Children's Biking for Nonschool Purposes

Getting to Soccer Games in Davis, California

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In recent years, transportation planning has devoted new attention to the goal of increasing the nonmotorized trips of children and adults, both as a means of increasing physical activity and as a means of reducing motorized trips. For children, much discussion has focused on the journey to school, with little attention to nonschool trips. In this study, patterns of travel of both children and their parents to youth soccer games in Davis, California, are examined. The study aims to identify factors influencing mode choice among children and parents to soccer games for the Davis American Youth Soccer Organization. Data come from a survey of 1,084 parents accompanying their children to Saturday soccer games. Over three-quarters of players and their parents drove to the game on the day of the survey, with fewer than 20% biking. Multivariate models show that distance to games is a significant deterrent to bicycling or walking to them, while players who bike to school and whose parents regularly bicycle are significantly more likely to bicycle to games.

In recent years, transportation planning has devoted new attention to the goal of increasing the nonmotorized trips of children and adults, both as a means of increasing physical activity and as a means of reducing motorized trips. Lack of physical activity has been identified as a major public health problem for both adults and younger people (*1*, *2*). A Centers for Disease Control report from 2002, for example, reports that about a third of American teenagers are not physically active enough (*3*). The lack of physical activity among children is, in part, associated with travel behavior and urban form (*4–6*): children living in auto-oriented areas in the United States use walking and biking as modes of transportation to nearby destinations to a limited extent and less than in the past (*7*, *8*). Their high level of auto use is, of course, tied to a high level of auto use among their parents, particularly their mothers (*9*).

For children, much discussion has focused on the journey to school, though researchers are now addressing nonschool travel as well. According to McDonald (*10*), who studied children's travel patterns based on the U.S. National Household Travel Survey (NHTS), only 12% of the trips to sport activities are made by bike. The NHTS data do not allow a full estimate of nonmotorized trips taken alone versus trips taken with a parent, but it is reasonable to assume that use of bikes is even lower when parents are involved in the trip. Copperman and Bhat (*11*) analyzed the determinants of children's weekend physical activity participation with data from the 2000 Bay Area travel survey. Their models correlate sociodemographic and land use variables with active and passive travel (i.e., nonmotorized and motorized) and with physically active and passive activities. Their findings suggest that children (ages 5 to 17 years) rarely use nonmotorized modes to get to places where they engage in physical activities and that individual and household demographics, along with environmental factors, affect the level of physical activity.

Using data from a survey of more than 1,000 parents of players, this paper explores factors associated with biking to Saturday morning youth soccer games in Davis, California. Davis, named the first platinum-level bicycling-friendly city in the United States by the League of American Bicyclists, offers greater potential for bicycling than most communities, and thus enables an identification of factors that in other cases are concealed by a lack of infrastructure. The results increase understanding of children's bicycling for nonschool purposes and may guide efforts to increase bicycling and improve the forecasting of nonmotorized family-oriented travel.

RESEARCH METHODS

In October and November 2006, a group of four University of California, Davis, students and several community volunteers administered a two-page survey to parents of players in the Davis American Youth Soccer Organization (AYSO). With the help of coaches and team parents, the survey takers approached parents at Saturday morning soccer games on three successive weekends. Survey takers focused on selected AYSO divisions (defined by age and gender) each weekend and attempted to collect one survey for each player in the league. Survey takers covered 76 games over the three weekends. The students and several paid assistants entered the data into an Excel spreadsheet. The data were then checked for accuracy and consistency. The final database includes surveys for 1,084 players, nearly half of all players in the league. The survey included questions on mode of transportation to that day's game for both the parent and the player. In addition, parents were asked to provide information about each child in the household, including age, gender, and bicycling abilities. The survey also included questions about the parent, including age, gender, and his or her bicycling frequency. Open-ended questions also asked about the most significant barriers to bicycling to soccer games.

Survey Sample

A total of 1,084 surveys were completed. This total represents 49% of the 2,210 players participating in the U6 (under 6 years old) through U19 divisions of Davis AYSO in 2006. The distribution across division (defined by age and gender) is shown in Table 1. About 55% of surveys were from boys' divisions and 45% from girls' divisions. Nearly 55% were from U8 and U10 divisions. This

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TABLE 1 Surveys by Division

	Boys		Girls		Total		Percent	
	Players	Surveys	Players	Surveys	Players	Surveys	Players	Surveys
U6	147	111	97	63	244	174	11.0	16.1
U8	299	156	204	107	503	263	22.8	24.3
U10	305	170	231	155	536	325	24.3	30.0
U12	215	54	194	58	409	112	18.5	10.3
U14	151	60	113	54	264	114	11.9	10.5
U19	129	44	125	52	254	96	11.5	8.9
Total	1,246	595	964	489	2,210	1,084		
Percent	56.4	54.9	43.6	45.1				

distribution is similar to but does not perfectly match the actual distribution of players. Because the response rate is not consistent across divisions and because mode choice is likely to vary with both age and gender, we calculate weights based on age and gender division [weight = (actual division share)/(sample division share)]. These weights were applied to the data for descriptive analysis but omitted in the multivariate analysis.

Calculating Nonmotorized Travel Distances

Travel distance is a potentially important influence on mode choice for soccer games, as it is for mode choice for other trip types. To estimate distances, we first geocoded home addresses for respondents. Street addresses in Davis were reported for 920 of the 1,048 completed surveys. About 60 lived out of town or did not fill up a valid address, precluding geocoding. Because Davis has an extensive system of off-street bicycle and pedestrian facilities, we used a network that includes all of the minor and primary roads in the city plus 60 mi of pedestrian and bike ways to estimate travel distance (Figure 1). This network includes 60 mi of off-street facilities and excludes freeways that are not open to bicyclists and pedestrians. The potential travel distance by bicycle for each player to his or her game was calculated by using geographic information system data based on the shortest route from the home address to the field. Average distances by division are shown in Table 2. Davis AYSO attempts to minimize distances, and thus encourage bicycling, by scheduling teams on fields in their own neighborhoods as often as possible.

Limitations

One limitation of this method is the use of a single game to establish travel patterns. The relatively large sample helps to ensure that the survey is representative of the overall pattern of travel for the season, even if that particular day was not typical for all individual players. The weather was sunny, with temperatures ranging from the 60s to the 80s all three weekends of the surveys. A second limitation is the reliance on parent surveys. This approach leaves out children who came to their games without their parents, a group that might be more inclined to bicycle. Anecdotal evidence suggests that for most children, however, parents attend their games. In addition, counts of the number of bikes at games were largely consistent with the reported number of players and parents biking to games. Thus it appears that relatively few children actually ride to the game without their parents. Still, the results probably provide a conservative estimate of children bicycling to games.

DESCRIPTIVE ANALYSIS OF PLAYER'S MODE

The survey collected data on biking both to games (i.e., the mode of travel to the game that day) and practices (i.e., whether the player usually bikes to practices). In analyzing biking levels, a variety of factors that might explain why some players bike and some do not were considered. In looking at these factors, the share of players biking in different categories was compared. The statistical difference between categories were tested by using the chi-square statistic. The total values may vary for the different analyses because of missing data for some survey questions.

Mode of Travel to Game

Driving dominates travel to games for both players and parents: 76.8% of players drove to the game the day of the survey versus 18.4% biking and 4.8% walking; 78.1% of parents drove versus 14.6% biking and 7.3% walking. However, these shares vary by a number of factors, including travel distance, age and gender, and family characteristics.

Travel Distance

The average distance from home to games via the bicycle network for players who live within the city of Davis was 1.82 mi and ranged from 0.06 mi to 5.93 mi. The average distance for players who walked to the game (5.8% of the sample with valid addresses) was 0.73 mi. The average distance for players who biked (20% of the sample with valid addresses) was 1.21 mi. The potential biking or walking distance for players who were driven (or drove) to their games (84.2% of the sample with valid addresses) was 2.09 mi. Clearly, longer distances to games are associated with an increased likelihood of driving.

Driving, however, is still the dominant mode, even for short distances. Among players who lived less than 1.5 mi from the field (38% of the sample), more than 50% of the players were driven (or drove) to their games. Only a few players walked more than half a mile and none beyond 2.5 mi. At less than half a mile from the field, about 40% of players bicycled and 20% walked, with just under 40% driving. The combined share of players walking and bicycling

FIGURE 1 Davis pedestrian and bicycle network and location of AYSO fields.

shows a steep drop-off between 0.5 and 2.0 mi but remains relatively steady up to 4.0 mi (Figure 2).

Age and Gender

The general pattern of modes to today's game holds across divisions for both players (Table 3) and parents (not shown), but with notable differences. Interestingly, 33% of the players in the under 10-years-old boys (U10B) division biked, the highest compared with the other divisions. Gender of the player was associated with biking to the game, with 21.4% of boys in all divisions biking to the game in contrast to 14.4% of girls. This pattern does not hold across all divisions, however. In the U6 division, girls were more likely than boys to bike to the game that day.

TABLE 2 Bicycling Distance in Miles Between Home and Field by Division

	N	Mean	Std. Dev.
U6	143	1.94	1.94
U8	229	1.49	1.49
U10	276	1.52	0.96
U12	84	2.42	1.43
U14	97	2.23	2.02
U19	81	2.51	1.17
Total	910	1.82	1.07

Family Characteristics

Players from families with more than one child were almost twice as likely to bike to games as players who were the only child in their family (Table 4). As discussed below, one of the most frequent challenges to biking to games mentioned by parents was having more than one player in the family.

The player's mode of travel to the game is also associated with the frequency with which their parents bike as a mode of transportation. Of players whose parents bike daily, 34.1% biked to their game; of players whose parents never bike, only 2% bike to their games (Table 5). Not surprisingly, players who bike to practice are more likely to bike to games, as are players who bike to school (results not shown).

Biking to Practice

Parents were also asked if their player usually biked to practice. Overall, 57.4% of players usually bike to practice. The differences by division are significant, however. Biking increases steadily with age until peaking for the U12 and U14 divisions, and then declines for the U19 divisions (Table 6). The differences by sex are not significant, however. There are several reasons why the travel mode to practice may differ from the travel mode to the weekend game. First, the average travel distance to practice is shorter, as practices are generally located on fields or at parks within the team's home neighborhood. Second, time and activity restrictions may be different for the player on weekdays and for parents as well. Third, players may be more likely to travel to practices on their own, while weekend games

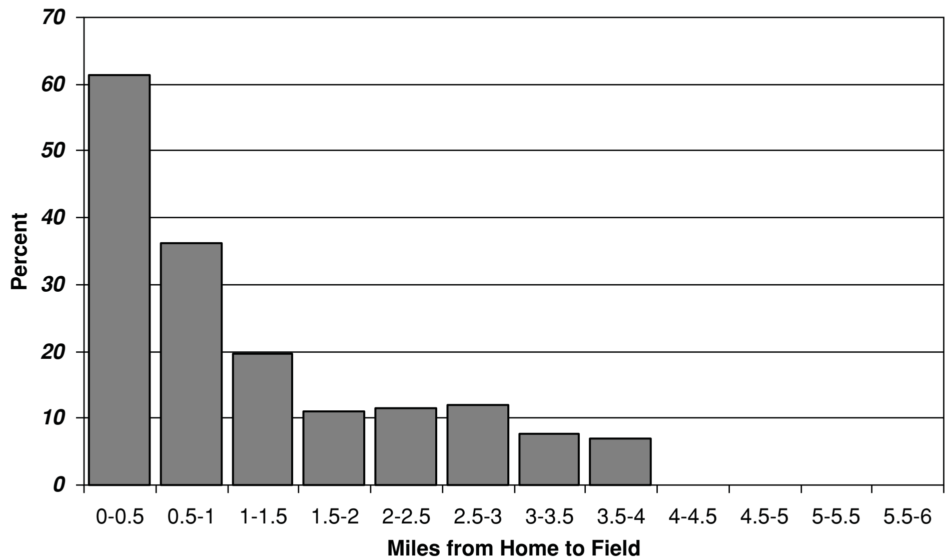

FIGURE 2 Share of players using nonmotorized modes by distance to field.

are traditionally a family event to which player, parents, and siblings travel together.

MULTIVARIATE ANALYSIS OF TRAVEL MODE TO THE GAME

Family members often travel to games together. Even so, the factors influencing mode choice may be different between the parent and the child for several reasons. First, parents and children may choose the same travel mode for different reasons, such as time constraints after the game or the need to carry equipment. Second, if one parent has two or more children playing simultaneously in different divisions, his or her mode choice may be constrained by the need to travel between games at different locations. Finally, at least for older children, parents may travel via a different mode than the children, usually driving while the player is biking.

Two binary logistic regression models for driving relative to not driving (i.e., biking or walking) were estimated: one for the mode choice of the player and one for the mode choice of the parent. These models use as explanatory variables (*a*) sociodemographic indicators such as age and sex of both the parent and the child and the number of children in the household, (*b*) estimated trip distance, (*c*) a dummy variable indicating whether the player can bike and dummy variables indicating whether the player bikes to school and to soccer practice, and (*d*) an indicator of parent biking frequency in the form of a dummy variable for biking at least once a week. These models are not conventional mode choice models, as mode-specific variables are not included.

The player travel mode model (Table 7) shows that only three variables are significant predictors of driving rather than biking or walking to games: trip distance, with a positive effect on driving; player bikes to school, with a negative effect on driving; and parent's biking at least once per week, with a negative effect on driving. The odds ratios show the magnitude of the effect. For each additional mile to the field, the odds of driving increase by a factor of 3.4. For players who bike to school the odds of driving are 0.6 times the odds of driving for those who don't bike to school. If the player's parent bikes at least once per week, the odds of driving are 0.4 times the odds for those whose parents don't bike. The child's age, gender, and ability to use a bike were not significant, nor were parent's age or gender or the number of children in the household. The model for parent's mode of travel (Table 8) is similar to the model for the child's mode of travel. The small differences between the models likely result from the reasons noted above.

TABLE 3 Players' Mode to Today's Game by Division

	Bike (%)	Walk (%)	Drive (%)	*N*
U6B	14.6	5.5	80.0	71
U6G	15.9	4.8	79.4	48
U8B	18.1	6.5	75.5	146
U8G	11.2	5.6	83.2	100
U10B	33.1	7.8	59.0	146
U10G	21.4	5.2	73.4	113
U12B	18.9	1.9	79.3	104
U12G	10.3	1.7	87.9	95
U14B	18.3	5.0	76.7	74
U14G	14.8	7.4	77.8	55
U19B	18.2	0.0	81.8	63
U19G	11.5	3.9	84.6	61
Total girls	14.4	4.6	81.0	472
Total boys	21.5	5.0	73.5	603
Total	18.4	4.8	76.8	1,076

NOTE: Chi-square = 49.4; $p = .0007$; $N = 1,076$.

TABLE 4 Players' Mode to Today's Game by Number of Children in Family

	Bike (%)	Walk (%)	Drive (%)	*N*
One child in family	10.9	1.9	87.7	172
More than one child	20.1	5.1	74.8	876
Total	18.6	4.6	76.8	1,047

NOTE: Chi-square = 14.08; $p = .0009$; $N = 1,047$.

TABLE 5 Players' Mode to Today's Game by Parents' Biking Frequency

	Bike (%)	Walk (%)	Drive (%)	*N*
Never	2.0	6.0	92.0	207
Less than once per month	6.8	6.8	86.4	276
Between once per week and once per month	12.6	4.7	82.7	250
More than once a week but less than daily	25.2	4.1	70.6	166
Daily	34.1	4.4	61.4	115
Total	18.3	5.0	76.7	

NOTE: Chi-square = 93.66; $p < .0001$; $N = 1{,}013$.

TABLE 7 Model for Players' Driving Versus Biking or Walking

	Coefficient	Odds Ratio
Intercept	2.26[a]	9.65
Trip distance (miles)	1.214[a]	3.368
Game is not at home field	0.224	1.251
Player age	−0.052	0.949
Player sex (female = 1)	−0.171	0.843
Player can bike	−0.753	0.471
Player bikes to school	−0.528[b]	0.590
Number of children in the household (1 to 4+)	−0.286	0.751
Parent sex (female = 1)	.0.037	1.037
Parent age	−0.008	0.992
Parent bikes more than once per week	−0.889[a]	0.411

NOTE: Adjusted $R^2 = 0.23$; $n = 705$.
[a] $p < .05$.
[b] $p < .1$.

Confirmation of these results and insights into additional factors that influence mode choice come from responses to an open-ended question about barriers to biking to the game (Table 9). Over three-quarters of parents reported one or more barriers to biking to games. At the top of the list was distance from home to the field, shown by the multivariate models to be the most significant predictor of bicycling for both players and parents. The second-most frequently named barrier was having multiple children at different fields, a factor not significant in the multivariate models. Other barriers were not measured in the survey. The third-most commonly mentioned barrier was the need to carry equipment or snacks. Several barriers related to schedule and time constraints added up to 38% comments, while safety concerns related to infrastructure accounted for 4.9% of comments. Only 2.1% indicated that willingness prevented them from biking. The physical demands of the soccer game itself were not mentioned as a barrier for players to bike.

CONCLUSIONS

By the standards of other communities, the level of bicycling to soccer games in Davis is probably high, though how high relative to other communities is uncertain. Almost one-fifth of participants chose to bike—20 times higher than typical bicycle mode splits for any purpose in the United States (*12*). Conversely, three-quarters of participants chose to drive, despite excellent biking conditions—extensive and high-quality bicycle infrastructure, good weather for the three weekends of the survey, and the relatively short distances to neighborhood fields for most players. This level of biking to soccer games in Davis may represent the most that other U.S. communities could hope to achieve, but it is possible that Davis could achieve even higher levels of walking and bicycling than measured here. Both the multivariate analysis and the open-ended question on barriers suggest two sets of strategies for increasing bicycling.

The first set of strategies addresses physical barriers. Distance to games is a critical factor in the decision to bike. Davis AYSO has already addressed this factor by scheduling games on fields within teams' neighborhoods, although the schedule includes many away games that necessitate travel across town; an optimized scheme

TABLE 6 Players' Biking to Practice by Division

	Drive (%)	Bike (%)	*N*
U6B	72.6	27.4	69
U6G	70.5	29.5	46
U8B	61.2	38.8	143
U8G	68.6	31.4	95
U10B	51.2	48.8	148
U10G	61.6	38.4	110
U12B	48.0	52.0	98
U12G	36.8	63.2	94
U14B	43.1	56.9	72
U14G	60	40	51
U19B	58.1	41.9	62
U19G	71.1	38.9	61
Total	57.4	42.6	1,049

NOTE: Chi-square = 49.4; $p = .0007$; $N = 1{,}076$.

TABLE 8 Model for Parents' Driving Versus Biking or Walking

	Estimate	Odds Ratio
Intercept	−1.106	3.21
Trip distance (miles)	1.295[a]	3.650
Game is not at home field	0.298	1.347
Player age	−0.011	0.990
Player sex (female = 1)	−0.029	0.972
Player can bike	−0.819[b]	0.441
Player bikes to school	−0.575[a]	0.563
Number of children in the household (1 to 4+)	−0.161	0.851
Parent sex (female = 1)	−0.056	0.946
Parent age	0.002	1.002
Parent bikes more then once per week	−0.951[a]	0.386

NOTE: Adjusted $R^2 = 0.23$; $n = 706$.
[a] $p < .05$.
[b] $p < .1$.

TABLE 9 Barriers to Biking to Games

Category	Count	Percent of Comments	Percent of Parents
Distance from house (Davis resident)	258	25.3	23.8
Multiple children at different fields or times	151	14.8	13.9
Carrying equipment and snacks	142	13.9	13.1
Time to get ready and organized	92	9.0	8.5
Time it takes to get to field	70	6.9	6.5
Schedule conflicts before or after game	63	6.2	5.8
Safety (dangerous route, traffic, or poor bike access)	50	4.9	4.6
Age of certain child	33	3.2	3.0
Distance from house (nonresident)	27	2.7	2.5
Child not on neighborhood team	25	2.5	2.3
Willingness	21	2.1	1.9
Children's riding ability	21	2.1	1.9
Punctuality at game	21	2.1	1.9
Lack of or damaged bikes or equipment	16	1.6	1.5
Weather	13	1.3	1.2
Adult physical disability	8	0.8	0.7
Irrelevant response	5	0.5	0.5
No place to put bikes	2	0.2	0.2
No barrier mentioned	243		22.4

might be able to reduce distances further. The city might also be able to reduce distances by adding new links in the bicycle network in key locations. A program to identify and implement such links could also increase bicycling to school, as many of the playing fields are located at elementary and junior high schools. The need to carry equipment and snacks was also cited as a barrier to bicycling. Many families use bicycle trailers to carry these items to games, and a program run by AYSO or the city to loan trailers to families for individual games or for the season could enable more families to bicycle.

The second set of strategies addresses attitudinal and logistical barriers. The significance of both biking to school for the player and the frequency of bicycling for the parent suggests that the more a family bikes for some purposes, the more they bike for other purposes. City programs to promote bicycling in general could thus lead to increases in bicycling to soccer games. Such programs might also encourage parents to get out of the house early enough to bike to games and might counteract a lack of willingness on the part of players or parents to bike rather than drive. Programs that focus on increasing bicycling safety or that help children learn how to bicycle could also help. Bike pooling programs that help players get to their games by bicycle when parents have scheduling conflicts (e.g., other children playing games at the same time on other fields) might also increase bicycling, at least among players.

Although this study focuses on a unique case—the very specific trip to soccer games and the very specific setting of Davis, California—it points to the need for future research to explore in more depth the influence of physical, attitudinal, and logistical factors on the choice to bicycle. Issues highlighted in this study and deserving of further exploration include the relationship between the travel choices of parents and children and the connection between mode choice for trips of different purposes. Implementation of this survey in a sample of communities reflecting a range of bicycling environments could yield further insights, as could the implementation of similar surveys targeting other specific trip purposes. With active travel among children and their parents on the decline, such research could provide a basis for the formulation of policies that would reverse this trend and generate significant health benefits.

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