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High School Bicycling Survey 2013: Summary Report

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Background

Concerns about childhood obesity and environmental problems such as climate change have led researchers to examine declining rates of bicycling and walking among children. Understanding the underlying reasons for these travel choices is an important foundation of any federal, state, and local programs aiming to reverse the trend. However, most existing studies have focused just on walking, and have focused on younger elementary school students, leaving important gaps in understanding choices about biking and the experiences of high school students, who have may have more autonomy than younger children as well as the new opportunity to obtain a driver's license.

To examine high school students' motivations to bicycle versus drive, Emond and Handy conducted a study in 2009 of students in Davis, CA, where there is a high level of bicycling relative to other US cities. They found higher rates of bicycling among male students and younger students, and that parents (versus peers) and perceived distance (versus actual distance) were more important factors influencing travel decisions (Emond & Handy, 2012). However, because those results may be particular to the unique Davis context, we conducted a follow-up study in 2013, replicating the investigation in two additional high schools situated in more typical Northern California communities, and also repeating the survey at Davis High. This report summarizes the data collection process and preliminary findings of this follow-up survey, conducted at a total of three Northern California high schools in the spring of 2013: Davis High (in Davis, CA), Sequoia High (in Redwood City, CA), and Tamalpais High (in Mill Valley, CA).

Data Source

School selection

Because a purpose of the study was to provide a comparison to the earlier (2009) study of travel among high school students in Davis, CA, a community in which rates of bicycling are relatively high, this study targets high schools situated in more typical suburban environments, where biking and walking may be feasible for some but is not as prevalent. The two other schools included in the study -- Tamalpais High School in Mill Valley (in Marin County) and Sequoia High School in Redwood City (on the San Francisco Peninsula) -- meet this criteria in that they are not nearly as bicycling-oriented as Davis, but are also in Northern California in communities with at least some bicycling activity and infrastructure.

However, the selection process was largely determined by where we could find individual school staff members willing to help administer the survey, including gaining approval from administrators and overseeing student volunteers who helped distribute and collect surveys from classrooms. Tamalpais came to be included because a parent of a former student interested in bicycling issues contacted the researchers for assistance in conducting a survey there and served to help facilitate contact with school staff. The researchers then contacted staff at a variety of other area schools (including some in South Bay, Santa Rosa, East Bay, Marin, and Sacramento region) and found some individual teachers at Sequoia who were interested in helping facilitate its administration there. At other schools, those

contacted were either interested but too busy, or declined to participate because of specific concerns. Concerns mentioned included the number of surveys and testing students are already asked to undergo, using class time for the survey, and the need to gain approval from the parent association before proceeding.

While a broader array of schools could better capture the full range of experiences in different community types, Tamalpais and Sequoia together provide diversity well beyond the Davis context. The three schools -- and the communities in which they are situated -- differ from each other in important ways, including the flavor and extent of bicycling culture in the broader community; the level of investment in bicycling infrastructure in the vicinity of the school; the topography and catchment area for the high school itself; and the socio-demographic make-up of each community.

Mill Valley, situated in Marin County, is a destination for recreational cyclists from throughout the Bay Area, but cycling for transportation is not prevalent. However, the county's bicycle coalition is large and active with a stated goal of 20% bicycle mode share by 2020, and the county was one of four nationwide to receive over \$25 million from the Federal Nonmotorized Transportation Pilot Program to invest in bicycle (and other nonmotorized) infrastructure. Contrasting with Davis, many residential areas are quite hilly, a potential factor for bicycling. Some schools in the area have been particularly active in encouraging alternative transportation (e.g. Sir Francis Drake High School in Fairfax), but less so at Tamalpais.

Sequoia High draws students from throughout San Mateo County, perhaps affecting the feasibility for some students to bicycle based on distance alone. The area is not as hilly as Mill Valley, but has more varied topography than Davis. As in Marin, other area schools in San Mateo County have a more active bicycling culture. However, there are bike lanes on the road leading to the school, an environmental club and a bicycle club on campus, and secure bike parking.

Table 1. Socio-demographic attributes of the three high school locations

	Davis, CA (Davis High)	Redwood City, CA (Sequoia High)*	Mill Valley, CA (Tamalpais High)	Statewide in CA
Median family income	\$106,586	\$88,525	\$167,561	\$70,231
Families <\$25,000	11.9%	9.5%	2.9%	15.2%
Families \$200k+	16.6%	17.3%	40.1%	8.4%
% workers commuting by car	68.9%	90.3%	80.1%	89.3%
% white (only)	64.9%	60.2%	88.8%	57.6%
% Hispanic (of any race)	12.5%	38.8%	4.5%	37.6%
% Asian (alone or with any other race)	25.3%	13.1%	7.7%	14.9%

Source: U.S. Census Bureau, 2010.

* The catchment area for students attending Sequoia extends beyond Redwood City, with likely more racial and economic diversity.

With respect to demographics, all three communities are somewhat wealthier than the state as a whole, according to the 2010 Census (see Table 1). Mill Valley (served by Tamalpais High) is especially wealthy and white. The community served by Sequoia is more economically and racially diverse than Davis or Tamalpais, and importantly includes students from areas beyond Redwood City where the school itself is located (and for which statistics are shown in Table 1).

Survey instrument

We collected data using a printed two-page questionnaire (front and back of a 8.5 x 14" sheet of paper) that students were to read, fill out with a pen or pencil, and pass back. The content was based on the 2009 survey administered at Davis High, including questions about students' transportation to school; where they travel from (cross-streets of their home locations); some of their opinions about transportation, environmental, and social issues; and some basic demographic information (race/ethnicity, gender, age, and parents' educational attainment). (See a copy in the appendix.) While retaining much from the 2009 survey, we revised and updated the survey to incorporate feedback from students and teachers at the three schools participating in 2013. The surveys were identical at all three schools, except for question 4, tailored to the schedules at each school.

Survey administration

We aimed to have the survey distributed to the entire student body at all three schools. In each case, we relied on a lead faculty member to help coordinate the distribution and collection of the surveys (in particular, the teachers serving as the advisers to the Environmental Clubs at Davis and Sequoia; and an Environmental Education teacher at Tamalpais). These faculty leads identified a date and time to conduct the survey that would work for their school's schedule, selecting a time period in which all students could be included while minimally interfering with class time. (The survey was conducted during particular class period at Davis and Sequoia, and during a tutorial period at Tamalpais.) The faculty leads notified other teachers at the school of the designated time when the survey would be conducted, and oversaw student volunteers (from their club/class) who helped organize the surveys into envelopes and distributed and collected them from each classroom before and after. During the designated time period, the teacher in each classroom passed out the survey, read a statement assuring students that it was voluntary, and then collected the completed surveys. Although cooperation was invited via encouragement from the lead faculty person, as well as endorsed by school administration, teachers in each classroom were not required to administer the survey.

While the survey was intended to be easy for all students to read and complete on their own in less than 10 minutes, we received feedback that in a few classes serving students with English as a second language, the survey was difficult for some. In these cases, the teacher helped students by reading all the questions aloud to the class, devoting over a half-hour to complete the survey.

In all three schools, the survey was conducted in the first week of May, when the weather is typically good, but before end-of-year testing and other activities potentially interfering with the schedule.

Participation rates

Although all teachers were encouraged to administer the survey, there were some classes in each school in which the survey was either never administered or not returned. We have no reason to believe that classrooms in which the survey was administered were systematically different from those in which it was (with respect to bicycling and transportation choices) and so this largest source of exclusion is not expected to introduce bias, but reduced the overall number of students invited to take the survey. In total, we received completed surveys from 143 of the 172 classrooms listed on the class schedules at the three schools, with the remaining 14% to 23% of classrooms excluded at any given school (Table 2). Because we do not have attendance numbers by classroom at the day and hour of the survey, we do not know the rate of refusal within each classroom, but we think most students who were present when the

survey was administered chose to complete it. In comparing the completed surveys to the overall enrollment at each school, participation ranged from 54% to 71% of total enrollment, lowest at Sequoia and highest at Davis (see Table 3). The participation rate is equivalent among males and females at Tamalpais and Davis, but slightly higher among females at Sequoia. Participation rates are somewhat lower among seniors at all three schools.

Table 2. Number of classrooms that participated at each school

Classrooms	Davis		Sequoia		Tamalpais		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Participating	48	86%	55	86%	40	77%	143	83%
Not participating	8	14%	9	14%	12	23%	29	17%
Total	56	100%	64	100%	52	100%	172	100%
Average number of students or seats per classroom	35.4		25.1		18.8		26.0	

The total number of classrooms is based on those listed on class schedule for the period when the survey was administered. Average class size reported here is based on the number of enrolled students or seating capacity listed on the class schedule. "Not participating" classrooms include those that returned no surveys (altogether missing) or only blank surveys, or that explicitly noted they did not participate. "Participating" classrooms include those that produced any completed surveys.

Table 3. Survey participation compared to total enrollment, by gender and grade level

	Total enrollment, 2012-13			Survey responses			Response as a percent of enrollment			
	Davis	Sequoia	Tamalpais	Davis	Sequoia	Tamalpais	Davis	Sequoia	Tamalpais	Overall
Total	1,747	2,025	1,229	1,237	1,090	763	70.8%	53.8%	62.1%	61.8%
Male	846	1,003	615	597	901	620	70.6%	50.0%	60.5%	59.7%
Female	901	1,022	614	372	614	383	73.3%	56.5%	62.3%	61.9%
9 th grade	n/a	446	318	n/a	266	193	n/a	59.6%	60.7%	60.1%
10 th grade	610	527	303	425	306	211	69.7%	58.1%	69.6%	65.4%
11 th grade	551	540	317	410	273	193	74.4%	50.6%	60.9%	62.2%
12 th grade	586	512	291	393	243	163	67.1%	47.5%	56.0%	57.5%

Enrollment data are for 2012-2013, as provided by the California Department of Education, Educational Demographics Unit (<http://dq.cde.ca.gov/>).

Data processing

Data entry and cleaning

Under the supervision of postdoctoral researcher at UC Davis, a team of 5 undergraduates and 1 staff person entered responses from the paper surveys into Excel spreadsheets. They entered numerical codes corresponding to each categorical response, transformed years/dates of birthday and licensing into a consistent format, and transcribed the names of cross-streets and towns and responses written in "other" fields. They also flagged anything unusual, and after a review, we discarded about a dozen surveys with not-credible (clearly bogus and/or joke) responses, as well as several Davis students who reported attending DaVinci High (primarily at another campus location). Among others, we retained all surveys that provided at least some non-missing, seemingly credible responses. For survey questions where a single response was sought, but multiple answers were given, we made the following edits: we rounded up to the highest number of days participating in after-school activities that were indicated; we rounded up to the highest level of parents' educational attainment indicated; and we rounded away from neutral (toward a stronger agree or disagree) for the Likert-type agree/disagree responses. If multiple responses were indicated for questions 3, 7, and 8 on typical mode to/from school, we noted the multiple modes indicated, but for our primary analysis counted these multiple responses as missing,

since there was no way to determine which response best reflects what the respondent did most. (See more discussion of this issue in the results section.) We used the dates given in questions 13 and 14 to calculate respondents' age and amount of time that they've had a driver's license (as the difference between the date given and May 2013).

Geocoding and distance calculations

Respondents were asked, "What is the nearest intersection to your home? (This is to give us an idea of how far away from school you live. If you live at more than one place, answer for wherever you spend more time)," with blank spaces provided for a street name, nearest cross street, and city name. About 80% of respondents provided at least some street and city information (see Table 4).

Surveys with non-missing information were imported into ArcGIS, where we used tools in the Network Analyst extension to locate the intersections on a street map and calculate the distance from each to the local high school. In particular, we used the "10.0 US Streets Geocode Service (ArcGIS Online)" in the "Geocode Addresses" tool to attempt to automatically match points to a location on a publicly available street network. In total, 37.8% of cases were matched automatically by the geocode service, with the remaining processed as "tied" or "unmatched." We then reviewed these by hand, locating them on Google maps as needed. The main problem was non-intersecting streets and cross-streets—about a third of the unmatched points resulted from non-intersecting streets and cross-streets. If sensible, a nearest cross-street was then chosen by hand. Misspellings, which caused about another 20% of the unmatched points, were another issue that we faced. In another 20% of cases, only one street was given without a cross-street, in which case we chose a point at the approximate midpoint of the primary street. In total, an additional 34.5% of cases were matched to specific locations using this by-hand review process, for a total of 72.3% of those with non-missing entries successfully geocoded (Table 4).

For the cases that were successfully geocoded, we then estimated the distance between each point and the high school using the "Network Analyst" tool, which calculated the shortest-time path between each pair of points along the street network. These distances were exported from ArcMap in a spreadsheet, and added to our main dataset using SPSS.

Table 4. Success rate in geocoding respondents' home locations

	Davis		Sequoia		Tamalpais		Total	
	Number	%	Number	%	Number	%	Number	%
Total responses	1237	100.0%	1090	100.0%	763	100.0%	3090	100.0%
Cross-streets missing	248	20.0%	217	19.9%	140	18.3%	605	19.6%
Cross-streets given	989	80.0%	873	80.1%	623	81.7%	2485	80.4%
Cross-streets located	926	74.9%	759	69.6%	548	71.8%	2233	72.3%
Automatically	499	40.3%	465	42.7%	203	26.6%	1167	37.8%
With review	427	34.5%	294	27.0%	345	45.2%	1066	34.5%
Not locatable	63	5.1%	114	10.5%	75	9.8%	252	8.2%

Results

This section provides an overview of responses to each of the survey questions at each of the three schools. A discussion of potential follow-up analysis (comparable to that conducted using the data from the survey at Davis in 2009) follows, as well as a discussion of lessons learned from this survey effort.

Means of transportation to and from school

The survey asked students how they usually get to school (question 3) and home from school (question 7), asking them to “check one” box only. Thus, while students could indicate doing something different in the morning versus the afternoon, there was no way to indicate doing different things on different days or at different times of the year – for instance anyone who bikes or walks only some days. Some students indeed checked more than one box (between 6% and 11% of answers to questions 3 and 7 at each school), but because we did not systematically collect from everyone data about using different means of transportation on different days, we excluded these responses altogether.

Valid (single-answer) responses to questions 3 and 7 are shown in Table 5, Table 6, and Figure 1. The results verify that bicycling is much more common at Davis than anywhere else, with about a third of students bicycling versus about 5 percent at the other schools. However, walking (especially home from school) is much more common at Sequoia and Tamalpais than at Davis. As a result, the overall portion of students using any “active” mode either to or from school is almost comparable (though still lower) at Sequoia and Tamalpais (see Table 6). Students at Tamalpais High have the highest rates of car use (over three-quarters, versus less than two-thirds at Davis). Among those arriving by car at each school, Davis students are most likely drive themselves and least likely to get rides from parents, followed by Tamalpais, and then Sequoia students (who are less likely to drive themselves and more likely to get rides from parents relative to students at the other schools).

Table 5. How do you usually get to school and home from school (questions 3 and 7), by school

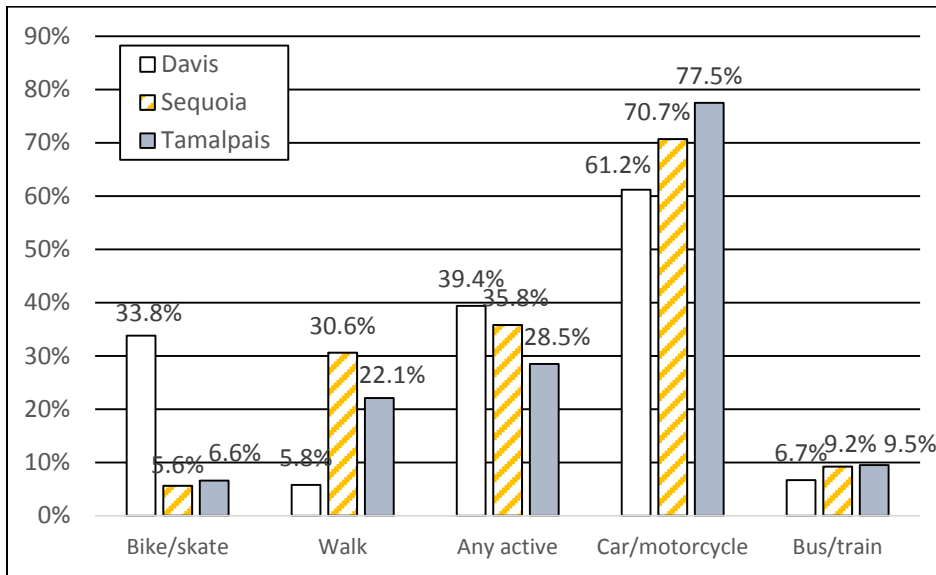
	Davis		Sequoia		Tamalpais	
	To school	Home after	To school	Home after	To school	Home after
Bicycle	32.4%	32.1%	4.1%	4.4%	6.1%	6.4%
Walk	4.4%	5.6%	20.6%	30.8%	13.9%	20.5%
Skateboard	0.7%	0.7%	1.1%	1.3%	0.4%	0.1%
Friend drives	3.3%	4.8%	2.4%	3.5%	3.8%	5.1%
Family drives	24.0%	19.4%	44.8%	31.4%	36.8%	27.9%
Another parent drives	3.0%	2.2%	5.1%	3.4%	5.5%	3.8%
Drive myself	28.6%	28.8%	15.7%	16.1%	27.0%	26.7%
Bus	3.6%	6.2%	5.4%	7.5%	5.8%	9.1%
Other	0.1%	0.1%	0.8%	1.7%	0.4%	0.4%
Total non-missing	1148	1142	985	951	703	689
Excluded because multiple responses	74	75	95	121	45	60
Other missing or blank	5	10	8	16	13	12
Total	1227	1227	1088	1088	761	761

Table 6. Percent using each mode (consolidated categories) either to and/or home from school, by school

	Davis	Sequoia	Tamalpais
Bike/skate	33.8%	5.6%	6.6%
Walk	5.8%	30.6%	22.1%
Any active	39.4%	35.8%	28.5%
Car/motorcycle	61.2%	70.7%	77.5%
Bus/train	6.7%	9.2%	9.5%
Total non-missing	1164	1011	725

Percentages within school columns may not add to 100% due to students indicating different modes for the morning versus afternoon. Consolidated categories are as follows: Bike/skate includes biking, skateboarding, and rollerblading; walk includes walk, jog, and run; car includes any driving or riding as a passenger in a private vehicle or motorcycle, either alone or in a carpool; transit includes bus and train. Respondents who indicated multiple selections are excluded.

Figure 1. Percent using each mode (consolidated categories) either to and/or home from school, by school



Morning versus afternoon

Most students reported using the same mode on the same day to and from school: if measured as consolidated categories, 85% at Sequoia and Tamalpais, and 93% at Davis, do the same thing in the morning as in the afternoon (Table 7). At all three schools, more students get a ride to school in the morning, but then walk or bus home in the afternoon (Table 8). In general, if students bike to school they also bike home.

Table 7. Percent whose usual mode to school versus home from school differs, by mode and school

	Davis		Sequoia		Tamalpais	
% using the same mode	93.0%		84.3%		84.5%	
% using different modes	7.0%		15.7%		15.5%	
Total non-missing	1151		954		696	
% different among those who:	To school	Home	To school	Home	To school	Home
Bike/skate	3.7%	2.7%	2.0%	7.7%	2.3%	2.3%
Walk	8.0%	28.1%	6.6%	35.0%	19.6%	43.5%
Car/motorcycle	8.5%	2.9%	19.5%	3.0%	16.3%	4.4%
Bus/train	12.2%	48.6%	15.8%	39.2%	10.3%	43.5%

Table 8. Cross-tabulation of how students usually get to school versus home after school, consolidated categories

Davis		How do you usually get to school? (%)				Overall	
		Bike	Walk	Car	Bus	Overall (%)	(N)
How do you usually get home after school? (%)	Bike	31.3%	-	0.9%	-	32.1%	44
	Walk	0.2%	4.0%	1.3%	0.1%	5.6%	138
	Car	1.0%	0.3%	54.6%	0.3%	56.2%	452
	Bus	0.1%	-	2.9%	3.1%	6.1%	62
Overall (%)		32.5%	4.3%	59.6%	3.6%	100.0%	
Overall (N)		374	50	686	41		1151
Sequoia		How do you usually get to school? (%)				Overall	
		Bike	Walk	Car	Bus	Overall (%)	(N)
How do you usually get home after school? (%)	Bike	5.0%	0.3%	0.1%	-	5.5%	44
	Walk	-	19.3%	10.1%	0.3%	29.7%	138
	Car	0.1%	0.9%	54.9%	0.6%	56.6%	452
	Bus	-	0.1%	3.1%	5.0%	8.3%	62
Overall (%)		5.1%	20.6%	68.2%	6.0%	100.0%	
Overall (N)		49	197	651	57		954
Tamalpais		How do you usually get to school? (%)				Overall	
		Bike	Walk	Car	Bus	Overall (%)	(N)
How do you usually get home after school? (%)	Bike	6.2%	-	0.1%	-	6.3%	44
	Walk	0.1%	11.2%	8.2%	0.3%	19.8%	138
	Car	-	2.6%	62.1%	0.3%	64.9%	452
	Bus	-	0.1%	3.7%	5.0%	8.9%	62
Overall (%)		6.3%	13.9%	74.1%	5.6%	100.0%	
Overall (N)		44	97	516	39		696

Change since middle school

Results show substantially less biking and walking (now) in high school versus middle school, at least for the trip to school (Table 9). (As noted, a greater share of students walk home from school than to school in the morning; this was not asked about middle school.) In total, the percent of students reporting using some active mode is half for the trip to high school versus the trip to middle school. Biking (especially), but also walking and busing, are displaced by driving and getting rides (Table 10).

Table 9. Modes usually used to get to middle school versus (now) in high school, by school

	Formerly, to middle school	Now, to high school	Now, to or from high school
Davis			
Bike	54.8%	32.6%	33.8%
Walk	9.0%	4.3%	5.8%
Any active	63.8%	36.9%	39.4%
Car	31.5%	59.5%	61.2%
Bus	4.7%	3.6%	6.7%
Total (N)	1138	1164	1164
Sequoia			
Bike	6.4%	5.0%	5.6%
Walk	21.6%	20.1%	30.6%
Any active	28.0%	25.1%	35.8%
Car	62.0%	68.9%	70.7%
Bus	10.1%	5.9%	9.2%
Total (N)	1004	1011	1011
Tamalpais			
Bike	17.6%	6.3%	6.6%
Walk	20.1%	13.5%	22.1%
Any active	37.7%	19.8%	28.5%
Car	54.7%	74.5%	77.5%
Bus	7.6%	5.7%	9.5%
Total (N)	706	725	725

Table 10. Cross-tabulation of how students usually get to high school (now) versus how they got to middle school, consolidated categories, by school

Davis		How do you usually get to school (now)? (%)				Overall (%)	Overall (N)
		Bike	Walk	Car	Bus	Overall (%)	Overall (N)
How did you usually get to middle school? (%)	Bike	26.0%	2.3%	25.5%	0.8%	54.6%	603
	Walk	2.7%	0.9%	4.9%	0.4%	8.9%	98
	Car	3.3%	0.9%	26.2%	1.4%	31.9%	352
	Bus	1.0%	0.5%	2.3%	1.0%	4.7%	52
Overall (%)		33.0%	4.5%	58.8%	3.6%	100.0%	
Overall (N)		365	50	650	40		1105
Sequoia		How do you usually get to school (now)? (%)				Overall (%)	Overall (N)
		Bike	Walk	Car	Bus	Overall (%)	Overall (N)
How did you usually get to middle school? (%)	Bike	1.7%	0.9%	3.7%	0.2%	6.5%	63
	Walk	0.9%	7.4%	11.6%	1.9%	21.8%	210
	Car	2.1%	8.0%	49.9%	1.9%	61.9%	596
	Bus	0.4%	3.3%	4.4%	1.7%	9.8%	94
Overall (%)		5.1%	19.6%	69.7%	5.6%	100.0%	
Overall (N)		49	189	671	54		963
Tamalpais		How do you usually get to school (now)? (%)				Overall (%)	Overall (N)
		Bike	Walk	Car	Bus	Overall (%)	Overall (N)
How did you usually get to middle school? (%)	Bike	4.0%	1.8%	11.1%	0.3%	17.1%	117
	Walk	0.9%	8.2%	9.8%	1.3%	20.2%	138
	Car	1.2%	3.4%	48.9%	1.9%	55.3%	378
	Bus	0.6%	0.6%	4.2%	1.9%	7.3%	50
Overall (%)		6.6%	13.9%	74.1%	5.4%	100.0%	
Overall (N)		45	95	506	37		683

Active modes by gender

Males bike much more than females at all three schools (see Table 11). They also walk more than girls at Davis and at Tamalpais, though not at Sequoia (where the difference is not statistically significant). The share of boys using active modes for their trip either to or from school is 10 (or more) percentage points higher at all three schools.

Table 11. Use of active modes by gender, at each school

		Male	Female	p-value
Davis	% Biking	41.6%	26.6%	0.000
	% Walking	4.5%	7.1%	0.056
	% Any active	45.9%	33.5%	0.000
	Total non-missing N	558	591	
Sequoia	% Biking	8.7%	2.5%	0.000
	% Walking	32.4%	28.7%	0.201
	% Any active	40.7%	30.9%	0.001
	Total non-missing N	469	525	
Tamalpais	% Biking	10.7%	2.7%	0.000
	% Walking	25.7%	18.4%	0.018
	% Any active	36.1%	21.1%	0.000
	Total non-missing N	354	369	

Active modes by grade

In general, fewer older students use active modes than younger students at all three schools, but the patterns differ for bicycling and for walking and at each school (see Figure 2 and Table 12). At Davis, bicycling rates drop at each successive grade level (by about 8 percentage points, representing about 35 fewer students bicycling at each grade level), but rates of walking, though lower in general, remain level and/or increase among older students (about 8 more students walking at each grade level). At Sequoia and Tamalpais more students walk and many fewer bicycle to begin with. At Tamalpais, walking drops off after freshman year, with fewer sophomores walking than freshmen, and juniors and seniors walking about the same rates, lower than freshman and sophomores. Meanwhile, the low rates of bicycling are about constant across all four grade levels. At Sequoia, walking actually peaks among sophomores, and is somewhat lower among freshmen and juniors, and lowest for seniors. Low rates of bicycling at Sequoia are lower among older students.

Figure 2. Percent using active modes by grade, at each school

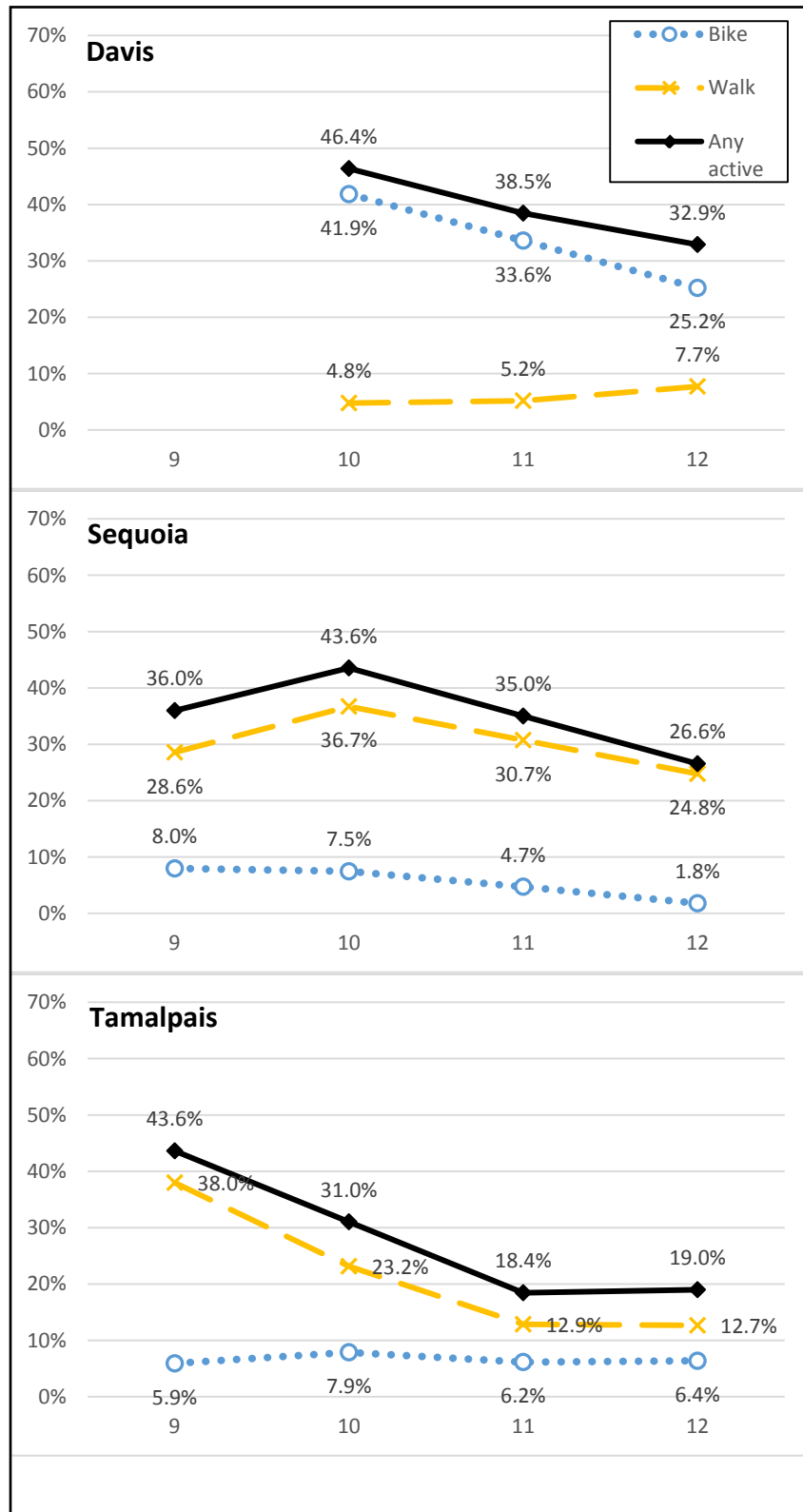


Table 12. Use of active modes by grade, at each school

	Grade				Overall
	9	10	11	12	
Davis					
% Biking	n/a	41.9%	33.6%	25.2%	33.8%
% Walking	n/a	4.8%	5.2%	7.7%	5.8%
% Any active	n/a	46.4%	38.5%	32.9%	39.4%
Total non-missing N	n/a	398	387	376	1164
Sequoia					
% Biking	8.0%	7.5%	4.7%	1.8%	5.6%
% Walking	28.6%	36.7%	30.7%	24.8%	30.6%
% Any active	36.0%	43.6%	35.0%	26.6%	35.8%
Total non-missing N	251	282	255	225	1013
Tamalpais					
% Biking	5.9%	7.9%	6.2%	6.4%	6.6%
% Walking	38.0%	23.2%	12.9%	12.7%	22.2%
% Any active	43.6%	31.0%	18.4%	19.0%	28.6%
Total non-missing N	186	203	179	157	725

Bicycling outside of school

Few students report bicycling every day, even at Davis, where rates are generally much higher (see Table 13). Rates of bicycling at Sequoia and Tamalpais are less, and remarkably similar to each other. At Sequoia and Tamalpais, most students report bicycling to other places “never,” and over 80% report either “never” or the most infrequent category “once a week or less.” However, the remaining 15% or more reporting bicycling a few days a week or more is notably higher than the 6% reporting that bicycling is their “usual” means of getting to and/or from school. Among those not biking to school (at least as reported in questions 3 and 7), just over a third of students at both Sequoia and Tamalpais report bicycling places at least sometimes (in question 10).

At Davis, almost 40% report bicycling a few days a week or more to places outside of school, with the remaining 60% evenly divided between “once a week or less” and “never.” Among those not bicycling to school at Davis (in questions 3 and 7), over half report bicycling other places at least sometimes.

Among those who *do* bicycle to school, almost all also report biking to other places at least sometimes, among students at Davis and Tamalpais. By contrast, about 20% of those who usually bike to Sequoia report that they “never” bike to other places.

Table 13. Percent of bicycling places other than school (question 10)

	Davis	Sequoia	Tamalpais
% bicycling places other than school...			
Every day	9.0%	3.0%	3.7%
Most days of the week	12.4%	3.4%	3.2%
A few days a week	18.2%	9.4%	10.3%
Once a week or less	29.7%	22.2%	26.8%
Never	30.7%	62.0%	56.0%
Total non-missing N	1217	1062	747
% bicycling places other than school at least sometimes (not never)	69.3%	38.0%	44.0%
Among those who usually bike to/from school	96.2%	80.4%	97.9%
Among those <i>not</i> biking to/from school	54.4%	34.8%	39.4%
Total non-missing N	1163	993	715

Driver’s licenses, learner’s permits, cars & gas

Among students of eligible age, around 20% have learner’s permits. Among students age 16 and over, just under half at Davis have driver’s licenses, just over half at Tamalpais, and just under a third at Sequoia report having one (see Table 14). The difference in licensing rates by gender is not statistically significant at any of the schools. The survey asked students if they had a car (or regular access to a car) and paid for their own gas only if they reported having a driver’s license, though these may be factors affecting whether students get a license in the first place. Most with licenses reporting having “regular” access to a car, and a third (at Davis) to half (at Tamalpais) reported paying for their own gas. In total, licensed students with regular access to a car comprises 17% (at Sequoia) to 37% (at Davis) of the total pool of survey respondents at each school.

Table 14. Percent of students with learner’s permits and driver’s licenses

	Davis	Sequoia	Tamalpais
Among those age 15½+ (N)	1144	776	563
% with learner’s permit	22.2%	19.3%	23.3%
Among those age 16+ (N)	986	654	462
% with learner’s permit or license	68.3%	48.3%	75.3%
% with driver’s license	48.4%	29.1%	56.1%
Among those with a driver’s license (N)	485	200	268
% with “regular” access to a car	90.3%	88.0%	87.7%
% who pay for own gas (yes or no only)	32.6%	43.5%	51.7%
% of total sample that has a license <i>and</i> “regular” access to a car	37.2%	17.4%	32.4%

Bicycle ownership

Most students report owning a bicycle, though rates are much higher at Davis where bicycling is more prevalent and lower at Sequoia (see Table 15). Ownership rates are comparable among males and females at Davis, but higher among males at Sequoia and Tamalpais (statistically significant at $p < 0.000$ using a chi-squared test). Ownership rates are notably high among students not biking to school (which is the majority of students in all three schools), at 83%, 59%, and 75%, at Davis, Sequoia, and Tamalpais, respectively, and even among students who report “never” riding one (in question 10).

Table 15. Percent of students owning a bicycle (question 9)

	Davis	Sequoia	Tamalpais
Among males	87.6%	65.6%	80.4%
Among females	88.1%	55.1%	71.7%
Among students <i>not</i> biking to school (question 3 and/or 7)	82.9%	58.8%	74.9%
Among students “never” biking to other places (question 10)	68.8%	42.7%	60.4%
Overall	88.0%	60.0%	75.9%
Total non-missing N (question 9)	1227	1077	746

Distance traveled from home to school

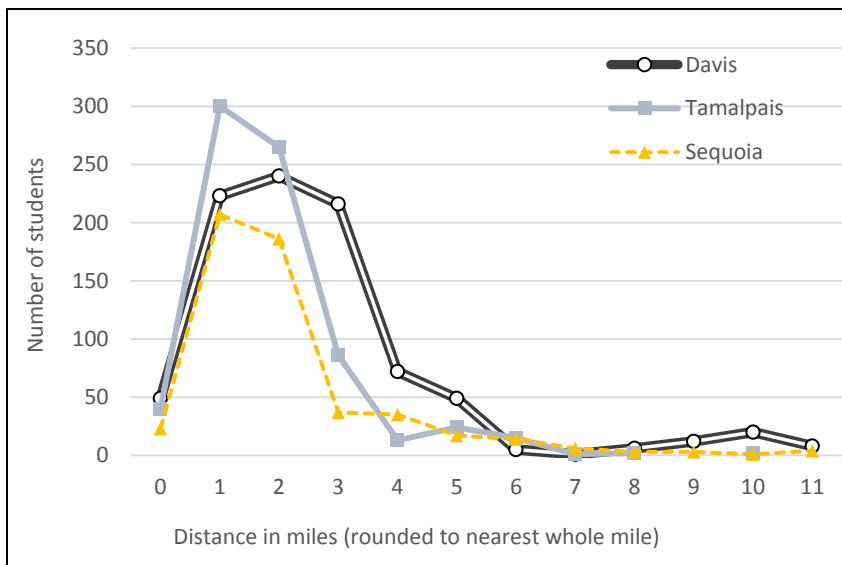
Using geocoded locations of the cross-streets respondents reported as nearest their homes, we calculated the distance between each respondent’s home and school. The portion of students living within a mile of school ranges between 16% (at Davis) and 26% (at Tamalpais). (Table 16 and Figure 3.) The majority lives within three miles at all three schools. In general, the homes of Davis students are somewhat farther from school than those of students at Tamalpais and Sequoia.

Rates of bicycling and walking vary greatly with distance students must travel to school (see Figure 4). In general, there is more biking and walking the closer students live, but with some variation in each community. At Sequoia and Tamalpais the majority (80% and 70%, respectively) who live within a half-mile of school walk, as do 62% and 41% living, respectively, 0.5 to 1 miles from school. By contrast, less than half of Davis students who live within this distance walk. However, Davis students living close by are much more likely to bike, with bicycling rates dropping only for those living 4 to 20 miles away. By contrast, bicycling rates are fairly constant for distances 1 to 3 miles at the other schools.

Table 16. Distance between home and school

	Davis	Tamalpais	Sequoia
Distance (in miles)			
Mean	3.02	2.08	2.48
Median	2.30	1.62	1.62
Smallest	0.06	0.15	0.15
Greatest	63.36	28.54	31.77
% living within			
0.5 miles	5.3%	5.3%	4.2%
1 mile	16.3%	25.5%	22.8%
2 miles	43.5%	64.6%	62.3%
3 miles	70.1%	87.7%	82.0%
Valid N	922	758	549

Figure 3. Distribution of distances between home and school



Other scheduling factors

Several factors that shape schedules and transportation choices include after-school activities and other aspects of students' home situation (Table 17). About half of students report participating in after-school activities on campus at least some days, and more than half report participating in activities somewhere else after school. About 1 in 10 split their time between two different homes of separated parents. A very large portion of respondents reported having siblings that currently attend their same school, with a higher rate at Sequoia than at Davis and Tamalpais.

Figure 4. Percent of students biking and walking to/from school by distance from home to school

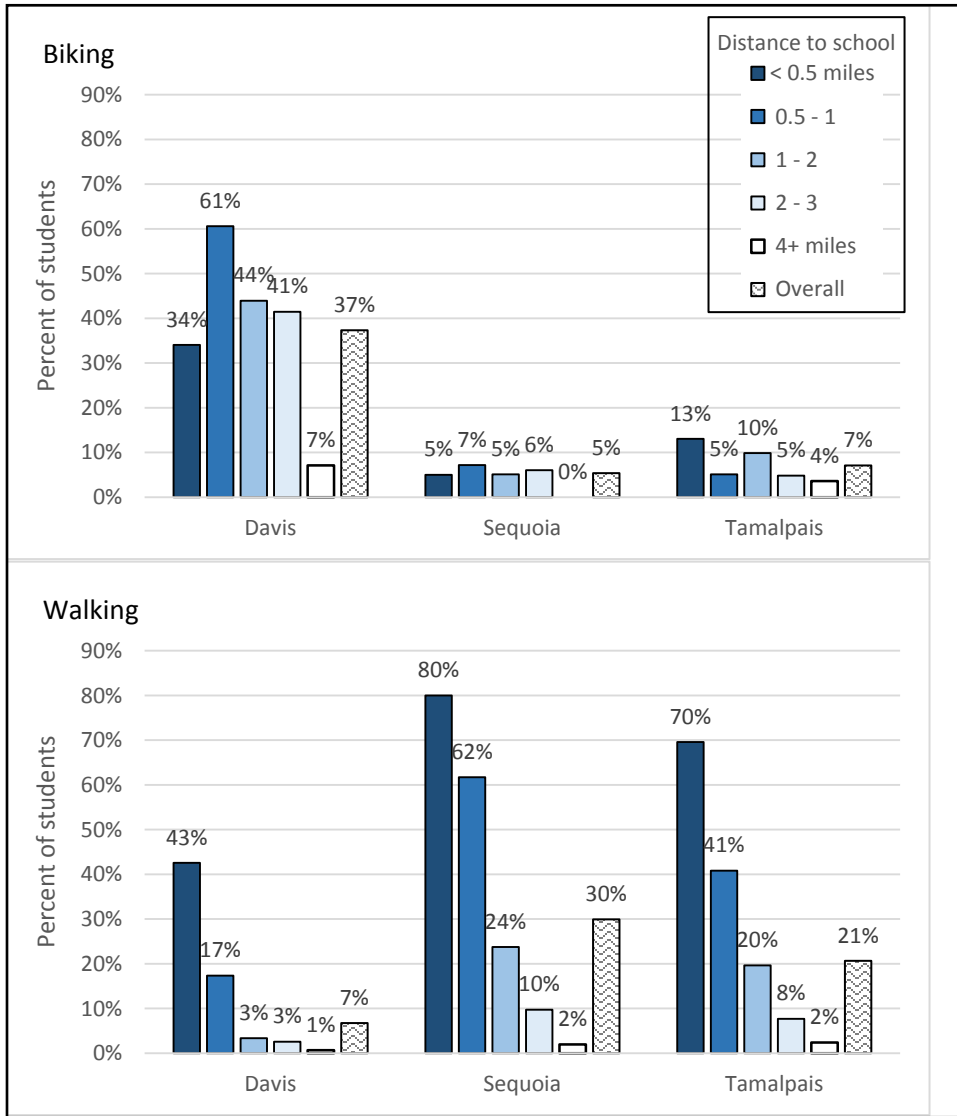


Table 17. Other life factors affecting students' schedules

	Davis	Sequoia	Tamalpais
% currently participating in after-school activities...			
At school			
Rarely/never	56.2%	48.5%	44.8%
1-4 days/week	21.4%	30.4%	22.8%
5 days/week	22.4%	21.1%	32.4%
Somewhere else			
Rarely/never	31.1%	45.4%	32.4%
1-4 days/week	53.7%	45.9%	57.2%
5 days/week	15.1%	8.7%	10.4%
% whose home-base is...			
Is one place	88.2%	91.4%	82.1%
Is split between different homes of separated parents'	11.8%	8.6%	17.9%
% with siblings...			
Currently at home and attending the same school	66.4%	82.5%	66.0%
None currently at home and attending same school	33.6%	17.5%	34.0%

Cell phones and scheduling rides

The survey asked students if they have a regular cell phone or smartphone, and about their use of cell phones as well as texting email and other electronic communications to arrange for transportation, though not necessarily to/from school. Over 90% of students at all three schools report owning a cell phone, and over two-thirds report having a smartphone with a data plan (see Table 18). Ownership rates are highest at Tamalpais. About 90% of all students report using phones (or other electronic communications) to arrange for transportation at least sometimes, and over half report doing so most days or every day. The frequency of using electronic communications for coordinating rides are highest among students at Tamalpais and Sequoia and somewhat lower among students at Davis.

Table 18. Cell phone ownership and use of electronic communications to coordinate transportation

	Davis	Sequoia	Tamalpais
Type of cell phone			
None	4.6%	8.5%	3.1%
Regular	25.6%	22.1%	19.8%
Smartphone (and data plan)	69.8%	69.3%	77.1%
How often you use of cell phone and other electronic messaging for arranging transportation			
Every day	31.6%	43.2%	40.1%
Most days of the week	15.2%	17.3%	18.6%
A few days a week	19.7%	15.5%	20.6%
Once a week or less	23.2%	15.4%	13.0%
Never	10.2%	8.7%	7.9%

Opinions and attitudes

Students were asked to rate their agreement with a series of statements on a scale of 1 “strongly disagree” to 5 “strongly agree,” with 3 as neutral. Table 19 provides an overview of responses to each statement, showing the average rating, as well as the portion of students that agreed (a rating of either 4 or 5) and disagreed (a rating of either 1 or 2), with the remaining portion neutral. The statements were in a random order on the survey, but grouped by general topic here.

General liking

The overwhelming majority of students agree with the statement “I like being physically active,” with most agreeing strongly and almost none disagreeing. Students aren’t as universally enthusiastic in response to “I like bicycling” though ratings are generally positive, and only slightly higher at Davis, where bicycling is so much more prevalent, versus at Tamalpais and Sequoia. “Being driven places” is somewhat better liked than bicycling. By contrast, “Riding the bus” is generally disliked.

Bicycling ability

Students at all schools generally indicate a high level confidence in their bicycling ability (though highest at Davis), but much less for feeling “comfortable bicycling on a busy street with a bike lane,” especially among those at Sequoia. Few at Sequoia or Tamalpais agree with the statement “bicycling is my usual way of getting around town,” compared with almost a third of Davis students.

Logistics of bicycling to school

Students mostly disagree that school is too far away for bicycling (though about a quarter feel that it is). Hills are not a widespread concern at Davis or Sequoia, but over half at Tamalpais rate their area as hilly. Students agree more often than they disagree that they are rushed and have lots to carry, especially at Tamalpais. They disagree more than they agree that clothing, sweat, and hair are worrisome aspects of bicycling, but a quarter to a third of students *do* agree that arriving sweaty and bad hair are concerns. About half agree that they hate wearing a helmet. Students generally disagree that they worry about stolen bikes, but more worry at Davis, followed by Sequoia and then Tamalpais. Davis students give fairly high ratings to the ease of using the bicycling parking at school.

Social and cultural concerns

Whether it matters to them or not, most students disagree (and almost none agree) that bicycling is considered “the coolest” way to get to school, with more (almost half) agreeing that driving is considered “the coolest.” The ratings for the extent of bicycling in the community show marked differences across the three communities, with more agreement than disagreement in all three schools but almost universal agreement at Davis, strong agreement at Tamalpais, and moderate agreement at Sequoia. While a quarter of students at both Davis and Tamalpais say their parents bicycle frequently, Davis students are much more likely to say their parents encourage them to bicycle than at Tamalpais (and even fewer at Sequoia). Students mostly agree that they feel comfortable and are allowed to go places on their own, though to a somewhat lesser degree at Sequoia than at Davis and Tamalpais. Students widely agree (about two-thirds in each school) that protecting the environment is personally important, with only about 10% disagreeing.

Other concerns

Students agree more than they disagree that a car is needed “to do the things I like to do” at all three schools, but the responses are more mixed at Davis. Over half report they can rely on their parents to give them rides places, with somewhat more widespread agreement at Sequoia than at Davis or Tamalpais. Students at Sequoia and Tamalpais are evenly divided on whether traffic congestion is a major hassle, while over half of Davis students agree that it is. Three-quarters of Tamalpais students and about half of Davis students go off campus for lunch (it is not allowed at Sequoia).

Table 19. Overview of ratings (indicated on a scale from 1 “strongly disagree” to 5 “strongly agree”)

Statement	Davis			Sequoia			Tamalpais		
	Disagree	Agree	Avg.	Disagree	Agree	Avg.	Disagree	Agree	Avg.
<i><u>General liking</u></i>									
I like being physically active.	4%	83%	4.4	5%	77%	4.2 **	5%	82%	4.3
I like bicycling.	17%	57%	3.6	21%	50%	3.4 **	24%	50%	3.4 **
I like riding the bus.	61%	15%	2.2	57%	14%	2.3	39%	27%	2.8 **
I like being driven places.	10%	60%	3.8	13%	55%	3.6 **	13%	54%	3.6 *
<i><u>Bicycling ability</u></i>									
I am confident in my bicycling ability.	6%	85%	4.4	15%	69%	3.9 **	14%	69%	3.9 **
I feel comfortable bicycling on a busy street with a bike lane.	21%	62%	3.7	45%	34%	2.8 **	29%	48%	3.3 **
I have a physical condition that makes it hard to bicycle.	93%	5%	1.3	90%	5%	1.4 *	92%	4%	1.3
Bicycling is my usual way of getting around town.	51%	30%	2.7	78%	11%	1.8 **	79%	11%	1.8 **

Statement	Davis			Sequoia			Tamalpais		
	Disagree	Agree	Avg.	Disagree	Agree	Avg.	Disagree	Agree	Avg.
<u>Logistics of bicycling to school</u>									
There is a safe route to bicycle from my home to school.	16%	70%	3.9	29%	40%	3.1 **	23%	55%	3.5 **
I worry about my bicycle getting stolen.	46%	33%	2.8	60%	23%	2.3 **	63%	19%	2.2 **
I live too far away from school to bicycle there.	59%	28%	2.5	60%	23%	2.4	60%	23%	2.3
It is hilly between my home and school.	62%	21%	2.3	68%	17%	2.1 **	33%	54%	3.4 **
I am always rushed to get ready in the morning.	25%	50%	3.4	29%	47%	3.3 *	21%	56%	3.6 *
I have lots of stuff to carry to school.	26%	48%	3.4	29%	43%	3.3	18%	60%	3.7 **
It's hard to ride a bicycle wearing my normal clothes.	70%	13%	2.0	59%	18%	2.3 **	54%	22%	2.5 **
I hate wearing a bicycle helmet.	29%	51%	3.4	27%	52%	3.5	30%	46%	3.3
I worry that bicycling to school means being sweaty when I get there.	39%	37%	2.9	42%	33%	2.8 *	42%	32%	2.8 *
I worry my hair won't look that great after bicycling to school.	44%	35%	2.8	50%	28%	2.6 **	51%	27%	2.6 **
I don't like to bicycle when the weather is bad.	17%	69%	3.9	30%	48%	3.3 **	25%	55%	3.5 **
The bicycle parking areas at my school are easy to use.	12%	64%	3.8	20%	41%	3.3 **	13%	59%	3.7
<u>Social and cultural concerns</u>									
Bicycling is considered the coolest way to get to school.	65%	6%	2.0	70%	4%	1.9 *	68%	5%	2.0
Driving is considered the coolest way to get to school.	14%	51%	3.6	21%	44%	3.4 **	20%	45%	3.4 **
Lots of people bicycle in my community.	4%	92%	4.6	20%	39%	3.3 **	8%	67%	3.9 **
My friends bicycle to school.	28%	47%	3.3	54%	21%	2.4 **	57%	17%	2.3 **
One or both of my parents/guardians bicycle frequently.	65%	23%	2.3	78%	12%	1.8 **	61%	24%	2.3
My parents/guardians encourage me to bicycle.	29%	43%	3.2	56%	17%	2.4 **	46%	27%	2.7 **
Protecting the environment is important to me.	11%	62%	3.7	11%	62%	3.7	8%	69%	3.9 **
Going to/from school with friends rather than alone is a priority.	53%	16%	2.4	43%	22%	2.7 **	50%	17%	2.5
I feel comfortable getting places on my own.	5%	85%	4.4	8%	73%	4.1 **	6%	82%	4.3
My parents/guardians allow me to go places on my own.	6%	87%	4.4	12%	70%	3.9 **	6%	85%	4.4
<u>Other concerns</u>									
I need a car to do the things I like to do.	31%	44%	3.2	21%	52%	3.5 **	23%	49%	3.4 **
I can rely on my parents/guardians to drive me places.	22%	54%	3.5	13%	64%	3.7 **	19%	54%	3.6
The traffic congestion getting in and out of school is a major hassle.	22%	56%	3.6	34%	33%	3.0 **	35%	35%	3.0 **
I often go off-campus for lunch.	32%	50%	3.4	80%	10%	1.7 **	12%	76%	4.2 **

The portion who "agree" shown here indicates all those giving ratings of either a 4 or 5 and "disagree" ratings of either a 1 or 2. (The remaining portion are those who indicated 3, neutral.) Average ratings that are statistically significantly different from the Davis average (based on a t-test of difference of means) are shown with * ($p < 0.05$) and ** ($p < 0.01$).

Conclusions and next steps

The 2009 survey at Davis High offered an opportunity to study motivations for bicycling (and not bicycling) among young people in one of the most bicycling-oriented communities in the United States. This follow-up survey at two additional high schools (for a total of three schools surveyed in 2013) offers an opportunity to examine motivations for bicycling among young people in other communities. This report describes the data collection process for the 2013 survey at three high schools and presents a summary of students' responses at each school. It shows that active travel is comparable at all three schools, with more biking and less walking in Davis. But driving dominates at all three schools, regardless of socio-demographic and environmental differences.

Further understanding of the motivations and barriers to bicycling in each community would be gained by conducting a multivariate analysis, similar to that in Emond and Handy (2012), which would help isolate the relative importance of various factors, such as distance, safety, ability, peers, and parents. This would help reveal whether motivations and barriers are different in communities like Tamalpais and Sequoia versus Davis, and therefore help inform the sorts of policies best suited to promoting bicycling in each context.

References

Emond, C.R. and Handy, S.L. (2012). "Factors associated with bicycling to high school: insights from Davis, CA." *Journal of Transport Geography* 20(1), 71-79.

U.S. Census Bureau. (2010.) 2010 Demographic Profile Data & 2008-2012 American Community Survey. <http://www.census.gov>.

Appendix: Survey instrument

UC Davis Survey on Travel to High School

We are collecting data about how high school students get to and from school. This study is being directed by Professor Susan Handy of the Institute of Transportation Studies at the University of California Davis.

The survey should take at most 10 minutes to complete. Your participation is completely voluntary, and you are not required to finish the survey, but we hope that you will answer each question on both pages. All of your responses will be completely confidential. No one will know which survey is yours. There are no direct benefits or compensation for participating, but by answering the survey you will help us understand the choices that high school students make about getting to school. The results can help your school and city in addressing transportation issues faced by students.

If you have any questions, please contact Professor Susan Handy (slhandy@ucdavis.edu), her assistant Kristin Lovejoy (klovejoy@ucdavis.edu), or the UC Davis Internal Review Board (916-703-9151). Your school will receive a summary of the survey results, but you may also request a personal copy be sent to you. -- Thank you for your assistance!

1. What grade are you in? 9th 10th 11th 12th
2. What is your gender? Male Female
3. How do you usually get to school? (check one)
 I bicycle A friend drives me I drive myself
 I walk A family member drives me I take the bus
 I skateboard Another parent drives me Other: _____
4. When do you usually arrive at school? (check one)
 For activities before 1st period For 1st period After 1st period
5. How many days in the school week do you currently participate in after-school activities at school?
 5 4 3 2 1 Rarely/never
6. How many days in the school week do you currently participate in after-school activities somewhere else?
 5 4 3 2 1 Rarely/never
7. How do you usually get home after school? (check one)
 I bicycle A friend drives me I drive myself
 I walk A family member drives me I take the bus
 I skateboard Another parent drives me Other: _____
8. How did you usually get to middle school? (check one)
 I bicycled A family member drove me I took the bus
 I walked Another parent drove me Other: _____
 I skateboarded
9. Do you currently own or have regular access to a functioning bicycle? No Yes

10. How often do you ride your bicycle to places other than school? (check one)
 Every day Most days of the week A few days a week Once a week or less Never
11. Do you have a cell phone? No Yes, but not a smartphone Yes, a smartphone with a data plan
12. How often do you use a cell phone, texting, email, instant messaging, or other electronic communications to arrange transportation with someone? (*Examples: find a ride; arrange to take the bus with a friend; tell your parents about a change in plans related to transportation, etc.*) (check one)
 Every day Most days of the week A few days a week Once a week or less Never
13. What is your birth date? Month born: _____ Year born: _____
14. What is the most recent driver's license/permit you have obtained? (check one)
 Provisional license Driver learner's permit – **SKIP TO THE NEXT PAGE**
 Regular driver's license I do not have a license or permit – **SKIP TO THE NEXT PAGE**

If you have a license:

- a. When did you get your license? Month: _____ Year: _____
- b. Do you have regular access to a car? No Yes
- c. Do you pay for your own gasoline? No Yes

15. Please tell us whether you agree or disagree with the following.	Strongly Disagree		Neutral		Strongly Agree
a. I like being physically active.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
b. Lots of people bicycle in my community.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
c. I like bicycling.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
d. I am confident in my bicycling ability.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
e. I have a physical condition that makes it hard to bicycle.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
f. Bicycling is my usual way of getting around town.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
g. I like being driven places.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
h. My parents/guardians encourage me to bicycle.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
i. I worry about my bicycle getting stolen.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
j. I feel comfortable getting places on my own.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
k. Protecting the environment is important to me.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
l. I like riding the bus.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
m. My parents/guardians allow me to go places on my own.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
n. I can rely on my parents/guardians to drive me places.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
o. I need a car to do the things I like to do.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
p. It's hard to ride a bicycle wearing my normal clothes.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
q. I feel comfortable bicycling on a busy street with a bike lane.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

