Health Promoting Community Design; Culture Change

The Role of Personal Values, Urban Form, and Auto Availability in the Analysis of Walking for Transportation

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Abstract

Purpose. *To examine the association of personal values, the built environment, and auto availability with walking for transportation.*

Setting. *Participants were drawn from 11 U.S. metropolitan areas with good transit services.*

Subjects. *865 adults who had recently made or were contemplating making a residential move.*

Measures. *Respondents reported if walking was their primary mode for nine trip purposes. "Personal values" reflected ratings of 15 variables assessing attitudes about urban and environmental attributes, with high reliability ($\alpha = 0.85$). Neighborhood form was indicated by a three-item scale. Three binary variables were created to reflect (1) personal values, (2) neighborhood form, and (3) auto availability.*

Design. *The association with walking was reported for each of the three variables, each combination of two variables, and the combination of three variables. An analysis of covariance was applied, and a hierarchic linear regression model was developed.*

Results. *All three variables were associated with walking, and all three variables interacted. The standardized coefficients were 0.23 for neighborhood form, 0.21 for autos per person, and 0.18 for personal values.*

Conclusion. *Positive attitudes about urban attributes, living in a supportive neighborhood, and low automobile availability significantly predicted more walking for transportation. A framework for further research is proposed in which a factor representing the role of the automobile is examined explicitly in addition to personal values and urban form. (Am J Health Promot 2007;21[4 Supplement]:363–370.)*

Key Words: Personal Values, Walking, Neighborhood Form, Auto Availability, Prevention Research. Format: research; Research purpose: modeling/relationship testing; Study design: cross-sectional retrospective survey; Outcome measure: behavioral; Setting: state/national; Health focus: fitness/physical activity: Strategy: public policy; Target population: adults: Target population circumstances: geographic location, level of automobile availability

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PURPOSE

There is a substantial literature suggesting that walking for transportation is related to built environment factors that affect the ability to walk to nearby shops and services.[1,2] Transportation studies show that values and beliefs are related to walking for transportation,[3] and research in the health field shows that a wide variety of psychologic variables explain physical activity[4] and walking for recreation.[5] It is well documented that walking to destinations is low when automobiles are available in households.[6] This article is based on the conclusions of a project undertaken in the Transit Cooperative Research Program entitled, ''Understanding How Individuals Make Travel and Location Decisions: Implications for Public Transportation.''[7] The project has examined the choice of residential location simultaneously with the choice of mode of transportation.

Studies in both the transportation and health fields have begun to examine the critical issue of how psychologic and environmental variables interact to explain walking and other physical activities. Since the groundbreaking work by Kitamura et al.,[3] transportation researchers have examined the role of both attitudes and characteristics of the built environment in relation to variation in travel behavior.[8] In the health field, Giles-Corti et al.[9] showed that psychologic, social, and environmental factors were all significant contributors to explaining recreational physical activity.

The present article explores the association among three factors and

the propensity to choose walking as a mode for utilitarian trips. Those three factors concern (1) the personal values held by the trip maker, (2) the nature of the built environment to either support or impede the inclination to walk, and (3) the availability of a private automobile.

This article builds upon the existing transportation literature but with several major differences. First, the sample comes from a much wider geographic cross-section of neighborhoods than used in most of the published research. Specifically designed for the transit industry, the sample is drawn from highly urbanized areas such as New York, Chicago, Los Angeles, and Boston, for example. In this sample, there is a greater degree of variation in the amount and form of transit service and in levels of auto ownership than in previous studies. Finally, the initial survey work was designed to explore motivations for choosing neighborhoods as well as choosing modes of transportation.

Secondly, the research applies a construct derived from the theory of planned behavior.[10] The present research explores a concept in which personal attitudes and the belief that others share those personal attitudes combine to form an intention (either positive or negative) to undertake a behavior, in this case the choice of walk mode for a trip.[11] Once that intention is formed, the individual makes a judgment about her/his ability to carry out this behavior, based on a review of the obstacles and difficulties that might impede the adoption of that behavior.[12] In the most basic case, the built environment (here expressed as neighborhood form) might either facilitate or impede the adoption of that behavior. This article additionally explores the concept that automobile availability impedes the adoption of the behavior of walking for transportation.

METHODS

Design

The research is based on a cross-sectional survey, which includes information collected on a retrospective basis.

Sample

The sample included 865 persons who had either recently made a residential location decision or were considering making one. The sample was selected to improve the understanding of people's decisions to move to a transit-oriented development, referred to in the project as a ''compact neighborhood.'' The sample was drawn from 11 major metropolitan areas, distributed across the United States, which offered public transportation services. Of the total sample, 639 were selected from a commercially owned panel of 40,000 Internet respondents, (referred to as the ''Survey Café'') while 226 were drawn from a research panel maintained by New Jersey Transit. Within the sample, 36% were under 30 years of age, while 33% were between 30 and 40 years of age, reflecting the group of mobile persons making/considering changes in their residential location. Females comprised 67% of the sample, while 81% were white, and 69% had a college degree. There was an average of 0.88 cars per adult in the sample. The net response rate is estimated at 42% based on the incidence rate for those who have moved within the past 2 years and accounting for undeliverable e-mail invitations. The survey was specifically designed to oversample groups within regions with good public transportation and was not meant to represent any kind of national random sampling.

This research was not intended to give results that could be expanded to the population as a whole. Its purpose was to increase understanding of the motivations of certain individuals who are of major interest to policymakers trying to promote Smart Growth and environmentally friendly modes. Future research will be needed to determine the overall incident rate of market segments described in this study.

An additional consideration was to ensure a sufficient number of users of public transportation in our sample to compare their characteristics with others. To do this, the project sampled from the NJ Transit e-panel in the same way that it sampled from the Survey Café e-panel and added those respondents to the panel. As part of this research, the regression model described in this article was run with and without the participation of the NJ Transit participants: there was no significant difference in the result, and the larger sample was selected for continuing analysis.

Measures

The survey was administered over the Internet and took approximately 35 minutes to complete.

Walk Mode Share. In this article, the term ''walking'' or ''walk trips'' refers to trips taken to a destination, such as the workplace, a restaurant, or a church for a purpose other than purely exercise or pleasure.[13] The former trips are referred to as ''walking for transportation'' in this article; the latter are referred to as ''walking for recreation'' and are not covered in this article.

Respondents were asked to name their primary mode of transportation for nine trip purposes: work, school, shop, entertainment/dining, medical, parks, family, friends, and church. The principal dependent variable in this article is self-reported walk mode share as primary mode for nine trip purposes, from which a weighted average walk mode share was calculated. The use of self-reported ''primary mode'' is consistent with most transportation surveys and with the U.S. Census.

Personal Values About Walkable Neighborhoods and Environmental Issues. A factor was created which reflected the personal values toward urban attributes and environmental issues. The factor for these personal values was created by combining 15 variables, which included eight items that were directly about walkable/protransit neighborhoods:

> ''For me to live within walking distance to stores, restaurants, a public library would be … desirable/undesirable'' and
> ''When you last considered changing your home location, how important was … having a commercial district (with things like a coffee shop, retail stores, and restaurants) within walking distance of my home … not important at all/extremely important.''

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In addition, three items reflected personal attitudes toward environmental issues (e.g., ''I am concerned about global warming/climate change''), and four items reflected beliefs that others hold similar attitudes (e.g., ''My friends and family are concerned about global warming/climate change''). All seven of these were measured from ''strongly agree'' to ''strongly disagree.'' All variables were scored on a seven-point scale.

The factor representing prourban/environmental values showed a high level of internal consistency with a Cronbach's α of 0.85. Deletion of the environmental values resulted in a decrease in the α and was rejected. The sample was then divided into two groups: one with higher than mean scoring on the combined factor, labeled as the ''high values group,'' and the second with scoring lower than the mean, labeled as the ''low values group.'' Of the total sample, 467 respondents had higher personal values and 398 had lower values.

Neighborhood Form. We created two groups based on location defined by three considerations. A respondent is referred to as living in a ''compact neighborhood'' if (1) there is some form of housing other than a single family home within 1/3 of a mile from the location, (2) there is a commercial district within walking distance of the location, and (3) there is transit service to the location. Each of these variables is based on the self-reporting of the respondent. No independent verifications were undertaken. Of the total sample, 222 resided in a compact neighborhood and 463 did not.

Auto Availability. Respondents reported both the number of automobiles in the household and number of adults living in the household. The term ''low auto availability'' refers to a household in which there are fewer cars than adults. The term ''high auto availability'' refers to a household in which the number of cars is equal to or greater than the number of adults.

Analysis

Cross Tabulations for the Three Independent Variables and the Mean Value of Walk Mode Share. Each of the three binary variables was first analyzed for its association with walk mode share. Then all combinations of two variables at a time were calculated. Eight subgroups were created, representing all combinations of the three binary variables. Each cell of each matrix shows the mean value of walk mode share for that subgroup.

Application of the Analysis of Covariance Procedure. To remove the effects of possibly confounding covariates, an analysis of covariance (ANCOVA) model was applied.[14] After reviewing possible demographic variables that might modify the relationship of the three categoric variables to walk mode share, only income and gender were found to have significance at $p < .1$. Both were identified as covariates for the ANCOVA model run. A test of between-subjects effects was created, as well as an examination of the significance of key mean differences in the study, all controlled for possible confounding effects of the two covariates.

Application of Hierarchic Linear Regression Models. To confirm the evident results from the ANCOVA analysis, a hierarchic linear regression model was created to demonstrate the R^2 resulting from models based on (1) personal values and neighborhood form, (2) that plus auto availability, and (3) that plus the two demographic variables. The standardized coefficients created in the final model allow a simple method by which to examine the relative importance of each of the explanatory variables.

RESULTS

Personal Values, Neighborhood Form, and Auto Availability Examined Individually

All three explanatory variables were related to walking for transport when examined individually. In terms of urban and environmental values, the high values group has a 16% mode share to walking, while the low values group has a 6% mode share. Those living in a compact neighborhood have approximately a 20% walk mode share; while those not living in such a neighborhood have less than a 9% mode share. Participants from households with less than one car per adult have a walk mode share of 19%; those from households with at least one car per adult have a walk share of 8%,

The Combination of Neighborhood Form and Personal Values

The analysis supports a conclusion that the three variables have interactive effects; for example, interactions can be observed when personal urban/environmental values are examined together with neighborhood form. For those living in a compact neighborhood, the high values group has a 24% walk mode share, while the low values group has only 10%. For those not living in a compact neighborhood, the high values group has a walk mode share of 12%, compared with 6% for the low values group. For those in the high values group, living in a compact neighborhood gains a 24% walk mode share compared with 12% for those outside of a compact neighborhood. (Each pair difference was significant at $p < .01$.) For those in the low values group, living in a compact neighborhood shows a 10% walk share, while living outside shows a 6% walk share. (Pair difference was significant at $p < .05$). Thus, the walk mode share for the combination of the two most supportive conditions is four times that of the walk share associated with the two least supportive conditions.

The Combination of Personal Values and Auto Availability

Similar interactions can be seen when personal urban/environmental values are examined together with auto availability. For those with low levels of auto availability, the high values group has a 21% walk share, compared with the low values group at 11%. For those with high levels of auto availability, the high values group has a walk share of 12% compared with the low values group at 5%. For those in the high values group, those with low auto availability show a 21% walk share, compared with 12% for the high auto availability group. For the low values group, low auto availability gains an 11% mode share, compared with only 5% for those with high auto availability. (All pair differences were significant at $p < .01$.) Thus, the walk mode share associated with the combination of the two supportive conditions is

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more than four times that of the walk share for the two least supportive conditions.

The Combination of Neighborhood Form and Auto Availability

Finally, the interactions between neighborhood form and auto availability are instructive. For those with low auto availability, living in a compact neighborhood shows a walk share of 27%, compared with only 13% for those outside such a neighborhood. For those with high auto availability, living in a compact neighborhood shows a walk share of 13%, compared with only 7% for those living outside such a neighborhood. For those in a compact neighborhood, those with low auto availability show a walk share of 27%, compared with only 13% for those with high auto availability. For those outside of compact neighborhoods, those with low auto availability show a walk mode share of 13%, compared with only 7% for those with high auto availability. (All pair differences were significant at $p < .01$.) Thus, the walk mode share associated with the combination of the two most supportive conditions is almost four times the walk share associated with the two less supportive conditions. In our sample, the majority of people in compact neighborhoods (51%) come from a household with less than one car per adult; for those living outside of the compact neighborhoods, only 25% have less than one car per adult.

When all three factors are examined simultaneously, eight subgroups are created, as shown in Table 1. Table 1 shows the derivation of the eight subgroups, ordered by considering personal values first and auto availability third. The results are consistent with expectations, ranging from a walk mode share of 28% associated with the combination of the three supportive conditions and a walk mode share of 5% associated with the three nonsupportive conditions (pair at $p < .01$). Table 2 shows the mean values, number in the sample, and standard error of the mean for each of the eight cells of Table 1, as well as the significance of differences between key mean values as ordered in Table 1.

Table 1

Walk Mode Share for Eight Subgroups

Eight Subgroups	*p*
High values group	<0.01
In compact neighborhood	
Low auto availability	
Walk share = 28%	
High values group	
In compact neighborhood	
High auto availability	
Walk share = 18%	
High values group	<0.01
Not in compact neighborhood	
Low auto availability	
Walk share = 15%	
High values group	
Not in compact neighborhood	
High auto availability	
Walk share = 10%	
Low values group	<0.01
In compact neighborhood	
Low auto availability	
Walk share = 20%	
Low values group	
In compact neighborhood	
High auto availability	
Walk share = 6%	
Low values group	<0.05
Not in compact neighborhood	
Low auto availability	
Walk share = 9%	
Low values group	
Not in compact neighborhood	
High auto availability	
Walk share = 5%	

Results from the ANCOVA Procedure

In the first step of the ANCOVA procedure, a test of between-subjects effects was created, shown as Table 3. The main effects of the three explanatory variables were found to be significant at $p < .001$. While neither sex nor income was found to be significant at $p < .05$ (when both were included together), both were retained in the analysis to ensure that any confounding effect of covariance might be revealed. No significant three-way interactions are reported, but the table does suggest that the interaction between neighborhood form and auto availability is characterized by the highest level of significance of the three possible two-way effects, and should be examined further.

The ANCOVA makes possible the analysis of the differences in pairs of means, holding constant the influence of potential confounding covariates, in this case income and gender. Part 1 of Table 4 shows the tests for significance of the difference in means between the two levels of each of the three primary explanatory variables in this article. Part 2 shows the significance of differences generated by all two-way combinations of the two levels of each of the three variables. Part 3 examines three-way combinations but shows only the differences from two levels of auto availability under four combinations of personal values and neighborhood form, consistent with the structure of Table 1. The significance column reveals that all differences but one are significant at $p < .01$: the difference between high and low urban values for persons with low auto availability was found to be significant at $p = .05$.

The results of the ANCOVA examination of differences between paired means shows that controlling for the two covariates had a relatively small impact on the range of differences presented in the descriptive statistics. For example, assuming high values, in compact neighborhood, and low auto availability, the highest mean value for walk mode share is 28.6% in the ANCOVA data and 27.9% in the descriptive statistics. The lowest mean value for walk mode share is 4.94% in the ANCOVA, while it is 4.95% in the descriptive statistics (assuming low values, not in a compact neighborhood, and high auto availability). Thus, those with the most supportive conditions had a walking rate 5.79 times that for those with the least supportive conditions in the ANCOVA analysis versus 5.64 times the lower rate in the descriptive statistics.

Results from the Regression Modeling

The results of the ANCOVA procedure support the logic of including all three of the primary explanatory variables in the analysis of walking and show a moderate influence from the two demographic variables. To confirm this conclusion, a hierarchic linear regression was undertaken, as shown in Table 5. Examination of only personal values and neighborhood form results in a R^2 of 0.16. The addition of auto availability raises the R^2 to 0.19, while the addition of the demographic variables results in a final model R^2 of 0.20.

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Table 2

Mean, Sample Size, Standard Error, and Significance for Values in Table 1

Urban Values	Compact Neighborhood (CN) Status	Auto Availability Index	Mean for Walk Mode Share	N	Standard Error of Mean	Significance from Paired t-test for Autoavailable Pairs
High urban values	Currently in CN	Low auto availability	27.9%	96	0.024	**
		High auto availability	17.9%	61	0.026	
		Total	24.0%	157	0.018	
	Not in CN	Low auto availability	15.4%	104	0.016	**
		High auto availability	9.8%	206	0.010	
		Total	11.7%	310	0.009	
	Total	Low auto availability	21.4%	200	0.015	**
		High auto availability	11.6%	267	0.010	
		Total	15.8%	467	0.009	
Low urban values	Currently in CN	Low auto availability	20.0%	17	0.048	**
		High auto availability	5.9%	48	0.016	
		Total	9.6%	65	0.019	
	Not in CN	Low auto availability	8.9%	57	0.019	*
		High auto availability	4.9%	276	0.004	
		Total	5.6%	333	0.005	
	Total	Low auto availability	11.4%	74	0.019	**
		High auto availability	5.1%	324	0.004	
		Total	6.3%	398	0.005	
Total	Currently in CN	Low auto availability	26.7%	113	0.022	**
		High auto availability	12.6%	109	0.017	
		Total	19.8%	222	0.015	
	Not in CN	Low auto availability	13.1%	161	0.013	**
		High auto availability	7.0%	482	0.005	
		Total	8.5%	643	0.005	
	Total	Low auto availability	18.7%	274	0.012	**
		High auto availability	8.0%	591	0.005	
		Total	11.4%	865	0.006	

* $p < 0.05$.
** $p < 0.01$.

Table 3

Between-subjects Effects from Analysis of Covariance Model

Source	Type IV Sum of Squares	df	Mean Square	F	*p*	Partial η^2
Corrected model	4.672†	9	0.519	24.253	0.000	0.214
Intercept	3.020	1	3.020	141.098	0.000	0.149
Income	0.075	1	0.075	3.495	0.062	0.004
Sex	0.065	1	0.065	3.058	0.081	0.004
Autos	0.791	1	0.791	36.973	0.000	0.044
Value	0.549	1	0.549	25.627	0.000	0.031
Neighbor	0.779	1	0.779	36.403	0.000	0.043
Autos * values	0.009	1	0.009	0.410	0.522	0.001
Autos * neighbor	0.126	1	0.126	5.880	0.016	0.007
Values * neighbor	0.053	1	0.053	2.475	0.116	0.003
Autos * values * neighbor	0.030	1	0.030	1.420	0.234	0.002
Error	17.211	804	0.021			
Total	32.571	814				
Corrected total	21.883	813				

Dependent variable: weighted walk mode share all trips.
† $R^2 = 0.214$ (adjusted $R^2 = 0.205$).

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Table 4

Analysis of Covariance with Income and Sex Treated as Covariants

Part 1: Main Effects

Name of Main Effect	Mean Value A	Mean Value B	Mean Difference (A−B)	Standard Error	*p*
Urban values	High urban values	Low urban values	0.073	0.014	0.000
Neighborhood form	In CN	Not in CN	0.088	0.015	0.000
Auto availability	Low auto availability	High auto availability	0.089	0.015	0.000

Part 2: Two-way Differences

Name of Two-way Effect	Constant	Mean Value A	Mean Value B	Mean Difference (A−B)	Standard Error	*p*
Neighborhood form and auto availability	In CN	Low auto availability	High auto availability	0.133	0.036	0.000
	Not in CN	Low auto availability	High auto availability	0.049	0.012	0.000
	Low auto availability	In CN	Not in CN	0.114	0.031	0.000
	High auto availability	In CN	Not in CN	0.051	0.014	0.000
Neighborhood form and urban values	In CN	High urban values	Low urban values	0.095	0.035	0.008
	Not in CN	High urban values	Low urban values	0.052	0.012	0.000
	High urban values	In CN	Not in CN	0.108	0.019	0.000
	Low urban values	In CN	Not in CN	0.069	0.016	0.000
Auto availability and urban values	Low auto availability	High urban values	Low urban values	0.061	0.031	0.051
	High auto availability	High urban values	Low urban values	0.085	0.014	0.000
	High urban values	Low auto availability	High auto availability	0.084	0.019	0.000
	Low urban values	Low auto availability	High auto availability	0.092	0.017	0.000

Part 3: Three-way Differences (partial list)

Name of Three-way Effect	Constant	Mean Value A	Mean Value B	Mean Difference (A−B)	Standard Error	*p*
Neighborhood form, urban values, and auto availability	High values and in CN	Low auto availability	High auto availability	0.102	0.038	0.008
	High values and not in CN	Low auto availability	High auto availability	0.063	0.020	0.001
	Low values and in CN	Low auto availability	High auto availability	0.160	0.047	0.001
	Low values and not in CN	Low auto availability	High auto availability	0.036	0.013	0.006

CN indicates compact neighborhood.

Table 5

Hierarchic Regression Analysis

				Change Statistics				
R	R^2	Adjusted R^2	Standard Error of the Estimate	R^2 change	F change	df1	df2	Significant F change
0.394*	0.156	0.153	0.15095	0.156	74.710	2	811	0.000
0.437†	0.191	0.188	0.14787	0.035	35.097	1	810	0.000
0.447‡	0.200	0.195	0.14723	0.009	4.533	2	808	0.011

* Predictors (constant): neighborhood form, high/low urban values group.
† Predictors (constant): neighborhood form, high/low urban values group, auto availability index.
‡ Predictors (constant): neighborhood form, high/low urban values group, auto availability index, sex 01, income per person.
Dependent variable: weighted walk mode share all trips.

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Table 6

Coefficients from Final Regression Model

	Unstandardized Coefficients		Standardized Coefficients		
	B	Standard Error	Beta	t	*p*
(Constant)	0.48	0.03		17.01	0.000
Neighborhood form	−0.09	0.01	−0.23	−6.91	0.000
Auto availability index	−0.07	0.01	−0.21	−6.22	0.000
High/low urban values group	−0.06	0.01	−0.18	−5.39	0.000
Income per person	0.00	0.00	0.06	1.94	0.053
Sex (F)	−0.02	0.01	−0.06	−1.98	0.049

Dependent variable: weighted walk mode share all trips.

Table 5 shows that each of the incremental changes were significant at $p < .05$. In short, the hierarchic regression procedure supports the major conclusions of the ANCOVA. In addition, the standardized coefficients from the model provide an overall sense of the relative importance of the three explanatory factors; the highest standardized coefficient is for neighborhood form (0.23), followed by auto availability (0.21) and personal values (0.18), as shown in Table 6.

DISCUSSION

Walking for transportation was associated with (1) the values and attitudes of the trip maker toward urban conditions and environmental issues, (2) the characteristics of the built environment which either facilitate or impede adoption of walking, and (3) availability of private autos within the household. Each of the three variables was related to walking for transportation in the expected direction, and all combinations of variables produced strong effects. Present results support previous findings from the transportation literature[1–3] that psychologic and environmental variables are strongly related to walking and other physical activities. Interactive effects suggest multiple strategies are needed to most effectively promote more walking for transportation, with the combination of supportive neighborhoods paired with lower auto availability showing the strongest level of interactive effects.

When the factors were examined individually, those with positive urban/environmental values reported 2.5 times the walking mode share compared with those with less positive values. Those living in a compact neighborhood had more than twice the walking mode share than those outside of compact neighborhoods. Those with constrained access to a car had more than twice the walking mode share than those with more autos available.

Examining the factors in combination suggests that multiple intervention strategies may be needed. Our review of the interaction between neighborhood form and personal values suggests that if a public policy intervention were to facilitate a person who values walkable neighborhoods to actually move to such a neighborhood, a major shift in walking could be expected. If the same public policy were to entice a member of the low values group into a walkable neighborhood, a much weaker impact on walk mode share might actually result. The examination of the two factors in combination reveals clear roles for *both* the nature of the built environment and the values/attitudes of the participant.

The creation of all eight cells allows the observation of each factor separately from the other two. For example, holding both personal values and neighborhood form constant, we can focus on the association between auto availability and walk mode share. Here, having stratified for the factor of personal values related to walkable neighborhoods (high group selected) and the factor of neighborhood form (compact neighborhoods selected), those with low auto availability had 56% higher walk mode share than those with high auto availability. This kind of observation can be made comparing any two cells in the matrix, and a general conclusion is that all three variables had important associations with walk mode share and there appear to be numerous substantial interactions among variables.

Given the substantial level of interaction among the key variables, the hierarchic application of the linear regression model is useful to reaffirm that all three factors were associated with walking for transportation. Studies of active living published in the health literature rarely consider the effect of automobile availability. However, present results indicate the role of auto availability as a factor similar in importance to the quality of the built environment or attitudes toward the desirability of living in walkable neighborhoods. The implications of the variable representing auto orientation need be examined in further research. The present study did not attempt to determine the extent to which the number of autos owned is merely a reflection of physical conditions (such as trip distance or lack of alternative) or the extent to which the number of autos owned is an affective condition based on emotional motivations.

Present results are limited by the reliance on a cross-sectional database consisting solely of self-reported measures. Another consideration is the fact that the sample was not selected to represent a random sample of the American population and that the results should not be misinterpreted to suggest such.

The definition of walk mode share was provided by the response to the question of ''your primary mode'' for nine trip purposes. A database derived from multiday diaries of all trips would provide a better description of the extent to which walking occurs outside of its role as the primary mode. On the other hand, use of ''primary mode'' could facilitate direct comparison with such data sources as the U.S. Census, which also uses this format.

In summary, the present study showed that basic indicators of per-

SO WHAT? Implications for Practitioners and Researchers

The creation of public policy interventions to increase the amount of walking for transportation in the United Sates needs to be based upon a solid analytic framework. Our work supports that of others who concluded that attention must be paid to both improving the quality of the built environment and affecting the values/attitudes of those making travel behavior decisions. This article adds consideration of automobile availability. A key finding is that people who have all three supporting conditions of (1) positive values for walkable neighborhoods, (2) location in a walkable neighborhood, and (3) limited automobile availability have mode share to walking more than five times that of those who have none of the three supporting conditions. The ANCOVA process shows that this is true when controlling for the influence of income and gender and as revealed in the purely descriptive statistics. Multiple strategies are needed to create the conditions that support walking for transportation.

sonal values, the built environment, and access to automobiles provide a useful framework for explaining extent of walking for transportation. These variables were shown to have strong interactions and to explain substantial variation in walk mode share. Thus, all three variables examined are candidates for inclusion in more comprehensive models. Further research should explore and refine the question of the role of attachment to the automobile, to improve understanding of the mechanisms by which this attachment is associated with walking for transportation. The analysis implies that multiple intervention strategies are needed to increase walking for transportation that might include increasing access within walkable neighborhoods, social marketing to alter attitudes about living in walkable neighborhoods, and reducing reliance on automobiles through a variety of strategies. The last intervention strategy may be the most challenging.

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