

Exploratory Analysis of Children's Travel Patterns

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Recent concerns about obesity in children have focused attention on children's travel behavior; however, there has been little study of children's travel. Five questions should be asked to fill this knowledge gap: (a) How much are children traveling? (b) Why are children traveling? (c) With whom are children traveling? (d) How do the observed travel patterns vary with demographic characteristics such as age, race, sex, and income? and (e) What are the barriers to the analysis of children's travel? Data from the 2001 National Household Travel Survey show that children's travel is similar to that of adults. For example, youth travel is dominated by the automobile, with nearly 75% of trips being made in a private vehicle. But in important ways children's travel is different. Because of their youth, children often travel with others. However, the burden of transporting children is not distributed equally between parents; young children are more than five times as likely to travel with their mothers as with their fathers. Age also greatly affects how much children travel. Finally, small changes in current travel surveys could make them much more useful for the analysis of children's travel.

Commuting in America (1, 2), a series of articles on the socioeconomics of urban travel (3–5), and numerous other papers and reports provide a fact base on American adult travel. From these, it is known that nearly 85% of daily local travel uses the private automobile, that there are more cars than licensed drivers, and that Americans make an average of four trips per day (3). But these statistics are not known for children. This is unfortunate because politicians and public health officials have begun to ask questions about how children travel. To make policy decisions about investments in Safe Routes to School programs and to investigate links between children's travel and obesity, a good understanding is needed of how youth are traveling.

This paper uses the 2001 National Household Travel Survey (NHTS) to address five questions: (a) How much are children traveling? (b) Why are children traveling? (c) Who are children traveling with? (d) How do the observed travel patterns vary with demographic characteristics such as age, race, sex, and income? and (e) What are the barriers to the analysis of children's travel? The picture of children's travel that emerges is an essential underpinning to policy decisions and future analyses of children's travel demand.

The results show that children's travel resembles that of adults in many ways. For example, youth travel is dominated by the automobile, with nearly 75% of trips being made in a private vehicle. But in important ways, children's travel is different. Because of their youth, children often travel with others. However, the burden of transport-

ing children is not distributed equally among parents; young children are more than five times as likely to travel with their mothers as with their fathers. Age also greatly affects how much children travel. Infants make half as many trips as 18-year-olds. Once teens reach driving age, they make many more trips, often driving themselves. Children from low-income, minority households without cars consistently travel less than their peers. These children show a deficit of recreation trips, particularly for sports and exercise. The differences are not large but they are suggestive, particularly given current concerns about obesity.

DATA

Data come from the 2001 NHTS, the most recent national travel survey collected by the U.S. Department of Transportation. The NHTS provides trip diaries for 66,000 households. Collected between March 2001 and May 2002, the data set includes information on trip purpose, mode, time, length, and who in the household was on the trip. The data set also includes descriptive information for each person (e.g., age, sex) and household (e.g., household size, income, auto ownership, density at residence). Each participating household was assigned a survey day on which it recorded all trips. For the 2001 survey, the survey methodology included prompts to ask respondents about nonmotorized trips, which tend to be underreported (6). This new methodology led to a substantial increase in the reporting of walking trips (3).

The present analysis includes only those households that

- Reported ages for all household members,
- Completed travel diaries for all household members, and
- Have an adult age 19 or older.

The sample thus includes 34,593 children between ages 0 and 18, who made 117,941 trips. The sample contains fewer minorities than the U.S. population. For example, the sample is 82% white versus 75% for the population. To correct for these sampling imbalances, the sample weights provided by the designers of the NHTS were applied.

HOW MUCH ARE CHILDREN TRAVELING?

Data from the NHTS show that those age 18 and younger make an average of 3.5 trips per day, and more than 75% of these trips are in a passenger vehicle. As a comparison, adults average 4.3 trips per day and make nearly 90% of their trips in passenger vehicles. Children spend 72 min traveling and cover 31 mi each day; adults spend 98 min per day to travel 51 mi. Given the distance that children travel

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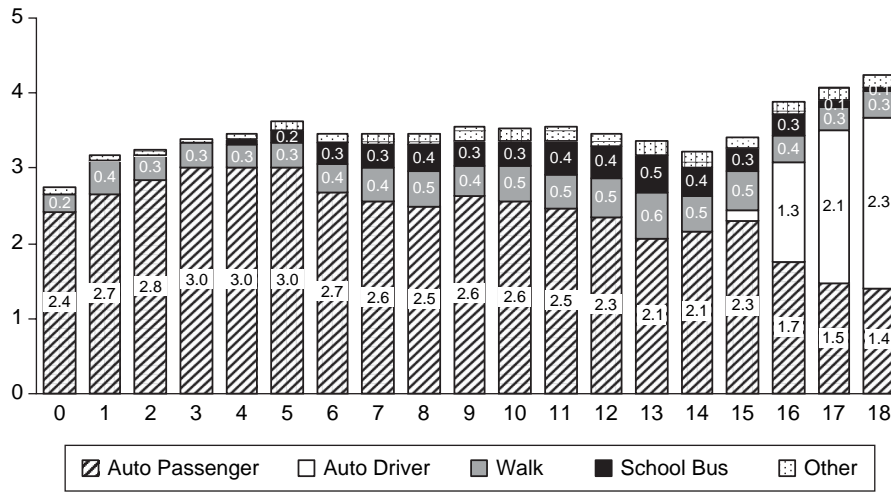


FIGURE 1 Average number of trips per day by age and mode.

each day, it is not surprising that 2.7 of these trips are by auto. The second most common mode is walking, accounting for 12% of trips. For trips of less than a half mile, walking has a 42% mode share. School buses are also an important mode for children. However, they are not the dominant mode for school travel; most children get to school in cars. Bikes do not account for much children’s travel. The overall bike mode share is only 0.8% overall, rising to 2% for trips of less than 1 mi.

As children mature and other travel options become available, they make more trips. Babies and toddlers have depressed trip rates because they are not able to travel by themselves (Figure 1). Between ages 3 and 12, trip making is relatively constant, but there is some variation. Young teenagers (ages 13 to 15) have slightly depressed trip rates because they make fewer automobile trips. Rather than being an indicator of decreased mobility, this may represent increased independence for children. For example, trip rates for young teenagers may decline because they are allowed to stay in the house by themselves rather than required to accompany parents on all trips.

Once youth reach driving age, their behavior changes dramatically. These teens travel more because they have access to cars. In fact, 69%

of teens ages 16 to 18 have driver’s licenses, and 40% report being the primary driver of a household vehicle. This means that 16- to 18-year-olds drive themselves on nearly half their trips. This newfound auto-mobility leads to a 40% decline in the average number of walk trips and a 33% decline in the average number of school bus trips. The extra trips these teens make are to work and for socializing. Increased auto accessibility leading to lower travel impedances for parents and children explains some of this increase in travel.

WHY ARE CHILDREN TRAVELING?

School, shopping, and socializing with friends or relatives are the most common trip purposes. However, children’s travel varies substantially from weekday to weekend and between the school year and summer. Figure 2 shows this variability for the major trip purposes and total trips per day. On school days, children make 1.3 trips to and from school (1.6 if only children age 5 and older are included). In the summer and on weekends, shopping, socializing, and going out to eat are more important activities. Unfortunately, with many trip purposes,

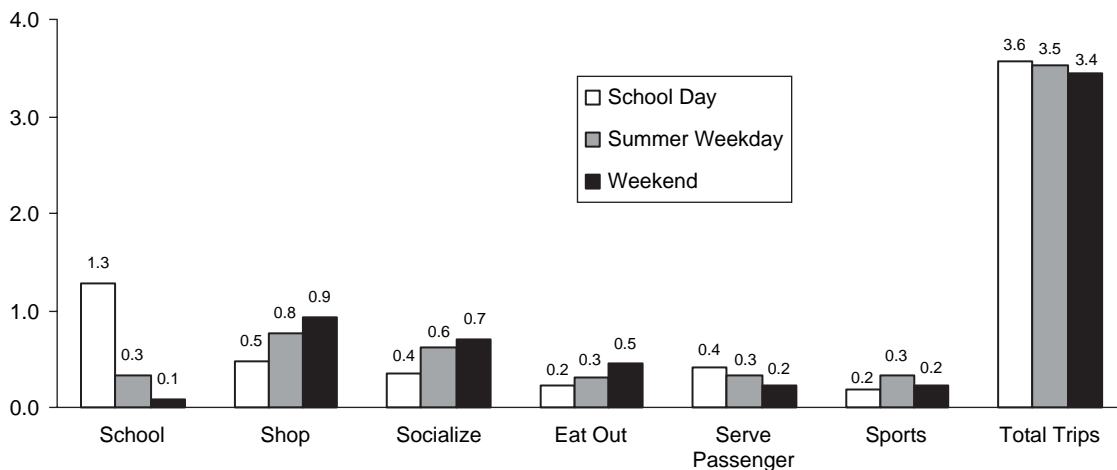


FIGURE 2 Average number of trips per day by trip purpose and season. Purpose is based on reason person traveled to destination unless destination is home; in that case, trip purpose is reason person traveled to origin.

TABLE 1 Mode Split by Trip Purpose

Mode	School	Shop	Socialize	Meals	Sports–Exercise	Total
Auto	54	90	73	93	57	77
School bus	30	0	1	0	1	7
Walk	13	8	20	5	27	12
Bike	1	1	4	0	12	2
Transit	2	1	1	1	0	1
Other	0	0	1	0	2	1
Total	100	100	100	100	100	100

NOTE: Columns may not total 100 because of rounding.

it is not possible to distinguish whether the trip was for the child or for the household. For example, shopping trips to buy the child new sneakers and trips to the grocery store are coded with the same trip purpose. Serve-passenger trips indicate the child accompanied a sibling or parent.

There is also substantial variation in travel mode by trip purpose. Whereas the automobile accounts for the majority of trips by all trip purposes, its level of dominance varies greatly by trip purpose (Table 1). For example, 54% of children use cars for school trips, versus nearly 90% for shopping. Instead, children rely much more heavily on school buses and walking to get to school. Walking is also important for trips to hang out with or visit friends and play sports; these are trips for which children are likely to travel without an adult.

WITH WHOM ARE CHILDREN TRAVELING?

Who children travel with, particularly if they travel alone, reflects their age and maturity level. Babies make nearly all their trips with parents; 18-year-olds make fewer than a quarter of their trips with parents (Figure 3). The proportion of children traveling alone begins to grow when children enter school, largely because of walking trips

to school, and continues to increase as youth age. The increased number of trips taken alone when children reach age 16 reflects their high levels of automobile access and that they can now drive themselves. Trips with people outside the household increase once children enter school, largely because this category includes school bus trips. In the teen years, trips with persons outside one’s household make up at least one-quarter of trips. These numbers probably reflect teens driving each other. However, because the NHTS does not report any information for travelers who are not members of the household, it is impossible to be certain.

Several researchers have suggested normative reasons for paying particular attention to how much children travel by themselves or with peers. First, independent travel presents a way for children to learn about their communities (7–9). Southworth promoted this view by noting that “before the automobile children were relatively free to explore their whole community, but today most urban and suburban children grow and learn in virtual isolation from vital processes of society” (10). Tranter echoed this position: “Independent mobility is important for children’s own personal, intellectual and psychological development and for allowing them to get to know their own neighbourhood and community” (11).

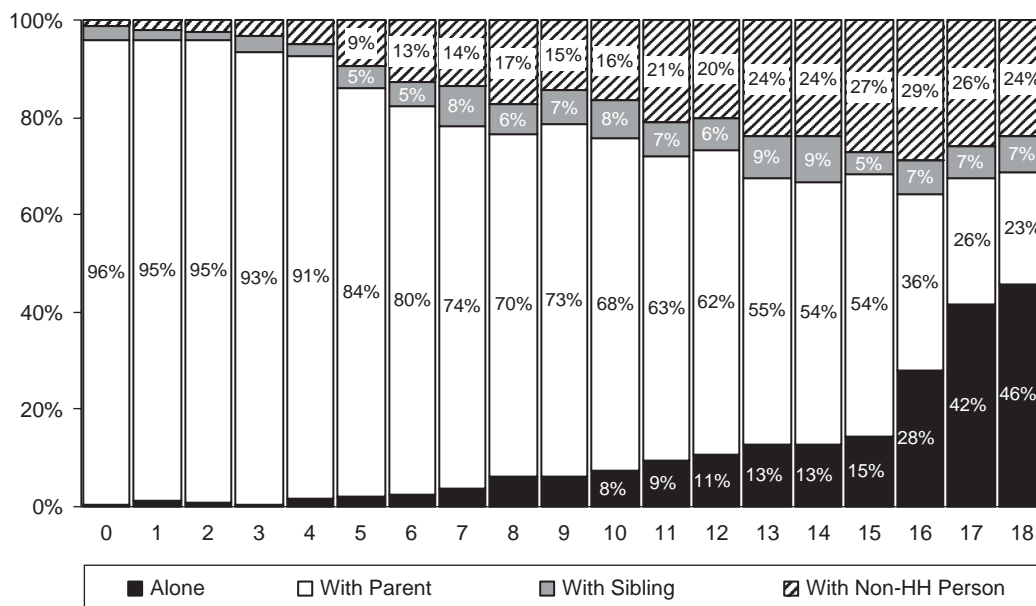


FIGURE 3 Children's travel companions by age (HH = household).

Hillman et al. showed that English schoolchildren had less travel freedom in 1990 than in 1971 (7). For example, 50% of schoolchildren ages 6 to 11 were allowed to ride buses alone in 1971, whereas only 14% were allowed to do so in 1990. The authors noted that the largest declines in independent mobility affected the youngest children. The authors asserted that these changes affected mode shares for the school trip. In 1990, more students were driven at the expense of walking trips.

When children travel with a parent, it is usually with the mother. In fact, the gap between trips taken with mothers and with fathers is quite striking (Figure 4). In intact households, children age 5 and younger make 50% of their trips with their mothers and 10% with their fathers. (Trips for which both the mother and the father are present are classified separately and are not shown here.) This gap equates to children making about one more trip a day with their mothers than with their fathers. As children mature, they make proportionately fewer trips with their mothers and the gap narrows; the proportion of trips taken with fathers hardly varies with age. Children’s increasing maturity allows them to travel by themselves or with friends, that is, to meet some of their own travel needs. At the same time, parents may feel more comfortable leaving the child alone in the house and not require the child to come on each trip.

Three factors likely account for the observed gap in children’s travel with mothers and fathers: (a) mothers earn less and therefore have a lower value of time, which makes economically efficient for them to take responsibility for children’s travel; (b) mothers work fewer hours and therefore are more available to transport children and must take children on more of their own trips; and (c) gender roles give mothers more responsibility for children’s travel regardless of their income or availability. Controlling for the effects of hours worked and personal income is necessary to directly test this hypothesis. Unfortunately the NHTS does not collect these data. However, it does collect parental work status (full time, part time), occupation, and education, which can serve as proxies.

In all intact households, children make 36% of their trips with mothers and 11% with fathers (Table 2). Controlling for parental availability shows that when both parents are full-time workers, the differential drops to 16 percentage points. In households in which both parents are college educated and have managerial or professional jobs, the differential drops slightly to 13 percentage points. These numbers suggest mothers are more likely to make trips with their children because in many households they work less and earn less. However, a large number of the observed differences are un-

TABLE 2 Children’s Trips Versus Parental Status

Household Type	% of Children’s Trips		Difference
	With Mothers	With Fathers	
Intact	36	11	25
Full-time workers	30	14	16
Management–professional w/college	30	17	13

explained by work status, occupation, and education, which suggests that gender roles influence mothers’ responsibility for children’s travel.

Across all trip purposes, children make a higher proportion of trips with mothers than with fathers. However, the gap is largest for serve-passenger and shopping trips and lowest for sports trips (Table 3). Previous research found that mothers make more trips for household-sustaining purposes (12). Therefore, it is not surprising that these are the trip purposes with the biggest gaps. Two factors affect this: mothers are more likely to have responsibility for meeting children’s travel needs, and children make more go-along trips with mothers and those trips on which mothers take them are for household-sustaining purposes, such as shopping.

HOW DO TRAVEL PATTERNS VARY WITH DEMOGRAPHIC CHARACTERISTICS?

Previous research on adult and children’s travel suggests there is important variation by sociodemographic characteristics in the described patterns. For adults, it is known that men travel differently from women; the same might be expected for children. It is also clear that economic status is correlated with the quality and availability of travel options, such as auto ownership. This section considers how travel patterns vary by race, sex, income, auto ownership, and household structure.

Race

Trip rates vary by race and ethnicity. White children make the most trips (3.7); black children make the fewest (3.1) (Table 4). The racial

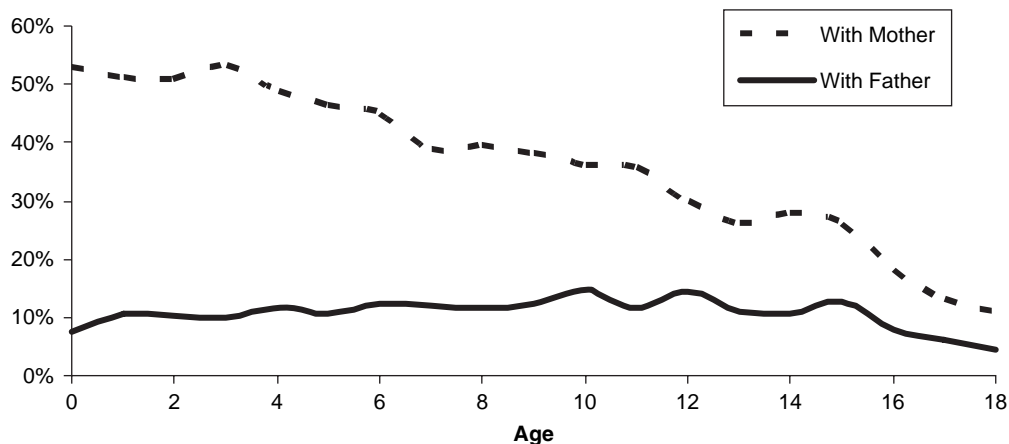


FIGURE 4 Children’s percentage of trips with mothers and fathers in intact households, by age.

TABLE 3 Children's Travel Companions by Trip Purpose

Travel Companions	School	Shop	Socialize	Serve Passenger	Meals	Sports
Family	3	24	17	12	33	12
Mother	29	47	28	57	31	33
Father	8	11	7	12	10	14
Siblings	6	3	9	5	5	10
Alone	44	6	20	5	6	17
Other	11	9	18	9	15	14
Total	100	100	100	100	100	100

NOTE: Columns may not total 100 because of rounding.

TABLE 4 Average Number of Trips by Race and Income

Race	Income			All
	0-30K	30-60K	60K+	
White	3.4	3.6	3.8	3.7
Hispanic	3.2	3.5	3.6	3.3
Black	3.0	3.2	3.4	3.1
Asian	2.5	2.8	3.7	3.2
Multi	3.1	3.3	3.3	3.2
All	3.2	3.5	3.7	3.5

variation is moderated by household income level. Children from households with incomes under \$30,000 show stronger racial variation than children from households with incomes above \$60,000. Social and recreation trips account for 75% of the overall difference in trip rates between whites and nonwhites. Within the category of social and recreation, nonwhites made fewer sports and exercise, socializing, and dining-out trips (Figure 5). For example, whites made 0.3 sports and exercise trips compared to 0.2 for nonwhites. This difference is small but statistically significant.

Income

Household characteristics determine the resources available and the rules that govern travel for children. Youth from households with incomes above \$80,000 take 19% more trips, spend 9% less time trav-

eling, and cover 36% more miles than children from households with incomes below \$20,000 (Table 5). This suggests the children from low-income households may be forgoing some activities, particularly for recreation. In fact, differing numbers of social and recreation trips account for almost all the variation in trip rates between the highest and lowest income groups.

Within the category of social and recreation trips, the biggest differences are for sports and exercise trips [analysis of variance (ANOVA) F -test = 36.85, $p < 0.01$] and going out for meals (ANOVA F -test = 30.11, $p < 0.01$). Children from households earning more than \$80,000 make more than double the number of sports and exercise trips and nearly double the number of trips for meals eaten outside the home as do their peers from the lowest-income homes (less than \$20,000). It is not surprising that wealthier households eat out more. But given the current concern about childhood obesity, the lower levels of sports and exercise trips for low-income households may be problematic. The difference in trip rates for sports may simply reflect that upper-income children are more likely to be involved in organized sports and that these activities are easier to report in a survey than unstructured after-school and weekend play activities. However, these findings highlight the need for further exploration of the links between physical activity and socioeconomic status (13).

Auto Availability

Given the importance of auto travel in explaining the travel differential between poor and rich children, analysis of household auto availability is the obvious next step. As Figure 6 shows, auto availability, defined as the ratio of vehicles to drivers, strongly correlates with trip

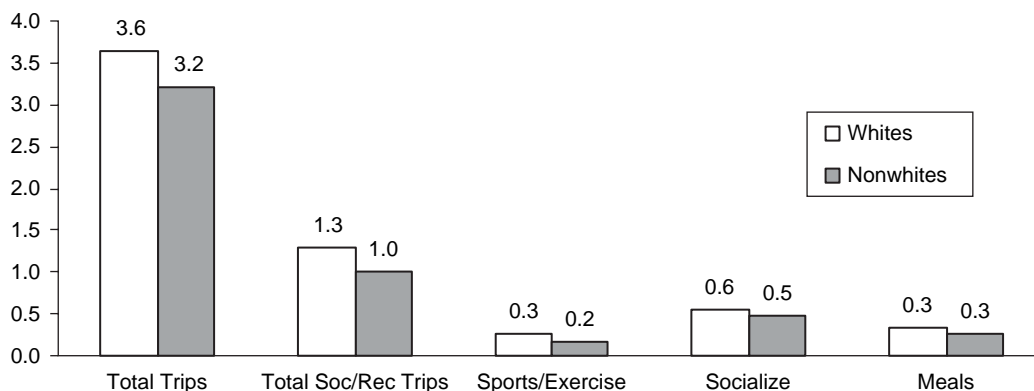


FIGURE 5 Racial differences in social and recreational trip rates.

TABLE 5 Variation in Trip Rates by Household Income

	Income				
	0–20K	20–40K	40–60K	60–80K	80K+
Trips per day	3.1	3.3	3.6	3.7	3.7
Travel time per day (minutes)	77	74	71	70	70
Distance traveled per day (miles)	25	29	32	31	34
Walk trips per day	0.6	0.5	0.4	0.4	0.3
Auto trips per day	2.2	2.5	2.8	3.0	3.1
Social/rec trips per day	0.9	1.1	1.2	1.2	1.4

making. The most critical differences in behavior occur between zero-vehicle households and all others. Children in households with cars make 0.8 trip per day more than those without cars, but they travel nearly 9 min less each day. As auto availability increases, children make more car trips.

Household Structure

Research on the travel patterns of single and married parents has found that single mothers travel differently from either married women or single fathers (14–17). Single mothers’ travel patterns tend to be less complex and have fewer linked and chauffeured trips than those of married women. Rosenbloom speculated that their travel patterns are “less responsive to the needs of children or household than those of married mothers, perhaps because they face more constraints with fewer alternatives” (14). Underlying this research has been a concern that the travel problems of single mothers may become the travel problems of their children. At first glance, the NHTS data appear to show that children of single parents—men or women—do travel less than their peers from intact households. Children in single-parent households make fewer automobile trips (2.4 versus 2.8 for children in two-adult households) and are less likely to travel by car

when they do make trips (67% by auto versus 75% for children in two-adult households).

However, deeper analysis reveals that household auto ownership strongly affects the relationship between number of adults and children’s travel. After accounting for auto ownership, it was found that children of single parents make more trips than their counterparts (Table 6). Unfortunately, it is difficult to know if all this travel is for the child’s benefit or if it amounts to “babysitting on the go.” Kostyniuk et al. showed that after controlling for auto ownership, single parents did travel more than married parents (15). It is likely that their children are accompanying them on many of these trips. To investigate this issue fully, surveys must probe deeper into why the trip is being made and for whose benefit.

BARRIERS TO ANALYSIS OF CHILDREN’S TRAVEL

To make informed policy decisions, researchers, elected officials, and advocates need a detailed picture of how children are traveling. The NHTS provides a great start on this but it lacks several critical pieces of information. One important piece of information is whether the trip was made for the child’s direct benefit. Children travel for two reasons. First, just as adults do, they want to reach activities like school and afterschool programs. But children also travel because their parents are traveling. They may be accompanying parents to spend time together or because no other form of babysitting is available. Having a way to distinguish trips taken for the child’s benefit, for the household’s benefit (such as grocery shopping), and for babysitting would make analysis of trip rates more useful.

Many researchers have identified trips taken without adults, that is, independently, as a critical feature of children’s travel and development (7, 8, 10, 11). In the current data set, it is not possible to fully estimate independent travel. Trips taken with peers are indistinguishable from trips taken with nonhousehold adults. This makes it difficult to describe children’s independent travel fully and also causes difficulties in studying how nonhousehold adults share responsibilities for children’s travel through carpools and newer arrangements, such as walking school buses. Adding questions to future

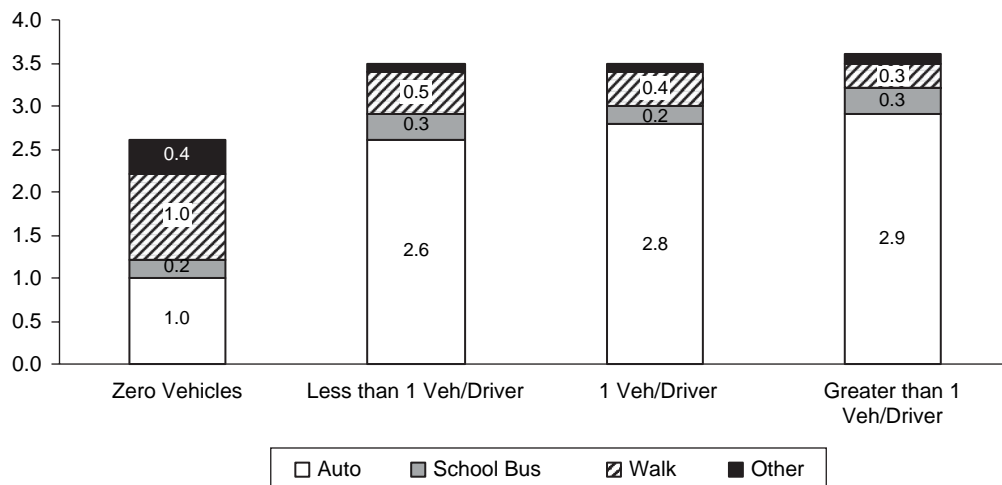


FIGURE 6 Average trips per day by car availability and mode.

TABLE 6 Average Number of Trips by Number of Adults and Vehicles

Number of Adults	Number of Vehicles				Average
	0	1	2	3+	
1	2.9	3.3	3.9	4.2	3.4
2	2.6	3.3	3.5	3.8	3.6
3+	2.0	2.9	3.2	3.3	3.2
Average	2.7	3.3	3.5	3.7	

surveys addressing the age of nonhousehold travel companions and the true purpose of children's trips would greatly assist further analysis of children's travel.

Finally, the issue of transportation affordability for school travel has become important in several regions. Most notably, elected officials and youth advocates in the San Francisco Bay Area created a program to broaden access to programs and activities and to improve attendance through the distribution of free bus passes to students (18). These programs raise the question of how much children are paying to get to school—either to ride the school bus or to take public transit. Because the NHTS does not collect data on cost, it is difficult to assess the scale of this issue.

CONCLUSIONS

What this entire analysis reveals is that children's travel has moved well beyond simplistic images of children being carted back and forth to school on yellow school buses or walking around the neighborhood. Children today need to reach many destinations and must rely on autos and parents to do so. This automobility has two major implications. First, parents, particularly mothers, spend significant amounts of time transporting children. Second, auto access is central to the travel patterns of driving-age teens. Many of them have primary access to a household vehicle, and they use it.

School, shopping, and socializing are the primary reasons children travel. One problem with current survey data for children is that it is impossible to determine whether the trip was taken for the child's benefit or if the child was simply going along with a parent. This difference is particularly important for shopping trips, many of which may prove to be grocery store trips rather than sneaker shopping trips. The finding that children of single parents make the most trips, after controlling for auto ownership, suggests that these babysitting or go-along trips are an important part of children's travel patterns and need to be better understood.

The analysis consistently showed that children from low-income or minority households traveled less than their peers and that the foregone trips were often for social and recreation purposes. In particular, these students made fewer sports and exercise trips. As mentioned, this may simply reflect that middle- and upper-class children are more likely to be involved in organized sports and therefore the act is recorded on a survey. Nevertheless, the current concern with physical activity and obesity make children's travel an area for further analysis.

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