of travel mode on the survey day. The top of the chart presents the share of young adults that used each mode, while the bottom of the chart depicts the mean number of trips by mode.



Source: 2009 NHTS, weighted values.

Figure 55. Chart. Travel mode on the survey day in 2009, by traveler type (ages 16 to 36).

This figure cements the importance of automobility in the lives of Drivers and Trekkers. The vast majority of these types drove an automobile on the survey day and riding in an automobile as a passenger was the second most common travel mode. In fact, Drivers and Trekkers almost never used other modes. In particular, less than one percent of young adults in these types used public transit on the survey day. Roughly one in ten Drivers or Trekkers walked on the survey day.

By contrast, a majority of Multimodals walked at some point during the day and averaged 1.4 walk trips. Multimodals were less likely than Drivers or Trekkers to drive an automobile, but they were the most likely of all of the traveler types to ride in a car as a passenger and to use public transit.

Finally, the figure illustrates the remarkably limited travel of the typical Car-less person. Only a third of Car-less people used public transit on the survey day, despite the fact that very few used an automobile as a driver or as a passenger. Not only did the majority of Car-less young adults walk on the survey day, but also the mean number of trips was much higher for walking than any other mode, which together suggests that the majority of Car-less young adults rely on walking to meet their needs.

Walking and biking

As the preceding figure suggests, biking on the survey day was very rare among young adults of all four traveler types. Are young people likely to do at least some biking over the course of a week? Table 24 compares the proportion of young adults in each type who biked or walked, as well as the mean number of bike or walk trips by young people in each type.

Table 24. Walking and biking in the past week by traveler type in 2009, (ages 16 to 36).

	Share of young adults who walked in the past week (%)			**Walk trips last week by young adults that walked (mean)**		
	Point estimate	95% confidence interval		Point estimate	95% confidence interval	
		Lower	Upper		Lower	Upper
Drivers	67.8	66.2	69.4	5.7	5.4	5.9
Trekkers	63.1	54.2	71.3	7.1	6.2	8.0
Multimodals	86.8	82.1	90.4	7.9	6.7	9.1
Car-less	83.0	79.5	86.0	8.8	8.1	9.5
	Share of young adults who biked in the past week (%)			**Bike trips last week by young adults that biked (mean)**		
	Point estimate	95% confidence interval		Point estimate	95% confidence interval	
		Lower	Upper		Lower	Upper
Drivers	8.7	7.8	9.6	2.5	2.3	2.7
Trekkers	7.9	4.8	12.6	2.7	2.1	3.3
Multimodals	19.2	13.2	26.9	3.3	2.7	4.0
Car-less	14.6	11.9	17.9	6.1	3.8	8.4

Source: 2009 NHTS, weighted values.
Note: Walking and biking information was not used to identify the traveler types.

We see that very few young adults rode a bicycle in the week prior to the survey, but Multimodals (19%) and Car-less (15%) young adults were roughly twice as likely to have biked in the previous week than Drivers (9%).

The majority of young adults, regardless of traveler type, made at least one walk trip in the previous week. This finding accords with Buehler and Hamre's (2014) findings on multimodality using the same

data. Trekkers were the least likely to walk and Multimodals were the most likely to do so. Restricting the analysis to only people who walked, Car-less and Multimodal young adults made more walk trips on average than Drivers, indicating that they relied on walking for a wider variety of trip purposes than Drivers.

The Prevalence of Each Traveler Type

The analysis presented to this point describes and characterizes the four types of young travelers in the U.S., but does not indicate the share of young adults in each of the four categories. Figure 56 reports the prevalence of each of the traveler types for the entire United States in 2009. The values in the figure are population estimates derived from a weighted sample. To account for the inevitable uncertainty of making population estimates, Table 10 in Appendix Va reports a point estimate of each population value along with a 95 percent confidence interval.

Source: 2009 NHTS, weighted values.

Figure 56. Graphic. Prevalence of the traveler types in 2009, United States (ages 16 to 36).

Note: Population estimates based on the weighted values from the NHTS.

In 2009 the vast majority of young adults were Drivers. Along with the Long-distance Trekkers, over 80 percent of young adults used an automobile for essentially every trip. Young adults who used a variety of modes—the Multimodals—were relatively rare; they comprised just four percent of the population. The final group, the Car-less, was the second largest travel type, representing 14 percent of the population.

Trekkers may have made up a relatively small share of the population in 2009, but because they drive so much over the course of a year, the Trekkers made a disproportionately large contribution to aggregate

total miles driven. While Trekkers comprised just three percent of the young adult population in 2009, they drove roughly 18 percent of all miles driven by young adults (see Table 25). Therefore, small reductions in the prevalence of Trekkers can lead to large reductions in travel, and attendant declines in emissions, collisions, and congestion.

Table 25. Trekkers contribute disproportionately to aggregate miles driven.

Travel type	Share of young adults (1)	Median miles driven per year (2)	Weighted number of miles driven (1)*(2)	Share of total (2)/(3)
Drivers	79%	9,000	7,149	82%
Trekkers	3%	50,000	1,586	18%
Multimodals	4%	300	11	0%
Car-less	14%	0	0	0%
Total	N/A	N/A	**(3)** 8746	N/A

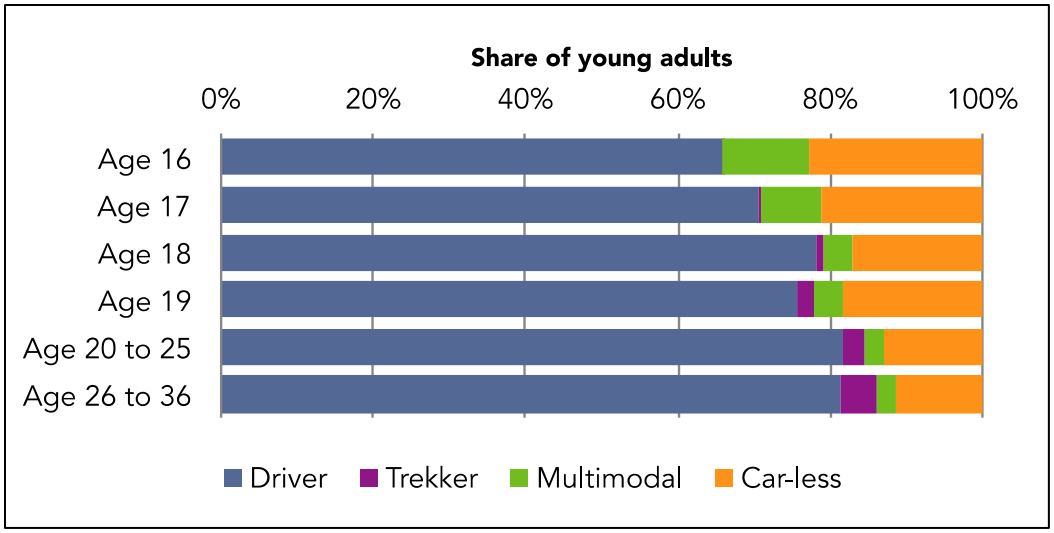
Source: 2009 NHTS, weighted values.

Traveler Types during the Life Course

The age range analyzed here is wide—age 16 to 36—and travel behavior may vary substantially by age, particularly as young people age out of licensing restrictions. Ideally we would be able to observe the evolution of travel patterns over time for each individual, for example as an 18-year-old in 1995, as a 23-year-old in 2001, and again as a 32-year-old in 2009. Unfortunately, such longitudinal data are extremely rare in travel behavior surveys and the data used here are a repeated cross-section instead.

Figure 57 depicts the prevalence of each travel type by age in 2009. Even at the youngest age—16 years old—the majority of young people were Drivers. The share of Drivers increased at higher ages, stabilizing by age 20, when eight in ten young adults were Drivers. Not surprisingly, very few teenagers were Long-distance Trekkers, and the share of Trekkers was higher for young adults in their twenties and thirties than for teenagers.

Teenagers were more likely than young adults in their twenties and thirties to be Multimodals or Car-less. Because the data are cross-sectional, it does not necessarily indicate that young people transition away from those traveler types as they age. Nevertheless, the data square with Clifton's (2003) observation that as soon as driving becomes an option, most young adults cease using other modes.



Source: 2009 NHTS, weighted values.

Figure 57. Chart. Prevalence of the traveler types by age in 2009 (ages 16 to 36).

Note: Solid bars reflect the weighted estimate of the prevalence of each traveler type. Error bars reflect the 95 percent confidence interval around the point estimate.

Conclusion

Travel behavior data are most often reported in terms of individual variables (vehicle miles of travel, share of trips on transit, etc.) and in terms of averages. But travel experiences and patterns vary widely, which are difficult to capture either through individual travel metrics, or with information about the mean or median traveler. Driving is down among young people in the 2000s; whether this is a good thing or not depends on the circumstances behind those driving declines. If some young people today are able to find good jobs, engage in lots of outside activities, and get around via a wide array of means—driving carpooling, public transit, cycling, and walking—then we might comfortably conclude that declining vehicular mobility is not associated with a declining quality of life, which is good for young people and good for our environments. If, on the other hand, young people today struggle to find good jobs, don't get out much at all, and drive less because limited incomes and access to vehicles give them no choice in the matter, then we might view declining automobility among youth to be a sign of a deeply troubling trend.

We see in the analysis presented here strong evidence for both of these characterizations of young people's travel. The former is characterized by the Multimodals, while the latter the Car-less. Unfortunately, Multimodals account for just four percent of all young travelers, while the Car-less 14 percent, or 3.5 times more than Multi-modals. That one in seven young adults in 2009 belonged to a group of travelers that made just two trips per day on average and over half of their trips on foot is both disturbing and likely reflects the profound economic hardships wrought by the Great Recession. While

economic conditions have eased over the past half-decade, only time (and new NHTS data) will tell if the size of the Car-less cohort remains so substantial.[16]

In contrast to the 18 percent of young travelers classified into the Multimodal and Car-less groups, four out of five (82%) young adults are in the Driver and Long-distance Trekker groups. So while per capita driving is down since 2000, the vast majority of young people remain firmly ensconced behind the wheel of automobiles.

16 A separate analysis by Ralph (2015) not reported on here finds that the share of young people who are drivers was down and the share of Multimodals were up slightly between 1995 and 2009, and she finds that the share of Long-distance Trekkers was down and the share of Car-less was up considerably over the same time period. Increases in Multimodals were largest among higher income youth, while increases in Car-less were greatest among lower income youth.

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VI. RESIDENTIAL LOCATION AND TRAVEL BEHAVIOR

Introduction

Why people travel, where they travel, how much, for how long, and by what means they travel are important matters of public policy. Travel to work, school, shop, and play confers enormous benefits on people and to the households in which they reside. But travel also entails substantial personal and societal costs. Cars are expensive, consume scarce resources, pollute the air, and kill with alarming frequency. Maximizing the benefits of travel and minimizing the costs are central concerns of transportation policymakers, as well as the professionals who plan, design, operate, and maintain transportation systems. To do their jobs, they must be able to understand, predict, and influence travel behavior, knowing that travel choices flow from individual and household characteristics, from the structure, function, and price of transportation systems, and from the nature of the built environment. When the goal is to influence rather than simply predict travel behavior, in addition to their central role in planning and operating transportation systems, the relationship between travel and the built environment is of particular interest because policy makers and planners and policy makers typically have a greater influence over the structure and function of land uses and what's built on them than they do over individual and household characteristics such as income or the presence of children.

The research presented in this chapter seeks to capture the multidimensionality of the built environment by applying the neighborhood typology developed in Chapter III to determine how the combined characteristics of each neighborhood type relates to the travel behavior of its residents. We simultaneously examine the differences in nine different measures of travel behavior from the 2009 National Household Travel Survey (NHTS) among the seven neighborhood types identified in Chapter III.

Previous Research

Several previous studies have examined the relationship between travel behavior and the built environment, both in terms of individual variables describing the built environment, and in terms of neighborhood type.

As described in Chapter III, many planners use words beginning with D to refer to one-dimensional characteristics of the built-environment that are thought to influence travel behavior: density, diversity, design, destination accessibility, and distance to transit. In general, studies have found most aspects of travel behavior, such as trip frequency (or trip generation) to be more influenced by socioeconomic characteristics than by built environment characteristics (Cervero & Kockelman, 1997; Ewing & Cervero, 2010), with the exception that average trip length is more influenced by the built environment than by socioeconomic characteristics (Cervero & Kockelman, 1997; Ewing & Cervero, 2010).

While the body of literature seeking to link characteristics of the built environment and travel behavior is quite large (Committee for the Study on the Relationships Among Development Patterns, Vehicle Miles Traveled, and Energy Consumption, 2009; Ewing & Cervero, 2010), many fewer studies have used neighborhood classification methods such as those described in Chapter III to relate neighborhood type (which are determined as a composite of multiple built environment and transportation network

characteristics) to particular travel behavior outcomes. As described in Chapter IV, Shay & Khattak (2015) apply a similar neighborhood classification method to ours, but the geographic scope of their analysis is limited to the Portland, Oregon area. They do not find neighborhood type to be associated with any significant difference in household auto ownership, and find only the City Center neighborhood type to be associated with a significant difference in trip generation.

Lin & Long (2008) find significant differences in travel behavior among neighborhood types, but their neighborhood types are defined in part based on the demographic characteristics of the people living in them, and not solely in terms of the physical characteristics of the place. Given that travel behavior is strongly influence by the socio-economic characteristics of travelers, apart from the environments within which they live, work, study, and play, it is very difficult to untangle the physical and social influences on travel in their work.

Analytical Approach

We describe below the multiple approaches taken and variables used to analyze travel behavior outcomes (see Table 26).

Table 26. Travel outcomes and modeling approaches.

Approach	Travel outcome variable	Model form	Control variables
Amount of survey day travel	Person miles of travel on the survey day (PMT)	Log-linear, given that PMT>0	Individual characteristics: • Age • Sex • Race/ethnicity • Employment • Lives with parents (for young adults only) Household characteristics: • Highest household education level • Household income • Number of adults • Number of children
	Vehicle miles of travel on the survey day (VMT)	Log-linear, given that VMT>0	
	Trips on the survey day	Poisson regression	
Access to automobiles	Vehicles per adult in the household	Tobit (censored) regression	
	Driver's license (y/n)	Logistic regression	
Survey travel mode	Single occupancy trip	Logistic regression	
	Carpool trip	Logistic regression	
	Transit trip	Logistic regression	
	Walk trip	Logistic regression	
Multifaceted Traveler type	Driver, Long-distance Trekker, Multimodal, and Car-less	Multinomial logistic regression	See note

Note: The traveler type analysis differs in a few important respects from the other analysis. The age range is different (Age 16 to 36 only), the control variables differ and include adult roles (employment status, lives independently, has a child, married), economic resource (household income quintile adjusted for the number of people in the households, educational attainment, and employment status), and race/ethnicity.

The variables we employed in our analyses can be grouped into four general types: (1) amount of travel on the survey day, (2) access to automobiles,[17] (3) travel mode, and (4) traveler type (the construction of which is described in detail in Chapter V). While the first three of these focus on one particular aspect of travel behavior, the fourth, traveler type, accounts for an array of travel characteristics: amount of travel, access to automobiles, and travel mode (over the survey day and an extended period).

17 The two variables describing access to travel by private vehicle may be seen as determinants of travel behavior, but they are also choices that individuals and households may make based on their travel preferences. Thus, we have chosen to treat these variables as travel behavior outcomes, rather than as determinants of travel behavior.

For each of these travel behavior variables, we first analyzed descriptive patterns by neighborhood type. In all cases we used the provided NHTS survey weights to reflect the characteristics of the U.S. population.

In the second phase of the analysis we estimated multivariate models. This was necessary because the personal characteristics of respondents vary considerably by residential location (see Chapter 3 and Appendix IIId), and as a result, descriptive results may misrepresent the independent relationship between neighborhood type and travel. As Table 26 indicates, the specific modeling approach differs depending on the nature of the dependent variable. Control variables for each model were drawn from the existing travel behavior literature and include personal and household characteristics. An important aim of this research is to identify differences by age. For this reason, we estimated each regression model three times: once for teens (age 16 to 18), young adults (age 19 to 26), and adults (age 27 to 61). Full model results for each travel variable are included in Appendix VIb.

We present the results of the regression models graphically to facilitate interpretation. To highlight differences between the types of neighborhoods, we graph the difference in the proportion relative to Rural neighborhoods. Conceptually this is similar to saying, "How would travel behavior change if someone moved from a typical Rural area to a neighborhood most often found in cities and suburbs?" When a bar is to the right of the y-axis, young people in that type of neighborhood had higher values for the travel variable (e.g. they traveled more miles or were more likely to use transit). Similarly, when the bar is to the left of the y-axis, young people in that neighborhood type drove fewer miles or were less likely to use transit, all else equal. In each figure, error bars are shown to represent 95-percent confidence intervals for model coefficient estimates; when these error bars cross the y-axis, the estimated effect of that variable is not statistically significant (in other words, we cannot with confidence conclude that the measured effect is different from zero). Thus, although the values of the estimates represent differences between each neighborhood type and Rural neighborhoods, the error bars can serve to indicate whether the estimates for any two neighborhood types are statistically different from one another.

The Causality Conundrum

Next, we carefully considered how to interpret the coefficients in the regression model. On one hand, the neighborhood type coefficient may reflect a causal effect. Neighborhood type is expected to influence travel patterns by altering the availability and relative utility of travel by various modes. For example, walking is an especially attractive and useful travel mode in very high density environments that (1) push many possible trip origins and destinations close together and (2) make it difficult to drive on crowded streets and find a place to park. There are, however, problems with viewing the causal arrow as running exclusively (or even primarily) from the built environment to travel behavior. Chief among them is the problem of self-selection: people may choose to live in neighborhoods that match their travel preferences. People inclined to walk to destinations may do so more than others regardless of their built environment; but these people are also more likely to "self-select" into neighborhoods conducive to walking. In such cases, the built environment may promote walking, but it may also attract

people who would walk regardless of the pedestrian-friendliness of the neighborhood. If this is true—and we do not include attitudes and preferences in our analysis—we may overstate the true effect of the built environment on travel behavior.[18]

The data used in this analysis, and most other travel behavior research, limit our collective ability to disentangle self-selection and other threats to validity from causal influences. We cannot, for example, observe if NHTS respondents self-selected into their neighborhoods because of pre-existing travel preferences, since the survey includes no information about travel preferences. Fortunately, considerable scholarly effort has already been expended to elucidate the self-selection issue. In general, scholars find that the estimated effect of the built environment diminishes somewhat, but remains important, when attitudes and preferences are included in the model (Cao, Mokhtarian, & Handy, 2009; Ewing & Cervero, 2010; Handy, Cao, & Mokhtarian, 2005; Mokhtarian & Cao, 2008; Zhou & Kockelman, 2008).

Results

The results of our analysis suggest that neighborhood type is strongly associated with travel behavior, both when travel behavior is described in terms of one-dimensional variables describing the amount of travel, automobility, and mode choice and when it is described in terms of more holistic traveler type profiles.

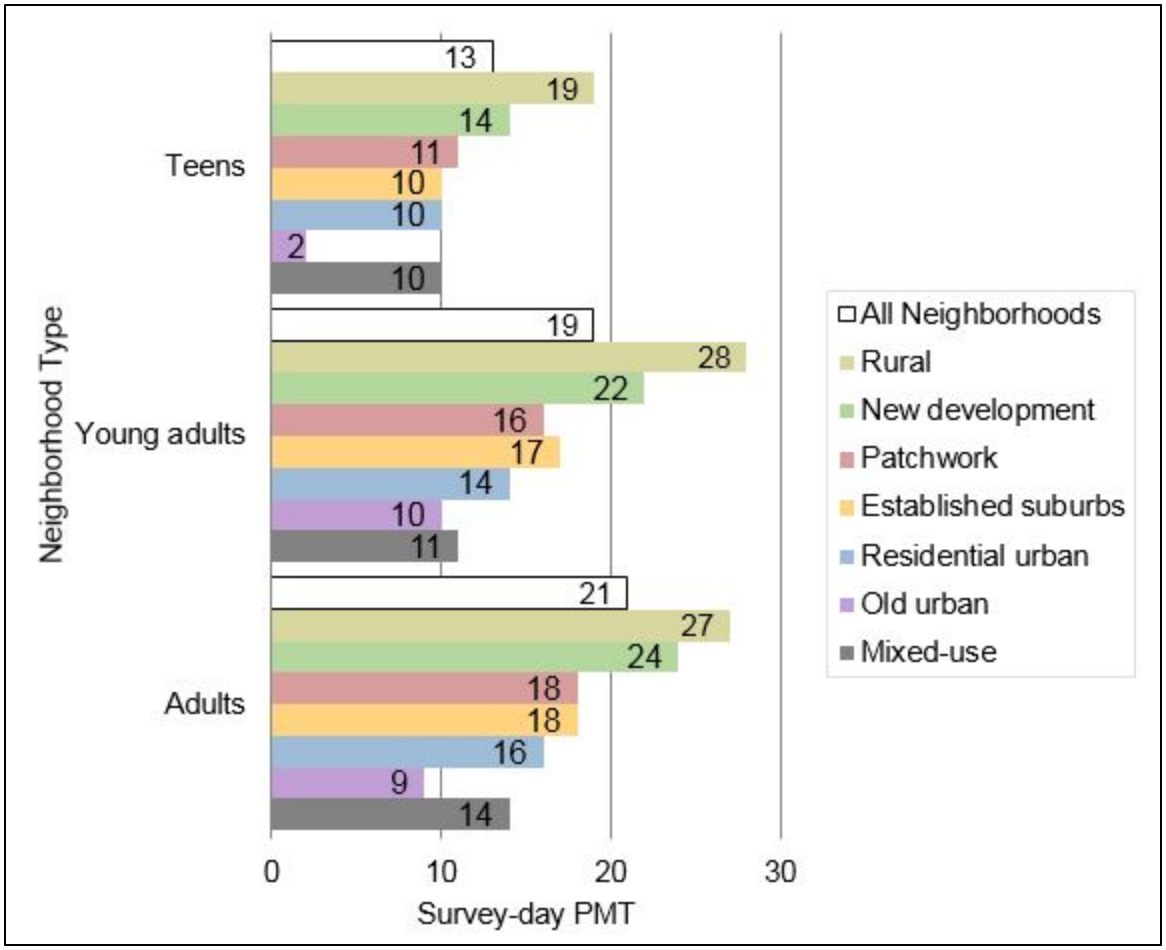
Travel on the Survey Day

The amount of travel a survey respondent undertook on the survey day is commonly described in terms of person-miles traveled (PMT), vehicle-miles traveled (VMT), or number of trips.

Person miles of travel

Figure 58 illustrates the variation in survey-day PMT among neighborhood types for each age category, and Figure 59 does the same for survey-day VMT. Residents of Rural neighborhoods in all three age groups had a higher median level of both survey-day PMT and VMT than did residents of any other neighborhood type. Residents of Old Urban neighborhoods had a lower level of median survey-day PMT than the residents of any other neighborhood type, and had a median survey-day VMT of zero for all three age categories. In general, adults and young adults traveled farther (both in terms of PMT and VMT) on the survey than did teens. In general adults traveled slightly more miles on the survey day than young adults, except in Rural and Old Urban neighborhood types, in which the median survey-day PMT and VMT are the same or slightly higher for young adults compared to adults.

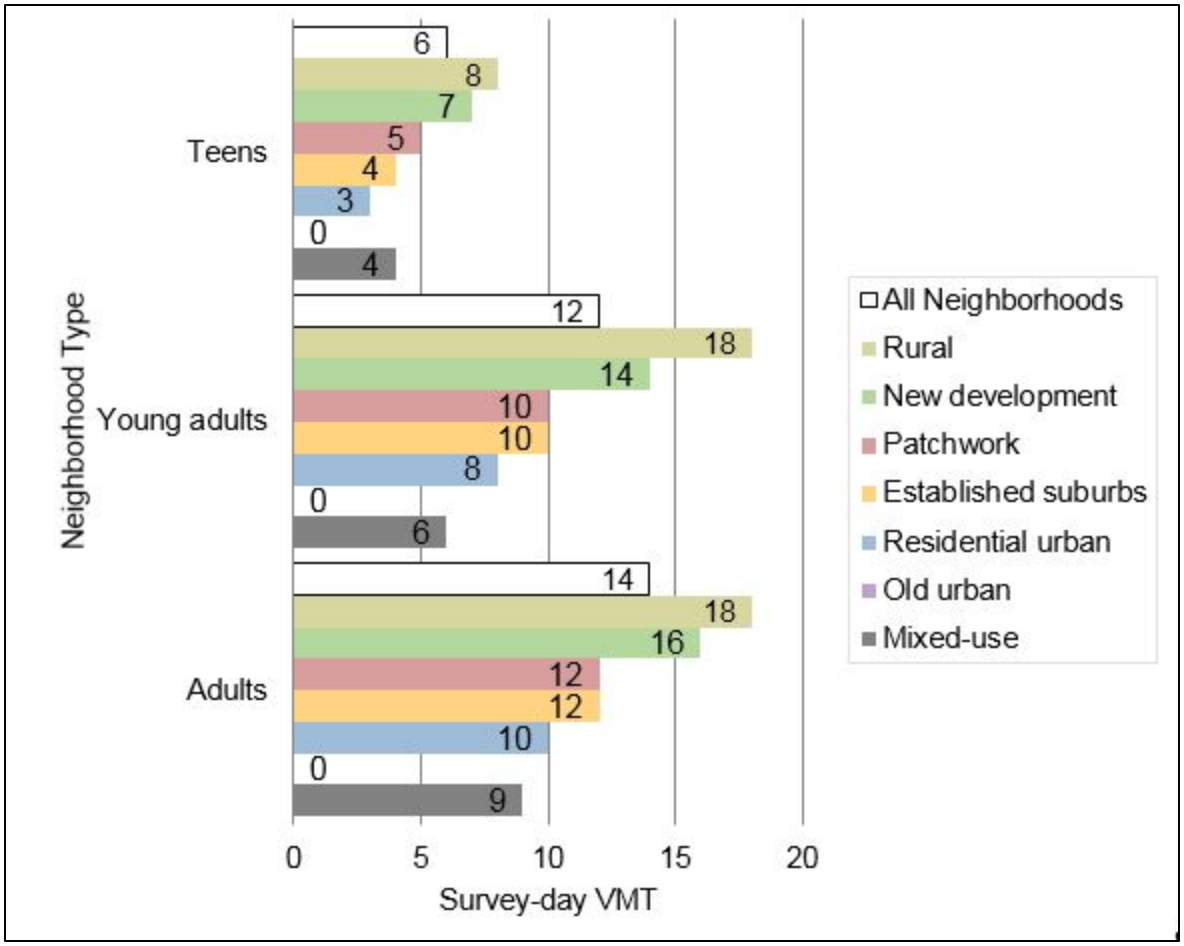
18 Although under some conditions we may also understate the magnitude of the effect (Chatman, 2014; Næss, 2014).



Source: 2009 NHTS, weighted values.

Figure 58. Chart. Median survey-day PMT by age category and neighborhood type.

Note: Descriptive values.



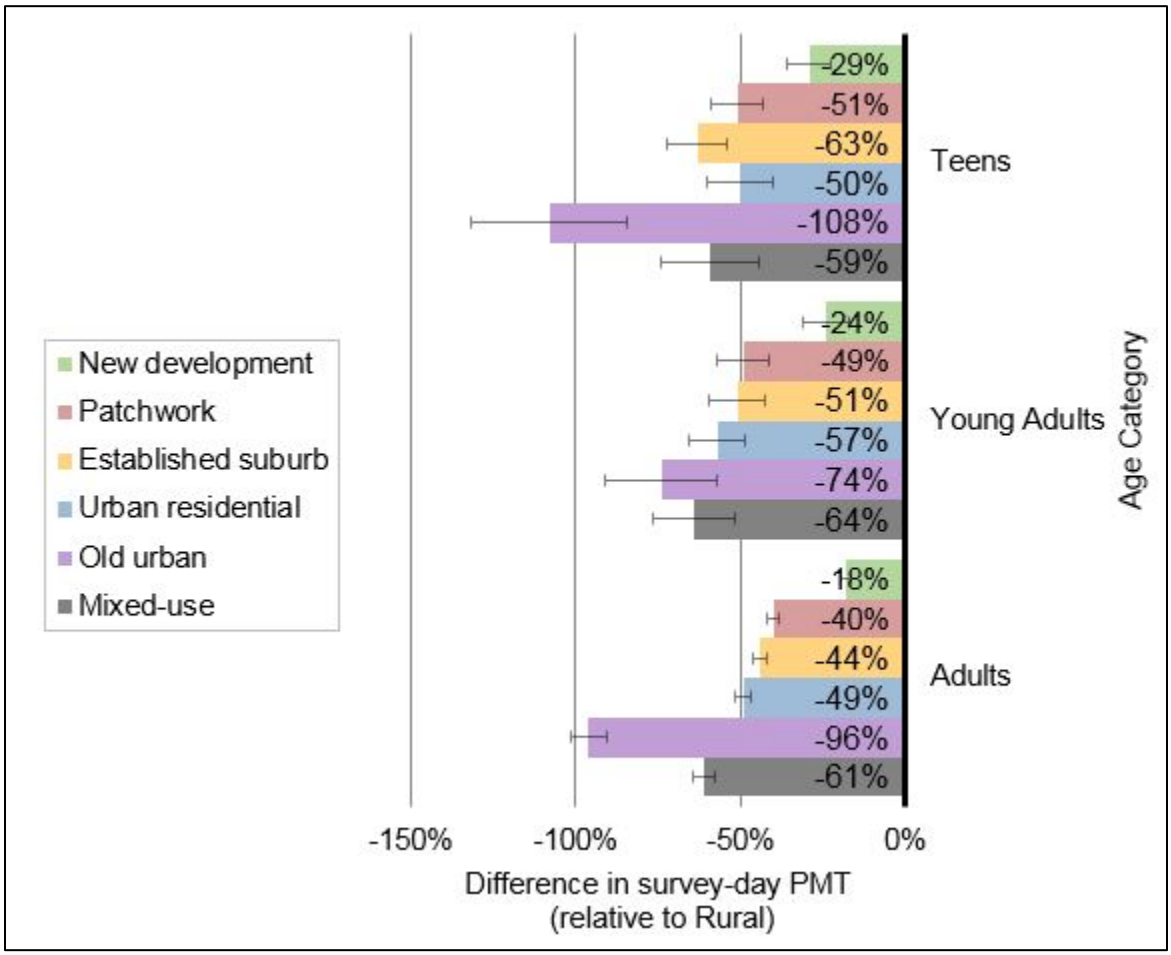
Source: 2009 NHTS, weighted values.

Figure 59. Chart. Median survey-day VMT by age category and neighborhood type.

Note: Descriptive values.

Even controlling for the individual and household characteristics listed in Table 26, the effect of neighborhood type on PMT and VMT is still statistically significant for all three age categories, as summarized in Figure 60 and in Figure 61, respectively. Everything else equal, Rural respondents had the highest PMT on the survey day. The reduction in survey-day PMT (relative to Rural neighborhoods) is the smallest for New Development neighborhoods and the largest for Old Urban neighborhoods, across all age categories. The difference in PMT between Old Urban neighborhoods and other neighborhood types is more pronounced for teens and adults than for young adults. Young adults' survey-day PMT in Old Urban neighborhoods is only significantly different (at a 95-percent confidence level) from Rural and New Development neighborhoods.

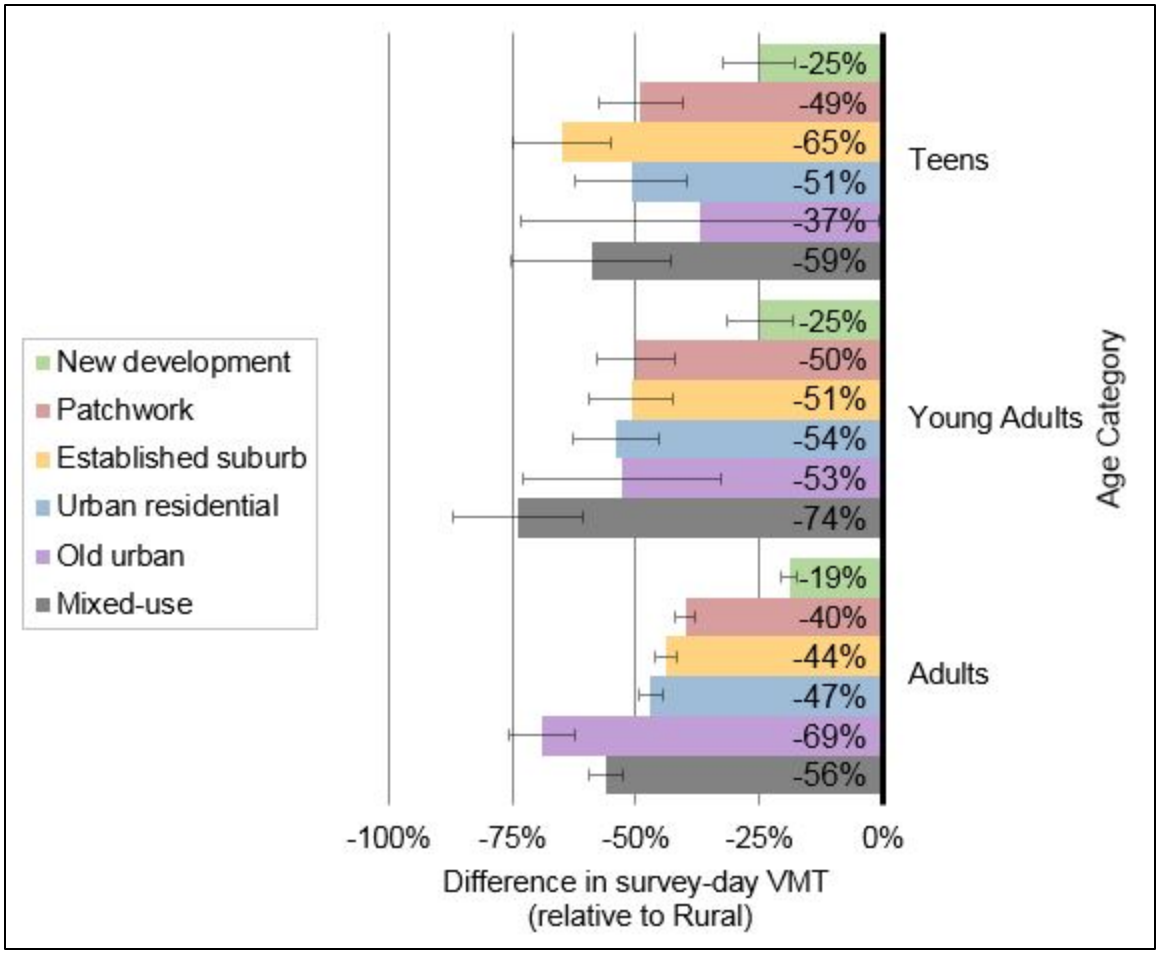
As is the case for PMT, the reduction in survey-day VMT (relative to Rural neighborhoods) is the smallest for New Development neighborhoods. For teens, the effect of neighborhood type on VMT is about the same for Patchwork, Established Suburb, Urban Residential, Old Urban, and Mixed-use neighborhoods.



Source: 2009 NHTS, weighted values.

Figure 60. Chart. Estimated independent effect of neighborhood type—PMT (relative to rural neighborhoods).

Note: Results of a multivariate regression model with statistical controls for individual and household characteristics. For more details see Table 26 on p. 123. Full model results are available in Appendix VIb.



Source: 2009 NHTS, weighted values.

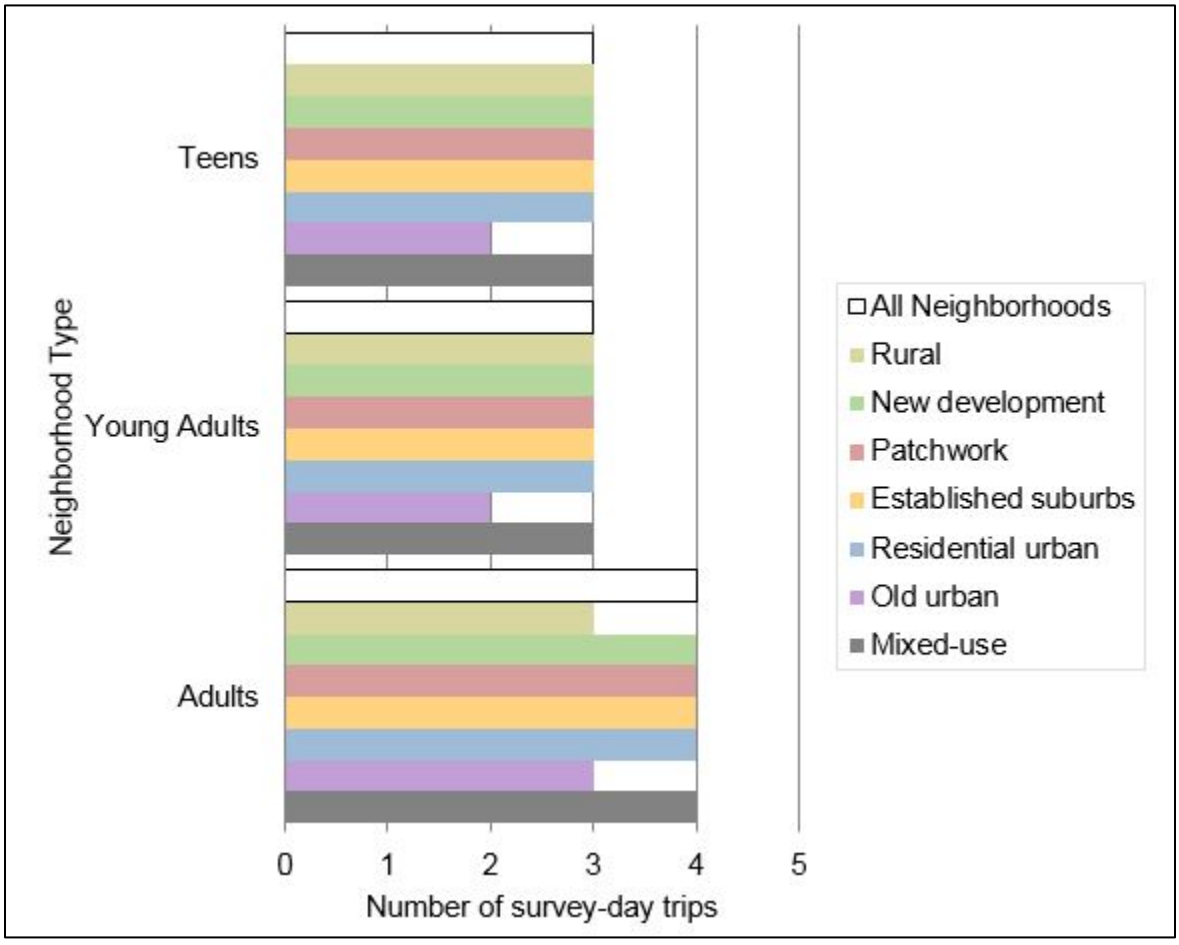
Figure 61. Chart. Estimated independent effect of neighborhood type—VMT (relative to rural neighborhoods).

Note: Results of a multivariate regression model with statistical controls for individual and household characteristics. For more details see Table 26 on p. 123. Full model results available in Appendix VIb.

Trip-making

As shown in Figure 62, the median number of survey-day trips is fairly consistent across age groups and neighborhood types. This finding suggests that the variation in PMT (shown in Figure 58) and VMT (shown in Figure 59) is a result of variations in trip length rather than in trip-making. In fact, although adults in Rural neighborhoods had higher survey-day PMT and VMT than adults in other neighborhood types, the median number of survey-day trips for adults in Rural neighborhoods is actually lower than that in any other neighborhood type other than Old Urban, suggesting that high levels of mobility in rural neighborhoods do not necessarily buy travelers high levels of access to destinations.

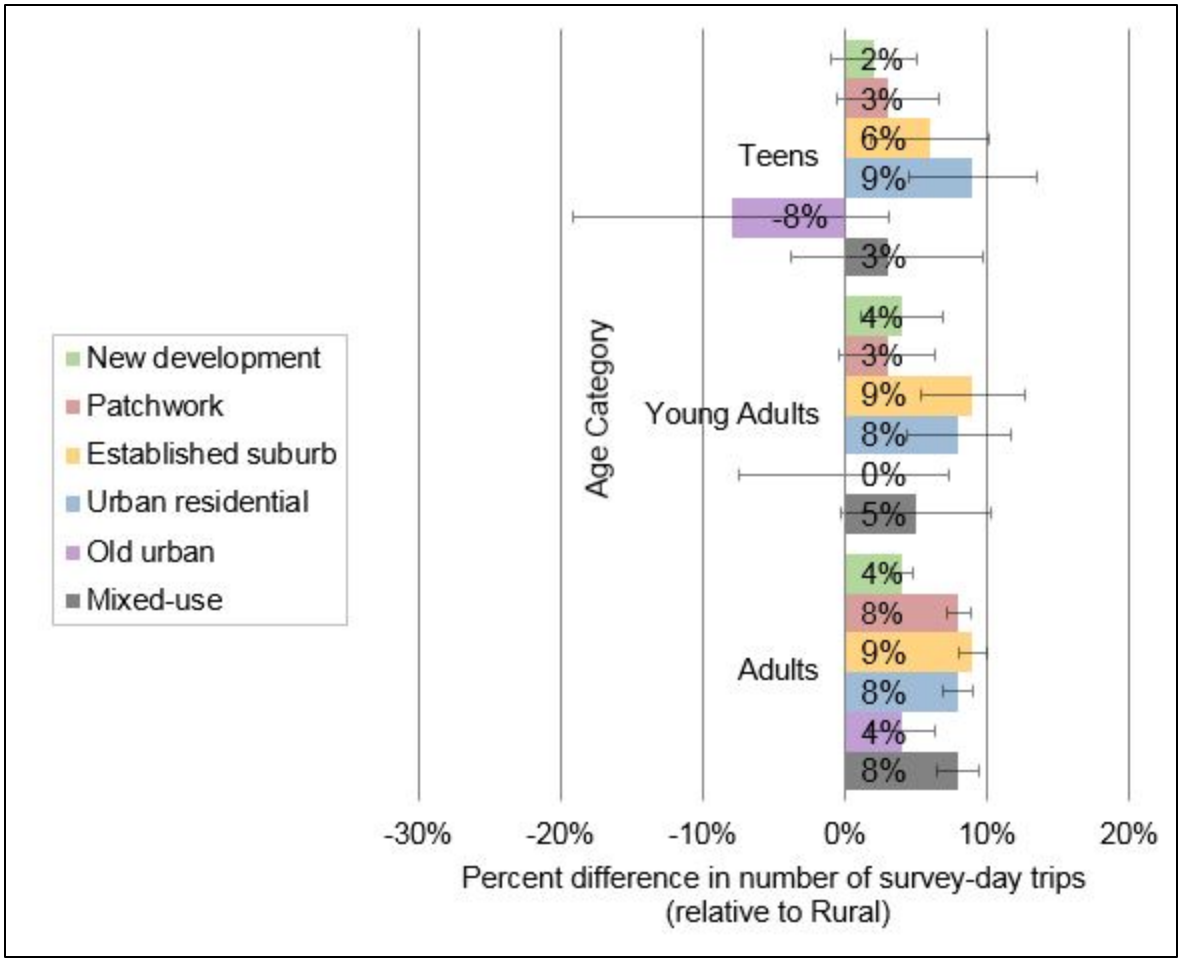
Figure 63 summarizes the estimated effects of neighborhood type on the number of survey day trips. For teens in all neighborhood types except Established Suburb and Urban Residential, the number of survey-day trips was no different than in Rural neighborhoods. The same is true of young adults in Patchwork, Old Urban, and Mixed-use neighborhoods. For all other combinations of age category and neighborhood type, respondents made more trips on the survey day than did their counterparts in Rural neighborhoods. Across all age categories and neighborhood types, respondents in non-Rural neighborhoods made as many or more trips than those in Rural neighborhoods, despite travelling far fewer miles on average.



Source: 2009 NHTS, weighted values.

Figure 62. Chart. Median number of survey-day trips —age category and neighborhood type.

Note: Descriptive values.



Source: 2009 NHTS, weighted values.

Figure 63. Chart. Estimated independent effect of neighborhood type on number of survey-day trips (relative to Rural neighborhoods).

Note: Results of a multivariate regression model with statistical controls for individual and household characteristics. For more details see Table 26 on p. 123. Full model results available in Appendix VIb.

Access to Automobiles

Provided that one is ambulatory, the decision to walk somewhere can be a spur-of-the-moment decision that requires little, if any, advance planning. By comparison, riding public transit requires a bit more advance preparation: one needs to understand elements of what can be hard-to-comprehend route structures and service schedules, and a dollar or two for the fare. A bicycle trip requires even more planning and investment. Scores, hundreds, or even thousands of dollars for a bicycle, more money for a lock and helmet, the skill to ride, and a place to park the bike at either end of the trip are all required (and even if one uses bikeshare to cycle, advance registration is required and a per use fee is paid).

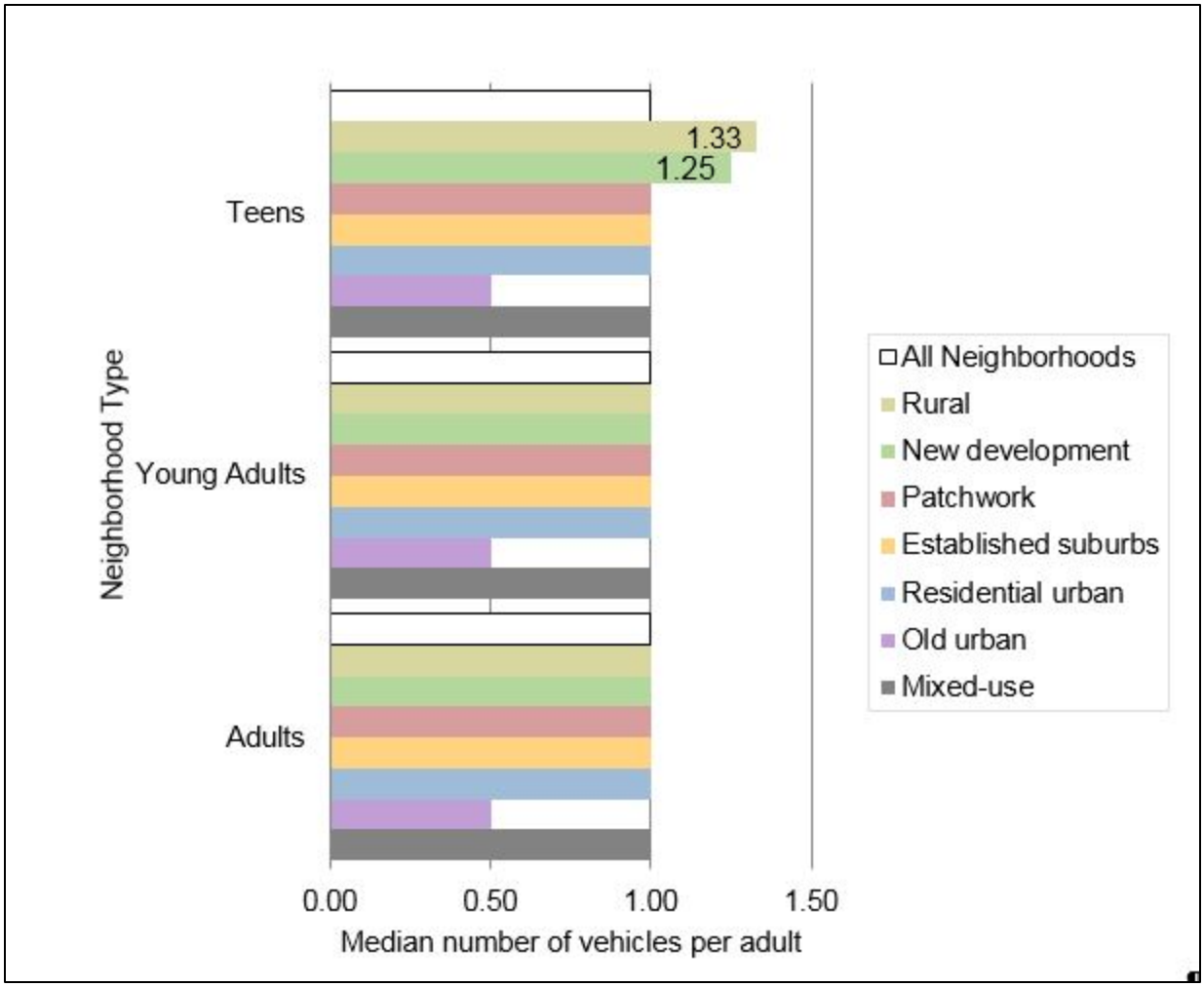
At the opposite end of the spectrum from walking for most types of daily trips is driving. One must be trained and licensed to drive, pay thousands and often tens of thousands of dollars for a vehicle, pay hundreds and often thousands of dollars each year to insure and maintain the vehicle, and then an additional $0.20 or so per mile is required for fuel. The decision to drive, in other words, begins long before someone hops behind the wheel and shoots over to the grocery store for milk and apples. And because the decision to drive requires so many up-front costs (time for the license, money to purchase and insure the car, and so on), the marginal cost of making an extra car trip is low. Once people have gone to the trouble to secure a license and buy a car, in other words, they are very likely to use it. And because autos are easier to drive and cheaper to park in suburbs and rural areas than in cities, the decision of where to live is likely affected by whether someone has already invested in a car or truck; likewise, the decision to invest in a car or truck is likely affected by where one lives. Thus, the decision of how to travel is not independent from *where* one travels, particularly for automobiles. Accordingly, we explore these relationships between vehicle use and neighborhood type below.

We measure automobile access in two ways: the number of household vehicles per adult, and percentage of the population that is licensed to drive.[19]

Vehicles per adult in the household

As shown in Figure 64, most households, almost regardless of neighborhood type, had one vehicle for each adult. There are two noteworthy exceptions. First, households with teens in Rural and New Development neighborhoods averaged more than one vehicle per adult, which suggests that teens in these neighborhoods were more likely than other teens to have access to a car. At the other extreme, households in Old Urban neighborhoods average just one vehicle for every two adults; in households in those neighborhoods, when two adults set off in different directions, one of them, on average, is likely to travel by a means other than driving.

19 Technically the NHTS does not include data on licensing. Instead, the head of each household identifies whether or not each member is a “driver”. To avoid confusion with the “Driver” traveler type below, we refer here to licensed drivers.

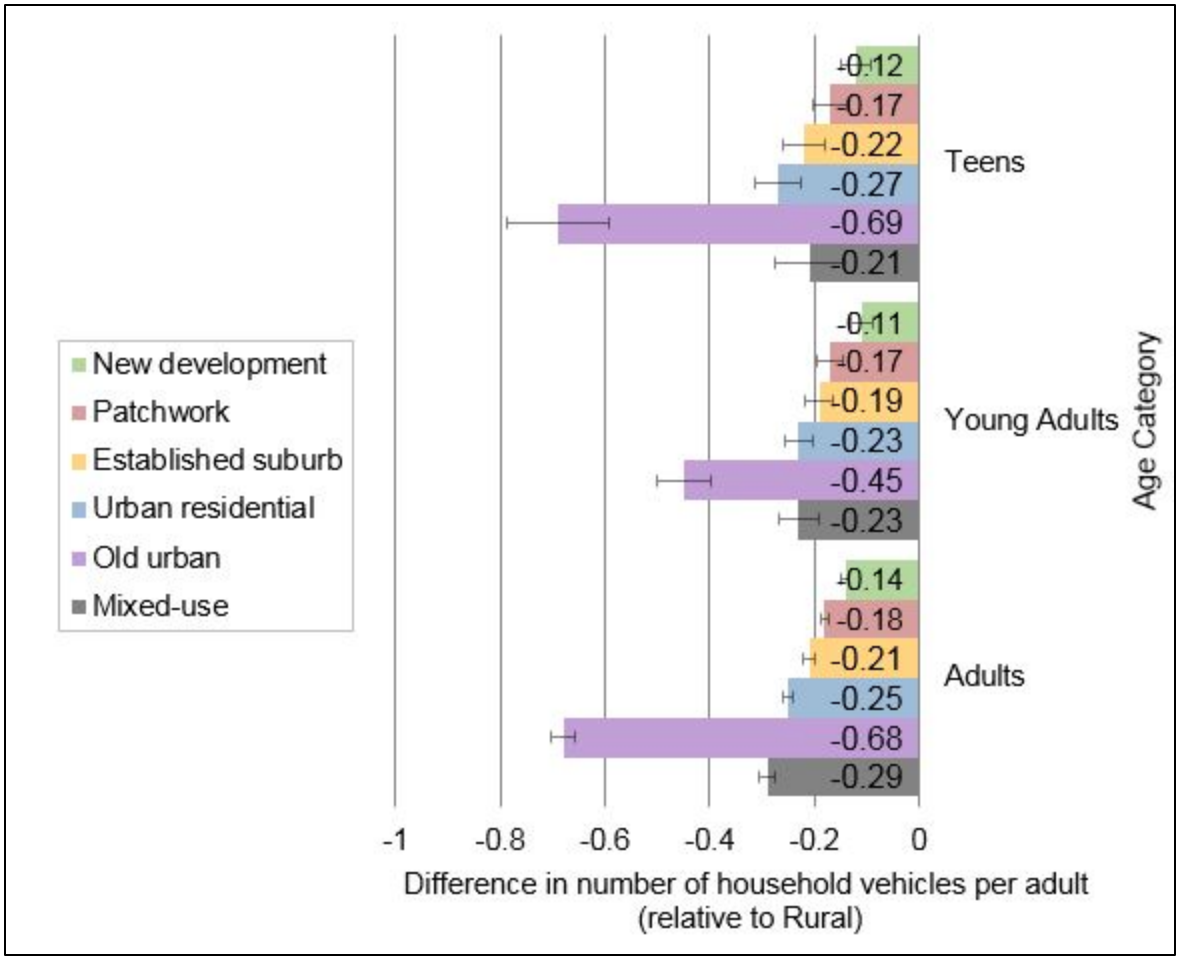


Source: 2009 NHTS, weighted values.

Figure 64. Chart. Median number of household vehicles per adult by age category and neighborhood type.

Note: Descriptive values.

Although residents of all non-Rural neighborhood types, regardless of age category, have fewer household vehicles per adults than those of Rural neighborhoods, the magnitude of this difference does not vary much among neighborhood types, except in the case of Old Urban neighborhoods. As Figure 65 shows, even controlling for the individual and household characteristics listed in Table 26, residents of Old Urban neighborhoods have significantly fewer vehicles per household adult than those of other neighborhoods. Within the Old Urban neighborhood type, young adults in Old Urban households have greater access to vehicles than do adults living in households with teenagers.



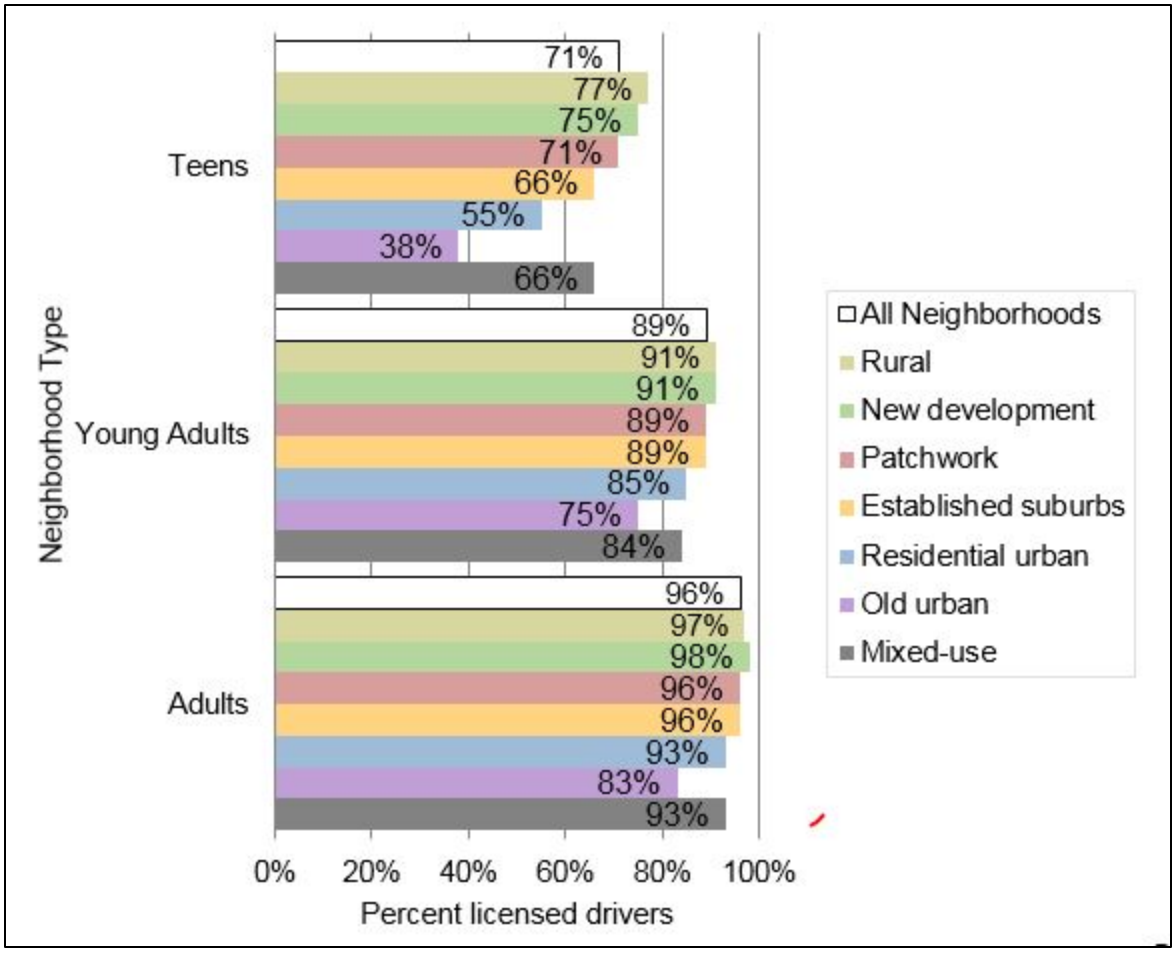
Source: 2009 NHTS, weighted values.

Figure 65. Chart. Estimated independent effect of neighborhood type on the number of household vehicles per adult (relative to Rural neighborhoods).

Note: Results of a multivariate regression model with statistical controls for individual and household characteristics. For more details see Table 26 on p. 123. Full model results are available in Appendix VIb.

Licensing

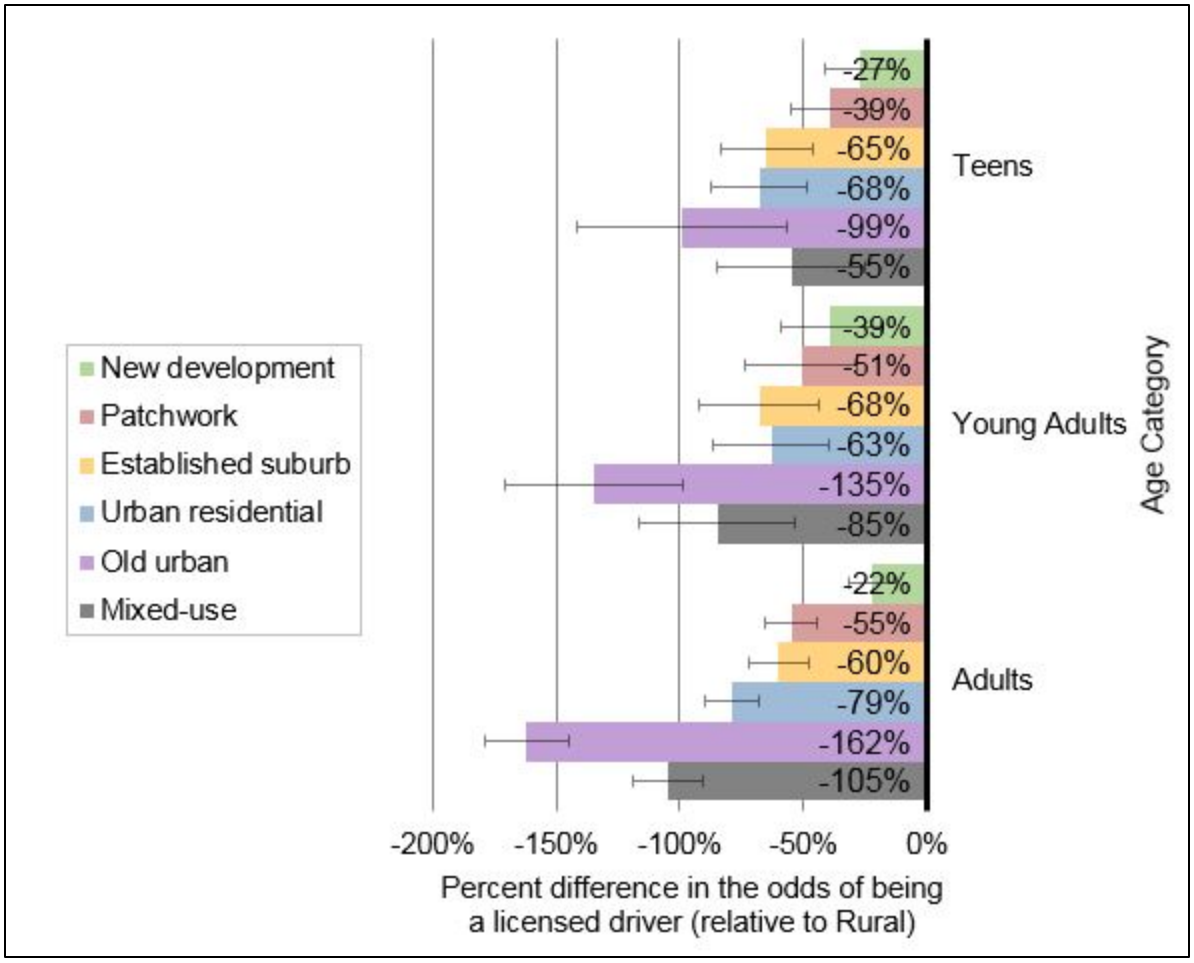
Figure 66 shows the percentage of the population that is licensed to drive. Unsurprisingly, teens were less likely to be licensed than either young adults or adults across all neighborhood types. Licensing was nearly universal for adults in most neighborhood types. The chief exception was in Old Urban areas where 83 percent of adults were licensed. Among teens, licensing varied substantially by neighborhood type. While three-quarters of teens were licensed in Rural and New Developments, just over half were licensed in Residential Urban areas, and only a third were licensed in Old Urban neighborhoods. Finally, young adults achieved licensing rates between those of teens and young adults, and, like adults, they generally displayed only slight differences in licensing by neighborhood type.



Source: 2009 NHTS, weighted values.

Figure 66. Chart. Population of licensed drivers by age category and neighborhood type.

Note: Descriptive values.



Source: 2009 NHTS, weighted values.

Figure 67. Chart. Estimated independent effect of neighborhood type—odds of being a driver (relative to Rural neighborhoods).

Note: Results of a multivariate regression model with statistical controls for individual and household characteristics. For more details see Table 26 on p. 123. Full model results are available in Appendix VIb.

Figure 67 summarizes the effect of neighborhood type on the odds of being licensed to drive, controlling for the individual and household characteristics listed in Table 26. In all age categories, the effect is greatest for Old Urban neighborhoods.

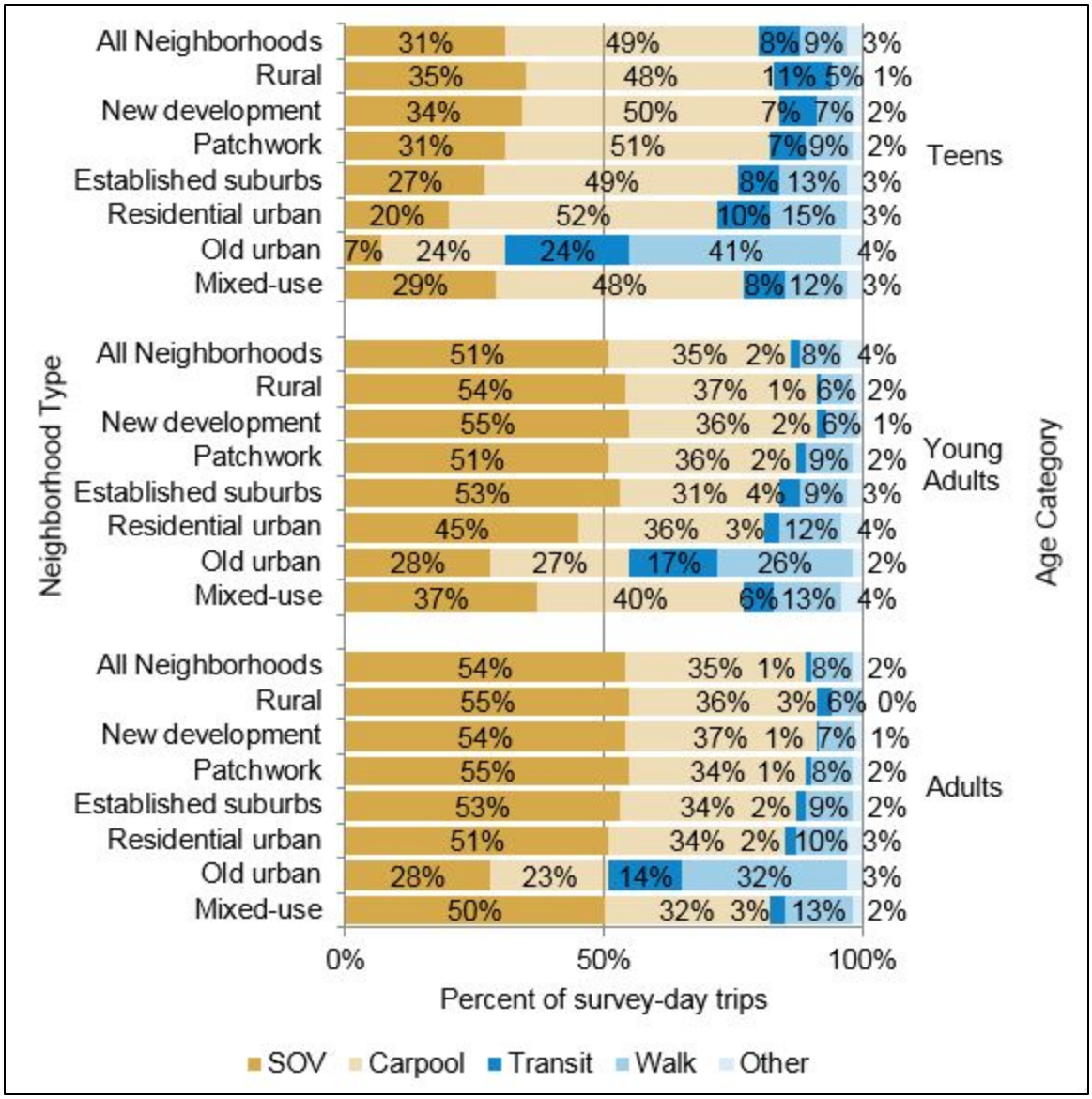
Travel Mode

As Figure 68 shows, mode shares were relatively consistent across neighborhood types, with the striking exception of Old Urban neighborhoods. The only neighborhood type in which Single Occupancy Vehicle (SOV) trips represented fewer than half of all survey-day trips by adults is Old Urban. Young adults' rates of SOV use was closer to that of adults than to that of teens in all neighborhood types accept Mixed-use. In all other neighborhood types, young adults were only slightly less likely to make an SOV trip than were adults.

A similar (if reversed) pattern appears for carpool trips. In all neighborhood types except Old Urban and Mixed-use, young adults and adults make carpool trips at about the same rate, and teens make carpool trips at higher rates than the older age categories. In Old Urban neighborhoods, members of all age categories carpool at similarly low rates. In Mixed-use neighborhoods, teens and adults carpool at about the same rate as in other neighborhood types, but young adults carpool at a rate halfway between that of teens and adults, rather than at about the same rate as adults, as they do in other neighborhood types.

Old Urban neighborhoods likewise represent an exception to the rule observed in other neighborhoods with regard to walking. Members of all three age categories in Old Urban neighborhoods are about three to four times as likely as their peers in other neighborhoods to make a trip by walking.

Rates of transit use are very low among adults in most neighborhood types, with the percentage of adult trips on transit ranging from one to three percent in all neighborhood types other than Old Urban. Transit use is higher among young adults than among adults, but is still quite low, ranging from one to four percent in all neighborhood types other than Old Urban and Mixed-use. Teens in Rural neighborhoods are more likely to ride transit than any other age category in any neighborhood type other than Old Urban. This is may well explained by the inclusion of school bus trips in the category of transit trips. In general teens are much more likely than members of other age categories to ride transit, and residents of Old Urban neighborhoods are likewise much more likely than residents of other neighborhood types to ride transit.

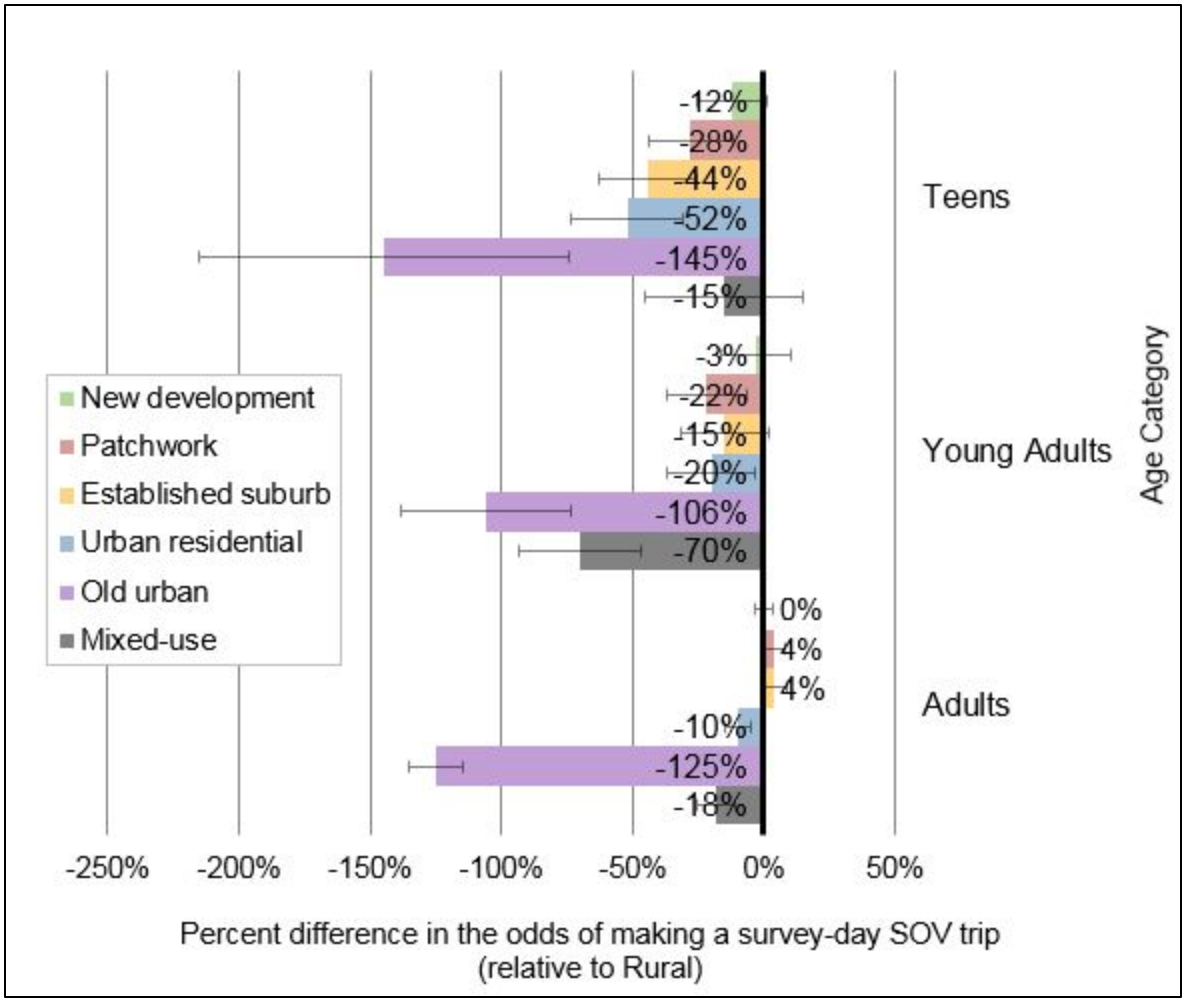


Source: 2009 NHTS, weighted values

Figure 68. Chart. Survey-day trips by each mode, by age category and neighborhood type.

Note: Descriptive values.

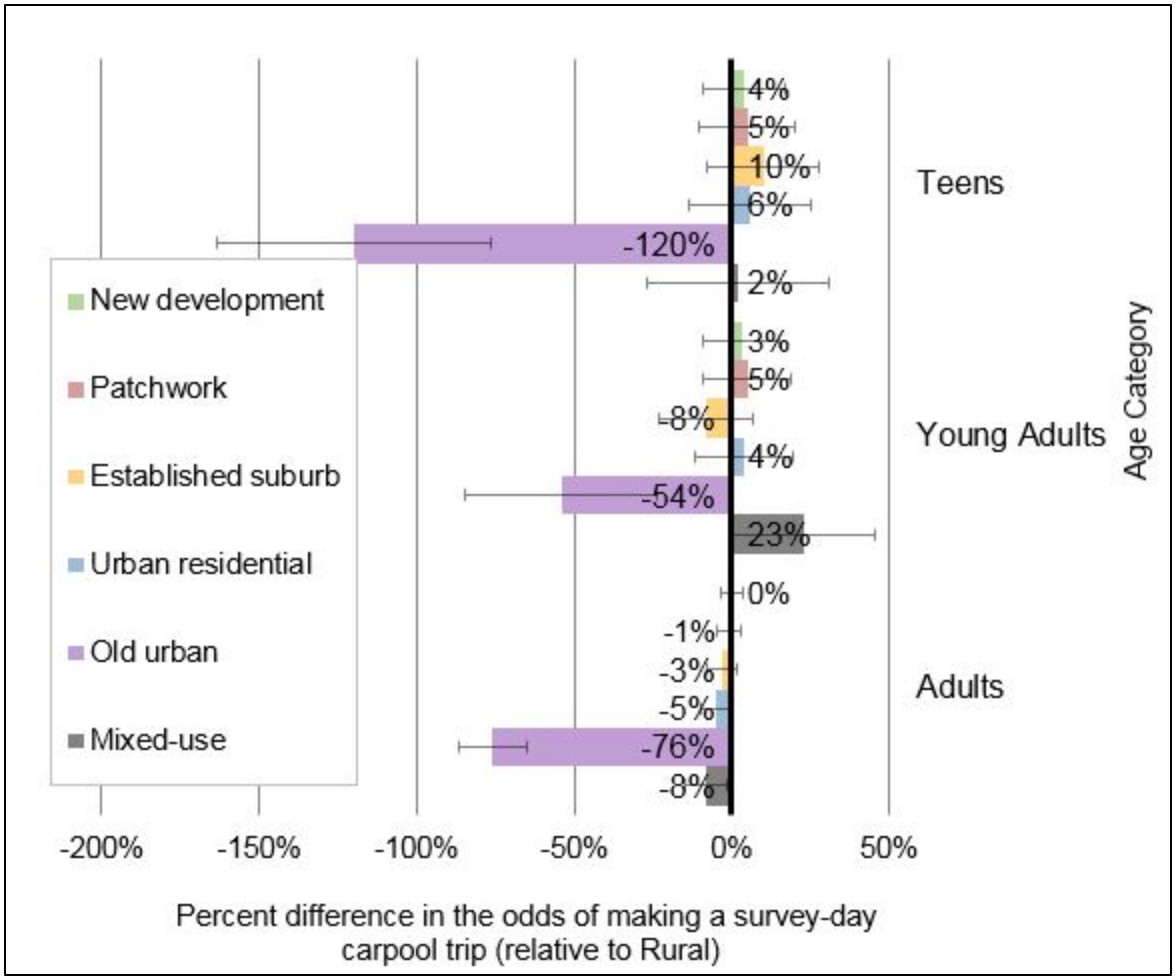
As Figure 69 shows, when we control for the individual and household characteristics listed in Table 26, the odds of making a survey-day trip by SOV are no different for residents of any age category in New Development neighborhoods than for residents of Rural neighborhoods, nor do they differ for adults in Patchwork or Established Suburb neighborhoods, for young adults in Established Suburb neighborhoods, or for teens in mixed-use neighborhoods. For teens, the effect of living in a Mixed-use neighborhood on the odds of making a survey-day SOV trip is similar to the effect of living in an Old Urban neighborhood. However, for all other age categories and neighborhood types, the effect of living in an Old Urban neighborhood dwarfs that of living in the other neighborhood types.



Source: 2009 NHTS, weighted values.

Figure 69. Chart. Estimated independent effect of neighborhood type—odds of making a survey-day SOV trip (relative to Rural neighborhoods).

Note: Results of a multivariate regression model with statistical controls for individual and household characteristics. For more details see Table 26 on p. 123. Full model results available in Appendix VIb.

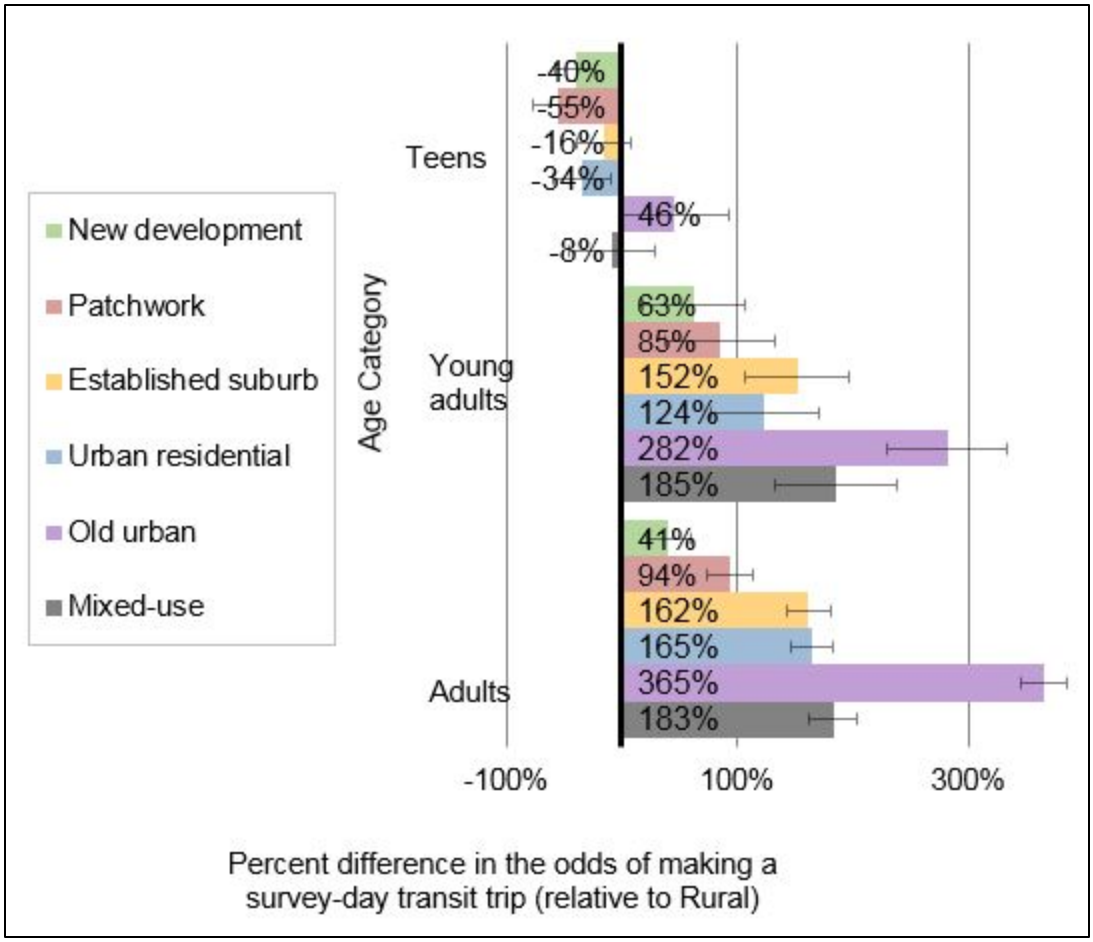


Source: 2009 NHTS, weighted values.

Figure 70. Chart. Estimated independent effect of neighborhood type —odds of making a survey-day carpool trip (relative to Rural neighborhoods).

Note: Results of a multivariate regression model with statistical controls for individual and household characteristics. For more details see Table 26 on p. 123. Full model results are available in Appendix VIb.

In Figure 70, we observe a similar pattern for the odds of making a survey-day carpool trip. For teens in all neighborhood types except Old Urban, neighborhood type does not have a significant relationship with the odds of making a survey-day carpool trip. For young adults and adults, the Mixed-use neighborhood type does have a small effect (which in both cases just barely registers as significant at a 95-percent confidence level). In contrast, the odds of making a survey-day carpool trip in an Old Urban neighborhood were much lower than in any other neighborhood type, controlling for individual and household characteristics. The greatest difference is observed for teens.



Source: 2009 NHTS, weighted values.

Figure 71. Chart. Estimated effect of neighborhood type—odds of making a survey-day transit trip (relative to Rural).

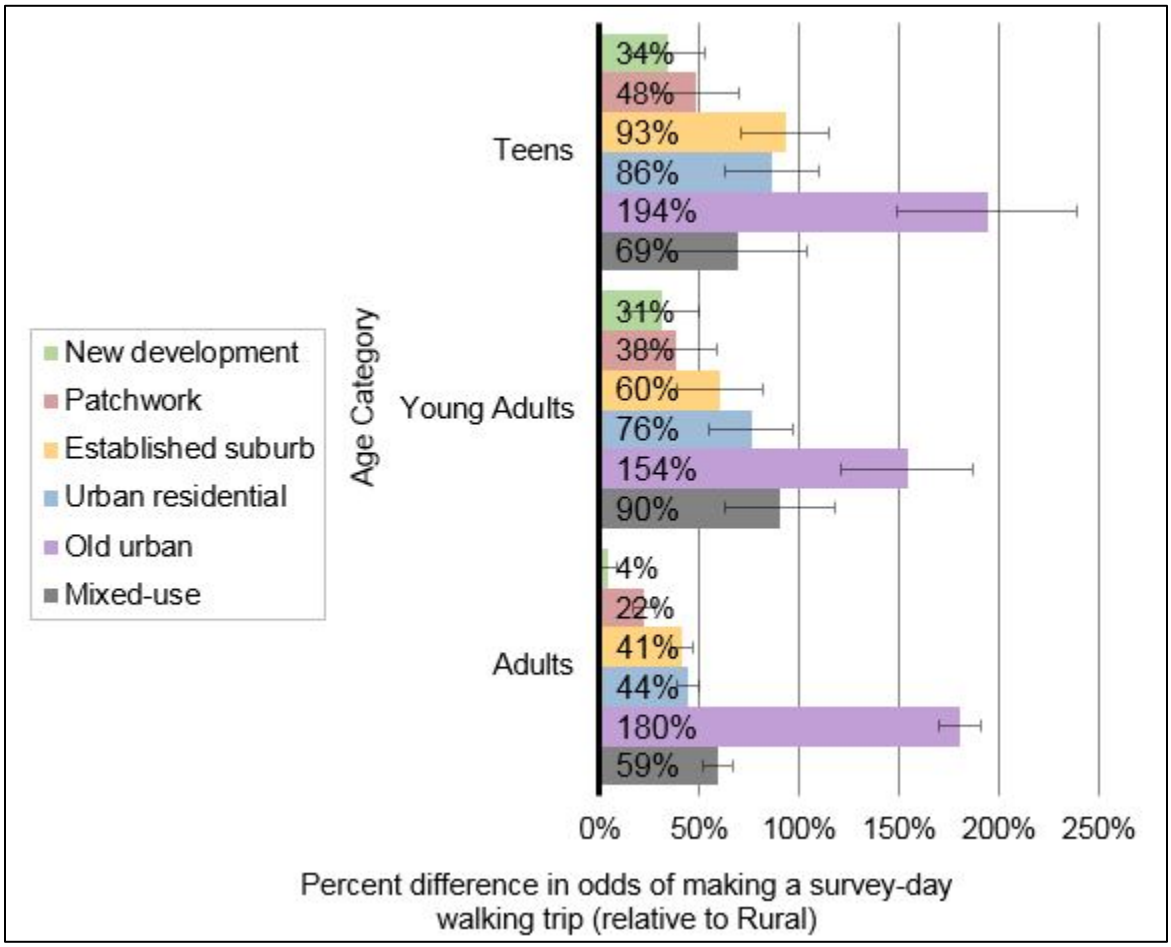
Note: Results of a multivariate regression model with statistical controls for individual and household characteristics. For more details see Table 26 on p. 123. Full model results are available in Appendix VIb.

As Figure 71 shows, the effect of neighborhood type on making a survey-day transit trip is only significant for teens in the New Development, Patchwork, and Urban Residential neighborhood types. In those cases, the effect is in the opposite direction for teens than it is for other age categories. Remember that, as shown in Figure 68, teens in rural areas had relatively high rates of transit use, and that this may be explained by the inclusion of school buses as a transit mode. In Figure 68, only the Old Urban neighborhood type showed higher rates of transit use by teens than in the Rural neighborhood type. However, as Figure 71 shows, even this difference is not significant at a 95-percent confidence level when we control for the individual and household characteristics listed in Table 26.

It is unsurprising that neighborhood type had a significant effect on the odds of making a survey-day trip by transit for young adults and adults, since the availability of transit service, as well as a number of factors that facilitate transit service (e.g. various measures of density), among other land use and built

environment factors, were used to define the neighborhood types. The Old Urban neighborhood type was observed to have the greatest effect on transit use. In both Urban Residential and Old Urban neighborhoods, the effect of neighborhood type on the odds of riding transit was greater for adults than for young adults. In all other neighborhood types, the effect was about the same for the two age categories.

As Figure 72 shows, neighborhood type has a significant effect on the odds of making a survey-day walking trip for all age categories. All non-Rural neighborhood types are associated with increased odds of a walking trip (relative to Rural), with the exception of adults in New Development neighborhoods. As is the case for other travel behavior variables, the effect is greatest for Old Urban neighborhoods.



Source: 2009 NHTS, weighted values.

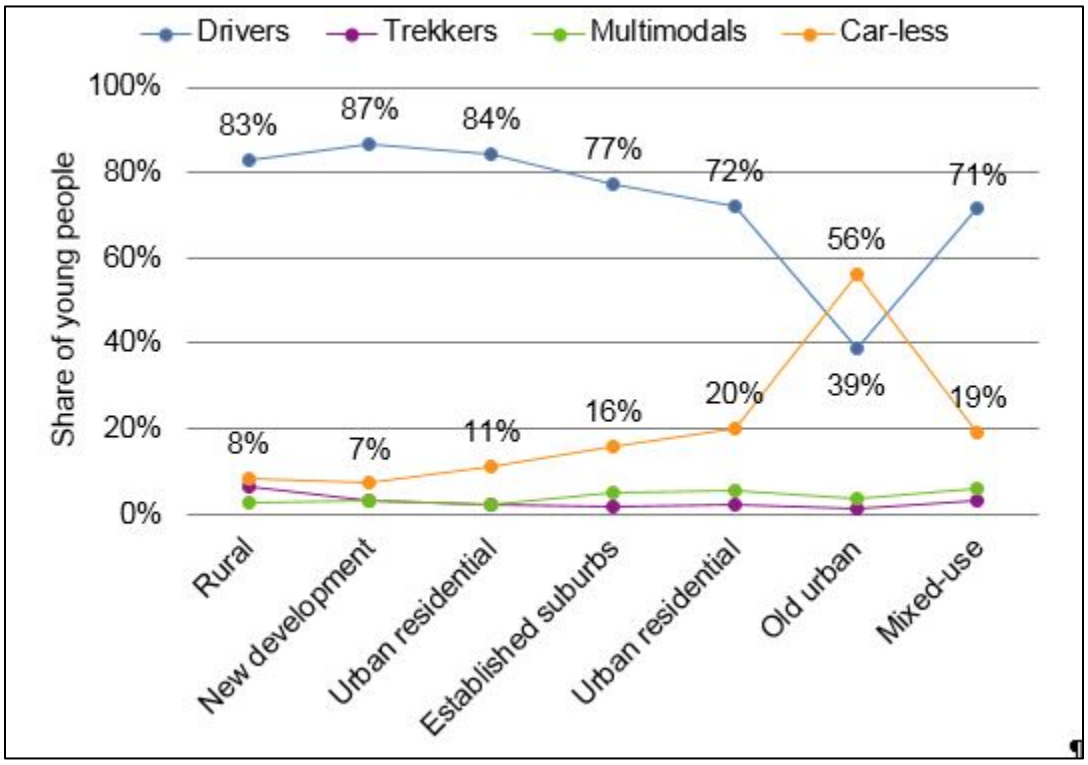
Figure 72. Chart. Independent effect of neighborhood type—odds of making a survey-day walking trip (relative to Rural neighborhoods).

Note: Results of a multivariate regression model with statistical controls for individual and household characteristics. For more details see Table 26 on p. 123. Full model results available in Appendix VIb.

Traveler Type

We now shift from the more conventional analysis of how socio-economic and built environment characteristics are relate to various travel behavior outcomes, to one where we ask how various neighborhood types affect the likelihood of being one of the four traveler types developed in Chapter V. Figure 73 depicts the proportion of young people that was in each traveler type in 2009 by neighborhood type. In all but one type of neighborhood (Old Urban), the vast majority of young people were Drivers. The share was highest in New Development neighborhoods. In Old Urban neighborhoods, by contrast, just 39 percent of young people were Drivers.

In most areas, few young people were Car-less. This is particularly true in areas with few alternatives to the automobile—Rural and New Developments. In Old Urban areas, by contrast, a majority (56%) of young people was Car-less.



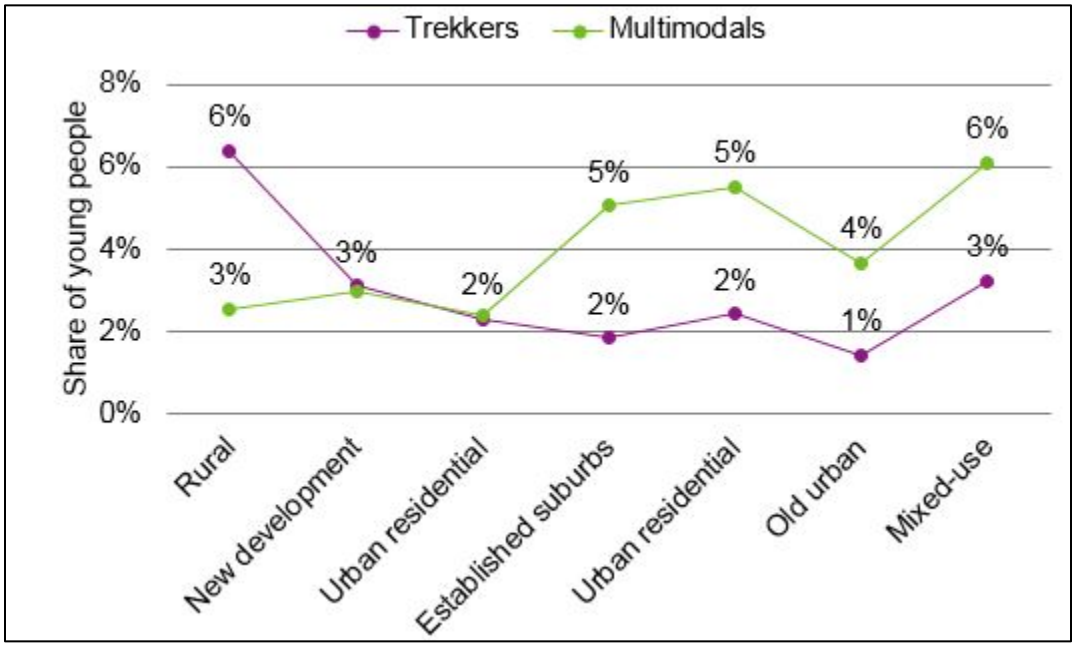
Source: 2009 NHTS, weighted values.

Figure 73. Graph. Ages 16 to 36 in each traveler type by neighborhood type in 2009.

Note: Descriptive values.

Because there are so few Long-distance Trekkers and Multimodals, it is difficult to discern variations by neighborhood type from Figure 73. For that reason, we include Figure 74, which depicts the neighborhood locations of just the Trekkers and Multimodals. Young people in Rural areas were by far the most likely of all of the neighborhood types to be Trekkers, and young people living in Old Urban areas were the least likely. Like the Trekkers, very few young people were Multimodals. Even in the

neighborhood type with the most Multimodals—Mixed-use neighborhoods—just six percent of young people were Multimodal in 2009.



Source: 2009 NHTS, weighted values.

Figure 74. Graph. Ages 16 to 36 classified as long-distance trekkers or multimodals in 2009 by neighborhood type.

Note: Descriptive values.

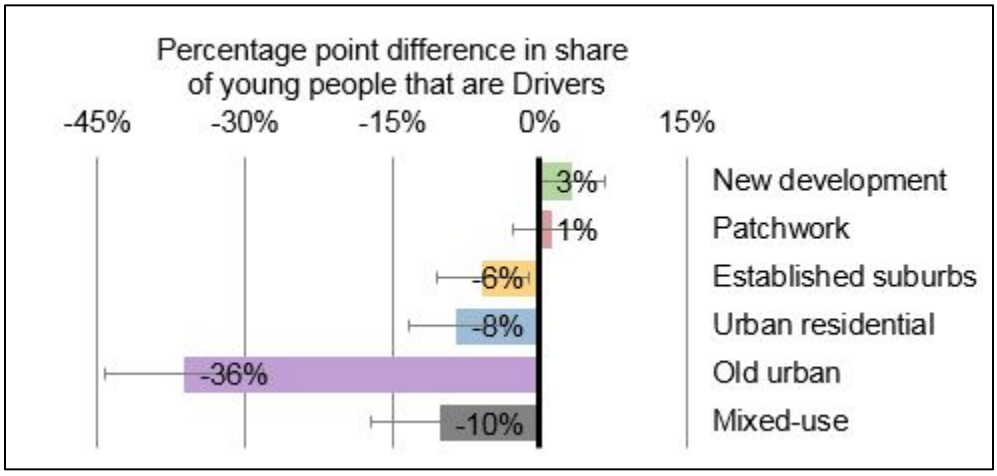
Drivers

Figure 75 indicates that, even when controlling for a variety of individual and household characteristics, the type of neighborhood a young person lives in has a strong relationship with his or her propensity to be a Driver. Young people were most likely to be Drivers, all else equal, if they lived in New Development neighborhoods. Young people in Rural and Patchwork neighborhoods were close behind. At the other extreme, young people were least likely to be Drivers if they lived in Old Urban neighborhoods. In between these extremes were young people in Established Suburbs, Urban residential, and Mixed-use neighborhoods.

Young people were also less likely to be Drivers if they had relatively low household incomes, lived independently, or were a racial/ethnic minority (other than non-Hispanic Asian). By contrast, young people were more likely to be Drivers if they were employed, married, had a child and/or were no longer a teenager.

Relative to these other factors, residential location had a strong relationship with the propensity to be a Driver. Living in a Mixed-use or Urban Residential neighborhood had roughly the same size of an effect

on the propensity to be a Driver as having a low income (Q1) or being employed (albeit in the opposite direction).



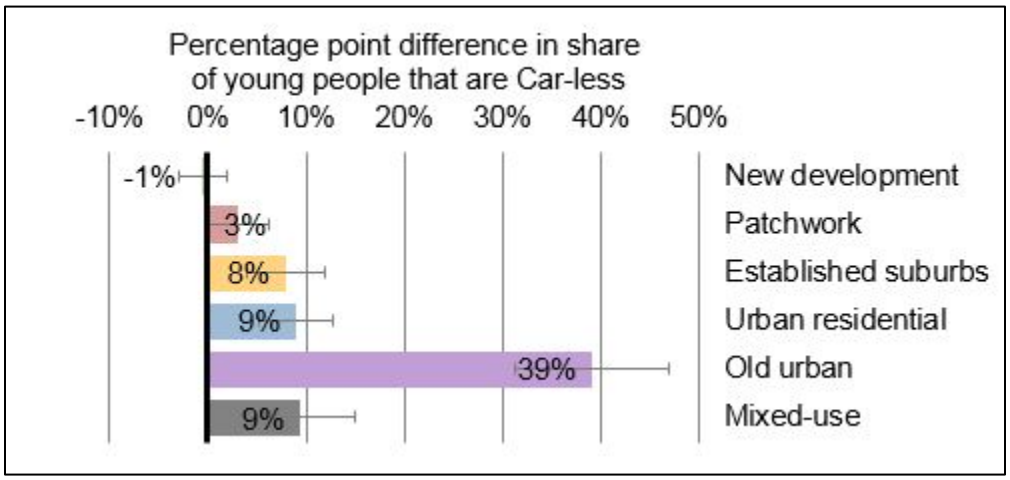
Source: 2009 NHTS, weighted values.

Figure 75. Chart. Independent effect of neighborhood type—likelihood person's ages 16 to 36 will be a driver traveler type (relative to Rural).

Note: Results of a multinomial logistic regression model with statistical controls for roles, resources, and race/ethnicity. Full model results are available in Appendix VIc.

Car-less

Figure 76 depicts the relationship between neighborhood type and the propensity to be Car-less, controlling for other factors. Recall from Chapter V that this is the traveler types whose members are most likely to be characterized as "transportation disadvantaged." Relative to Rural young people, young people in all other neighborhood types (except New Developments) were more likely to be Car-less, everything else equal. Not surprisingly, the magnitude of the effect was particularly strong in Old Urban neighborhoods.



Source: 2009 NHTS, weighted values.

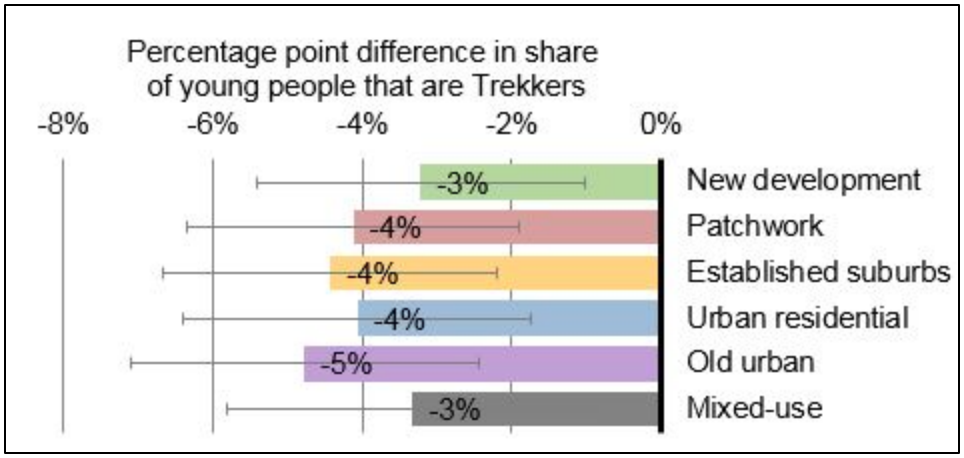
Figure 76. Chart. Independent effect of neighborhood type—likelihood persons ages 16 to 36 will be a Car-less traveler type (relative to Rural).

Note: Results of a multinomial logistic regression model with statistical controls for roles, resources, and race/ethnicity. Full model results are available in Appendix VIc.

In addition to the effect of neighborhood type, young people were also more likely to be Car-less if they had low incomes or were a racial/ethnic minority. Young people were less likely to be Car-less if they were employed, married, and/or were no longer teenagers. Again, relative to the other variables, neighborhood type had a strong relationship with the propensity to be Car-less. The effect of living in an Established Suburb or Mixed-use area, for example, was roughly equal to the magnitude of having a low income or being employed (albeit in the opposite direction).

Long-distance Trekkers

Figure 77 depicts the relationship between neighborhood type and the propensity to be a Long-distance Trekker, when controlling for other factors. Relative to young people in Rural areas, young people in other neighborhood types were less likely to be Trekkers. The magnitude of the effect was rather large, considering that the base value was so low: just six percent of Rural young people were Trekkers. In non-Rural neighborhoods, the share of young people that was Trekkers fell by four percentage points.



Source: 2009 NHTS, weighted values.

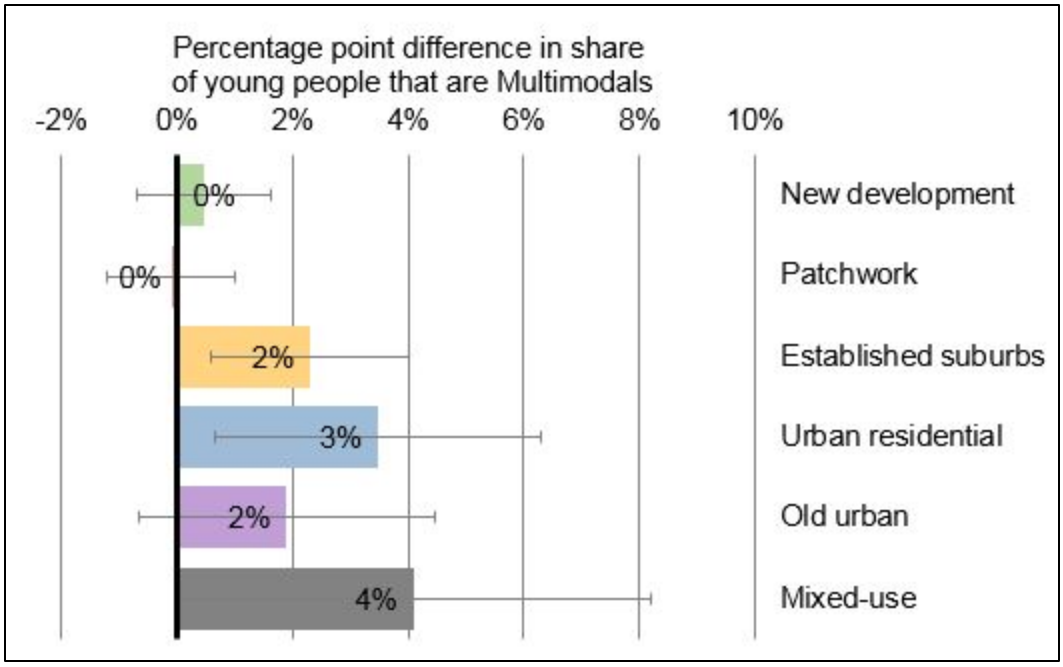
Figure 77. Chart. Independent effect of neighborhood type on likelihood persons ages 16 to 36 is a long-distance trekker traveler type (relative to Rural areas).

Note: Results of a multinomial logistic regression model with statistical controls for roles, resources, and race/ethnicity. Full model results are available in Appendix VIc.

Of the variables in this model, residential location had by far the strongest relationship with the propensity to be a Trekker. Young people were slightly more likely to be Trekkers if they were employed, lived independently, and/or were not a teenager. Young people were less likely to be Trekkers if they were Asian. The relationship between household income and the propensity to be a Trekker was slightly U-shaped. Young people at extreme high and low ends of the income spectrum were less likely than middle-income young people to be Trekkers, altho0ugh the relationship was only statistically significant for young people in the highest income quintile.

Multimodals

Recall from Chapter V that the Multimodal traveler type is one whose members enjoy high levels of accessibility (measured in terms of trips) without depending exclusively or almost exclusively on automobiles for their mobility. They are, in many ways, an aspirational traveler type for those concerned with the social and environmental costs of auto dependence. As Figure 78 indicates, neighborhood type was an important predictor of being a Multimodal, even when controlling for other factors. Young people in three—generally outlying—neighborhood types were the least likely to be Multimodals: Rural, New development, and Patchwork. Young people were more likely to be Multimodal in the remaining four neighborhood types—Established suburbs, Urban residential, Old urban, and Mixed-use.



Source: 2009 NHTS, weighted values.

Figure 78. Chart. Independent effect of neighborhood type—likelihood of persons ages 16 to 36 being a Multimodal traveler type (relative to Rural areas).

Note: Results of a multinomial logistic regression model with statistical controls for roles, resources, and race/ethnicity. Full model results are available in Appendix VIc.

Notably, age also had a strong relationship with the propensity to be Multimodal. Young people who were in their twenties or older were much less likely to be a Multimodal than young people in their teens. Finally, young people were less likely to be Multimodal if they were in the second income quintile or were married and were more likely to be Multimodal if they lived independently.

Conclusion

This chapter brought together the factor and cluster analyses we used to identify seven basic neighborhood types in the U.S. in Chapter III, with the latent class analysis we used to identify four basic youth traveler types in Chapter V. We also analyzed the relationship between neighborhood type and various travel outcomes, controlling for an array of individual and household characteristics of travelers. Recall that we identified our neighborhood types in terms of their physical attributes irrespective of the characteristics and travel patterns of the people who live and work in them. Further recall that we identified traveler types in terms of their travel patterns, irrespective of the socio-economic characteristics of the travelers or their households, or the physical environment in which the travelers live and work.

We observe in this analysis consistent effects between neighborhood type and travel behavior, for the most part along expected lines. People in Rural areas drive more and farther, and walk and use public transit less, than do people in metropolitan areas. Of all of the metropolitan neighborhood types, travel

patterns in New Developments, often on the suburban fringe, are most similar to Rural areas. Migrating across neighborhood types, like Burgess' concentric rings for 1920s Chicago, we observe travel patterns that are increasingly "urban" and multi-modal in character. In all but one of these neighborhood types, private vehicle travel (driving alone and carpooling) dominates personal travel for all three age groups (teens, young adults, and adults) analyzed. For six of the seven neighborhood types, only in the case of teens in Residential Urban neighborhoods does private vehicle travel for teens (72%) account for less than three-quarters of all trips. Even in the Mixed Use neighborhoods that host most of the urban and suburban central business districts in the U.S., more than three out of four trips by teens, young adults, and adults living in them are made by private vehicle.

There is one very notable exception to the above patterns. Among the seven neighborhood types, Old Urban neighborhoods host decidedly different travel patterns than any of the other urban, suburban, or rural neighborhoods.

The average teenager in our sample travels 13 miles per day by all modes, but in Old Urban neighborhoods teens average just two miles per day. Likewise, young adults in our sample average 19 miles per day, but just 10 in Old Urban neighborhoods. Controlling for an array of individual and household characteristics, teens in Old Urban neighborhoods travel 108 percent fewer miles per day than teens in Rural areas, young adults 74 percent less, and adults 96 percent less than their Rural peers.

The number of daily trips is an important measure of activity participation and social and economic engagement. While the median number of daily trips by teens and young adults is the same (3 trips) across the six other neighborhood types, only in Old Urban neighborhoods do these two categories of young people make fewer daily trips (2 trips) on average. Auto access (measured in terms of household vehicles per licensed driver) in Old Urban neighborhoods is about half of what it is in all other neighborhood types, even controlling for the individual and household characteristics of the travelers. Licensing rates in Old Urban neighborhoods are considerably lower—38 percent for teens, compared with 71 percent for the entire sample, and 75 percent for young adults, compared to 89 percent for the entire sample). Controlling for travelers' individual and household characteristics, teens in Old Urban neighborhoods are 50 percent less likely than their Rural peers to drive alone, young adults are 76 percent less likely, and adults a whopping 62 percent less likely. Neighborhood type has no statistically significant effect on carpooling across any of the age groups, with the exception of in Old Urban neighborhoods, where teens are 35 percent less likely than their Rural counterparts to share a ride, young adults 35 percent less likely, and adults 43 percent less likely, all else equal.

The effect of living in an Old Urban neighborhood and traveling by public transit and foot is perhaps most dramatic in its contrast with other neighborhood types. Compared with Rural areas, Old Urban young adults are 282 percent more likely to ride transit, and adults 365 percent more likely. For adults, the Old Urban effect on transit use is twice that of other urban and old suburban neighborhoods, and nine times greater than in New Development suburbs. Likewise, and again compared with Rural areas,

Old Urban teens are 194 percent more likely to walk, young adults 154 percent more likely to walk, and adults 180 percent more likely to walk.

Finally, with respect to traveler types, living in an Old Urban neighborhood decreases the likelihood of being a Driver by 36 percent, *ceteris paribus*, and increases the chance of being Car-less by a similar 39 percent.

The travel disparities in Old Urban neighborhoods compared with the six other neighborhood types among teens, young adults, and adults are dramatic. They offer important insights into the debate over the effect of land use and urban form on travel. While metropolitan travel in general contrasts notably with travel in Rural areas, travel differences among five of the six metropolitan neighborhood types (New Development, Patchwork Suburban, Established Suburbs, Urban Residential, and Mixed Use) are comparatively, and perhaps surprisingly, modest. This finding generally squares with a now large body of research showing that the effects of the built environment on travel behavior are statistically significant, but relatively modest (Committee for the Study on the Relationships Among Development Patterns, Vehicle Miles Traveled, and Energy Consumption, 2009; Ewing & Cervero, 2010). But, as Ewing & Cervero (2010) and others have argued, the particular mix of built environment characteristics can substantially leverage the built environment effects on travel.

Old Urban neighborhoods are very different from the neighborhoods in which most Americans reside, and the travel patterns there are very, very different as a result. At 27.5 dwelling units per acre, the average housing density of an Old Urban neighborhood is nearly eight times greater than average across all neighborhood types, and the level of transit service is more than eight times greater than average level of service across all neighborhood types. This helps to explain why fewer than half of all trips made by residents of Old Urban neighborhoods are by car for teens, young adults, and adults.

Old Urban neighborhoods are indeed unique, but also comparatively rare. Just four percent of the U.S. population resides in Old Urban neighborhoods, compared for example with 27 percent who live in decidedly auto-centric New Developments. Old Urban neighborhoods are, in fact, confined almost exclusively to a few of the largest, most transit-rich metropolitan areas:

- 50 percent of all Old Urban neighborhoods are in metropolitan New York
- 72 percent are in New York and Los Angeles
- 81 percent are in New York, Los Angeles, and Chicago—the three largest U.S. metros
- 90 percent are in New York, Los Angeles, Chicago, San Francisco, Boston, and Washington, DC—the six largest U.S. metropolitan areas

Old Urban neighborhoods, it would seem, are outliers in every sense of the word.

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VII. CONCLUSION

In this study, we use individual data from the 2001 and 2009 National Household Travel Surveys and associated neighborhood-level data from the Environmental Protection Agency (EPA) Smart Location Database and the Decennial U.S. Census to examine geographic variation in the travel behavior of youth relative to other age groups. We used these combined data to perform five related, yet distinct analyses:

- The composition, character, and distribution of neighborhood types across the entire U.S.;
- Changes in the location of young adults across these neighborhood types over time and relative to other age groups;
- The composition, character, and distribution of types of youth travelers in the U.S., as well as the relationships between neighborhood types and youth traveler types;
- The relationship between neighborhood type and travel behavior (measured by person miles of travel, vehicle miles of travel, trips, access to automobiles, and travel mode) by age group; and
- The relationship between living in a particular neighborhood type and the likelihood of being a certain type of youth traveler.

Using first factor and then cluster analysis, we define seven distinct neighborhood types in terms of the characteristics of the built environment and transportation systems—but not in terms of the characteristics of the people in those neighborhoods or their travel. We labeled the seven neighborhood types based on the most salient characteristics of each: Mixed Use (urban), Old Urban, Urban Residential, Established Suburbs, Patchwork (Suburban), New Development, and Rural. We were then able to place virtually every single census tract in the country (including in Alaska and Hawai'i) in one of these seven neighborhood types. Figure 79 shows each neighborhood type, its prevalence, and basic built environment characteristics, as well as the characteristics of the people living in them. While there is substantial variation in the distribution of these neighborhoods across metropolitan areas, they generally tend to be arranged in a roughly concentric ring pattern described by classical Chicago School urban sociologist and geographer Ernest Burgess nearly a century ago. Mixed Use (urban) neighborhoods (which are also found in the central business districts of suburbs and small cities, as well as in major commercial/industrial areas) are at the core, New Developments at the fringe, and Rural areas outside of cities and suburbs, with the remaining neighborhood types in between Mixed Use and New Development. These neighborhood types serve as the foundation of the subsequent analysis of the residential location and travel behavior of youth relative to older adults.

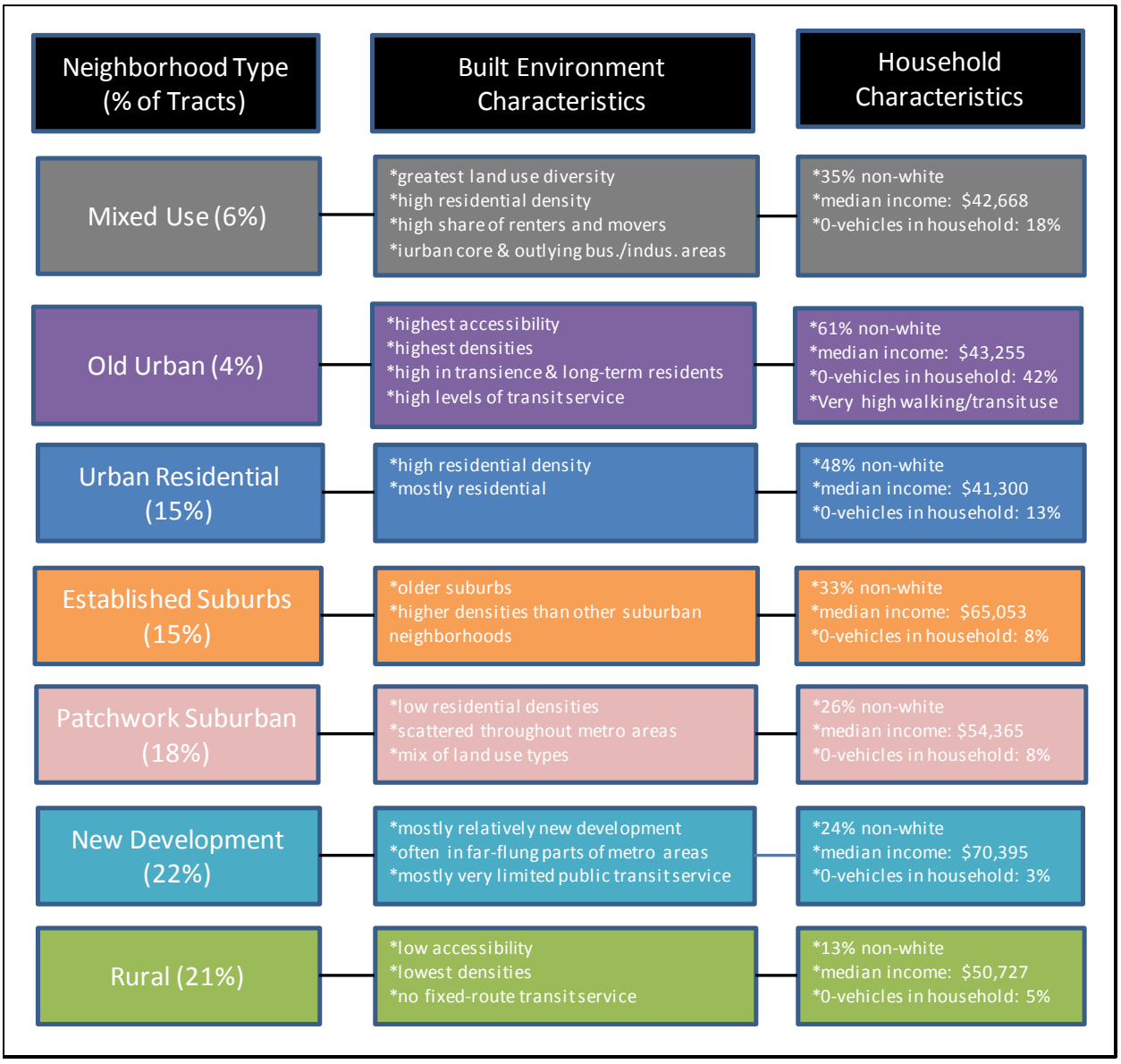


Figure 79. Chart. Neighborhood types.

Note: The neighborhood types are defined only by their built environment characteristics and by not their household characteristics.

Our principal findings are summarized below:

Neighborhood Types

- A majority of Americans live in suburbs. Nearly 3 out of 5 people (58%) live in the three suburban neighborhood types, while just over 1 in 5 (23%) live in the three urban neighborhood types. Figure 80 shows that only four percent of the population lives in Old Urban neighborhoods where transit service and use tends to be highest. In contrast 46 percent of the

population (and 43% of census tracts) are located in Rural and New Development suburbs with little to no public transit service.

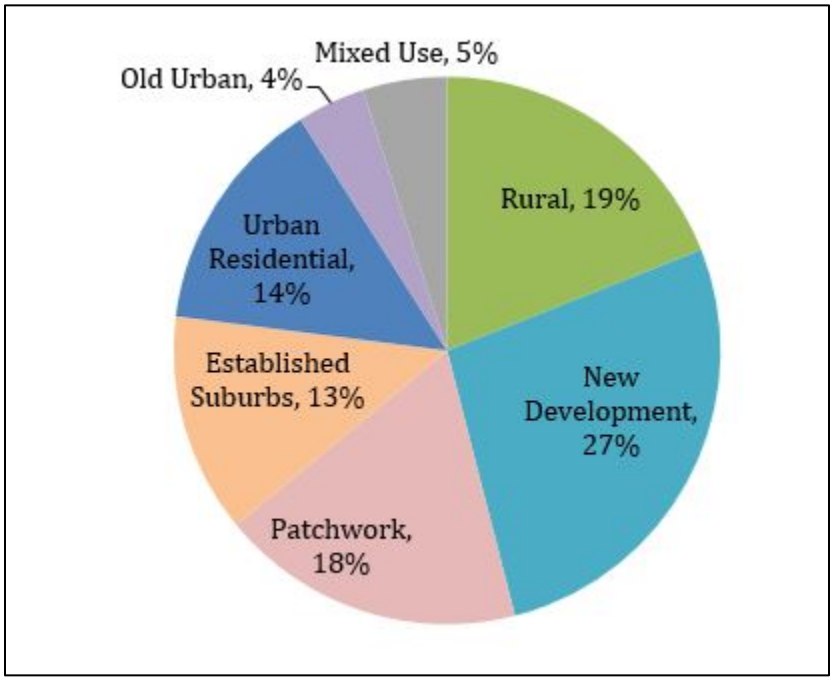


Figure 80. Chart. Residential location by neighborhood type.

- As Table 1 shows, the distribution of neighborhood types varies significantly within and across metropolitan areas.
  - Old Urban neighborhoods are concentrated in the very largest metropolitan areas. The top two metropolitan areas (New York and Los Angeles) collectively host about 10 percent of the U.S. population but 72 percent of transit-rich Old Urban neighborhoods in the U.S.
  - As the largest metropolitan area, New York has the most neighborhoods and, therefore, the greatest number of many neighborhood types (rural, patchwork suburban, established suburban, old urban, and mixed use). However, two other large metropolitan areas make an appearance on the leaderboard. Phoenix has the greatest number of New Development neighborhoods and Los Angeles has the greatest number of Urban Residential neighborhoods.

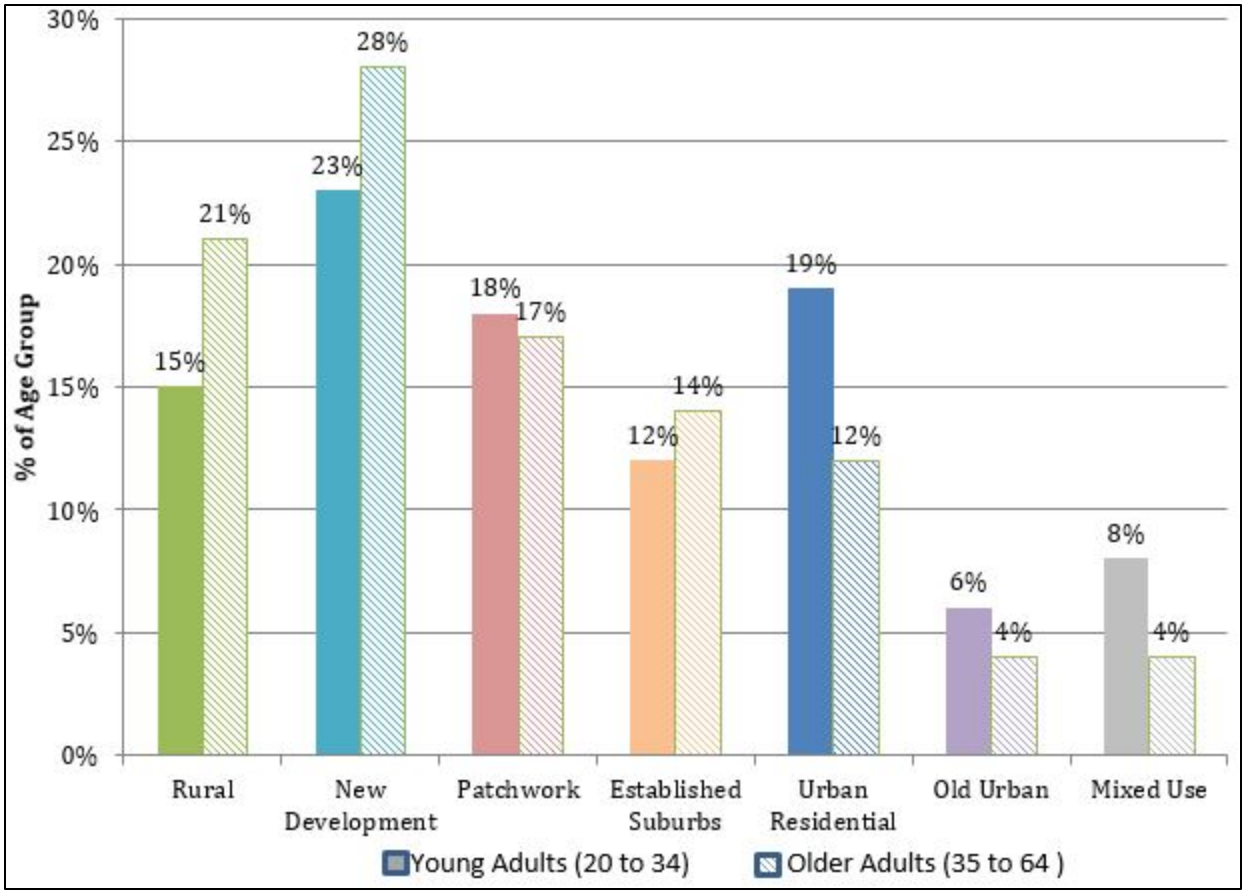
Table 27. Distribution of neighborhood types, across and within CBSAs.

Neighborhood Types	Highest # of Tracts (% of national tracts)*	Highest % of Tracts (%)
Rural	New York 161 (1%)	Central city, KY, Pierre Part, LA, Raymondville, TX, Summerville, GA (100%)
New development	Phoenix 524 (3%)	Palm Coast, FL (90%)
Patchwork suburban	New York 518 (4%)	Hood River, OR (75%)
Established suburbs	New York 1,418 (13%)	Scranton, PA (41%)
Urban Residential	Los Angeles 513 (5%)	Pecos, TX (40%)
Old urban	New York 1,630 (50%)	New York (36%)
Mixed-use	New York 232 (5%)	Ketchikan, AK (50%)

*The percent is the percentage of tracts of this neighborhood type. For example, New York is home to 161 rural census tracts, one percent of all rural census tracts in the U.S.

Residential Location of Youth

As Figure 81 shows, young adults are more urbanized than middle-aged and older adults. While more than half of all youth live in suburban neighborhoods, a higher percentage of youth live in neighborhoods that tend to be found in urban areas—Urban Residential, Old Urban, and Mixed Use.



Source: U.S. Census, 2010.

Figure 81. Chart. Residential location of young and older adults by neighborhood type.

- Accounting statistically for other determinants of residential location, youth remain more likely than otherwise similar adults to reside in the three urban neighborhood types—Mixed Use, Old Urban, and Urban Residential neighborhoods.

- Different socioeconomic characteristics tend to be associated with residing in particular neighborhood types. For example, living independently (not with one's parents), the presence of a child, low incomes, and minority racial/ethnic status are positively associated with living in Old Urban neighborhoods.

- The data for this analysis do not include information on people moving from one neighborhood type to another. However, the data are suggestive of a "back-to-the-city-movement." After population losses in the 1990s, between 2000 and 2010 the number of young adults living in urban neighborhoods—Urban Residential, Old Urban, and Mixed Use—increased by over four million.

- However, any "back-to-the-city" movement since 2000 was swamped by what might best be described as a larger "out-to-the-suburbs" movement (though again, our focus here is on residential

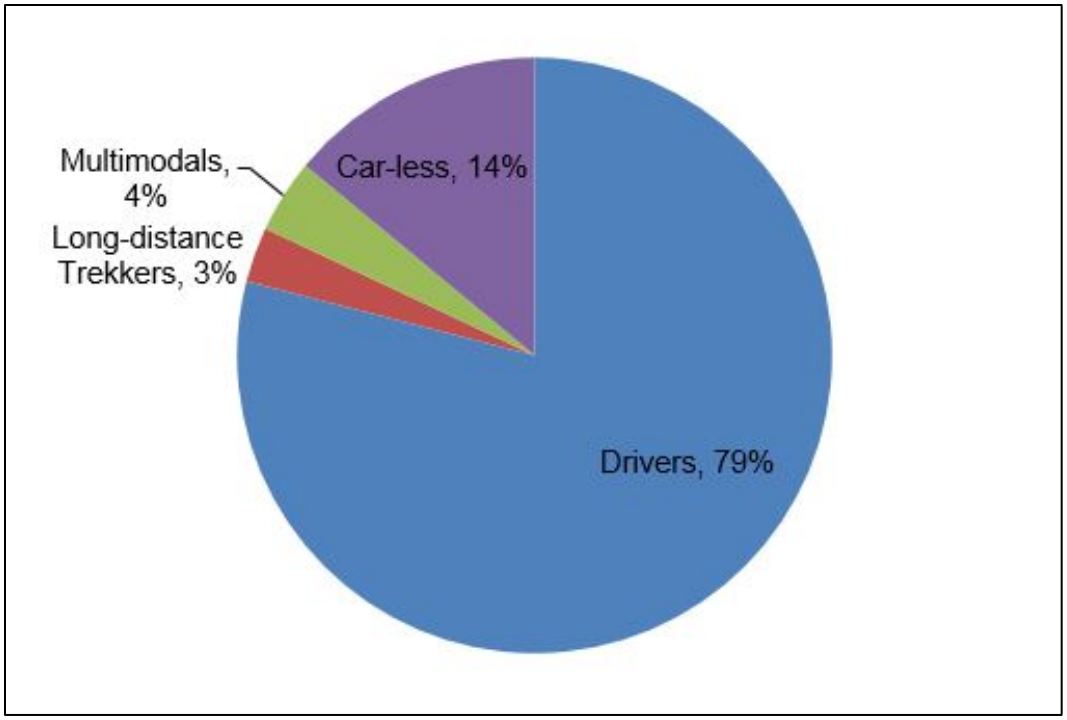
location and not migration). In other words, the increase in youth living in urban areas was dwarfed by the growing numbers of young adults living in suburban neighborhoods, and in particular the generally far-flung New Development neighborhoods.

Youth Traveler Types

- Analysis of travel behavior shows that youth travelers (in this case aged 16-36) can be grouped into one of four different traveler types—Drivers, Long-distance Trekkers, Multimodals, and the Car-less.

- The names of these four traveler types reflect the predominant travel behavior patterns of each group.
  - Drivers make most of their trips by car and have extensive mobility.
  - Long-Distance Trekkers travel the most miles but make no more daily trips than Drivers.
  - Multimodals use a mix of modes and generally enjoy the highest levels of access.
  - The Carless do not travel by automobile, have little mobility, and lower levels of access than those in any of the other three group.

- As Figure 82. Chart. Prevalence of traveler types (2009)Figure 82 shows, Drivers and Long-Distance Trekkers rely on private vehicles for their mobility and comprise 82 percent of all youth traveler types. High accessibility Multimodals comprise only four percent of young travelers, while the low-accessibility Car-less comprise 14 percent of young travelers.



Source: 2009 NHTS, weighted values.

Figure 82. Chart. Prevalence of traveler types (2009).

Note: Population estimates based on the weighted values from the NHTS.

Travel Behavior

- As Figure 83 shows, while we observe travel behavior differences across five of the seven neighborhood types (New Development, Patchwork Suburban, Established Suburbs, Urban Residential, and Mixed Use), these variations are relatively, and to some extent, surprisingly modest.

- In contrast, travel patterns in Rural areas and, in particular, Old Urban neighborhoods varies substantially from the patterns seen in the three suburban and two urban neighborhood types listed above.

- With the exception of Old Urban neighborhoods, private vehicle travel (driving alone and carpooling) dominates personal travel for all age groups analyzed (teens, young adults, and adults) in the six other neighborhood types.

- Travel in Old Urban neighborhoods is decidedly different than any of the other urban, suburban, or rural neighborhoods. Residents of Old Urban neighborhoods make fewer trips, travel fewer miles, have lower rates of automobile access and licensing, are less likely to drive alone, and are much more likely to walk and travel by public transit than are the residents of any other

neighborhood type. Further, teen and young adult residents of Old Urban neighborhoods are less likely to be Drivers and more likely to be members of the Car-less traveler type.

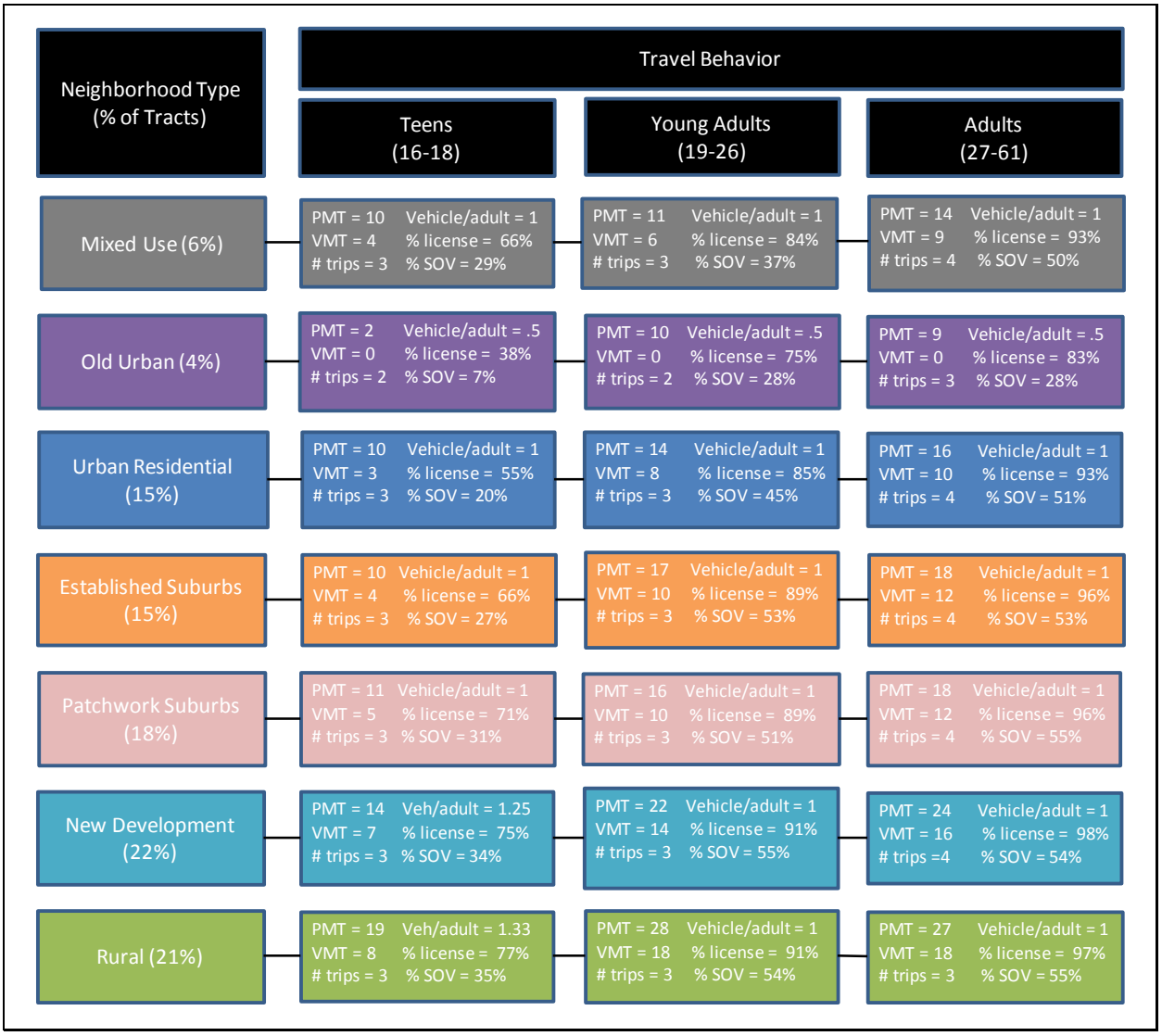


Figure 83. Chart. Travel behavior by age group and neighborhood type.

Note: PMT = Personal Miles Traveled; VMT = Vehicle Miles Traveled.
Median number of PMT, VMT, and trips.

Implications for Policy

The findings of this detailed, and in many ways unique, analysis reveal the folly of excessive aggregation in seeking to either understand travel behavior or make transportation policy. Are young people more likely than older adults to live in central cities? Yes. But the number of young adults living in new suburbs has grown far faster since 2000 than the number in older urban areas. Are teens and young adults today driving less and traveling more by alternative modes than either older adults or youth of earlier generations? Yes. But the vast majority of young travelers travel almost exclusively by automobile and there are 3½ Car-less youth who barely travel at all for each Multimodal young person who enjoys high levels of accessibility. Are there urban neighborhoods where travel by foot and public transit is greater than travel by car? Yes, but these account for just four percent of all U.S. neighborhoods and 9 out of 10 of them are in the six largest U.S. metropolitan areas, more than 7 out of 10 are in the two largest metropolitan areas (Los Angeles and New York), and fully half are in the Big Apple alone; in all other neighborhood types, private vehicle travel dominates.

Such geographically and demographically varied patterns in residential location and travel behavior call into question one-geography-fits-all transportation policies premised on homogeneous characterizations of travelers. Public transit use is concentrated among the lowest income households and in the densest, most urban neighborhoods, yet public policies tend to favor widening the geographic scope of public investments in transit to neighborhoods where cars are king and transit use is sparse (Taylor & Morris, 2015). Cities around the U.S. enforce often uniform minimum parking requirements in even the densest, least car-oriented neighborhoods, driving up development costs and subsidizing car travel in the process (Shoup, 2005).

Over the longer term, the neighborhood and traveler type analyses presented in this report present a policy dilemma. Should efforts to promote more sustainable forms of mobility in the years ahead focus on creating more of the kind of (Old) urban environments that support and encourage travel by means other than driving in order to increase the currently small share of Multimodal travelers? Or should the interventions focus instead on targeting very different and highly targeted transportation policy interventions across different types of neighborhoods? Most youth and adults live in suburbs, and sprawling New Development suburbs are the fastest growing neighborhood type. These facts present enormous challenges to those who aim to promote mobility by means other than driving alone.

By moving away from notions of the average traveler across crude (central city, suburb, rural) geographies, analyses of the sort developed here point to the need to target transportation policies to fit local built environments and the particular mobility needs of those living in them. For example, Car-less youth may fare reasonably well in Old Urban neighborhoods rich in public transit service and walkable destinations, but the Car-less also comprise 16 percent of those in Established Suburbs (where transit service is limited) and 8 percent in Rural areas (where it is largely absent, which the exception of school bus service). For example, attempting to improve the mobility of Car-less youth in these auto-oriented areas by investing in traditional public transit is likely to be expensive and unlikely to have

much effect. But the rise of shared mobility services, including transportation network companies like Lyft and Uber, present unprecedented opportunities to cost-effectively provide auto-mobility for those without access to cars in outlying areas. Such services are currently entirely privately financed. However, if they continue to expand in the years ahead, targeting user-side subsidies to the Car-less to enable their use of shared mobility services may prove to be an effective, targeted policy particularly in suburban and rural areas.

We have endeavored in this study to cast the fascinating and nuanced story of youth mobility in to far sharper relief than has been done elsewhere to date. Multimodal youth are indeed embracing urban, car-light lifestyles, but they are comparatively rare and far, far from the whole story of youth travel. We have seen that proclamations about the era of driving and roadbuilding fading into the sunset (Davis & Baxandall, 2013; Baxandall, 2013; Dutzik & Baxandall, 2013) may well be apt for certain types of travelers (Car-less and Multimodals) and certain types of neighborhoods (Old Urban), but our analysis shown quite clearly that for the vast majority of U.S. neighborhoods and young travelers, a eulogy for cars and suburbs is likely premature.

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