Conceptualizing Social Capital and Active Transportation to School through a Social-Ecological Model

by

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ABSTRACT

Active transportation to school (ATS) has received an increasing amount of attention over the past decade due to its promising health contributions. Most of the existing research that surrounds ATS investigates factors from the physical environment as well as factors from the individual perspective that influence walking and biking to school. This research attempts to add to the existing knowledge by exploring the impact that social relationships within the neighborhood have on ATS.

A model, based on social ecological theory, was presented and tested to examine elements thought to influence ATS. A logistic regression analysis was run to determine the odds of students walking or biking based on the influence of each construct within the model. Results indicated that the physical and socio-cultural constructs were directly and significantly related to ATS behavior while the construct of safety had an indirect effect. These findings support the idea that there are several factors that operate within and across different ecological levels to influence the mode of transportation to school. Therefore, programs to promote ATS should involve multi-level strategies. In addition to the physical environment, interventions should address interpersonal relationships within the family, school, and neighborhood.

DEDICATION

I would like to thank my family, specifically my husband Dave, for the support and encouragement they provided.

ACKNOWLEDGMENTS

I would like to thank my entire dissertation committee for their insight and support during this entire process. The many hours of time they dedicated to me were invaluable. My journey certainly had some bumps along the way, however the individuals on my committee provided nothing but backing and encouragement. I am truly grateful and inspired by each member. I would also like to acknowledge David Maestas and Mary Witkofski with the City of Maricopa. This research would not have been possible without their partnership and assistance.

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Introduction

Obesity among children continues to be a major health issue in the United States (Ogden, Carroll, Kit, & Flegal, 2014; Office of President, US Department of Health and Human Services, US Department of Agriculture, US Department of Education, US Department of the Interior, 2012). A contributing factor is that most children do not engage in sufficient amounts of physical activity (PA) (Iannotti & Wang, 2013; Ogden, Flegal, Carroll, & Johnson, 2002). Less than half of children aged 3 – 11 and only 8% of adolescents aged 12 - 17 in the United States meet the recommended 60 minutes of daily PA (US Department of Health and Human Services, Office of Disease Prevention and Health Promotion, 2008; US Department of Health and Human Services, 2010). Opportunities for increasing PA are becoming important considerations for researchers and practitioners in efforts to reverse the childhood obesity epidemic (Giles-Corti, Kelty, Zubrick, & Villanueva, 2009; Stanley, Ridley, & Dollman, 2012; Trost & Loprinzi, 2008).

Active transportation to school (ATS), or any form of active travel such as walking or biking, has received recent attention due to its promising contribution toward meeting the recommended number of daily PA minutes (Johnston & Moreno, 2012; Lubans, Boreham, Kelly, & Foster, 2011; Tudor-Locke, Ainsworth, & Popkin, 2001; van Sluijs et al., 2009). Research has found that children who walk to school are significantly more physically active (Alexander et al., 2005; Cooper, Andersen, Wedderkopp, Page, & Froberg, 2005; Cooper, Page, Foster, & Qahwaji, 2003; Faulkner, Buliung, Flora, & Fusco, 2009; Sirard, Ainsworth, McIver, & Pate, 2005), have lower Body Mass Index (BMI) scores (Rosenberg, Sallis, Conway, Cain, & McKenzie, 2006), lower waist circumferences (Pizarro, Ribeiro, Marques, Mota, & Santos, 2013), lower odds of being overweight (Bere, Oenema, Prins, Seiler, & Brug, 2011; Østergaard et al., 2012) and are more likely to meet PA guidelines (Tudor-Locke, Neff, Ainsworth, Addy, & Popkin, 2002) than those who use motorized forms of transportation to school. Despite the health benefits, ATS rates have declined in the United States. In 1969, approximately 48% of all schoolchildren walked or biked to or from school. By 2009, the overall rate had dropped to 13% (McDonald, Brown, Marchetti, & Pedroso, 2011). Additionally, in an analysis of the trends from

1995-2001, Ham, Macera, and Lindley (2005) reported that most children did not meet the walking for transportation objectives established by Healthy People 2010.

There has been a national movement to increase levels of ATS. The 2010 White House Task Force on Childhood Obesity recommended that "active transport should be encouraged between homes, school, and community destinations" (p. 82) and set a standard of increasing the percentage of children ages 5 – 18 taking walking and biking trips to and from school by 50% (White House Task Force on Childhood Obesity, 2010). Two of the objectives of *Healthy People 2020* (USDHHS, 2012) are to increase the proportion of trips made to school by walking within one mile or less and biking within two miles or less among children ages 5 – 15. Additionally, a report by the Institute of Medicine (IOM) recommended increasing opportunities for active transportation in an effort to meet the guidelines of 60 minutes of daily PA (Institute of Medicine, 2013). The report also recognized the influence of parents/guardians on children's behaviors and recommended that parents and guardians encourage and support regular physical activity such as walking and biking.

Purpose of Study

Given the decline and deficiency in ATS among youth in the United States, there is a need to better understand the factors that contribute to this problem. To date, four models have been developed in efforts to explain this phenomenon. While these models have helped to better understand correlates of ATS, they also share some limitations. In an effort to improve upon these shortcomings, a new model is introduced in this study to address the following three concerns.

First, in the existing models, individual attitudes of the parent and/or child are often included as an influence on ATS behavior. While this single factor has merit, there is a need to better understand how the shared beliefs of parents and/or children within the community might also influence behavior. Defined as "features of social organizations, such as networks, norms, and trust, that facilitate action and cooperation for mutual benefit" (Putnam 2001, p. 67), the element of social capital has potential to reveal elements within the social environment that may impact ATS. While social capital exists in the relationships between individuals, its power lies in the ability of those individuals to promote collective behavior, conceivably walking and biking to school.

Second, there is discrepancy among existing models with regard to the selection of included variables and their predicted associations. For example, the models highlight different decision-makers when it comes to ATS (i.e., parents, children, or a combination of both). The proposed model aligns with current research that suggests, at the elementary level, it is parents who ultimately make the decision to support ATS (Faulkner, Richichi, Buliung, Fusco, & Moola, 2010; McDonald, 2007; Stewart, 2011).

Third, the causal direction of variable associations in the existing models is inconsistent. This discrepancy with the direction of variable associations could be related to the fact that some of the models do not have clear theoretical bases. Research has shown that ATS is influenced by a variety of factors across a series of levels (Stanley, Ridley, & Dollman, 2012; Sallis, 2006). The proposed model was constructed on the principles of social-ecological theory, which describes how health behavior at the individual level interacts with the physical and socio-cultural environment (Zhang, Solmon, Gao, & Kosma, 2012).

By (1) introducing the community-level construct of social capital and (2) specifying variable associations based on current research and social-ecological theory, the proposed social-ecological model of active transportation to school (SEMATS) addresses the aforementioned issues. The purpose of this research is to introduce and test this new model to explain the strength and influence of variables on ATS using data gathered at six elementary schools and two middle schools in one school district.

Limitations

As with any self-report survey, there is a potential for survey response bias. This may occur because of unclear or misinterpreted question items or because participants over/underestimated certain responses. However, response bias is not expected to be problematic for questions related to ATS given that the questionnaire was pre-tested by 38 parents at another school district to verify comprehension.

The cross-sectional nature of this study may also limit the ability to determine if causal relationships between measured constructs and transportation behavior exists. Despite this limitation, significant relationships, including possible mediating factors, can be established. Sirard, Riner, McIver, & Pate (2005) emphasized the need for more experimental interventions to examine the change in children's PA levels related to ATS. Because of time constraints and intervention programs already in place at research sites, this study was not able to accommodate an experimental design.

Although a comprehensive model of active transportation to school is presented within this paper, only the central components of the model are included in the analysis. Because of the inability of the survey instrument to fully capture each construct, neither the outermost layer of the model, the policy environment, nor the health outcome was tested in this study. Future research should elaborate on the present study to obtain information about and analyze the impact in these two domains.

Research questions

Goals of this research were to address the following questions:

1. Does the proposed model, based on social-ecological theory, explain the odds of elementary school-aged students using ATS?
2. Does the construct of social capital significantly impact the odds of using ATS among elementary school-aged students?

Literature Review

Theoretical Framework

Social Capital Theory. Social characteristics of neighborhoods have the potential to influence health behaviors (Kawachi, Kim, & Subramanian, 2008), such as physical activity behaviors of walking and biking. A growing body of research suggests that social networks rich in trust and norms, have resources that help individuals achieve health enhancing objectives (Lin, 2001). Social capital refers to these social networks and bonds among individuals that enable people to achieve a variety of goals and health-promoting effects (Kunitz, 2004).

Although there are several definitions of the term, Putnam's (2001) leading view of social capital "refers to connections among individuals … and the norms of reciprocity and trustworthiness that arise from them" (p. 19). He stresses that the collective value of these social networks and the inclinations that arise from them result in doing things for each other. Interestingly, one of Putnam's primary indications of social capital is the extent to which individuals engage in organized leisure (Leonard, 2005). These associations suggest that measures of neighborhood integration may be useful in explaining variability in ATS behavior among student residents. The possibility that walking and/or biking to school represents a form of leisure and may be facilitated by networks, norms, and trust within the neighborhood could be supported by social capital theory.

***Social-Ecological Theory*.** Physical activity behavior, such as active transportation to school, is influenced by a complex interaction of factors at a variety of levels including intrapersonal, social, and physical (Sallis, 2006; Stanley et al., 2012;. Efforts to understand and explain ATS, therefore, must take these influences into consideration. The social-ecological perspective addresses the dynamics of individual health behavior and their interactions with the physical and socio-cultural environment (Sallis & Owen, 1999). This paper presents a theoretical framework of the ATS behavior from a social-ecological perspective. Before discussing the specific implications of the proposed framework, the evolution of the social-ecological perspective will be reviewed.

Historical overview of health behavior theories.

General exercise recommendations with scientific foundations began to emerge in the 1970s (Blair, LaMonte, & Nichaman, 2004). The American College of Sports Medicine (ACSM) document, *Guidelines for Graded Exercise Testing and Exercise Prescription*, was published in 1975 and contained recommendations for exercise prescription and daily amounts of exercise. Following that publication, other organizations began releasing guidelines and recommendations related to PA (e.g., American Heart Association, 1992; Centers for Disease Control, 1995; National Institutes of Health, 1996; U.S. Department of Health and Human Services, 1980; U.S.

Surgeon General, 1996; World Health Organization, 1995). These reports were influential in terms of health promotion, but focused largely on individual or intrapersonal behaviors.

Intrapersonal theoretical influences. The analysis of health behavior that was dominant from the 1970s to the 1990s focused on changing individuals' health-related habits and lifestyles. Research during this period was guided primarily by motivation and behavioral change theories such as the Health Belief Model and Ajzen and Fishbein's Theory of Planned Behavior (Welk, 2002).

Health belief model. The health belief model (HBM) has been one of the most widely used frameworks in health behavior research since the 1950s. It was initially developed by social psychologists in the United States Public Health Service to explain failure of people to participate in programs for preventing and detecting disease (Glanz, Rimer, & Viswanath , 2008). For example, Evenson and Bradley (2010) used the HBM to investigate the factors influencing the lack of PA during pregnancy. Similar studies have investigated engagement in PA in alternate settings (Ceria-Ulep, Serafica, & Tse, 2011; Ehrlich-Jones et al., 2011). Within the theory, several perceived constructs (susceptibility, severity, benefits, barriers, and self-efficacy) are defined to predict why people will or will not take action.

The HBMs focus on perceived barriers widely influenced research efforts. It became the most influential single predictor of health behavior across all studies from 1974-1984 (Glanz et al., 2008). Although HBM continues to be a leading theory, it is limited in that each construct is particular to a given situation and measurement tools must be modified appropriately. If not developed correctly, measures of HBM constructs risk error within different populations or circumstances. Additionally, the model does not account for emotional or environmental contributors of behavior.

Theory of planned behavior. The theory of planned behavior (TPB) was introduced in 1985 by Icek Ajzen to predict human behavior (Ajzen, 1985). TPB states that attitudes toward behavior, subjective norms, and perceived behavioral control together shape an individual's behavioral intention, which ultimately predicts their behavior. The TPB model has been used to study the prevalence of various types of physical activities in part because of the focus on perceived behavioral control. This variable aims to understand why individuals' feel that PA is within or beyond their capabilities. The TPB has become an increasingly popular framework for investigating healthy behaviors such as ATS (Murtagh, Rowe, Elliott, McMinn, & Nelson, 2012), walking (Maddison et al., 2009; Rhodes, Brown, McIntyre, 2006), cycling (Saelens, Sallis, & Frank, 2003), and cardiorespiratory fitness (Martin et al., 2005).

Although progress toward understanding health behaviors based on the HBM and TPB frameworks was encouraging, there remained gaps in the literature (Glanz et al., 2008) and in effective programming. These cross-sectional studies explained small amounts of variance in PA, but did not capture the full complexity of behavior (Bauman, Sallis, Dzewaltowski, & Owen, 2002; Trost et al., 1997; Welk, 2002;). In fact, Spence and Lee (2003) found that these models explained only 20% to 40% of variance in PA behavior in children. The next step in the progression toward the social-ecological perspective was the investigation into the interpersonal level.

Interpersonal theoretical influences.

Social cognitive theory. Originally known as social learning theory (Miller & Dollard, 1941), social cognitive theory (SCT) was further developed by Bandura (1977) to emphasize the interaction between individuals and their environments. Major concepts of SCT include psychological, observational, and environmental determinants; self- regulation; and moral disengagement. The reciprocal determinism of people and their environments are dependent upon these concept categories. This theoretical progression toward ecological thinking posits that no observational learning can occur unless the observers' environments support the new behaviors (Bandura, 2002). Although it recognizes how environments shape behavior, SCT focuses on the ability of individuals to shape the environment as suited for themselves (Glanz et al., 2008).

Several studies have used SCT as a framework for increasing PA (McAlister, Perry, & Parcel, 2008; Zhang, Solmon, Gao, & Kosma, 2012). These studies have focused on the influence of social support on self-efficacy. The concept of self-efficacy has been validated extensively (Moritz, Feltz, Fahrbach, & Mack, 2000) and become an important concept in behavior change research. Because the theory primarily focuses on the individual and his/her self-efficacy, however, it may not encompass all of the concepts involved in achieving sustained behavior change.

Environmental theoretical influences. The term ecology was introduced in 1869 to refer to the scientific study of the "household of nature" (Pickett, Buckley, Kaushal, & Williams, 2011). Although it has many different connotations, ecology generally refers to the interrelation of organisms and their environments. In the social sciences, ecology focuses on the transactions of people and their physical and sociocultural surroundings (Stokols, 1996). Ecology as a science has characteristics that clarify how it relates to social agendas (Kolasa & Pickett, 2005). The systems view, which is at the core of ecological science, studies the interactions among entities, the way that they are connected, and the implications of the porous boundaries within which they exist (Pickett & Cadenasso, 2002; Cadenasso, Pickett, Weathers, & Jones, 2003).

Although the advancement of ecological models was based on many contributors, Bronfenbrenner could be called the forefather of the movement as he developed the Ecological Systems Theory in 1977 (Figure 1.1). His perspective was founded on the person, the environment, and the continual interaction of both. He visualized influences on behavior as a series of layers, similar to "Russian dolls" (Bronfenbrenner, 1994), where the innermost layer represented the individual, and the outer dolls were the surrounding environmental influences.

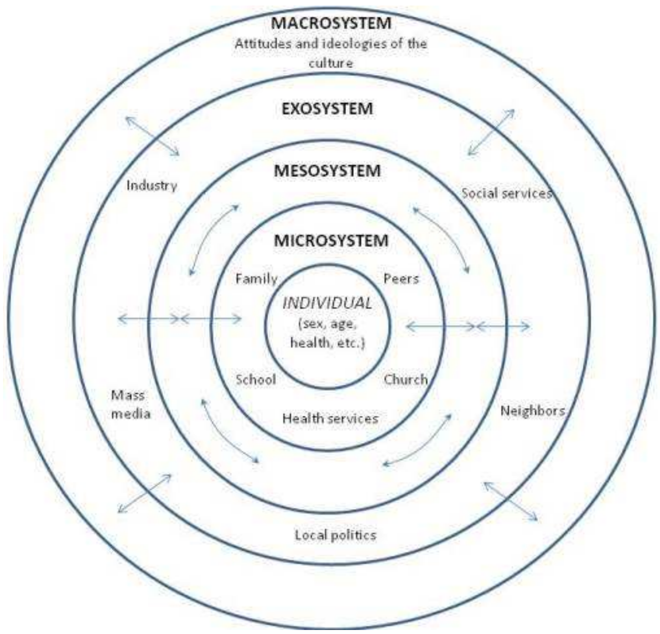


Figure 1. Bronfenbrenner's Ecological Systems Theory

Ecological models have seen a large growth of interest and use over the past two decades (Glatz et al., 2008). The use of these models in the general health behavior field has become popular by agencies such as the U.S. Department of Health and Human Services (2010), the Institute of Medicine (2001), and the World Health Organization (2004) since ecological strategies to promote health have the capacity to benefit a larger population. With the ecological perspective, the health behavior of all persons exposed to an environment may be reached as opposed to focusing on individual change.

Social-ecological theoretical influences. A leader in introducing the theoretical perspective of social-ecology into health behavior research was McLeroy (1988). His model (Figure 2) classified five different levels of influence on health behavior: intrapersonal, interpersonal, institutional, community, and public policy. While worth including in the history, McLeroy's model did not include the physical environment, which is an essential element in some health areas (such as PA).

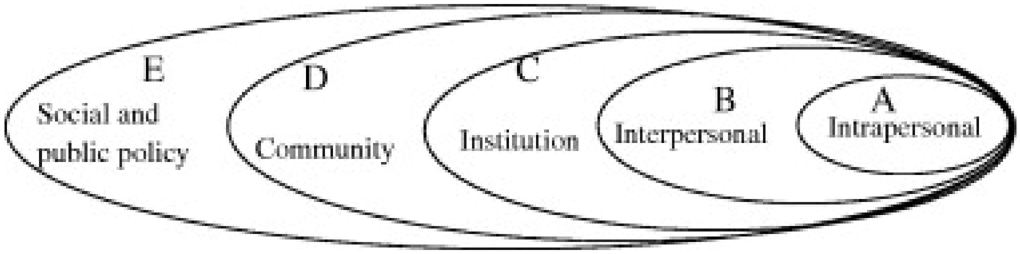


Figure 2. McLeroy's Ecological Model

Stokols (1996) introduced his Social Ecological Model of Health Promotion (1996) to explain the usefulness of social-ecological theory in health behavior research. Stokols (1996) argued that human health is comprised of the dynamic interplay between situational and personal factors rather than environment, biology, or behavior on its own. Stokols held strong systems theory foundations and agreed that relationships between people and environments were dynamic and interrelated. However, he felt that environmental approaches to health promotion were limited because of varying behavioral characteristics and sociodemographics of populations.

The social-ecological perspective that he described was bigger than one theory; it was an overarching paradigm (Stokols, 1996). It encompassed an interdisciplinary approach from fields such as the medical, behavioral, and social sciences. He proposed an overarching theoretical framework that had practical applications. To guide program development, he suggested six guidelines that stemmed from the core theoretical basics of social-ecology.

Sallis' (2006) ecological model of four domains of active living (AL) (Figure 3) is a more comprehensive model that emerged in response to the need to achieve population change in PA. The researchers identified the four domains of active recreation, active transportation, occupational activities, and household activities, which together make up AL. The multi-level model focuses not only on the interaction between levels, but the connection itself. Linking related influences across levels can represent new associations. Without this concept, the model would simply be a large-scale representation of separate influences. The acknowledgment that each level must be connected is a powerful component of the AL model.

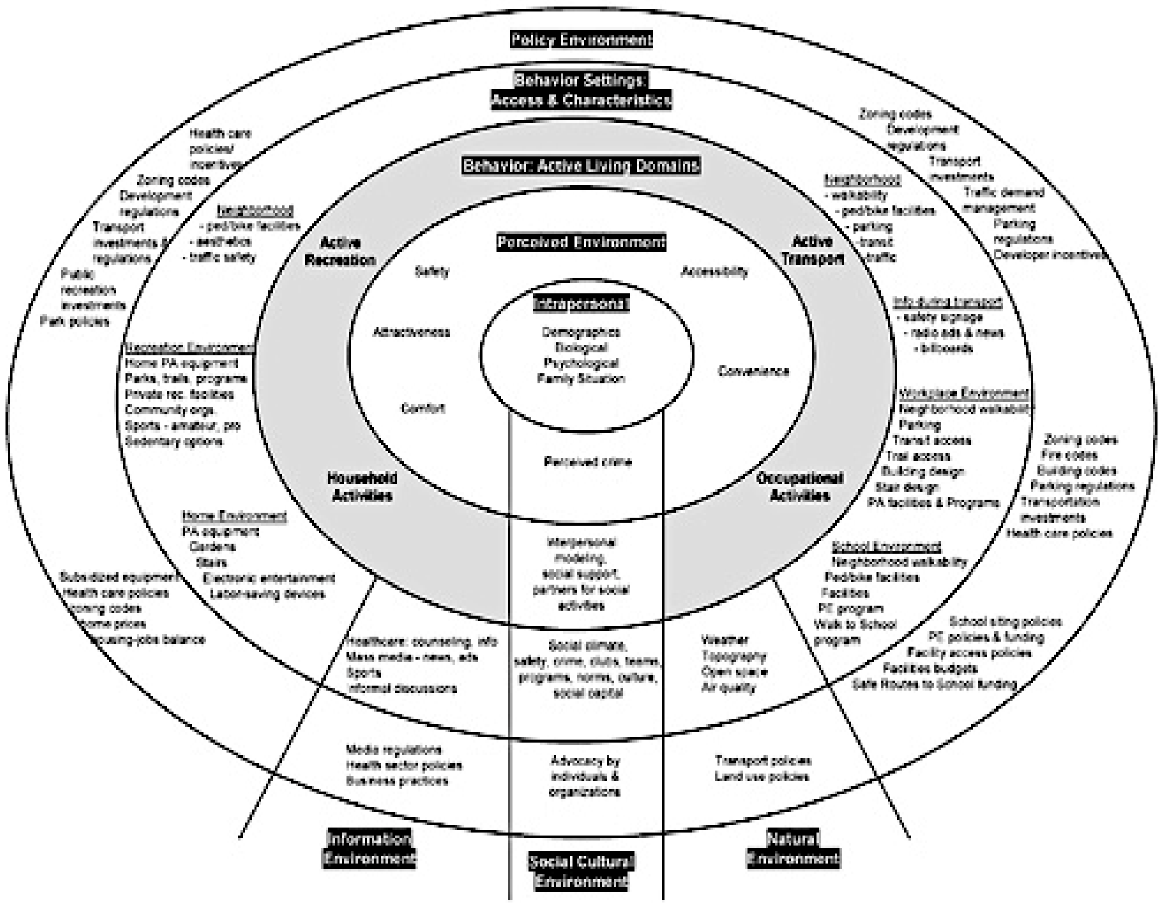


Figure 3. Sallis' Ecological Model of Four Domains of Active Living

The AL model provides researchers with the ability to connect pertinent information on various levels. It was also developed to illustrate the roles of numerous disciplines (Sallis, 2006). Since it has been established that there are many influences on health behaviors, the use of a multi-level, multi-disciplinary model is very appropriate. Specifically, Sallis' model can be a useful tool to identify and connect facilitators and constraints toward AT in youth on a variety of levels.

Several researchers have called for an increase in research utilizing a social-ecological framework (Giles-Corti et al., 2005; Glanz, Rimer, & Vizwanath, 2008; Spence & Lee, 2003). This approach goes beyond behavior and environmental change strategies and offers a dynamic insight into the connection between individuals, their social interactions, and environments. Researchers agree that this framework has great potential to offer insight into the dynamic concept of ATS. “In undertaking further research, particular attention should be given to the use of multi-level study designs including objective measures of the physical environment, as well as the parents’ perceptions of environments so that comparisons between objective and perceived attributes of environments, and their relative impact on ATS can be clarified” (Pont et al., 2009).

Existing models of active transportation to school. McMillan’s Conceptual Framework of an Elementary-Aged Child’s Travel Behavior (McMillan, 2005) (Figure 4) addresses the relationship between urban form and a child’s trip to school. Urban form relates to travel patterns primarily by impacting proximity between origins and destinations and among destinations, and directness of travel (i.e., connectivity) (Su et al., 2013). The conceptual framework suggests that, given particular elements of urban form (i.e. sidewalks), a parent forms opinions about the ability of the physical environment to support different modes of travel for their child’s trip to school (McMillan, 2005).

The outcomes of McMillan’s research support the complexity of active transportation behavior. One crucial conclusion that resulted from her framework is the role that parents/guardians play in determining ATS behavior in children. This critical component provides a foundation for the model being presented in this paper. Despite the many benefits, McMillan’s framework is restricted by its narrow definition of the environment and by its more linear construction. She aimed to uncover how neighborhood safety, traffic safety, and transportation options mediated the relationship between urban form and the child’s trip to school but found ambiguous evidence that these factors were in fact mediators (McMillan, 2003). Instead, it was discovered that a variety of factors interacted with each other to explain the phenomenon of ATS. For example, the results indicated that neighborhood safety on its own did not mediate the relationship between urban form and travel behavior, except when modified by ease of travel and the number of children within a household.

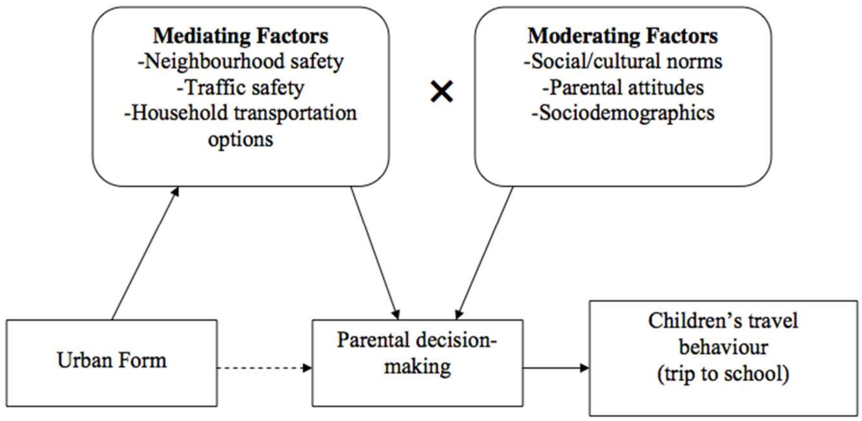


Figure 4. McMillan's Conceptual Framework of an Elementary-Aged Child's Travel Behavior

The Ecological and Cognitive Active Commuting Framework (ECAC) (Figure 5) developed by Sirard and Slater (2008) is an extension of McMillan's framework and utilizes the social-ecological perspective along with elements of social cognitive theory. It suggests policies operate at the first level which then influence parental perceptions and school travel decision-making. Although the authors state that the framework is in its early stages of development (p. 392), the model has provided great insight into the direction that certain variables interact with one another. One portion of the model that is unclear surrounds sociodemographics. The authors state that sociodemographics would modify the parent's decision; however, in the model, these variables do not appear to be connected.

The ECAC model suffers from two other distinct limitations. First, to date, the model has yet to be tested. Secondly, several of the proposed relationships within the model are indeterminate. For instance, dashed lines represent constructs that are believed to be of lesser importance or have not yet been identified. There are also areas of the model (i.e., frequency of active commuting and physical activity) where causality is uncertain (p. 378).

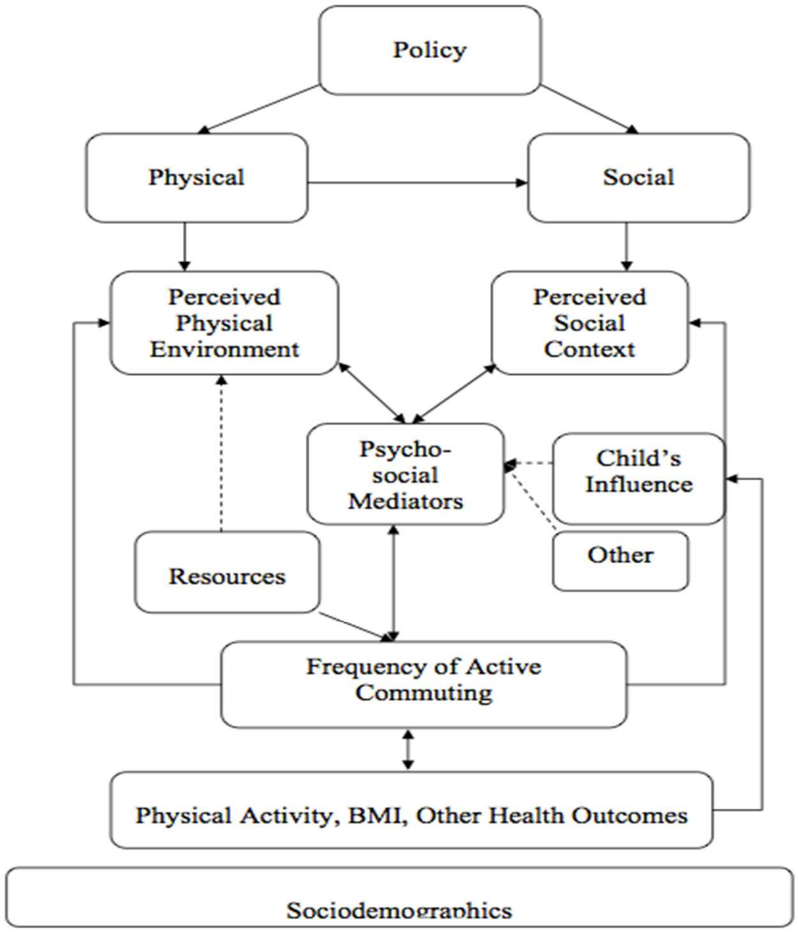


Figure 5. The Ecological and Cognitive Active Commuting Framework (ECAC)

Panter, Jones, and van Sluijs (2008) extended upon existing models by offering the idea that either children or parents may make the travel behavior decision. Their conceptual framework for the environmental determinants of active travel in children (Figure 6) contains four domains of influence of active travel behavior: individual factors, factors related to the physical environment, external factors, and main moderators. This model is useful for attempting to understand the factors that influence travel behavior of adolescents, although not a current focus of this paper.

Despite the potential usefulness of this model, it also has some major deficiencies. First and foremost, the model appears to lack a theoretical base. Additionally, the vast number, variety, and complexity of physical environment factors may be difficult to measure. For example, determining “provision of facilities, facilities to assist walking and cycling, urban form, and aesthetics” as well as “attributes of destination and surroundings” and “attributes of route” require more in-depth objective measures while the other factors require subjective forms of measurement. Lastly, the researchers highlight gender as a main moderator, however research has generally not supported this variable as having a significant impact (Black, Collins, & Snell, 2001; CDC, 2005). Overall, the depth of variables included in the model is appealing, but the lack of a theoretical influence is concerning.

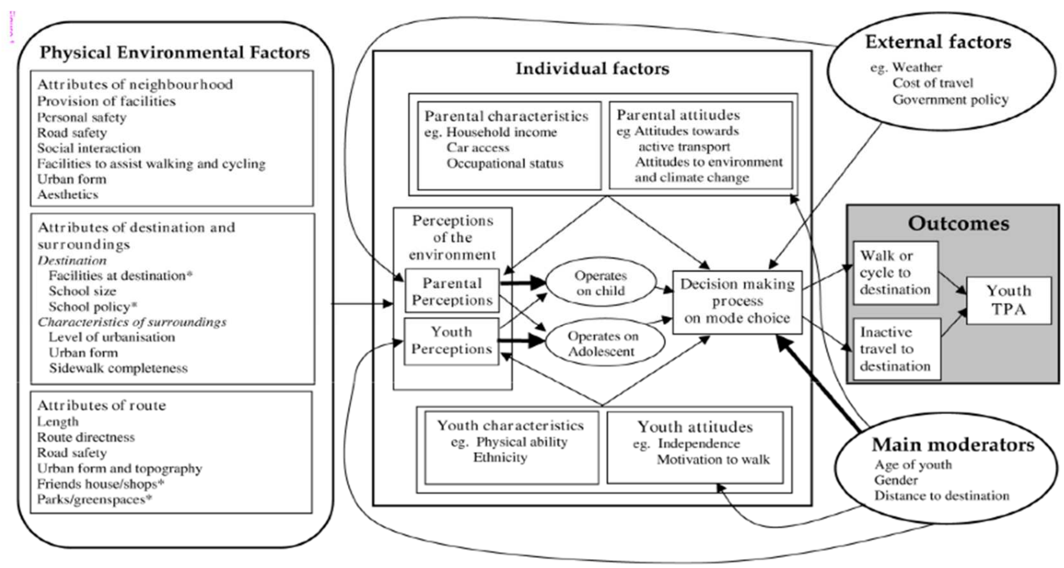


Figure 6. A conceptual framework for the environmental determinants of active travel in children

The Model of Children’s Active Travel (M-CAT) (Figure 7) developed by Pont, Ziviani, Wadley, and Abbott (2009) highlights the decision-making process involved in active transportation to any destination among children. It incorporates the environment, parental perceptions, and children’s own perceptions with regard to active transport over time. One novel idea present in the model is that of the feedback loop. This demonstrates the idea that every trip a child makes influences the factors in the model and reformulates the outcome for the future. A controversial aspect of the M-CAT is the emphasis on the power of the child. The model is based on the principle that "the child ultimately makes his/her own decision to engage in AT" (Pont et al., 2010, p. 142) which is a statement that needs more research to support it. Currently, the literature demonstrates that children may influence the decision, but it is in fact the parent that has the ultimate say in ATS (Eyler et al., 2008; McMillan, 2007). Another problematic feature of the MCAT is the categorization of some of the variables. Pont et al. (2010) describe the objective elements as being "independent of emotions or prejudices" (p. 140). However, some of the examples that are used to describe this element may actually be based on emotion or perception. For example, the ability to pursue ATS safely and whether a child enjoys using ATS are both included within the MCAT's objective domain. These examples also seem to fit into the MCAT's perception element.

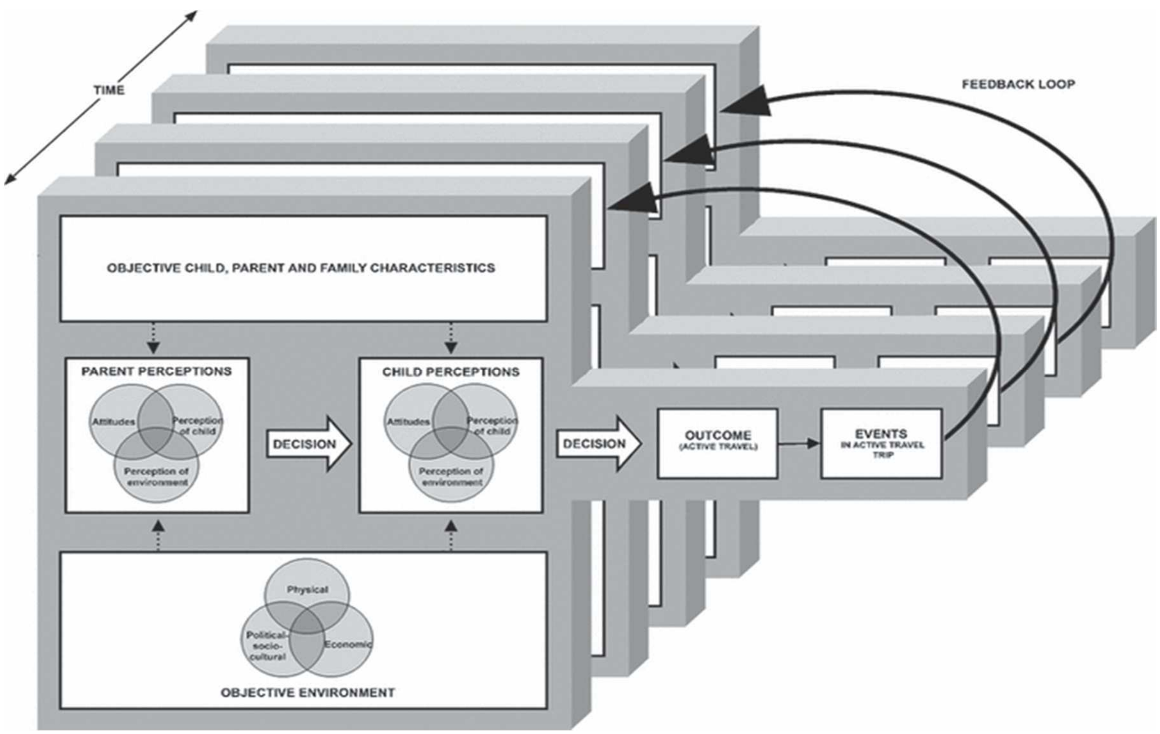


Figure 7. The Model of Children's Active Travel (M-CAT)

These four models have added to the current knowledge surrounding ATS but each one has limitations, including the lack of supporting research. In an effort to alleviate this and the aforementioned issues, a new social-ecological model of active transportation to school (SEMATS) (Figure 8) presented in this paper includes the following features:

1) The inclusion of the construct of social capital, a variable that has received little attention in the current ATS literature
2) A framework based on social-ecological theory that also indicates possible interaction between levels

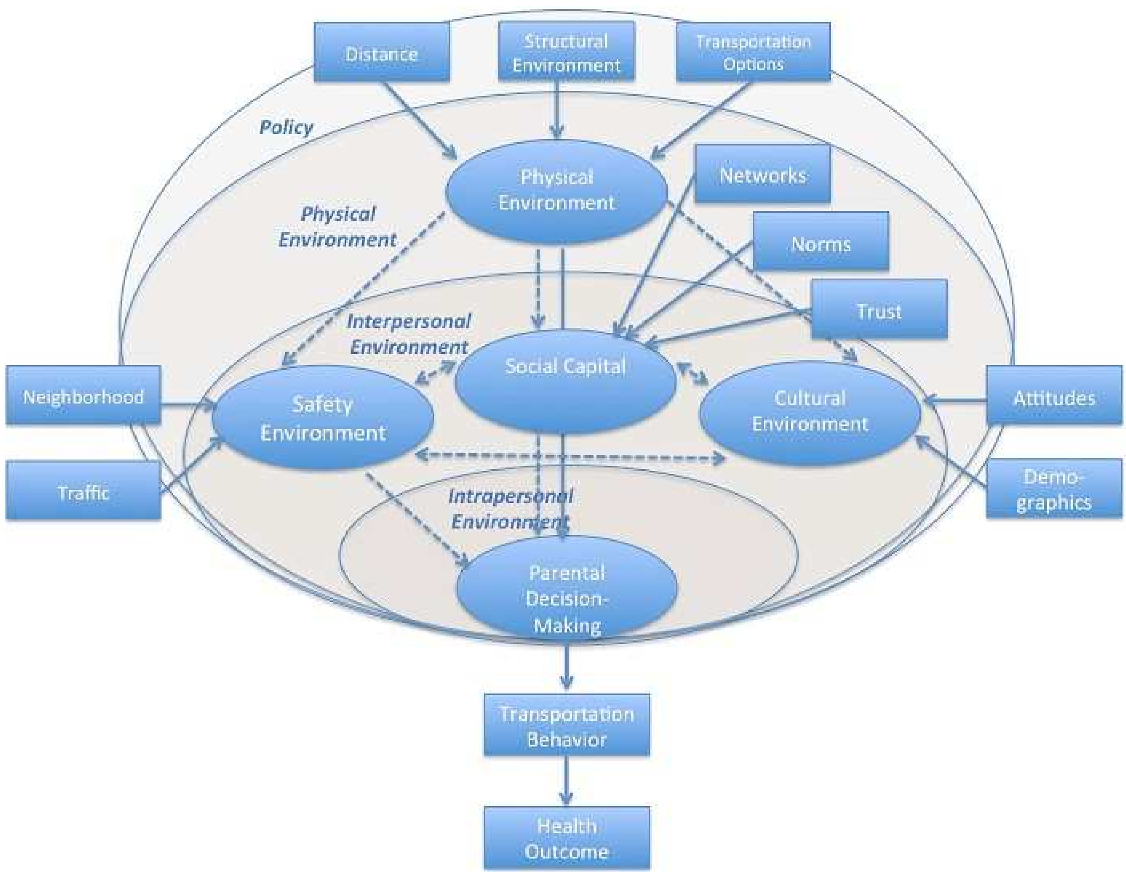


Figure 8. Social Ecological Model of Active Transportation to School (SEMATS)

Discussion of Past Research

The research topic of active transportation to school is relatively new with prominent literature surrounding the subject emerging only within the past decade. Throughout this time period, however, distinct trends have developed.

The most commonly reported barriers to ATS reported by parents and guardians are related to concerns about student safety and distance to school (Ahlport, Linnan, Vaughn, Evenson, & Ward, 2008; DiGuiseppi, Roberts, Li, & Allen, 1998; Faulkner, Richichi, Buliung, Fusco, & Moola, 2010; Kerr et al., 2006; Martin & Carlson, 2005; Timperio et al., 2006). Additional reported factors that influence ATS behavior include physical factors such as the structural environment (i.e., presence of sidewalks) (Braza et al., 2004; Ewing et al., 2004; Mitra et al., 2010) and transportation options (Eyler et al., 2008; Hosking et al., 2011). Social factors such as the presence of crossing guards and ease of travel (Chriqui et al., 2012; Ahlport et al., 2008; Dumbaugh & Frank, 2007) as well as community norms and attitudes (Eyler et al., 2008) have also been reported as correlates of ATS. The following section will describe the current literature surrounding the major influences on ATS and their placement within the SEMATS.

Policy

The outermost level of the model contains elements related to programs or policies that are in place at the school or community level (i.e., the availability to take a school bus). School district policies can play an important role in preventing or enabling students to walk or bike to school. Six percent of parents identified school policies as a barrier to ATS (CDC, 2005). An example of such policy could be a school rule that bans walking and biking to school. Not surprisingly, similar policies were found to be significantly associated with less walking and biking in a national sample (Martin & Carlson, 2005). Programs that encourage ATS, such as the Walking School Bus (WSB) are also examples that may fall into this category. The WSB is an adult-supervised walking group, with the goal of enabling children to walk to school safely and adding more physical activity into their day. Several studies have shown that WSB programs are successful at increasing moderate to vigorous intensity physical activity, overall physical activity, and active commuting behavior in children (Heelan, Abbey, Donnelly, Mayo, & Welk, 2009; Heelan & McFarland, 2006; Mendoza et al., 2011).

Physical environment

Distance. Distance from school has been reported as a key barrier while shorter distances have been reported as facilitators of ATS (Ahlport et al., 2008; Dellinger & Staunton, 1999; DiGuiseppie et al., 1998; Faulkner et al., 2010; Greves et al., 2007; Kerr et al., 2006; Martin & Carlson, 2005; Rodriguez & Vogt, 2009; Schlossbert et al., 2006; Su et al., 2013; Timperio et al., 2006). It is therefore critical for studies to identify a walkable distance. One mile has become the consistent recommendation as a reasonable distance to walk to school (McDonald et al., 2011; Timperio et al., 2004; USDHHS, 2010). Timperio et al. (2006) found that children who lived within ½ mile of their school were 5 – 10 times more likely to use ATS. Similarly, McMillan (2007) reported that children were 3 times more likely to engage in ATS if the school was within 1 mile of their home. Despite the growing evidence that distance to school impacts ATS, Falb et al. (2007) found that only 1 – 51% of children lived within a "safe and reasonable" walking distance of 1 mile along streets with posted traffic speeds of less than 25 miles per hour.

***Structural environment**.* There is a growing interest in objective measures of the physical environment as they relate to ATS behaviors in children. Current literature suggests that street connectivity, route directness, and mixed land use are positively correlated with walking behaviors in children (Gallimore et al., 2011; Giles-Corti & Donovan, 2002; Saelens et al., 2003; Sallis, 2006; Wendel-Vos et al., 2004). However, inconsistent methods of labeling and measuring structural elements of the environment have resulted in conflicting results. For example, Dunton et al. (2009) reported that varying results may be potentially influenced by different ways of measuring connectivity and different definitions of neighborhood.

Street connectivity (i.e., shorter blocks, less dead-ends, and more intersections) and route directness are thought to increase active transportation by making travel easier. The number of and type of streets crossed is often used as an indicator of connectivity and as a measurement of traffic exposure (Carlin et al., 1997; Macpherson et al., 1997). In 2006, Timperio et al. used geographic information systems (GIS) measures and found that the need to cross a busy street (freeway, highway, or arterial road) was negatively correlated with walking and biking in children. Similarly, Bringolf-Isler, Grize, Mäder, Ruch, Sennhauser, & Braun-Fahrländer (2008) and Timperio et al. (2006) found that major road crossings were twice as likely to have a negative association with ATS.

An increasingly common effort to alleviate the physical environment as a barrier to ATS is to improve the design and condition of sidewalks. In an evaluation of ten schools, the frequency of walking and biking to school increased after the construction and maintenance of sidewalks (Boarnet et al., 2005). Ewing et al. (2005) also found that more children may walk to school in places where there are amenities such as sidewalks. However, there is mixed evidence regarding the complete role that sidewalks play in ATS (Chriqui et al., 2012). Although most studies report favorable correlations between sidewalks and ATS (Davison et al., 2008; Fesperman, Evenson, Rodríguez, & Salvesen, 2008), many studies report that having supportive physical structures such as sidewalks are not enough alone to encourage ATS (Ahlport et al., 2008; Boarnet et al., 2005; McMillan, 2007).

Eyler et al. (2008) held interviews with 75 people responsible for making transportation policy decisions in six school districts. The authors found that the mere presence of sidewalks was not enough to encourage ATS behaviors. Incomplete sidewalks, debris, and cracks were further identified as barriers that prevented students from walking or biking. In a national study on ATS in children grades 4–12, Fulton, Shisler, Yore, & Caspersen (2005) found that the presence of sidewalks was the main modifiable characteristic associated with ATS. This supports the notion that sidewalks of good condition may be one of the influential components of ATS.

It is interesting to note that some studies have found that parental attitudes or perceptions are more strongly associated with travel behaviors than are elements of the physical environment (Giles-Corti & Donovan, 2003; Kerr et al., 2006; Kitamura et al., 1997; McMillan, 2007). For example, some parents feel that the streets closest to the school are the most dangerous locations to cross on foot because of high traffic volumes and erratic driving (Anderson, Boarnet, McMillan, Alfonzo, & Day, 2003; Bradshaw, 1995). This suggests that ATS behavior of children may not change with modifications of the physical environment unless parents' attitudes are also addressed.

Transportation options. In their interviews with 69 parents whose children attended a school participating in some kind of ATS initiative, Eyler et al. (2008) found that the first step in successful behavior change was informing parents of transportation choices. One parent, for example, commented that she did not like sending her child to ride the bus because kids "talk nonsense and sometimes fight each other" (p. 142) but had never thought about walking until her school implemented a Safe Routes to School (SRTS) program.

Walking and biking to school provide a more cost efficient and environmentally friendly alternative to using a car for transport. Despite this, children are increasingly chauffeured to and from school via and automobile (Carver et al., 2008). In 1969, 12.2% of elementary and middle school students were driven compared to 45.3% in 2009 (McDonald et al., 2011). Because of this, car dependency amongst children is increasing (Mackett, 2002).

Some evidence suggests that car ownership is associated with lower odds of walking to school (Carlin et al., 1997; Timperio et al., 2004) and a greater likelihood of car travel (Roberts et al., 1997). In fact, DiGuiseppi et al. (1998) found that car ownership was one of the greatest determinants of car travel to school. Once distance was taken into consideration, however, some studies found no association between family ownership of a car and ATS behavior (McMillan, 2007; Merom et al., 2006).

Another factor that may influence transportation options for the trip to school is the availability of a bus. All public school districts provide busing options for their students, but many have minimum distance policies which may influence the transportation options for students. In their study, Chriqui, Taber, Slater, Turner, Lowrey, and Chaloupka (2012) found that 51% of states had no minimum distance requirement, 13.7% had ≤ 1 mile requirements, 27.5% had > 1-2 mile requirements, and 7.8% had > 2 mile requirements. Of these, the proportion of students' walking/biking to school was significantly lower in schools in states with minimum busing distances of ≤ 1 mile compared to schools in states without bussing distance laws.

Interpersonal Environment

Safety environment.

Neighborhood safety. Perceived neighborhood safety has been found to be negatively associated with levels of ATS (Carver et al., 2008; Faulkner et al., 2010; Salmon et al., 2007). Fear of abduction or "stranger danger" is a major concern among parents. It is one of the most frequently reported barrier to walking and biking to school (Eyler et al., 2008; Kerr et al., 2006;

Timperio et al., 2004; Timperio et al., 2006). Interestingly, this concern exists despite statistics that indicate crimes against children are less likely to occur from strangers than family members or acquaintances (Finkelhor & Omrod, 2000). In fact, the actual risks of abduction overall have been found to be substantially lower than risks of injury from automobile accidents, pedestrian injuries, and bicycle injuries (Eichelberger et al., 1990; CDC, 2012). The phenomenon of parents fearing for their child's safety was explained in an Australian Criminology Research Council report (Howard & Johnson, 2000) as "risk-victimization paradox" meaning that parents are overly anxious and create an exaggeration risk of "stranger danger".

Research has generally focused on perceived measures of neighborhood safety (Carver et al., 2005; Mota et al., 2005; Timperio et al., 2004). A number of studies have found that parental perceptions of neighborhood safety are strong predictors of child PA (Ferriera et al., 2007; Kerr et al., 2006; Lumeng et al., 2006). Kawachi and Berkman (2003) found that subjective fear is more predictive of behavior than actual crime statistics. In their qualitative study, Eyler et al. (2008) found that although most parents felt their communities were safe, the chance of child abduction was still a barrier toward ATS. However, many parents reported that safety was promoted through walking and biking to school because children learned safe routes and got to know their neighbors. Similarly, Stewart (2011) suggests that walking to school with neighbor children can promote a sense of community and trust among families.

Studies have found that social interaction can contribute to a sense of safety among children (Burman et al., 2002; Carver et al., 2005; Evenson et al., 2006). In addition to the company of other students, Ahlport et al. (2008) reported that when group of children in supervised by an adult, there is less chance of encountering bullies. Parental concerns about stranger danger also appear to vary by the child's sex. Valentine (1997) found that girls rely more on the company of friends and family to feel safe compared to boys. One study found that almost twice as many parents of teenage girls restricted their child from venturing out alone compared with parents of teenage boys (Hillman et al., 1990). In their New Zealand study, Tranter and Pawson (2001) identified that parents of girls had greater concerns about safety compared to boys.

The presence of crossing guards may generate feelings of safety which enhance ATS behaviors. When states have laws requiring crossing guards around schools, it appears to be effective at reducing barriers to walking/biking (Ahlport et al., 2008; Chriqui et al.,2012; Dumbaugh & Frank, 2007). Greves et al. (2007) found that policies requiring crossing guards appear to be an effective strategy in reducing barriers and facilitating ATS. One parent in the 2008 interviews by Ahlport et al. stated that crossing guards served as adult supervisors who "deter individuals from stopping and hanging out looking for kids" (p.229).

Traffic safety. Along with neighborhood safety, perceived issues regarding traffic are one of the most commonly reported barriers to walking and biking to school (Ahlport et al., 2008; Carver et al. 2008; Kerr et al., 2006). Parental perceptions of road safety may restrict their children's ATS behaviors. For example, Timperio et al. (2004) found that parents who perceived local road conditions to be unsafe reported that their children walked and biked less. Similarly, Gielen et al. (2004) found that 70% of parents restricted their children's outdoor play because of "unsafe cars". Perceived traffic danger has been associated with lower rates of ATS among children (McMillan, 2007) and was estimated to inhibit approximately 40% of children from walking or biking to school according to another study (Dellinger & Staunton, 1999).

One study found that children aged 10-12 were less concerned about road safety than their parents (Timperio et al., 2004). However, parental perceptions had stronger associations with walking and biking within the neighborhood compared to children's perceptions indicating that parents actually control these behaviors. Consequently, the more parents who drive their children to school because of these fears, the less safe the roads are for children who walk or bike.

The literature indicates that traffic speeds can influence ATS (Eyler et al., 2008; Martin & Carlson, 2005). Chriqui et al. (2012) found that state laws requiring speed zones around schools lowered the odds of zero students walking or biking to school by 51%. McDonald & Alborg (2009) found that local traffic safety improvements alone were not enough to change ATS behaviors indicating that state level traffic control measures may be more effective.

The volume of traffic can negatively impact ATS behaviors and children's PA behaviors (Davison & Lawson, 2006). However, driving children to and from school in a private vehicle only adds to this problem and may place other children at risk for injury (Tranter & Pawson, 2001; Tudor-Locke et al., 2001). In fact, McMillan (2005) has reported that the streets closest to schools are some of the most dangerous locations for children who utilize ATS because of the erratic driving behavior of parents attempting to get to work or other destinations on time.

Social Capital. While a number of studies have investigated social support as an indicator of PA in adults (Ball et al., 2010; Trost, Owen, Bauman, Sallis, & Brown, 2002), there is a dearth of research surrounding the impact of social capital on PA, and specifically ATS, among youth.

Networks. Several studies suggest that networks within the community affect walking (Ball et al., 2007; Echeverria, Diez-Roux, Shea, Borrell, & Jackson, 2008; de Leon et al., 2009) and PA (Ball et al., 2010; Fisher, Li, Michael, & Cleveland, 2004) in adults. Some research has begun to explore the relationship of similar social networks and ATS. Eyler et al. (2008) interviewed one parent who commented "there's such a huge benefit to building a community when kids are walking to school. It connects the parents, it connects the kids" (p. 143). When many children in the neighborhood are all out and walking together, it can create a feeling of community pride.

Norms. Timperio et al. (2006) found that children were more likely to walk or bike to schools when parents perceived that other children in the area used ATS. In their interviews, one parent noted the importance of social support in promoting ATS by stating, "for our own kids to continue the behaviors we've taught them, they have to see that other people do it too" (Eyler et al., 2008, p. 143).

Trust. Hume et al. (2009) surveyed 957 Australian primary school children and found that there was a significant positive association between knowing and trusting neighbors and walking frequency. In their interviews, Ahlport et al. (2008) quoted a parent as saying, "If I see more kids on the road walking to school, I would feel more comfortable with my kids walking and joining them. If my kids are the only ones walking, I feel uncomfortable" (p. 226). Additionally, walking and biking has been found to enhance self-esteem and responsibility in children (Collins &

Kearns, 2001; Davis & Jones, 1996), which could lead to parents entrusting their children to walk or bike.

Cultural environment.

Attitudes. A number of interventions have been utilized in efforts to create positive attitudes toward walking and biking to school. Examples of such interventions are walk/bike to school days, bike rodeos, school assemblies, and walking/riding school buses. However, it has been found that parents return to driving their children to school if they suspect that other families are no longer engaging in ATS behaviors (Tranter & Pawson, 2001). In the United States in general, there is a cultural norm of preferring the automobile as a means of travel to walking, biking, or any other form of transport (Ewing et al., 2003; McDonald et al., 2011). A 2001 national transportation survey found that less than 36% of all trips to and from school were made by walking or biking (USDOT, 2004). It may be the case that long-term efforts are needed in order to establish behavior change.

The importance of incorporating more physical activity into a child's day is becoming more recognized. Encouraging walking and biking to school is one way that parents can instill such healthy habits in their children. One study found that walking or biking to school accounts for and average of 16 of the recommended 60 minutes of recommended daily physical activity (McDonald, 2008). Merom et al. (2006) found a positive association between students who used frequent modes of ATS and parents who believed that walking was beneficial to health. Despite the known health benefits of active transport, barriers such as safety and distance have been reported to surpass the decision to walk or bike. Even in the case of more health conscious individuals, this norm of utilizing the automobile still takes precedence. In a qualitative study by Eyler et al. (2008), one parent commented "I see people driving their kids to school, dropping their kids off to go to the gym to walk on the treadmill" (p. 144).

Research has found that parents cite lack of time or work schedules as reasons for not encouraging their children to walk or bike to school (Eyler et al., 2008). For these parents, it is easier to send their child on a bus or drop him/her off on the way to work. Several parents in interviews by Ahlport et al. (2008) identified not having enough time in the mornings, inflexible work schedules, and the convenience of driving as central issues surrounding ATS.

In their qualitative study, Faulkner et al. (2010) interviewed 37 parents and found that every single individual based their decision on how to send their child to school on efficiency. Two parents whose children utilized ATS methods explained their reasoning because “it’s faster to walk than get the car out of the driveway” (p. 5) and “walking is the fastest because we’d still have to find parking if we drove” (p. 5). Lack of time and work schedules were cited by non-ATS parents as reasons they do not support walking or biking. For example, one parent said it would take an extra 20 minutes in the morning but recited that neither her children nor herself wanted to wake up earlier. In addition to work schedules and time, parents cited dropping multiple children off at different schools, weather, and participation in extra-curricular activities. A parent summarized the core of the research by stating “I’m going to choose the easy way versus the best, healthy way … I’m always going to choose the easy way, unfortunately” (p. 6).

Demographics. There is mixed evidence that ATS behavior differs depending on age. Some studies have found that younger students walk more (Cooper et al., 2006; Evenson, Huston, McMillen, Bors, & Ward, 2003; Tudor-Locke, Ainsworth, Adair, Du, & Popkin, 2003) while other studies discovered that older students walk more than younger students (Timperio, Crawford, Telford, & Salmon, 2004; Timperio et al., 2006). Still other research found no significant differences between older and younger children (Black, Collins, & Snell, 2001; CDC, 2005). These inconsistent results may indicate that the relationship between age and transportation behavior is not linear and is affected by other variables.

Some studies have indicated that ATS behaviors may differ according to gender (Rosenberg et al., 2006), but the results are indecisive. For example, Cooper, Andersen, Wedderkopp, Page, and Froberg (2005) found that boys who used ATS accumulated 45 more minutes of moderate to vigorous physical activity (MVPA) compared to boys who were driven, but girls who used ATS only accumulated 4 additional minutes of MVPA compared to girls who were driven to school. Marten and Olds (2004) determined that boys were almost twice as likely as girls to walk or bike to school. These findings may reflect the willingness of parents to be more protective of girls and to allow more freedom to boys (McDonald et al., 2010).

Two studies have identified that children who live in rural areas may be less likely to use methods of ATS than children who live in urban areas (Schofield, Schofield, & Mummery, 2005; Sjolie & Thuen, 2002). These differences could be attributed to longer distances or less infrastructure for walking and biking. It may be the case that differences exist among children from varying types of suburban, urban, or rural settings (Faulkner et al., 2009), but few studies identify this variable.

Intrapersonal Environment

The individual level contains the decision-making of the parent. Research has shown that the ultimate travel decision of the child is made by parents at the elementary level (McDonald, 2007; McMillan, 2005; Stewart, 2011). In this model, the various factors from the policy, physical, and interpersonal levels all influence the intrapersonal environment.

Health Outcomes

A variety of health effects have been studied in correlation with active transportation to school including total physical activity and body composition. The most commonly used method to determine physical activity has been accelerometers (Faulkner et al., 2009). The use of accelerometers has led researchers to report that children who actively commute to and from school accumulate significantly more time in moderate intensity physical activity compared with their driven peers (Heelan & McFarland, 2006). In fact, research has indicated that when children use active forms of transportation to school, they accumulate approximately 20 additional minutes of MVPA per day (Alexander et al., 2005; Cooper et al., 2005; Heelan et al., 2005; Sirard, Riner, McIver, & Pate, 2005). Additional measures of physical activity include step counts and self-report of PA. A review of the literature found that 11 of 13 possible studies demonstrated evidence that ATS contributes to higher total PA (Faulkner et al., 2009), but some research found no correlation (Ford, Bailey, Coleman, Woolf-May, & Swain, 2007; Metcalf, Voss, Alison, Perkins, & Wilkin, 2004; Rosenberg et al., 2006).

The findings for skinfold measurements and BMI are inconsistent. Rosenberg et al. (2006) found that boys classified as active commuters had lower skinfold values but that there was no association between overall active commuters and change in BMI over a 2-year period. Their findings are difficult to interpret because causation is unclear. It could be that boys are allowed to walk more or that ATS does help reduce measures of body composition. Although studies have found that children who use active forms of transport have lower BMIs (Gordon-Larsen, Nelson, & Beam, 2005; Rosenberg et al., 2006), other studies found no correlations (Fulton et al., 2005, Sirard et al., 2005, Tudor-Locke et al., 2003). Another prospective study actually found a positive association between ATS and BMI among overweight children (Heelan et al., 2005). In this study, it was suggested that children in the overweight category needed to attain significantly more PA than what was achieved by ATS because of chronic and severe weight gain. The authors did note that ATS had the potential to reach this population if the frequency and distance of trips to school were increased. The lack of clear findings about the relationship of skinfolds and BMI with ATS could suggest that a low frequency of walking and biking is not enough to influences weight status, but more research is needed to be conclusive.

Summary

The increasing depth of literature has greatly contributed to the knowledge surrounding ATS in recent years. However, there are still some gaps in the research that need to be examined to come to a more complete understanding of the topic. Two important shortcomings will be identified and paired with suggestions to fulfill them below.

It is becoming apparent that the phenomenon of active transportation to school is influenced by many factors and on many levels. Panter et al. (2008) indicated that research has failed to “consider the potentially complex role parents’ decision making play in controlling their children’s travel behaviors and how environmental characteristics interact with these processes” (p. 11). This collaboration is a central component of community change in general (Homan, 2007). The SEMATS model presented in this paper offers a framework to better understand ATS behaviors from a parent’s perspective that accounts for a multi-level variety of influences.

While studies have begun to investigate social factors as influences on walking and biking to school, there is a dearth of research involving broader social characteristics of the neighborhood. Since ATS begins in the neighborhood, its characteristics should play an important role in promoting or hindering active transportation behavior. This research will attempt to fill the gap in the literature by examining the influence of social capital, or networks, norms, and trust, within the neighborhood as they relate to ATS.

Methods

Research Design

To examine the factors that influence active transportation to school (ATS), this study implemented a single stage, cross-sectional survey design. The purpose of this design is to generalize information gained from the sample to the overall population (Babbie, 1990). Questionnaires were administered to the parents or guardians of students in eight schools within the Maricopa Unified School District (MUSD) in March, 2014. Study instruments and procedures were approved by the Arizona State University Institutional Review Board (Appendix B). Permission was granted from both the Maricopa Unified School District and City of Maricopa. From this point forward, the term “parents” will be used to represent both parents and guardians.

Participants

MUSD is located in a suburban area outside of Phoenix, Arizona. The school district was chosen because it received a Safe Routes to School grant in the fall of 2011. The district implemented educational (annual bike rodeos and police officer visits) and enforcement (crossing guard training and equipment) strategies at each of its eight elementary and middle schools over the span of three years to promote ATS.

A non-stratified convenience sample of parents or guardians of children in grades 3 – 8 was taken at the six elementary schools and two middle schools within MUSD. According to the National Highway Traffic Safe Administration, children are generally ready to cross the street alone by age 10 (NHTSA, 2013). Therefore, parents of students in grades three or higher were included in the sample.

Classroom teachers handed out questionnaires to students and asked them to have their parent complete the information and return it back to class. A cover letter, included with the questionnaire, explained the study and asked for voluntary participation. Parents were asked to complete only one survey (of their oldest child in grades 3 – 8) if they had more than one child who brought a questionnaire home.

In an effort to have as high of a response rate as possible, this research followed Dillman's (1978) four-phase administration process. Initially, the superintendent of MUSD sent an email to principals of all eight MUSD schools to educate them on the purpose and importance of the survey. Principals then conveyed the intent and significance of the survey to classroom teachers and office staff at their schools. One week after the notification emails, the researcher hand delivered the questionnaires to the office manager at each school. The office staff then delivered the questionnaires to participating teachers. Principals sent a follow-up email one week after the questionnaire was distributed to encourage teachers to return completed questionnaires. A second reminder email from principals was sent one week later and included a link where classroom teachers could print out additional questionnaires. During this time, the researcher checked in with office staff every week and delivered additional questionnaires when needed. The survey information also indicated that there would be a random drawing for several $25 gift card as an incentive for parents to participate.

Instrumentation

Self-administered, paper questionnaires were utilized (see Appendix A). Completion time for the survey instrument was approximately 15 minutes. Items on the questionnaire were taken primarily from two existing instruments that have shown valid and reliable scores: the Safe Routes to School Parent Survey about Walking and Biking to School (McDonald, Dwelley, Combs, Evenson, & Winters, 2011) and the Active Where? Parent - Child Survey (Joe, Carlson, & Sallis, 2008; McDonald, Dwelley, Combs, Evenson, & Winters, 2011). The questions about social capital were adapted from the U.S. General Social Survey (GSS), a popular survey instrument with questions designed to measure social capital (Smith, Marsden, Hout, & Kim, 2014). To establish content validity and ensure the clarity of questions, the questionnaire was first pilot tested by 37 parents of the Higley Unified School District. There were no major revisions made to the final survey instrument.

The survey was designed to assess elements that impact the travel behaviors of students. Since the ultimate travel decision of the child is made by parents/guardians at this age (McDonald, 2007; McMillan, 2005), the questions were directed toward adults. The survey asked about active transportation behavior, policies related to busing, aspects of the physical environment (distance, structural form, and transportation options), aspects of the interpersonal or social environment (safety, social capital, and cultural), and information related to daily physical activity.

Active transportation behavior

To assess ATS behavior, parents/guardians were asked to circle the number of days their child used the following methods to get to/from school: walk, bike, bus, car or other vehicle. Walking and biking were considered ATS while riding in a bus or car constituted non-ATS behavior. In their review of ATS literature, Sirard and Slater (2008) found that most studies use the criteria of walking or biking at least one day a week. In their research, Merom (2006) and Timperio et al. (2006) suggest that students who use ATS on just one day may be active commuters, but those who walk or bike most days of the week should be considered frequent active transporters. Similarly, Rosenberg, Sallis, Conway, Cain, and McKenzie (2006) suggested that an active commuter should be considered a child who uses active modes of travel on three or more days per week. This study used recommendations from the latter three researchers. All children who engaged in more than three active trips to school were considered “active transporters”. Those who walked or biked three or less trips per week were categorized as “non-active transporters”.

Active transportation as a form of PA has been measured in multiple ways: self-reported measures (e.g., surveys, activity logs), instrumental measures (e.g., pedometers, accelerometers), and direct observation. Self-report surveys have been the most common method due to the inexpensive nature and ability to provide details about specific activities (IOM, 2013). However, self-report has been discouraged as a mode of physical activity assessment for children less than 10 years of age (Kohl & Hobbs, 1998). Research has substantiated the idea that the decision to engage in ATS is largely in the hands of the parent (Eyler et al., 2008; McMillan, 2007). Because this sample included children aged 10 and higher, this study aligned with the most common method and asked parents to provide information on the ATS behavior of their children.

Policy

Parents were asked if the school district provided bus transportation for their student.

Physical environment. Within the construct of the physical environment, there are factors of distance, the structural environment, and transportation options. These factors are latent variables meaning they are represented by other measured variables instead of being observed or measured directly (Bollen, 1989).

Distance. Distance to school was measured by asking parents how far they live from school and how long it takes their child to get to school. Parents were asked to report the furthest distance they would be comfortable letting their child walk and bike. Research has indicated that a distance of equal or less than one mile is reasonable to walk or bike to school (McDonald et al., 2011). Parents were also asked to identify the nearest street intersection from their home to determine distance to school. Finally, parents were asked to rate their level of agreement on a seven-point scale (1=strongly disagree, 7=strongly agree) with whether “it is difficult for my child to walk or bike to school (alone or with someone else) because… “it is too far”.

Structural environment. Parents were asked to provide the street intersection nearest to their home. Although not analyzed in this study, intersections could be geocoded to determine participant-specific neighborhoods. The neighborhoods could be used to determine the presence of busy streets (freeway, highway, or arterial road) and the presence of sidewalks.

Transportation options. Two questions on the survey instrument asked parents/guardians about transportation options. First, parents were asked if their school district provides a bus for their student. Second, they were asked if they have a car available to drive their child to school.

Interpersonal environment. The interpersonal/social environment contains the latent variable factors of safety environment, social capital, and cultural environment.

Safety environment.

Neighborhood Safety. Perceptions of neighborhood safety were assessed by asking parents to rate their level of agreement with the following statements (question 20): “it is difficult for my child to walk or bike to school (alone or with someone else) because…” on a scale of 1 – 7 (strongly disagree to strongly agree).

i. There are no other children to walk with
j. There are no other adults to walk with
k. There are no crossing guards
n. There are unsafe animals along the way
o. It is unsafe because of crime
p. My child gets bullied, teased, harassed
q. There is nowhere to leave a bike safely

Traffic safety. Perceptions of traffic safety were assessed by asking parents to rate their level of agreement with the following statements: “it is difficult for my child to walk or bike to school (alone or with someone else) because…” on a scale of 1 – 7 (strongly disagree to strongly agree).

a. There are no sidewalks or bike lanes
b. There is one or more dangerous crossing
c. The route does not have good lighting
d. There is too much traffic along the route
e. The traffic speeds are too high along the route

Social Capital**.** In general, the social capital of children is thought to be a by-product of their parents’ relationships with others (Leonard, 2005). Therefore, this study will assume that networks, norms, and trust within the neighborhood as reported by parents transfer to measures of social capital among children.

Networks. To measure the social capital of networks, a modified measure adapted from Baum (1999) was used. Parents were asked to report the number of neighbors their child(ren) knows by first name on the path from home to school.

Norms. Norms were assessed by asking parents to rate their level of agreement with the following statements on a scale of 1 – 7 (strongly disagree to strongly agree).

a. Other kids my child's age walk or bike to school by themselves
b. Other kids my child's age walk or bike to school with a parent/other adult

Trust. To assess the social capital variable of trust, parents were asked to rate their level of agreement with the statement, "people in this neighborhood can be trusted" (Lochner, Kawachi, & Kennedy, 1999) on a scale of 1 – 7 (strongly disagree to strongly agree). The variables of knowing neighbors by first name and measuring levels of trust within the neighborhood have been used as an indicators of social capital (Stone, 2011) and are used to represent the "networks, norms, and social trust" that Putnam (2001) described to "coordinate and cooperate" the facilitating of ATS.

Cultural environment.

Attitudes. Parents reported if their child had ever asked permission to walk or bike to school in the last year as well as the grade that they would allow their child to walk or bike without an adult. Parents were also asked to rate their level of agreement with the following statements on a scale of 1 – 7 (strongly disagree to strongly agree).

d. My child enjoys walking or biking to school
e. My child enjoys walking or biking to school with friends
f. My child enjoys walking or biking to school with a parent or other adult
g. My child's school encourages walking and biking to/from school
h. My child has fun walking or biking to/from school
i. It is healthy for my child to walk or bike to/from school

Additionally, parents were asked to rate their level of agreement with the following statements and "it is difficult for my child to walk or bike to school (alone or with someone else) because…" on a scale of 1 – 7 (strongly disagree to strongly agree).

g. There is not enough time
h. The weather makes walking or biking difficult
l. It is easier for my child to take the bus to school
m. It is easier for me to drive my child to school

Demographics. Parents were asked to share the following information about their child.

1a. What is your child's age?
1b. What is your child's birthday?
1c. What is the grade of the child who brought home this survey?
2. What is your child's gender?
3a. What is your child's height?
3b. What is your child's weight?
4. How many children do you have in Kindergarten through 8th grade?

Parents were also asked about personal information including their level of education and employment status.

Health Outcomes

A variety of health outcomes (e.g., body mass index (BMI), physical activity recall, direct physical activity measurement) have been studied in relation to walking and biking. The results of comparisons of ATS and body composition have been irregular, largely due to variability in study methodology. It is critical to continue to contribute to the current literature to learn more about the relationship among ATS and health outcomes. In this study, physical activity patterns were measured using parent recall and BMI was calculated based on parent report of height and weight.

Physical activity. Physical activity was defined according to the Active Where? Parent-Child Survey as "any activity … that makes your child get out of breath for some of the time" (http://activelivingresearch.org/node/11951). Parents were asked to circle the number of days per week that their child engages in PA for at least 60 minutes.

Body mass index. Parents were asked to report the height in feet and inches and weight in pounds of their child. BMI was calculated by dividing weight in pounds by height in inches squared and multiplying by a conversion factor of 703 (CDC, 2015).

Data Analysis

The primary purpose of this research was to focus on parent perspectives that influence ATS. Therefore, this research concentrated on measuring the odds of students walking or biking to school depending on the influence of the constructs within the physical, interpersonal, and intrapersonal levels of the model. The outermost layer, policy, was not included in this analysis. Additionally, ATS was not measured against a health outcome in this study because the response rates for physical activity and BMI measures were low.

Data were first analyzed to outline descriptive information about participants, school sites, and travel patterns. Next, items that were negatively keyed were reverse-coded to ensure that all results were measured in the intended direction. A correlation matrix was presented to identify variables that were significantly associated with the dependent variable. Variables that showed significant associations as well as those that were theoretically relevant were then organized into constructs. The dependent variable (DV), walking/biking to school (ATS), was measured by students who walked/biked three or more days or not. Because of the binary DV, a logistic regression model was performed to test the odds of each construct impacting ATS.

The testing of the Social Ecological Model of Active Transportation to School (SEMATS) revealed some issues with regard to the proposed measurement model. In the original model, constructs were developed based primarily on empirical and theoretical knowledge. Because there is no common factor structure used to measure ATS, a principle components analysis (PCA) was used to identify and compute composite scores for the major factors to reveal a better construct design. After the PCA identified issues with factor loadings and multicollinearity, several variables were removed, constructs were redesigned, and a revised model was presented and tested. Descriptive data and results of logistic regression tests for the original and revised model are included in the following results section.

Results

A total of 217 parents out of a possible 2,709 completed and returned questionnaires – an overall response rate of 8.0%. Although the same distribution procedures were used at each school site, the response rates by school varied from a low of 5.3% to a high of 27.2%. During the recruitment phase, some principals expressed more confidence than others with regard to potential responses from parents. This may account for some of the variation across school sites. Additionally, the level of effort of individual classroom teachers to encourage students to return completed surveys may have affected the response rate. Offering incentives to classroom teachers instead of or in addition to parents may improve response rate.

Collectively, questionnaires returned from the elementary schools accounted for the majority (87%) of the data, while the middle school questionnaires represented only 13% of the responses. The proportions of responses by grade can be seen in Figure 9. Among elementary schools, each grade level accounted for approximately 15% - 28% of respondents (3rd grade – 28.2%, 4th grade – 24.2%, 5th grade – 14.9%, 6th grade – 20.6%). Each middle school grade level accounted for less than 10% of respondents (7th grade – 6.9%, 8th grade – 5.2%). The average

age of the child returning the completed questionnaire was 10.3 years old (standard deviation = 1.649). Parents of more females (61.0%) than males (37.5%) participated in the survey.

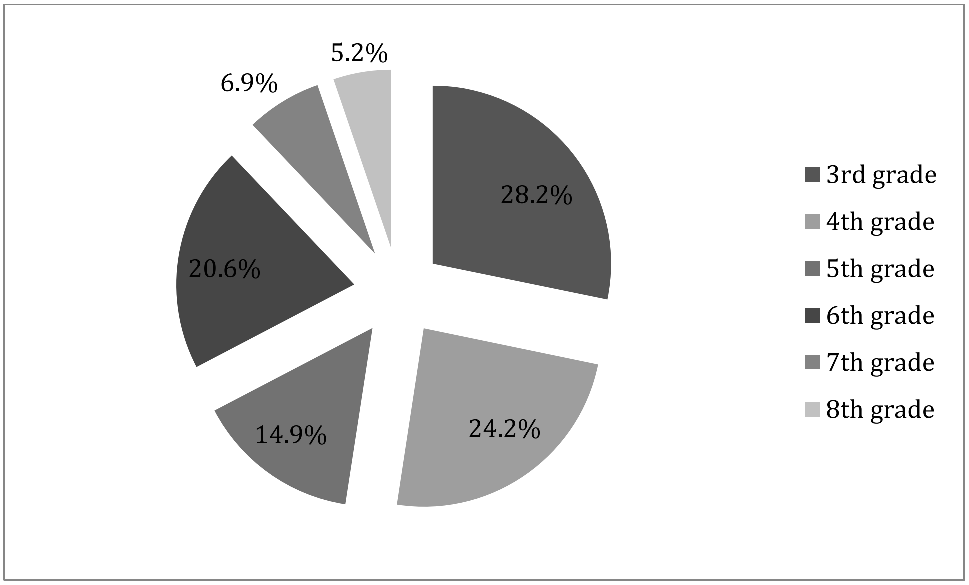


Figure 9. Grade distribution of survey respondents

The percentage of parents who had bachelor's degrees or higher was 26.7%, which is equivalent to the Arizona population as a whole (Arizona percent of persons 25+ with a bachelor's degree or higher = 26.6%) (U.S. Census Bureau, 2010). The percentage of parents with a high school diploma or higher (89.6%) was slightly greater than the Arizona state average (85.7%) (U.S. Census Bureau, 2010). The questionnaire did not ask about socio-economic status (SES). This information may be useful to gather in future research to investigate if a relationship between ATS and SES exists.

Over half of respondents (54.2%) reported that they worked full-time and 26.7% of parents indicated that they were homemakers. Figure 10 shows the summary of each employment classification. The questionnaire did not distinguish whether families consisted of one- or two-parent households and did not ask if one or both parents worked. This information may be useful to measure in future studies.

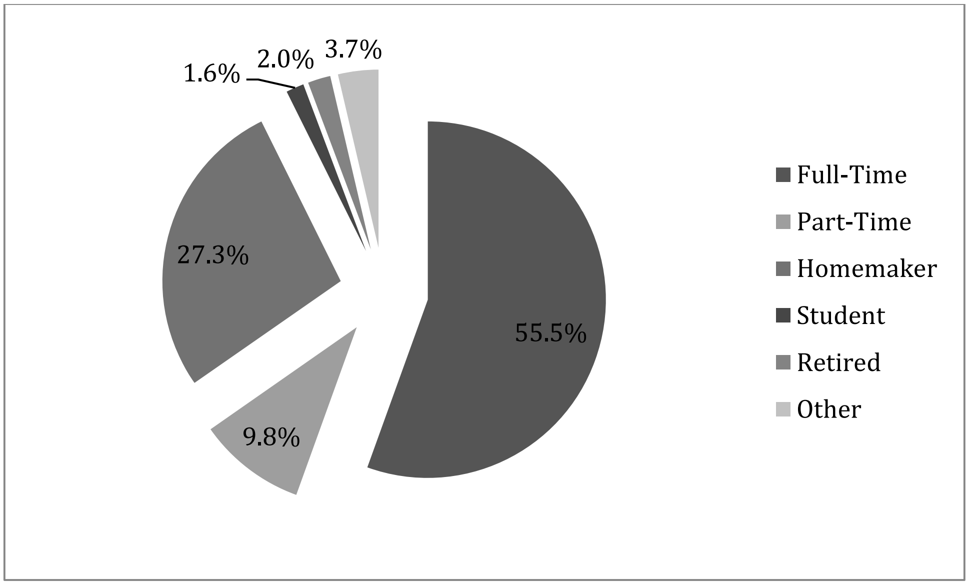


Figure 10. Employment distribution of survey respondents

The majority of parents (72.1%) had at least two children in grades K-8 at the time of survey completion (Figure 10).

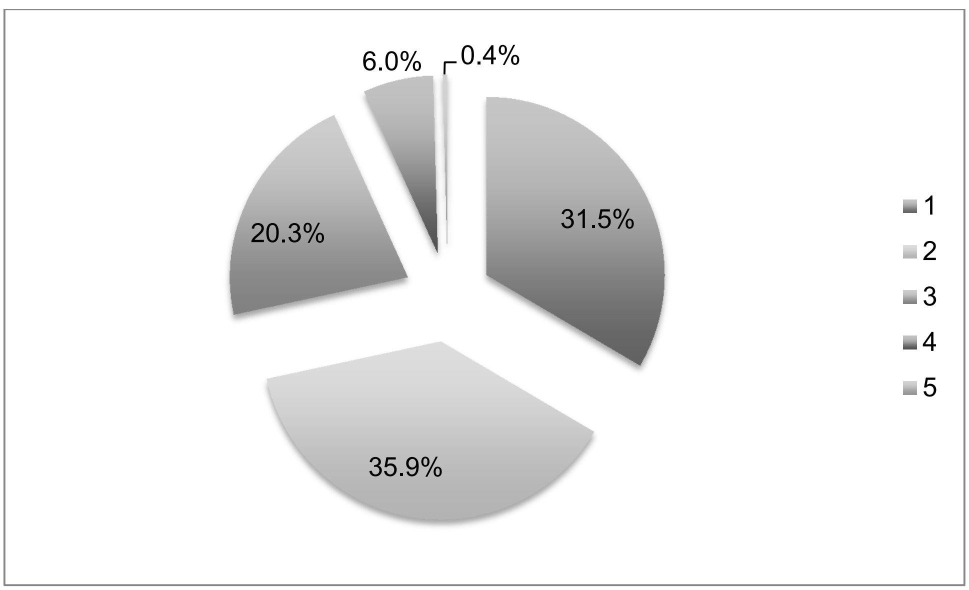


Figure 11. Reported number of children in grades K-8

Parents were asked to report on the mode of transportation (walk, bike, bus, car or other vehicle) that their child used each day during an average week to and from school. The data were transformed to include modes a child used on three days or more per week. The most common mode of transportation to school (42.2%) and from school (37.8%) was by car or other vehicle (Table 1). The 4.4% decline in car usage from the morning to afternoon presumably occurred because parents' work schedules made it more difficult for them to pick up their children after school. Of those children who changed modes from riding a car to school, 2.4% of them walked and 2% of them took the bus home. In this study, the focus was on students who used ATS to only.

Table 1

Most Common Reported Mode of Travel

		Frequency	Percent	Cumulative Percent
To school				
	Walk	37	14.7	14.7
	Bike	27	10.8	25.5
	Bus	79	31.5	57
	Car/Other Vehicle	106	42.2	99.2
	Missing	2	0.8	100
From school				
	Walk	43	17.1	17.1
	Bike	27	10.8	27.9
	Bus	84	33.5	61.4
	Car/Other Vehicle	95	37.8	99.2
	Missing	2	0.8	100

Active forms of transportation (walking and biking) were utilized by over 25% of the total sample both to and from school. Collectively, 27.4% of elementary students walked or biked to school and 29.6% from school. Pima Butte Elementary School had the highest percentage of students who used forms of ATS to and from school (40.0%, 45.0%), followed by Butterfield Elementary School (35.8%, 37.3%), and Santa Cruz Elementary School (30.8%, 34.6%) (Figures 12 and 13). At the middle schools, 16.8% of students used ATS to school and 20.7% of students used ATS from school. At Maricopa Wells Middle School, in particular, there was a change in ATS behavior from morning to afternoon. After school, 7.7% of students who rode a car to school in the morning then walked home.

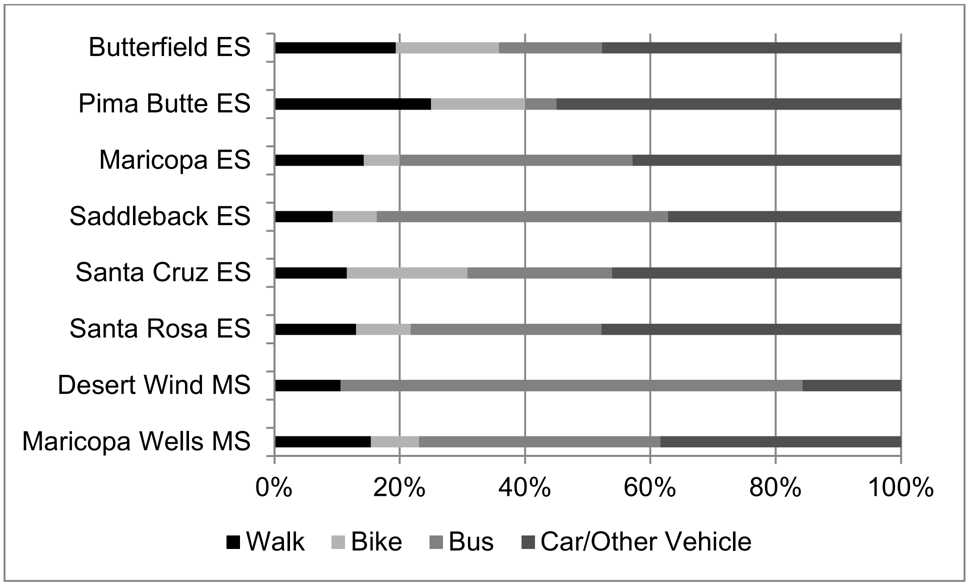


Figure 12. Most common reported mode of travel to school by site

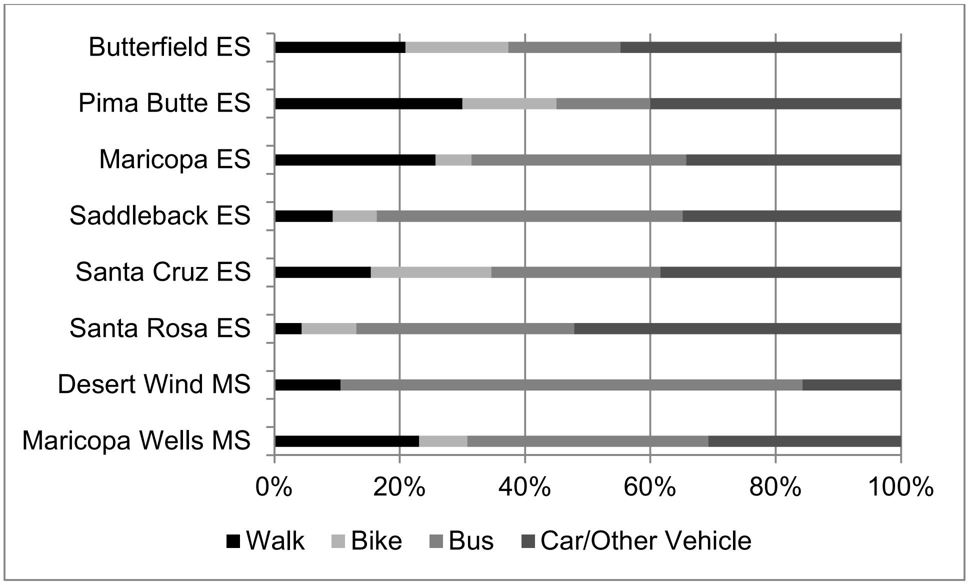


Figure 13. Most common reported mode of travel from school by site

Physical Environment. Approximately 49% of parents reported living within one mile of school (Table 2), with approximately 22% living between one and two miles and 27% living more than two miles. Of those students who walked three or more times per week, 91.8% of them lived within one mile of school (Table 3). Of children who biked three or more times per week, 84% of the lived within one mile and 100% of them lived within two miles of school. The number of students who were driven to school by car or other vehicle increased as distance increased, until the distance was greater than two miles. At that point, the majority of students rode the bus (71.6%).

Table 2

Reported Distance from School

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 1/4 mile	36	14.3	14.5	14.5
1/4 - 1/2 mile	36	14.3	14.5	29.0
1/2 - 1 mile	50	19.9	20.2	49.2
1 - 2 miles	54	21.5	21.8	71.0
More than 2 miles	66	26.3	26.6	97.6
Don't know	6	2.4	2.4	100.0

** Excludes three missing responses*

Table 3

Cross Tabulation of Mode of Travel by Distance from Home to School

	< 1/4 mi.	1/4 - 1/2 mi.	1/2 - 1 mi.	1 - 2 mi.	> 2 mi.	Total
Walk	16	9	9	2	0	37
	44.4%	25.0%	18.4%	3.7%	0.0%	14.9%
	43.2%	24.3%	24.3%	5.4%	0.0%	100.0%
Bike	8	8	5	4	0	25
	22.2%	22.2%	10.2%	7.4%	0.0%	10.1%
	32.0%	32.0%	20.0%	16.0%	0.0%	100.0%
Bus	1	2	7	19	48	79
	2.8%	5.6%	14.3%	35.2%	71.6%	31.9%
	1.3%	2.5%	8.9%	24.1%	60.8%	100.0%
Car/Other vehicle	11	17	28	29	19	107
	30.6%	47.2%	57.1%	53.7%	28.4%	43.1%
	10.3%	15.9%	26.2%	27.1%	17.8%	100.0%
Total	36	36	49	54	67	248*
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	14.5%	14.5%	19.8%	21.8%	27.0%	100.0%

* Excludes three missing responses

Note. Mode of travel includes responses of three or more days per week. For each mode, the first row represents the frequency, the second row represents the column percentages, and the third row represents the row percentages.

Parents were asked to report the furthest distance they would feel comfortable allowing their child to walk or bike to school (Table 4). Interestingly, when comparing parents' comfort zone distance to actual distance, more students walked in the shortest two distance categories than parents were comfortable with (Table 5). Of those students who lived within the comfort zones for walking and/or biking, 20.8% used ATS. This is lower than the overall percentage of students who walked or biked to school (25.5%). This may indicate that parents of some students were not comfortable allowing their child to walk but felt they had no alternative. Alternatively, two students between the ½ - 1-mile distance and four students between the 1 - 2-mile distance did not walk but could have based on their parent's comfort levels.

Table 4

Maximum Distance Reported by Parents

		Frequency	Percent	Cumulative Percent
Walking to school				
	Less than 1/4 mile	89	35.5	35.5
	1/4 - 1/2 mile	56	22.2	57.7
	1/2 - 1 mile	63	25.1	82.8
	1 - 2 miles	16	6.4	89.2
	More than 2 miles	1	0.4	89.6
	Don't know	16	6.4	96
	Missing	10	4	100
Biking to school				
	Less than 1/4 mile	52	20.7	20.7
	1/4 - 1/2 mile	70	27.9	48.6
	1/2 - 1 mile	52	20.7	69.3
	1 - 2 miles	37	14.7	84
	More than 2 miles	6	2.4	86.4
	Don't know	22	8.8	95.2
	Missing	12	4.8	100

Table 5

Cross Tabulation of Maximum Walking Distance within Comfort Zone and ATS Behavior

	< 1/4 mile	1/4 - 1/2 mile	1/2 - 1 mile	1 - 2 miles	> 2 miles	Don't know	Total
Walk	13	6	11	6	0	1	37*
	35.1%	16.2%	29.7%	16.2%	0.0%	2.7%	100.0%
Bike	4	6	11	5	0	0	26**
	15.4%	23.1%	42.3%	19.2%	0.0%	0.0%	100.0%

* Excludes 11 missing responses

* Excludes 13 missing responses

Note. Mode of travel included responses of three or more days per week. For each mode, the first row represents the frequency and the second row represents the column percentages.

Travel time also appears to be a factor in determining the mode of travel to school. Slightly more than half of parents (58.2%) reported that it took their child 10 minutes or less to get to school (Table 6). More than half of students (54%) who walked to school three or more days per week reported that the trip took 10 minutes or less (Table 7). Of those students who biked to school, almost all (96.2%) identified the trip as taking 20 minutes or less. A surprising finding was that 78% of students who had a short trip to school (>5 minutes) rode in a car or other vehicle. This suggests that factors other than just the time to travel to school must be influencing the travel mode.

Table 6

Reported Travel Time to School

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 5 minutes	59	23.5	23.7	23.7
5 - 10 minutes	86	34.3	34.5	58.2
11 - 20 minutes	64	25.5	25.7	83.9
More than 20 minutes	30	12.0	12.0	96.0
Don't know	10	4.0	4.0	100.0
Missing	2	0.8		

Table 7

Cross Tabulation of Mode of Travel to School by Time from Home to School

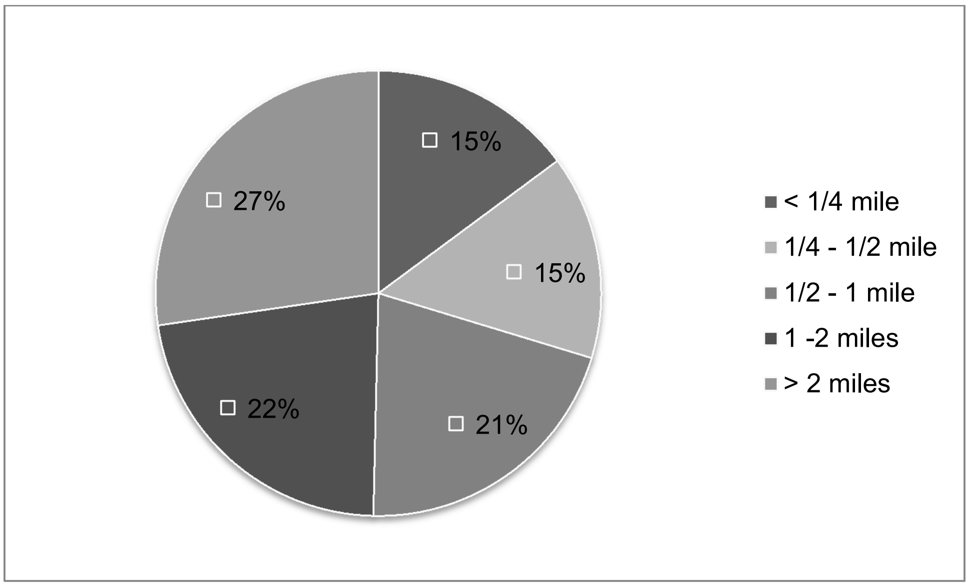
	< 5 min.	5-10 min.	11-20 min.	> 20 min.	Don't know	Total
Walk	3	17	12	4	1	37
	5.1%	19.8%	18.8%	13.3%	11.1%	14.9%
	8.1%	45.9%	32.4%	10.8%	2.7%	100.0%
Bike	8	12	6	1	0	27
	13.6%	14.0%	9.4%	3.3%	0.0%	10.9%
	29.6%	44.4%	22.2%	3.7%	0.0%	100.0%
Bus	2	22	27	20	7	78
	3.4%	25.6%	42.2%	66.7%	77.8%	31.5%
	2.6%	28.2%	34.6%	25.6%	9.0%	100.0%
Car/Other vehicle	46	35	19	5	1	106
	78.0%	40.7%	29.7%	16.7%	11.1%	42.7%
	43.0%	32.7%	17.8%	4.7%	0.9%	99.1%
Total	59	86	64	30	9	248*
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	23.8%	34.7%	25.8%	12.1%	3.6%	100.0%

* Excludes three missing responses

Note. Mode of travel included responses of three or more days per week. For each mode, the first row represents the frequency, the second row represents the column percentages, and the third row represents the row percentages.

Parents were asked to respond to questions and rate their level of agreement with several elements of the physical environment surrounding the trip to school. The average temperature parents reported to be too hot to walk was 96 degrees (standard deviation – 9.65). Just over half (54.2%) of parents reported that their district did provide a bus for their student. The majority of parents (84.5%) stated that they did have a car available to drive their child to school.

Families were spread out across the school district and lived within varying distances from schools (Figure 14). Two schools in particular (Butterfield Elementary and Pima Butte Elementary) had a large portion of parents who reported that students lived within one mile of school (Table 8). Four schools (Maricopa Elementary, Saddleback Elementary, Desert Wind Middle, and Maricopa Wells Middle) had large student populations that lived greater than one mile from school.



Note. Excludes three (1.2%) missing responses. Excludes six (2.4%) responses of "don't know"

Figure 14. Reported distance to school

Table 8

Cross Tabulation of Reported Distance from Home to School by Site

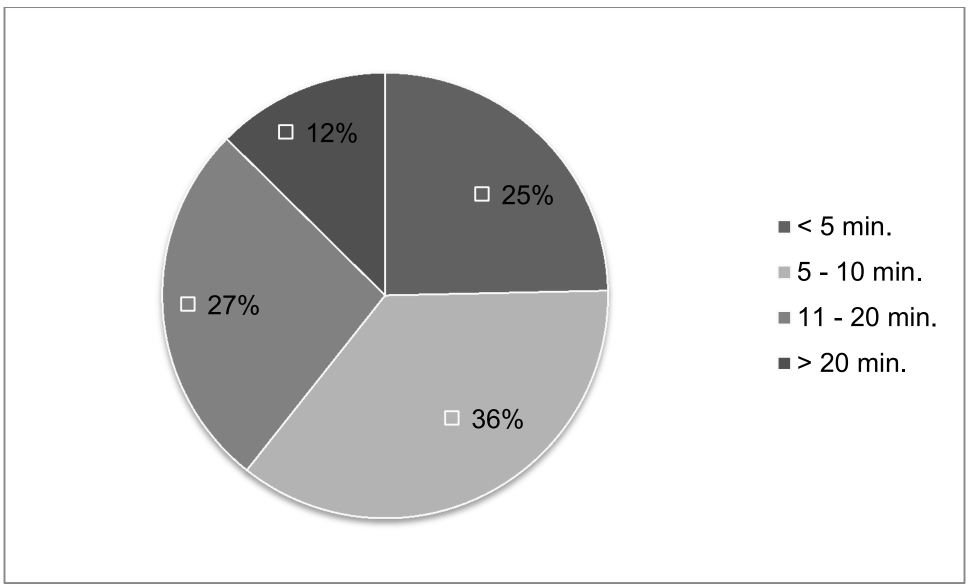
	Less than 1/4 mile	1/4 - 1/2 mile	1/2 - 1 mile	1 - 2 miles	More than 2 miles
Elementary Schools					
Butterfield*	17	13	18	7	8
	26.2%	20.0%	27.7%	10.8%	12.3%
	47.2%	36.1%	36.0%	13.0%	12.1%
Maricopa	4	3	6	12	10
	11.4%	8.6%	17.1%	34.3%	28.6%
	11.1%	8.3%	12.0%	22.2%	15.2%
Pima Butte**	6	4	5	2	2
	30.0%	20.0%	25.0%	10.0%	10.0%
	16.7%	11.1%	10.0%	3.7%	3.0%
Saddleback**	2	3	6	15	16
	4.7%	7.0%	14.0%	34.9%	37.2%
	5.6%	8.3%	12.0%	27.8%	24.2%
Santa Cruz	4	5	9	1	7
	15.4%	19.2%	34.6%	3.8%	26.9%
	11.1%	13.9%	18.0%	1.9%	10.6%
Santa Rosa**	1	6	2	10	3
	4.3%	26.1%	8.7%	43.5%	13.0%
	2.8%	16.7%	4.0%	18.5%	4.5%
Middle Schools					
Desert Wind**	1	0	1	3	13
	5.3%	0.0%	5.3%	15.8%	68.4%
	2.8%	0.0%	2.0%	5.6%	19.7%
Maricopa Wells	1	2	2	2	6
	7.7%	15.4%	15.4%	15.4%	46.2%
	2.8%	5.6%	4.0%	3.7%	9.1%

* Excludes two missing responses.

** Excludes one missing response.

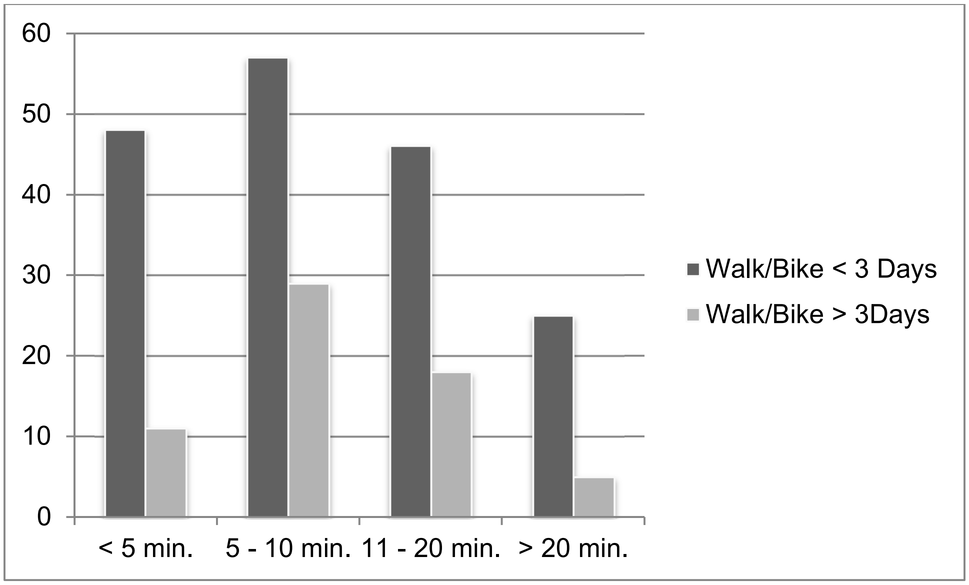
Note. For each distance, the first row represents the frequency, the second row represents the column percentages, and the third row represents the row percentages.

Slightly more than a third (36%) of parents reported that the trip to school took between 5 and 10 minutes (Figure 15). This group also reported to have the highest percentage of students (33.7%) who used ATS three or more days to school. Contrary to expectations, the group of students who lived less than five minutes from school used ATS three or more times each week just 18.6% of the time; only slightly more than students who lived more than 20 minutes from school (16.7%) (Figure 16). This finding provides evidence that other factors beyond travel time to school must influence the mode of travel.



Note. Excludes two (0.8%) missing responses. Excludes 10 (4.0%) responses of "don't know"

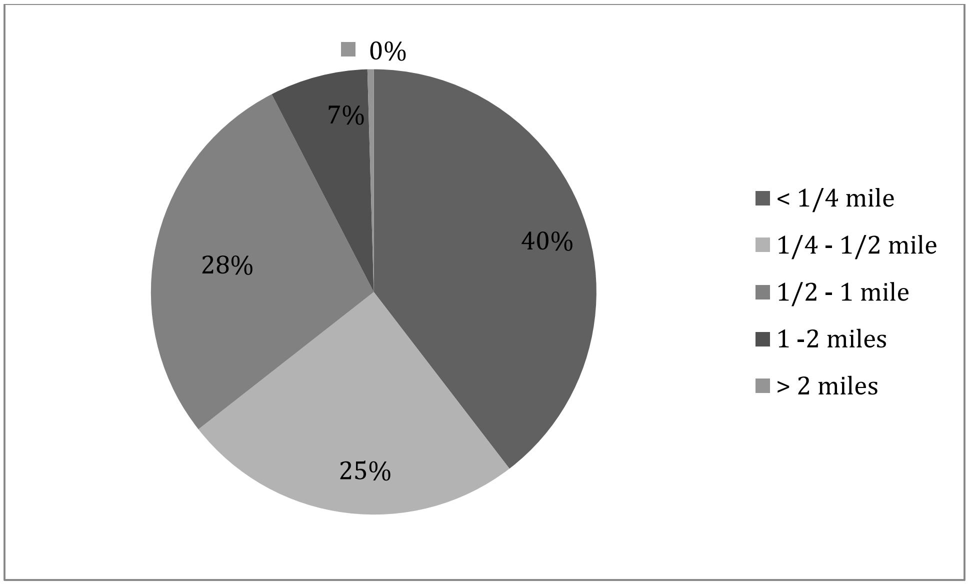
Figure 15. Reported trip time to school



Note. Excludes 10 (4.0%) responses of "don't know"

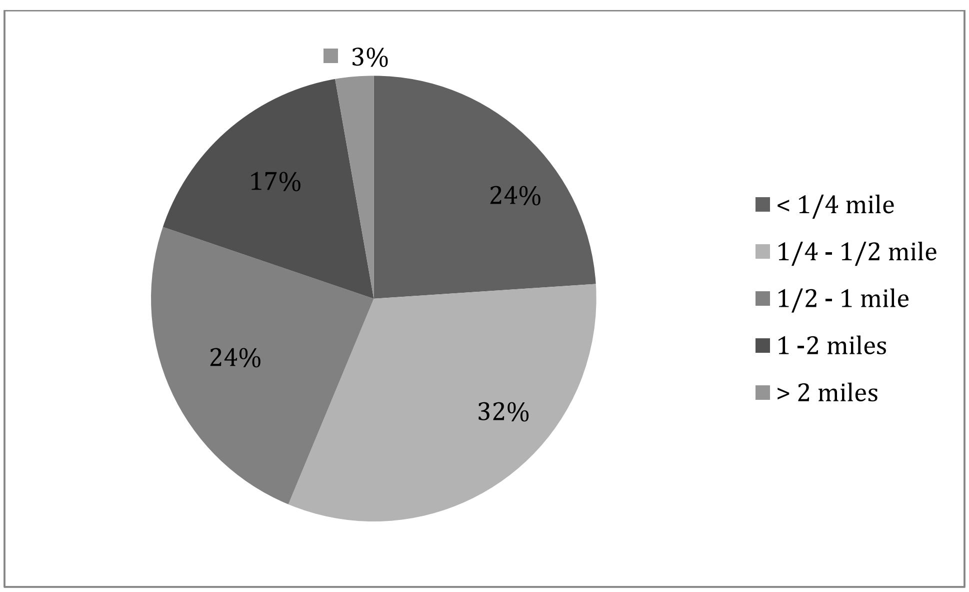
Figure 16. Reported ATS use by travel time

Current physical activity objectives (USDHHS, 2010) and research (McDonald et al., 2011) support using one mile for walkers and two miles for bikers as reasonable distances over which to expect children to engage in ATS. Results show that parents in the MUSD felt differently. When asked if it was difficult for their child to walk or bike to school because it was too far, parents reported on average that they agreed (mean = 4.12 on a seven point scale where 1 – strongly disagree and 7 = strongly agree). Figure 17 shows that almost half (40%) preferred the distance to be less than ¼ mile. About one quarter of all parents (24%) (Figure 18) were comfortable letting their child bike to school only if the distance is less than ¼ mile. Another 32% of parents would allow their child to bike if they lived within ¼ - ½ mile from school. Future research should continue to examine parents perceptions of appropriate distances to walk and/or bike to and from school.



Note. Excludes 10 (4.0%) missing responses. Excludes 11 (6.4%) responses of "don't know"

Figure 17. Reported distance which parents were comfortable with child walking



Note. Excludes 12 (4.8%) missing responses. Excludes 22 (8.8%) responses of "don't know"

Figure 18. Reported distance which parents were comfortable with child biking

The school with the largest percentage of children who used ATS regularly was Pima Butte Elementary (40.0%)(Table 9). This school also had the highest percentage of students who lived within one mile of school (75.0%). Similarly, the schools with the next highest portion of students living within one mile (Butterfield – 73.9% and Santa Cruz – 69.2%) also had the next highest percentages of students who used ATS (35.8%, 30.8%). This finding mirrors existing research and suggests that distance plays an important role in determining mode of transport.

Table 9

Cross Tabulation of School Site and ATS Use

		ATS	Non-ATS	Total
Elementary Schools				
	Butterfield	24	43	67
		37.5%	23.6%	27.2%
		35.8%	64.2%	100.0%
	Maricopa	7	28	35
		10.9%	15.4%	14.2%
		20.0%	80.0%	100.0%
	Pima Butte	8	12	20
		12.5%	6.6%	8.1%
		40.0%	60.0%	100.0%
	Saddleback	7	36	43
		10.9%	19.8%	17.5%
		6.5%	33.6%	40.2%
	Santa Cruz	8	18	26
		12.5%	9.9%	10.6%
		30.8%	69.2%	100.0%
	Santa Rosa	5	18	23
		7.8%	9.9%	9.3%
		21.7%	78.3%	100.0%
Middle Schools				
	Desert Wind	2	17	19
		3.1%	9.3%	7.7%
		10.5%	89.5%	100.0%
	Maricopa Wells	3	10	13
		4.7%	5.5%	5.3%
		23.1%	76.9%	100.0%
Total		64	182	246
		71.9%	65.4%	67.1%
		25.8%	73.4%	99.2%

Note. For each distance, the first row represents the frequency, the second row represents the column percentages, and the third row represents the row percentages.

Safety Environment. Parents were asked to rate how difficult walking or biking was for their child with regard to several elements of safety surrounding the trip to school (Table 10).

Table 10

Potential Factors Related to Safety Environment

		Mean	Std. Deviation
Neighborhood Safety			
	My child gets bullied, teased, harassed	5.42	1.81
	There is nowhere to leave a bike safely	5.24	1.98
	There are unsafe animals along the way	4.88	2.02
	There are no crossing guards	3.89	2.43
	There are no other children to walk or bike with	3.84	2.27
	There are no other adults to walk or bike with	3.61	2.28
	It is unsafe because of crime (strangers, gangs, drugs)	3.41	2.31
Traffic Safety			
	There are no sidewalks or bike lanes	5.12	2.38
	The route does not have good lighting	4.12	2.34
	The traffic speeds are too high along the route	3.72	2.31
	There is too much traffic along the route	3.42	2.16
	There is one or more dangerous crossings	3.41	2.31

Note. Safety was measured using a 7-point scale where 1 = strongly disagree and 7 = strongly agree.

Cultural Environment. Parents were asked to rate their level of agreement with several elements of the cultural environment surrounding the trip to school (Table 11).

Table 11

Potential Attitude Factors Related to Cultural Environment

		Mean	Std. Deviation
Attitudes			
	It is healthy for my child to walk/bike to/from school	5.50	1.88
	It is easier for me to drive my child to school	4.44	2.47
	My child enjoys walking/biking to school with friends	4.42	2.11
	My child has fun walking/biking to/from school	4.16	2.09
	My child enjoys walking/biking to school	4.15	2.17
	The weather makes walking or biking difficult	4.11	2.13
	My child's school encourages walking/biking to/from school	4.10	1.93
	It is easier for my child to take the bus to school	3.97	2.64
	My child enjoys walking/biking to school with a parent or other adult	3.92	1.96
	There is not enough time	3.79	2.36

Note. Statements regarding attitudes were presented using a 7-point scale where 1 = strongly disagree and 7 = strongly agree.

Slightly less than half of parents (48.6%) reported that their child had asked permission to walk or bike in the past year. Parents were also asked if and at what grade they would be comfortable allowing their child to walk or bike to and from school alone (Figure 19). 32.7% of parents said they would not feel comfortable no matter what grade the child was in. Of those who were comfortable allowing their child to walk or bike, almost half (47.5%) reported that third grade was an acceptable one to actively commute. These findings align with the literature and support using third grade as the one to begin focusing ATS efforts toward. Of those not comfortable with allowing their child to walk or bike at any grade, less than one third reported any positive attitudes toward ATS (ranked 4 or lower on scale). In fact, the only attitude factor that this group of parents reported favorably was ATS being healthy (57% ranked 5 or higher on scale).

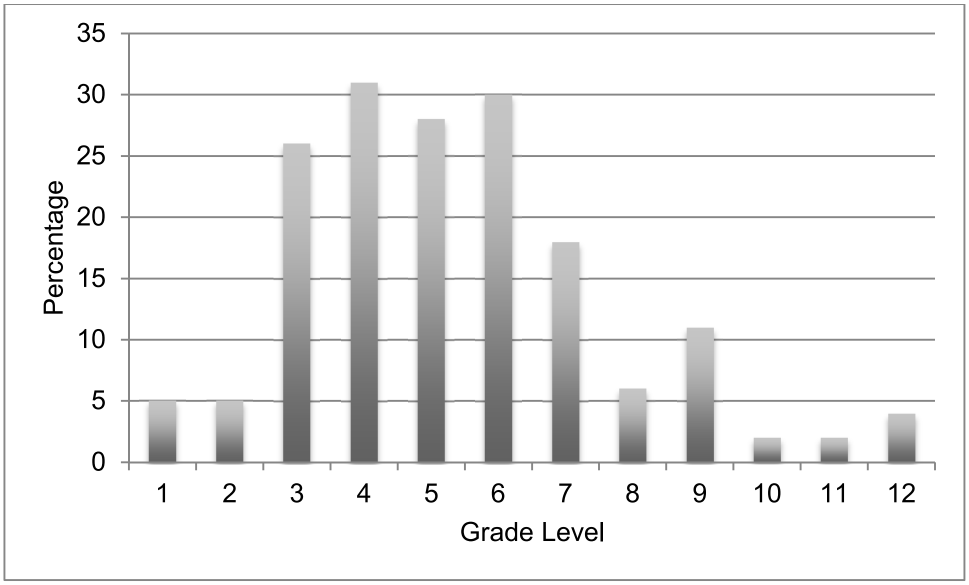
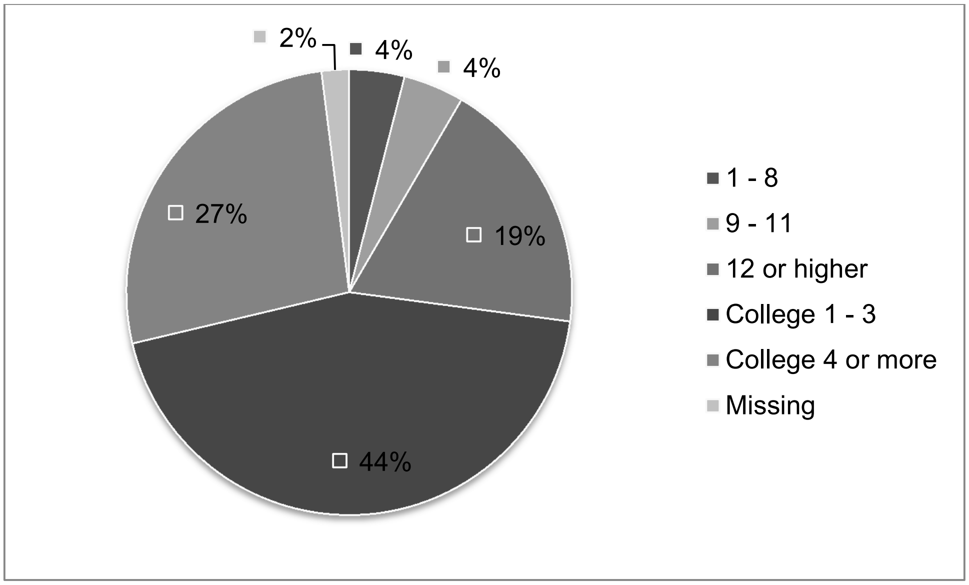


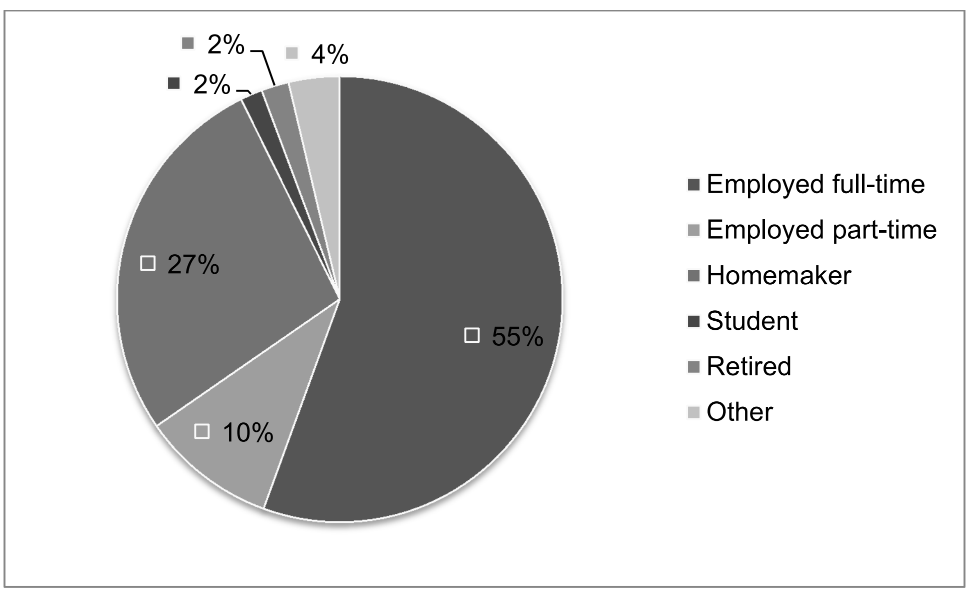
Figure 19. Reported grade levels when ATS is allowed by parents

Almost three quarters of parents (72.8%) reported attending at least some college (Figure 20). Slightly more than half of parents (55.5%) reported that they worked full time and slightly more than one quarter of parents (27.3) reported being homemakers (Figure 21).



Note. Excludes five (2%) missing responses.

Figure 20. Highest reported educational level of parents



Note. Excludes six (2.4%) missing responses.

Figure 21. Reported employment status of parents

Social Capital. Parents were asked to respond and to rate their level of agreement with several elements of social capital surrounding the trip to school (Table 12). The questionnaire did not account for the length of time individuals had lived in their neighborhood which could influence the number of neighbors known by name and levels of trust. Future research should include this question and investigate this topic in more depth.

Table 12

Potential Factors Related to Social Capital

		Mean	Std. Deviation
Networks			
	How many neighbors does your child know by name on the path from home to school?	2.62	2.77
Norms			
	Other kids my child's age walk or bike to school by themselves	4.80	1.99
	Other kids my child's age walk or bike to school with a parent or other adult	4.22	1.94
Trust			
	People in this neighborhood can be trusted	4.22	1.60

Note. The question regarding networks was open-ended. Statements regarding norms and trust were presented using a 7-point scale where 1 = strongly disagree and 7 = strongly agree.

In the proposed conceptual model, proposed that the probability a child would use active forms of transportation to school was determined by the parent. The decision of the parent (ATS) was hypothesized to be a function of several different influences within the domains of the physical environment (PE), safety environment (SE), cultural environment (CE), and social capital (SC). All variables considered in this study are listed in Table 13. Table 14 provides a list of only those items that were used to form composite indicators of the model constructs.

Table 13

Variables Considered for Association with ATS Behavior from Parent Survey

Dependent Variable		
	ATSWalkTo	walk or bike to school three or more days
Physical Environment		
	Transportation Options	
	Bus	if district provides bus for student (0=yes, 1=no)
	CarAvailable	if car is available to drive student to school (0=yes, 1=no)
	Distance	
	ReportedDistance	how far child lives from school (6 point scale)
	ReportedTime	how long it takes to get to/from school (5 point scale)
	DistComfortWalk	furthest distance parent is comfortable letting child walk to school (6 point scale)
	DistComfortBike	furthest distance parent is comfortable letting child bike to school (6 point scale)
	TooFar	difficult to walk/bike because too far (7 point scale, strongly disagree to strongly agree)
	Structural Environment	
	TempTooHot	what temperature is too hot to walk/ride to school
Safety Environment		
	Neighborhood	

	NoOtherChildren	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	NoAdults	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	NoCrossingGuards	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	UnsafeAnimals	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	UnsafeCrime	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	Bullies	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	NoSafeBike	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	Traffic	
	NoSidewalk	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	DangerousCrossing	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	PoorLighting	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	TrafficAmount	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	TrafficSpeeds	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
Cultural Environment		
	Attitudes	
	Permission	level of agreement (7 point scale, strongly disagree to strongly agree)
	EnjoysATS	level of agreement (7 point scale, strongly disagree to strongly agree)
	EnjoysATSFriends	level of agreement (7 point scale, strongly disagree to strongly agree)
	EnjoysATSAdults	level of agreement (7 point scale, strongly disagree to strongly agree)
	SchoolSupportATS	level of agreement (7 point scale, strongly disagree to strongly agree)
	FunATS	level of agreement (7 point scale, strongly disagree to strongly agree)
	HealthyATS	level of agreement (7 point scale, strongly disagree to strongly agree)

	NotEnoughTime	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	BadWeather	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	EasierBus	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	EasierDrive	difficult to walk/bike because ... (7 point scale, strongly disagree to strongly agree)
	Demographics	
	Age	age in years
	Birthday	birthday in month/year
	Grade	grade level
	Gender	0=male, 1=female
	TotalChildren	children in kindergarten through grade 8
	SchoolName	name of school
	EducationParent	highest grade completed (1=1-8, 2=9-11, 3=12 or higher, 4=college 1-3 years, 5=college 4 or more years)
	EmploymentParent	employment status (1=full-time, 2=part-time, 3=homemaker, 4=student, 5=retired, 6=other)
Social Capital		
	Networks	
	NeighborsByName	number of neighbors known by name from home to school
	Norms	
	NormATSAlone	level of agreement (7 point scale, strongly disagree to strongly agree)
	NormATSAdult	level of agreement (7 point scale, strongly disagree to strongly agree)
	Trust	
	Trust	level of agreement (7 point scale, strongly disagree to strongly agree)

Variables from the parent survey were included if they showed significant association with the dependent variable in preliminary correlation matrices (Table 14). The dependent variable of active transportation to school (ATSTo) was a dichotomous indicator, coded as 1 for students who walked and/or biked to school three or more days per week and 0 for students who walked or biked fewer than three days per week. Variables that were empirically and theoretically relevant were also included even if they did not result in statistically significant associations (Giles-Corti & Donovan, 2002).

Because response scales differed across items, item scores were standardized by transforming them into z-scores prior to being combined into composites. To overcome issues with multicollinearity, two variables were removed. It is likely that having fun is a part of enjoying ATS (EnjoysATS) so the variable FunATS was removed. The variable TrafficSpeeds was also removed since it is likely that high speeds would be a part of overall traffic amount (TrafficAmount). Additionally, keeping reports of overall traffic is important since it can refer to congestion (a common concern around school sites). To improve the accuracy of the model, the data were examined for outliers. One outlier was found (standardized residual = 6.62) and as a result of eliminating that case, the model accuracy improved by 6%.

Table 14

Included Variables and Their Correlation with ATS

Physical Environment		
	Bus**	-0.314
	CarAvailable**	-0.246
	ReportedDistance**	0.536
	TooFar**	0.515
Safety Environment		
	NoSidewalk**	0.382
	DangerousCrossing**	0.373
	PoorLighting**	0.292

	TrafficAmount**	0.469
	NoOtherChildren**	0.468
	NoAdults**	0.517
	NoCrossingGuards**	0.447
	UnsafeAnimals**	0.289
	UnsafeCrime**	0.300
	NoSafeBike*	0.165
Cultural Environment		
	Permission**	0.395
	EnjoysATS**	0.515
	EnjoysATSFriends**	0.464
	EnjoysATSAdults**	0.206
	SchoolSupportATS	0.283
	HealthyATS**	0.326
	NotEnoughTime**	0.516
	BadWeather**	0.353
	EasierBus**	0.438
	EasierDrive**	0.437
Social Capital		
	NeighborsByName**	0.217
	NormATSAlone**	0.263
	Trust**	0.216
	NormATSAdult[1]	0.103

** Correlation is significant at the 0.01 level (2-tailed).
[1] Variable not statistically significant but included.

The conceptual model addressed the construts relevant to the physical environment (PE), safety environment (SE), cultural environment (CE), and social capital (SC). These constructs are latent variables in that they were not directly observed, but rather represented by several measured variables (Bollen, 1989). Scores from the items thought to be reflective of each construct were combined (averaged) to form a composite measure for the corresponding construct. Cronbach's alpha (α) was calculated to assess the internal reliability of each construct. Table 15 summarizes the variables included in each index as well as the Cronbach's α for each of the levels. A value of 0.70 is generally used to indicate an adequate reliability (de Vaus, 2002). Both the SE, which consisted of 10 items (α = 0.89), and the CE, which consisted of 10 items (α = 0.83), had good reliability. Both the PE, which consisted of four items (α = 0.57), and the SC, which also consisted of four items (α = 0.26), were found to have low reliability. Individual items within each scale were evaluated. All SC variables reported poor reliability. One item within the PE construct (CarAvailable) showed particularly low reliability. The removal of that item would have resulted in only a minor increase is scale reliability (α = 0.64) so the item was kept. Because there is a likelihood that Cronbach's alpha may be inaccurate when only a scale includes only a small number of items (de Vaus, 2002), both the PE and SC constructs continued to be utilized.

Table 15

Summary of Levels, Descriptive Statistics, and Cronbach's Alpha on Conceptual SEMATS (N = 217)

Level	Number of items	*M*	S.D.	α
Physical environment	4	2.13	0.45	.57
PE = Bus + CarAvailable + ReportedDistance + TooFar				
Safety environment	10	4.22	1.59	.90
SE = NoSidewalk + DangerousCrossing + PoorLighting + TrafficAmount + NoOtherChildren + NoAdults + NoCrossingGuards + UnsafeAnimals + UnsafeCrime + NoSafeBike				
Cultural environment	10	3.83	1.31	.83
CE = Permission + EnjoysATS + EnjoysATSFriends + EnjoysATSAdults + SchoolSupportATS + HealthyATS + NotEnoughTime + BadWeather + EasierBus + Easier Drive				
Social capital	4	3.93	1.15	.26
SC = NeighborsByName + NormATSAlone + NormATSAdult + Trust				

Analytic Approach and Logistic Regression Results – SEMATS v.1

Logistic regression was used to examine how the odds of students using active forms of transportation to school on three or more days per week was related to the four constructs. Logistic regression, as opposed to linear regression, was used as it allows for appropriate modeling of a dichotomous dependent variable (Hosmer, Lemeshow, & Sturdivant, 2013). A model of the form depicted below was estimated.

$\Pi^2_{ATS} = b_0 + b_1X_{PE} + b_2X_{SE} + b_3X_{CE} + b_4X_{CC} + e$

Here, each b coefficient represents the parameter describing the relationship between the corresponding independent variable (e.g., b_1 and X_{PE}, where X_{PE} is the value of the physical environment composite score) and the likelihood of engaging in ATS. The value of the b coefficient equals the natural log of the odds of engaging in ATS associated with a 1-unit increase in the corresponding independent variable, adjusting for the other independent variables in the model. Table 16 provides a summary of the results of the analysis.

Table 16.

Summary of Logistic Regression Results from SEMATS v.1 of Influences on ATS (N = 217)

Constructs	b	*SE(b)*	Wald Test	*p*	Odds Ratio
Physical	***-2.602***	***0.701***	***13.796***	***.000***	***0.074***
Safety	1.007	0.579	3.023	.082	2.738
Culture	***3.436***	***0.865***	***15.773***	***.000***	***31.054***
Social	0.279	0.634	0.193	.660	1.322

Note. See Table 13 for code and scale information. $R^2 = .68$.

$p < .01$ is bold and italicized; $p < .05$ is bold

The Hosmer and Lemeshow test of goodness of fit (p = .689) resulted in non-significance indicating that the model was a good fit of the data. Nagelkerke's effect size ($R^2 = .68$) was high indicating a strong association between the independent and dependent variables (Nagelkerke, 1991). Together, the predictors improved model fit for the prediction of ATS ($x^2(3, N = 217) = 112.672$, $p < .001$).

The Wald test for the physical environment coefficient indicated that the negative association between the physical environment composite and ATS was significant (x^2(1, N = 217) = 13.80, p < .05). The regression coefficients and odds ratios in Table 16 can be interpreted by applying the following calculation to determine the percent change in the odds of ATS for one-unit increase in the independent variable: $\%\ change\ in\ odds(ATS) = 100\%\ x(Exp(b) - 1) = 100\%\ x\ (OR - 1)$. So, for example, compared to a student with a physical environment composite score of 0.0, a student with physical environment composite score of 1.0 would have a predicted odds of using ATS that are 100% x (0.074 – 1) = -93% or 93% lower. The Wald test for the cultural environment coefficient indicated that the positive association between the cultural environment was also significant (x^2(1, N = 217) = 15.77, p < .01) such that for every +1-unit difference in the cultural environment composite score the odds of using ATS increased by 100% x (31.054– 1) = 3001%. The constructs of the safety environment and social capital were not statistically significant related to ATS use.

The conceptual model suggested that constructs may interact to affect ATS. In models that contain large numbers of independent variables (such as the SEMATS), it is likely that there is some level of association among variables and between levels. To understand these interactions and develop a comprehensive model, Hosmer, Lemeshow, and Sturdivant (2013) recommend statistically adjusting the estimated effect of each construct in the model for differences in the distributions and associations among other constructs. Centering the scale scored of each construct, or subtracting the mean from each case, can help make the interaction effects more interpretable. When scales are centered, the effect of one construct on the dependent variable is based on the "average" of the other construct(s) in the interaction.

After centering and testing the interactions, none had a significant effect at the .05 level. The four-way interaction of all constructs (PE*SE*SC*CE) did not have a significant effect on the model (x^2(1, N = 217) = .153, p = .696). Neither three-way interaction (PE*SE*SC) (x^2(1, N = 217) = .691, p = .406), (PE*SE*CE)(x^2(1, N = 217) = 2.922, p = .087), (PE*CE*SC) (x^2(1, N = 217) = .469, p = .493) had a significant effect on the model.

To investigate the indirect effects that social capital and the safety environment may have on the associations of both the physical environment and the cultural environment and ATS, bootstrapping was used. Bootsrapping is one of the most valid and powerful methods for testing for mediation or indirect effects (Willams, 2008), especially because it does not required a large sample size and makes no assumption about sampling distribution (as in the popular Sobel test) (Hayes, 2009). Bootstrapping is a method of resampling the data a large number of times (typically 100 or more) to determine a confidence interval for each of these samples. If zero is not in the interval, an indirect effect is determined to exist.

The Hayes and Preacher (2014) macro for SPSS was used to test for indirect effects. This mediation analysis is appropriate because of its ability to handle dichotomous outcomes (Hayes & Preacher, 2014). Unstandardized indirect effects were computed for each of 5,000 bootstrapped samples. The test for SC as an indirect influence on the relationship between the PE and ATS was not significant (IE = -.01, CI = -.29, .27). Because zero fell within the 95% confidence interval, the indirect effect is not significant. The test to measure the indirect effect of SC on the relationship between the CE and ATS was not significant (IE = .14, CI = -.02, .34) because zero was in between the 95% confidence interval. Neither the test to measure the indirect effect of the SE on the relationship between the PE and ATS (IE = .07, CI = -.15, .28) nor the test to measure the indirect effect of the SE on the relationship between CE and ATS (IE = .11, CI = -.12, .24) was significant.

The testing of the SEMATS model revealed some promising results but also raised some questions. For example, why did elements of the physical environment decrease the odds of students walking or biking? Why did the odds of walking or biking increase by such a large percentage (3001%) with the influence of the cultural environment? Also, why was the construct of social capital not a strong indicator in the hypothesized model when the research shows it to be associated with physical activity behavior? The literature reports that safety is one of the most salient influences on ATS (Sirard & Slater, 2007). Why then did the construct of safety not appear to be a significant contributor in the model? In order to investigate these concerns further, it was first necessary to identify problems with the conceptual model.

Table 17

Logistic Regression Results and Correlation of SC variables (N = 217)

Variable	B	SE	Wald	Sig.	Odds Ratio	Correlation with ATS	Correlation with Trust
NeighborsByName	.207**	.064	10.576	0.001	1.23	.271**	0.158*
NormATSAlone	.331*	.104	10.062	0.002	1.392	.263**	0.189**
NormATSAdult	.063	.095	0.443	0.506	1.065	.103	0.099
Trust	.229*	.116	3.905	0.048	1.257	.216**	-

Note. See Table 13 for code and scale information.

$R^2 = .20$
*p < .05
**p < .01

Construct Design. A major concern with regard to the conceptual model was the low reliabilities of the physical environment and social capital scales. Although a value of 0.70 is generally used to indicate a good reliability (de Vaus, 2002), there are researchers who suggest that lower values may be acceptable. According to Boyle (1991), there is an optimal range of internal consistency necessary in order to avoid the issue of item redundancy which is possible when item correlations are higher than 0.7. Similarly, Cummins (1997) suggests that alphas should be in the range of 0.3 to 0.7. Because it is not likely that the physical environment construct contained issues of item redundancy and because the Cronbach's α of the social capital construct was lower than 0.3 (α = 0.26), both constructs were deemed to be problematic.

There is no consensus on a factor structure of physical and social influences on ATS so a principle components analysis (PCA) was used to identify and compute composite scores for the major factors. Initially, all variables were included and eigen values showed that the first factor explained 24% of the variance, the second factor explained 12% of the variance, and each of the next four factors explained less than 10% of the variance. Five variables (Bus, CarAvailable, PoorLighting, NoSafeBike, and NeighborsByName) were removed because they did not contribute to a simple factor structure and failed to meet a minimum cross-loading of .3 or above.

A fifth variable (ReportedDistance) was removed because of issues with multicollinearity. It is likely that a parent's report of distance from home to school is related to a report of school being too far to walk or bike. A PCA of the remaining 22 items, using varimax rotation, was conducted with three, four, five, and six factor solutions. The three factor solution (Table 18), which explained 55% of the variance, was preferred because of its theoretical support and the leveling off of eigen values on the scree plot. The variables included in each of the factors were used to determine the three new constructs of perceptions of the physical environment, socio-cultural environment, and perceptions of the safety environment.

Table 18

Factor Loadings Based on PCA with Varimax Rotation for 22 Items (N=217)

	Physical environment	Socio-cultural environment	Safety environment
TooFar	.81		
NoSidewalk	.71		
DangerousCrossing	.72		
TrafficAmount	.75		
NoOtherChildren	.77		
NoAdults	.70		
NoCrossingGuards	.71		
UnsafeAnimals			.48
UnsafeCrime			.62
Permission		.49	
EnjoysATS		.74	
EnjoysATSFriends		.76	
Enjoys ATSAdults		.76	
SchoolSupportATS		.63	
HealthyATS		.68	
NotEnoughTime	.72		
BadWeather	.66		
EasierBus	.64		
EasierDrive			.70
Trust			.62
NormATSAlone		.48	
NormATSAdult		.54	

These three constructs are supported by social ecological theory and had similar or higher reliability indexes than the constructs included in the original conceptual model. Composite scores were created for each of the three factors, based on the mean of the items within each factor. Descriptive statistics as well as Cronbach's alpha scores are reported in Table 19. In addition to better reliability indexes, these constructs were able to overcome a multicollinearity issue that the constructs in the original model encountered. The original cultural environment was highly correlated with the original safety environment. This may have contributed to the non-significant contribution of the safety environment in the analysis.

Table 19

Summary of Levels, Descriptive Statistics, and Cronbach's Alpha of Revised SEMATS (N = 217)

Level	Number of items	*M*	S.D.	α
Physical environment	10	3.94	1.79	.92
PE = TooFar + NoSidewalk + DangerousCrossing + TrafficAmount + NoOtherChildren + NoAdults + NoCrossingGuards + NotEnoughTime + BadWeather + EasierBus				
Socio-cultural environment	8	3.94	1.26	.82
SCE = Permission + EnjoysATS + EnjoysATSFriends + EnjoysATSAdults + SchoolSupportATS + HealthyATS + NormATSAlone + NormATSAdult				
Safety environment	4	4.29	1.46	.67
SE = UnsafeAnimals + UnsafeCrime + EasierDrive + Trust				

Sample Size. Another concern with the original model was the low sample size. Hosmer and Lemeshow (2000) recommend that there be at least 10 cases per independent variable. The constructs in the original model contain a combined 28 variables signifying that the sample size should equal at least 280. Since the sample (N = 217) was considerably less than the recommended number, an adjustment to the number of independent variables was made. The model revision contained a combined 22 variables among three constructs. Additionally, if causally irrelevant variables are included in the model, the common variance they share with included variables may be wrongly attributed to the irrelevant variables. The logistic regression results of the original SEMATS showed that one construct, the cultural environment would have extremely greater odds (750%) of using ATS. This finding caused concern because large odds ratio estimates may arise from small sample size in relation to a large number of covariates used as controls (Greenland, Schwartzbaum, & Finkle, 2000).

To address the concerns with construct design and sample size, a new model (Figure 22) was presented and tested.

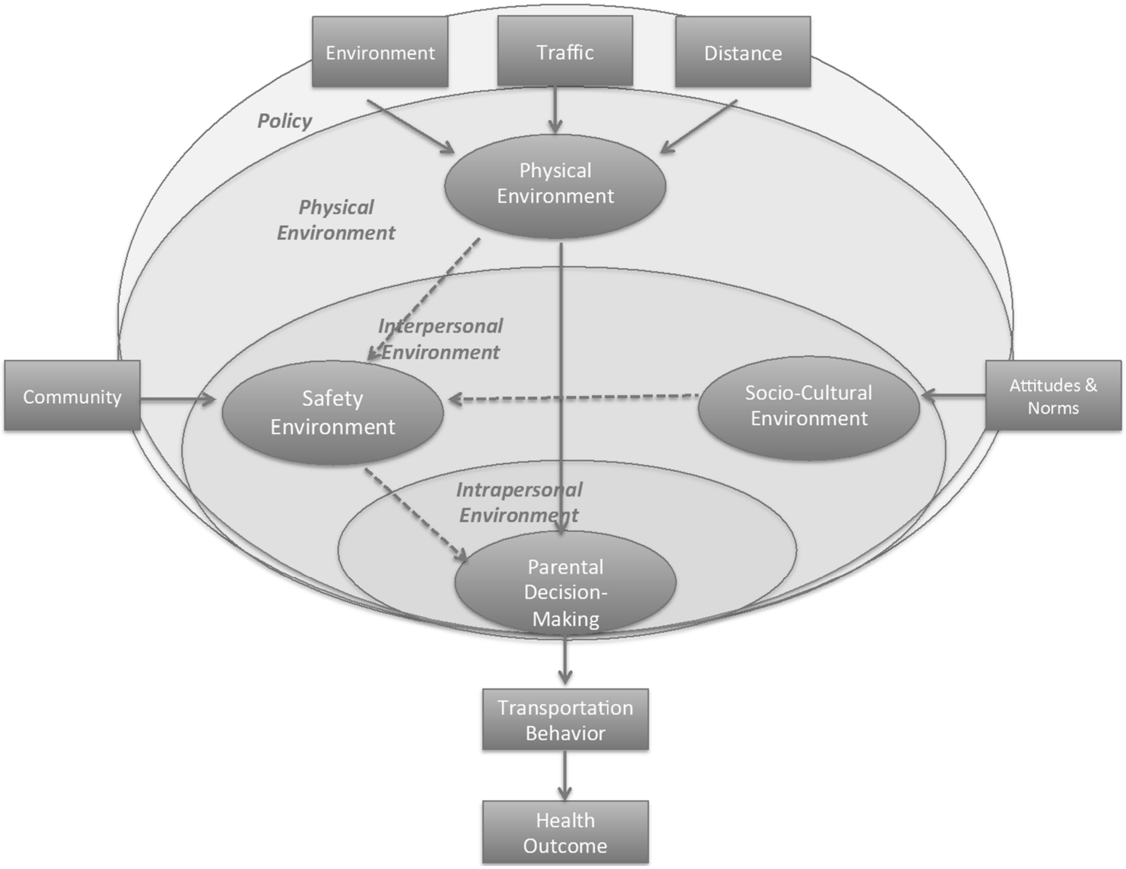


Figure 22. SEMATS v. 2

Analytic Approach and Logistic Regression Results – SEMATS v.2

The Hosmer and Lemeshow test of goodness of fit (p = .123) resulted in non-significance indicating that the model was a good fit of the data. Nagelkerke's effect size (*R^2 = .57*) was high indicating a strong association between the independent and dependent variables (Nagelkerke, 1991). As a set, the SEMATS v.2 predictors significantly improved fit ($x^2(3, N = 217) = 107.863$, $p < .001$).

Table 20 provides the results of the logistic regression analysis used to test SEMATS v.2. The regression coefficients and odds ratios can be interpreted by applying the following calculation to determine the percent change in the odds of ATS for one-unit increase in the independent variable: $\%\ change\ in\ odds(ATS) = 100\%\ x(Exp(b) - 1) = 100\%\ x\ (OR - 1)$. The Wald test for the physical environment coefficient indicated that the association between the physical environment composite and ATS was signficant (x^2(1, N = 217) = 20.464, $p < .01$). Compared to a student with a physical environment composite score of 0.0, a student with a physical environment score of 1.0 would have a predicted odds of using ATS that are 100% x (2.436 – 1) = 1.436% or 144% higher. The Wald test for the socio-cultural environment coefficient indicated that the association between the socio-cultural environment composite and ATS was also signficant (x^2(1, N = 217) = 10.433, $p < .01$) such that for every +1-unit difference in socio-cultural environment composite score, the odds of using ATS increased by 100% x (2.144 – 1) = 114%. The construct of the safety environment was not statistically significant related to ATS use.

To test whether the impact of one construct on ATS was affected by an interaction with one or both of the other constructs, all constructs were centered. None of the interactions had a significant effect at the .05 level. The three-way interaction of all constructs (PE*SE*SCE) did not have a significant effect on the model had a significant effect on the model (x^2(1, N = 217) = 1.958, p = .162). Neither two-way interaction (PE*SCE) (x^2(1, N = 217) = 1.137, p = .286), (PE*SE)(x^2(1, N = 217) = .161, p = .688), (SCE*SE) (x^2(1, N = 217) = .495, p = .482).

Table 20

Summary of Logistic Regression Results of Influences on ATS (N = 217)

Constructs	b	*SE(b)*	Wald Test	*p*	Odds Ratio
Physical	***0.89***	***0.197***	***20.464***	***.000***	***2.436***
Socio-Cultural	***0.763***	***0.236***	***10.433***	***.001***	***2.144***
Safety	0.224	0.193	1.336	.248	1.251

Note. See Table 17 for code and scale information. $R^2 = .57$.

p < .01 is bold and italicized; p < .05 is bold

The Hayes & Preacher (2014) macro for SPSS was used to test for indirect effects. Unstandardized indirect effects were computed for each of 5,000 bootstrapped samples. The relationship between the PE and ATS was partially mediated by the SE (IE = .175, CI = .05, .34). Because zero is not in the 95% confidence interval, the indirect effect is significant. As Figure 23 illustrates, the direct effect of PE on ATS was significant (DE = .989, SE = .181, *p* = .000) and the indirect effect between the SE and ATS was significant (IE = .399, SE = .176, *p* =.023. The total effect of PE on ATS was significant (TE = 1.188, SE = .169, *p* = .000). For every unit increase in the PE, a .175 increase in SE results. A corresponding change of .399 units indicates the effect of a one unit change in SE on ATS. The total change on transportation behavior through the SE as the PE changes by one unit it .07 (.175 * .399).

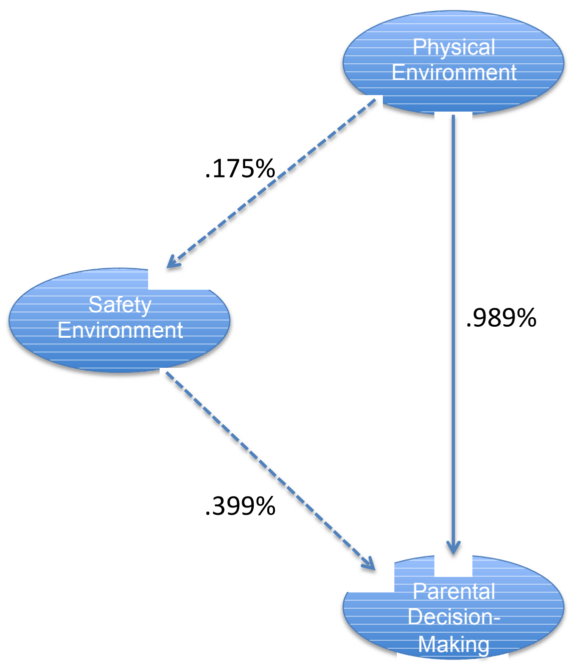


Figure 23. Indirect effect of SE on PE and ATS

The relationship between the SCE and ATS was partially mediated by the SE (IE = .304, CI = .16, .52). Because zero is not in the 95% confidence interval, the indirect effect is significant. As Figure 24 illustrates, the direct effect of SCE on ATS was significant (DE = 1.069, SE = .221, *p* = .000) and the indirect effect between the SE and ATS was significant (IE = .673, SE = .161, *p*

=.000. The total effect of SCE on ATS was significant (TE = 1.358, SE = .222, *p* = .000). For every unit increase in the SCE, a .304 increase in SE results. A corresponding change of .673 units indicates the effect of a one unit change in SE on ATS. The total change on transportation behavior through the SE as the SCE changes by one unit it .20 (.304 * .673).

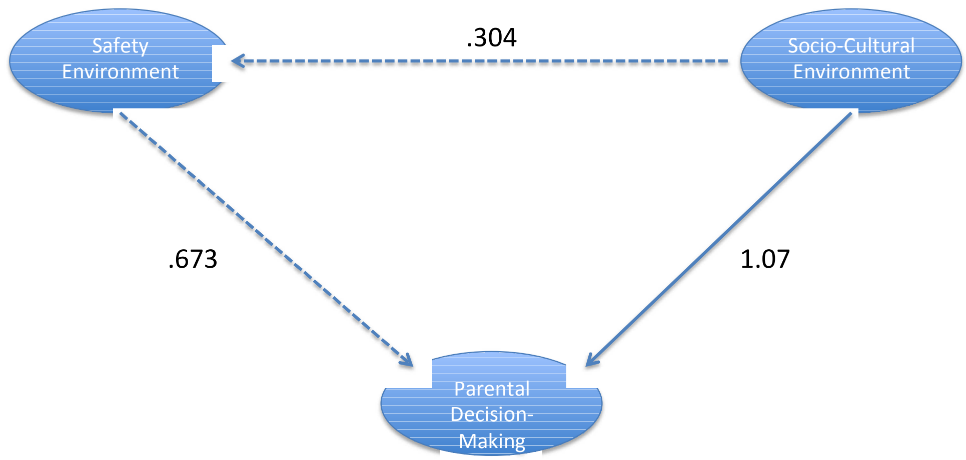


Figure 24. Indirect effect of SE on SCE and ATS

Discussion

In this study, one model of active transportation to school (SEMATS v.1) was presented and tested. It was hypothesized that (1) the model would explain the odds of social and physical variables influencing ATS behavior and (2) social capital would be a significant contributor to the odds of using ATS. Although the Hosmer and Lemeshow test for the original model indicated that it was a good fit of the data, low reliability scores revealed that the data were not necessarily measuring the intended constructs. Consequently, the variables and constructs in the original model were reexamined for flaws. In addition to a low sample size, it was determined that the fault was largely a result of the construct design. A PCA revealed that the factor structure was better aligned with a different set of constructs: the physical, socio-cultural, and safety environments. As a result, a new version of SEMATS was developed and tested. Throughout this process, several important findings about the constructs and variables that influence ATS were uncovered.

Physical Environment

The construct of the physical environment changed considerably between the SEMATS revisions. The construct of the PE in the original model was intended to define objective measures. Initially, the PE contained only four variables that measured transportation options and distance. The SEMATS revision included a total of 10 variables that could all be categorized as perceptions of the built environment, traffic, and distance. This shift from objective measurements to perceptions indicates the importance of the point of views of the decision-maker when it comes to ATS. The literature is beginning to show that perceived measures may be more adept at incorporating factors important to individuals (Caspi, Kawachi, Subramanian, Tucker-Seeley, & Sorensen, 2013) and may be more strongly linked to health behaviors (Weden, Carpiano, & Robert, 2008), including physical activity (Nasar, 2015). This consideration should be accounted for as research continues in the field of active transportation.

The mediating influence of the safety environment on the relationship between the PE and ATS was another finding that has implications for future research. This study found that the impact of the SE was significant enough to alter the direct influence of the PE on the decision to walk or bike. It is plausible that the feelings of safety felt by parents have such an effect that barriers in the physical environment were not as important. For example, the influence of trust among neighbors could be so powerful that the problem of not having a sidewalk was overcome. This opposite of this effect was found in a study by Kerr et al. (2006) where parents with safety concerns kept their children from walking even if the physical neighborhood was deemed highly walkable. As research continues, the association between safety and elements of the physical environment should be considered.

In this study, students were 144% more likely to use ATS if positive features in the physical environment were present. This finding highlights the importance of continuing to examine the influence of the built environment, traffic, and distance on ATS. Four of the variables (lack of sidewalks, dangerous street crossings, high vehicular traffic, lack of crossing guards) used to measure the PE construct were related in some way to dangers of crossing busy streets. In their study, Heelan et al. (2008) found that having to cross at least one busy street on the trip to school was enough to prevent parents from allowing children to use ATS. Another variable used to measure the PE was distance (TooFar). Distance continues to be one of the most important and consistent predictors of ATS (Panter et al., 2008). In this study, zero children who lived more than two miles used ATS and just six children who lived between one and two miles walked or biked. This aligns with recommendations that one mile be the cutoff point for promoting walking to school. Not having enough time is often a reported barrier to ATS. Parents often weigh the time it takes to walk versus drive to school when they consider this influence. Interestingly, Heelan et al. (2008) counted the number of vehicles in line before and after school at six elementary schools. They found that 259 cars spent at least 15 minutes before and 117 waited at least 30 minutes before dismissal. Including this measure in the construct of the PE is an important consideration, especially as the traffic concerns at pick-up/drop-off times become more of an issue.

Social Capital

The concept of social capital as it relates to active transportation to school is relatively novel. Of the research that exists, the relationship and significance is unclear. For example, in their research, Dentro, Broyles, Tudor-Locke, and Katzmarzyk (2014) found that social capital had no significant relationship with ATS. However, Timperio et al. (2006) found that trusting the neighborhood community and the presence of other children had a positive influence of using active forms of travel locally.

Despite the fact that the construct of social capital did not play a significant role in the original conceptual model, individual measures of social capital may still influence the decision to support ATS. Social capital and safety have been found to be associated with walking behaviors in adults (Addy et al., 2004; Caspi et al., 2013; deLeon et al., 2009). Foster and Giles-Gorti (2008) suggested that perceived safety was one of the primary links between social capital and health. These findings in adult populations make it plausible to consider that an association between elements of social capital, safety, and active travel modes of students may exist. Additionally, an

Australian study found that children were more likely to walk for exercise if they knew their neighbors and felt that roads were safe (Dollman & Lewis, 2007).

To determine where each measure of social capital should fit in the revised model, several considerations were made. When analyzed individually, three of the four variables used to measure social capital (NeighborsByName, NormATSAlone, Trust) were significantly associated with ATS behavior (Table 17). Therefore, it was reasonable to consider that those variables may be better aligned within different constructs in the SEMATS model. In this research, the variables measuring norms were significantly correlated with trust. Since studies have shown that even modest intercorrelations among predictor variables can reduce statistical power (Mason & Perreault, 1991), the SEMATS revision placed the variables measuring norms within the socio-cultural environment and the variable measuring trust within the safety environment. Although the variable to measure networks (NeighborsByName) was significantly correlated with ATS when individual social capital variables were measured, it did not align with any construct in the SEMATS revision and was therefore removed. It is possible that the survey question was not an accurate measure of the element of networks in this setting. In general, close networks result in more social support, which impacts individuals to conform to network norms (Heaney & Israel, 2008). However, while low quality but a large number of networks are good at passing information, high quality but a limited number of connections provide more support (Granovetter, 1995). Asking about the number of neighbors an individual knows by name may not be the most appropriate measure of networks that influence social capital in this setting.

This study aimed to identify social capital as an influence on ATS behavior. It is possible, however, that the act of walking or biking to school might actually contribute to the social capital within a neighborhood. In their 2015 review of literature, Sallis et al. found that strong evidence exists between ATS programming efforts at school and social benefits. In his study of adults, Leyden (2003) found that walkable communities had residents that were more likely to know and trust their neighbors. Similarly, a report by the New Zealand Public Health Advisory Committee (2003) found that active travel among adults promotes social cohesion and social interaction within the neighborhood. It could be that social capital is actually a result of ATS. This phenomenon is similar to the “self-selection bias” which is often mentioned in the built environment literature: Do active people move to walkable communities or does living in a walkable community contribute to more active people? Future research should investigate the effect of ATS on social capital.

Socio-cultural Environment

The socio-cultural environment in the SEMATS model revision, which included the addition of the two variables used to measure norms, was significantly and directly related to ATS behavior. Although the association of norms and ATS is a relatively new concept, research consistently confirms that norms are positively related to physical activity behaviors (Ball, Jeffery, Abbott, McNaughton, & Crawford, 2010; Priebe & Spink, 2011). Carver et al. (2005) found that boys were more likely to bike for recreation or transport and girls were more likely to bike for recreation and walk to school when they had peers that lived locally and engaged in those behaviors. In their study, Chillón et al. (2014) found that the norm of parents believing other children were walking and biking was associated with ATS use in their own children. The researchers also found that children’s perceived norms of other kids walking and biking were significantly and positively related to ATS use.

Attitudes toward walking and biking have been shown to be salient factors that influence ATS (Stewart, 2005). Heelan et al. (2008) found that whether or not the child wanted to use ATS was the most influential determining factor when measuring walking and biking to school. Studies have also found that parents who walked to school themselves were more likely to have children who use ATS (Ziviani, Scott, & Wadley, 2004). Stuckyropp and Dilorenzo (1993) reported that enjoyment influenced PA levels in children. Participation in ATS may similarly rely on children’s enjoyment. It is interesting to note that, although MUSD had been educating students and parents about the benefits of ATS for three years prior to data collection, approximately 33% of students had not asked their parents for permission to walk or bike to school. Although we do not know whether these students already used forms of ATS, it is likely that some of the students did not.

This percentage could indicate that more attention should be dedicated to the education portion of the Safe Routes to School and other program interventions.

The findings within the socio-cultural domain suggest that parents are more likely to allow their children to use ATS when others are walking/biking and when they feel others in the area are present and will watch out for their children. For example, in their study, McDonald, Deakin, & Aahlborg (2010) found that parental reports of higher levels of social cohesion were significantly related to increased rates of walking and biking. This suggests that programs to encourage ATS may benefit from incorporating elements of adult interaction and neighborhood cohesion. Programs such as walking school buses, which provide adult escorts for children on the way to school, may also increase effectiveness of programming efforts.

Safety Environment

The safety environment, which included the variable of trust, played an indirect role on both the physical environment and socio-cultural environment and ATS in the revised model. In his paper, Adams (2000) talks about some of the relationships that may exist involving trust and the neighborhood. He proposes that trust among neighbors is related to crime and community involvement. He also suggests that trust in the neighborhood goes down when communities are car-oriented because it fosters anonymity. He found that as traffic on one's street increased from 2,000 to 16,000 vehicles per day, the number of friends and acquaintances was cut in half.

In a study of walkable neighborhoods in Ireland, Leyden (2003) found that when people walked they were more likely to trust their neighbors. In their study, Eyler et al. (2008) also found that walking was associated with getting to know neighbors, which could serve as a safety purpose. They interviewed one student who said:

> You get to know the neighbors as you walk through. If there ever were a problem like a kid being followed home, he would know that Mrs. Smith lives in that house. I can knock on her door if I am scared because someone is following me. (p. 142)

Studies have also found that those who live in areas with more trust and social cohesion tend to have higher levels of physical activity (Cradock, Kawachi, Colditz, Gortmaker, & Buka; 2009, Lindström, Hanson, & Östergren, 2001). Safety has been proposed as a mediator in the relationship between social capital and health outcomes (Foster & Giles-Corti, 2008). For example, King (2008) found evidence that social capital and safety mediate the relationship between physical environment features and PA in older adults.

The indirect role that safety plays on the dynamics of walking and biking to school are significant and complex. For example, parents who drive their children to school (EasierDrive) may be trying to protect them from safety concerns such as traffic. On the contrary, the act of driving to school is actually contributing to the traffic problem. Increased traffic has been associated with fewer people walking and biking (CDC, 2005), which may result in less trust and friendship within the neighborhood. This, in turn, could contribute to the cycle of parents driving their children to school.

Recommendations

Future testing

The SEMATS model was tested using data from two validated sources – the Parent Survey about Walking and Biking to School (McDonald, Dwelley, Combs, Evenson, & Winters, 2011) and Active Where? Parent-Child Survey (Joe, Carlson, & Sallis, 2008; Forman, Kerr, Saelens, Durant, Harris, & Sallis, 2008). Future research should continue to test this model using these two common survey instruments. The model should also be cross-validated using alternate sources of data. It is possible that the questions taken from the existing survey instruments utilized in this study were not able to distinguish between variables that may strongly associated (i.e., norms, trust, attitudes). In fact, although objective measures showed high reliability, McDonald et al. (2011) found that the subjective attitudinal questions on the SRTS Parent Survey proved to have unacceptably low test-retest reliability. An examination of the language, clarity, and design of subjective items may improve the reliability of the survey instrument and could yield deeper insight into the constructs examined in this study. It is possible that adding a qualitative form of research, such as interviews, could provide important insight into the constructs of the model as well.

Although this social-ecological model provides a framework for identifying the various levels of factors that may influence behavior, it is not necessarily a solution for all problems because it does not provide an indication of how these levels may interact with one another (Sirard & Slater, 2008). To overcome this problem, additional analyses should be utilized to uncover the possible interactions across and within levels. Structural equation modeling (SEM) is a statistical technique that tests directional relationships using a combination of path analysis, factor analysis, and multiple regression analysis. It can be particularly useful when testing latent constructs, such as the physical environment, safety environment, social capital, and cultural environment constructs of the SEMATS. This method of analysis is preferred over logistic regression because it would result in fewer Type II errors (Garson, 2014). SEM is limited in that it does require a large sample and does not perform well with non-normal data (Hoyle, 1995). Because of the smaller sample size and likelihood that much of the data in this study was non-normal, SEM was not utilized.

The construct of social capital did not prove to be a significant influence on ATS behavior in the original SEMATS model. One reason that this result occurred could be because the concept of social capital is very difficult to measure, especially in a quantitative fashion. In fact, Brondizio, Ostrom, and Young (2008) claim that social capital is practically invisible unless serious efforts are made to understand the ways in which individuals organize and the beliefs that are behind their actions. It may be beneficial, therefore, to engage in qualitative research with individuals in a neighborhood to elicit more in-depth information about social capital and it's relation to ATS.

Research design

Because this survey experienced a low (8%) response rate, additional steps may be necessary to improve future outcomes. One suggestion would be to offer incentives to the classroom teachers or school sites. This survey included a gift card raffle for parents only. Including the teachers and/or other school professionals responsible for actually promoting and collecting the questionnaires might boost return rates.

This study used the trip from home to school as the dependent variable (ATSTo). Some research (Braza et al., 2004; Parker, Schlossberg, Phillips, & Johnson, 2005) found that more students used active modes of travel from school to home. Because factors such as transportation and time constraints might actually change from being barriers to becoming enabling factors during the trip after school, future research should explore the potential of trips from school to home.

Currently, there is not an established method used to classify children as “active transporters”. The literature shows quite a variation in the determination of this title. Researchers such as Chillón et al. (2010); D’Haese, De Meester, De Bourdeaudhuji, Deforche, & Cardon, (2011); Fultron, Shisler, Yore, & Casperson (2005); Ziviani, Kopeshke, & Wadley (2006); and Ziviani, Scott, & Widley (2004) ask questions similar to “how do you usually get to school?” and measured ATS with binary coding such as 0 = no, 1 = yes if children walked at least one day. (Braza, Shoemaker, & Seeley, 2004) asked a similar question but calculated the number of minutes spent using ATS weekly by determining each child’s travel time from home to school. In their studies, Merom, Tudor-Locke, Bauman, & Rissel (2006) and Timperio et al. (2006) use the classification system of 0=never, 1-4=occasionally/active commuter, and 5=frequently/frequent active commuter. Other researchers considered students who use forms of ATS three or more days to be active commuters (Pabayo, Gauvin, & Barnett, 2011; Rosenberg, Sallis, Conway, Cain, & McKenzie, 2006). Still other researchers (i.e., (Cooper, Page, Foster, & Qahwaji, 2003), Johnston & Moreno (2012)) don’t actually specify how they determine their dependent variable of active transportation to school.

Considerable variation was noted in the measurement of independent and dependent variables in the studies appraised. With respect to rates of AT among children, measurement was achieved through self-reported usual mode of travel, mode of travel on the day of survey completion, travel diaries over a number of days, or frequency of mode of travel over a specific time period, through parent proxy or children's self-reported data. Although the validity of self-report data of older children has been documented (Sallis, 1991), the range of methods used to measure AT, and the duration of observation and categorization of AT frequency can confound results (Pont et al., 2009). Future research should aim for consistency when categorizing the frequency of active transportation to school.

Active transportation to school programming

Two of the most commonly cited barriers to ATS are distance and safety (Stewart, 2011, Zhu, Lee, Lu, & Yu, 2012; McMillan, 2007; CDC, 2005). Beginning in the 1970s, a trend has developed in which large schools are being built to accommodate more students (Council of Educational Facility Planners International, 2004). These schools are often located in the outskirts of cities or towns, contrary to the once popular neighborhood school. This leads to fewer students living close to school. For example, in 1969, 45% of elementary school students lived less than a mile from their school; in 2005, fewer than 24% were found to live within this distance (McDonald, 2005). In fact, in her sample of 6,508 students, McDonald (2008) found that only 20% lived within the typical walking range of one mile. While many programming efforts are designed to target individual characteristics associated with walking and biking to school, there is a need to address the problem of distance and school siting. The National Physical Activity Plan, introduced by the American Heart Association in 2015, calls for an improvement of "infrastructure access to and site location of schools … to increase walking and bicycling" (Kraus et al., 2015) (p. 5). To achieve this goal, collaboration between schools, communities, and land-use planners must occur.

Another effect of students living further from school is the rise in personal automobiles used to drive to school. This increase leads to motor vehicle traffic, which contributes to parental safety concerns about walking and biking to school. Other safety concerns include fear of crime or strangers. While this barrier is likely a combination of both objective and perceived measures, it is likely that subjective fears are responsible for a large portion. For example, according to the U.S. Department of Justice (Sedlak, Finkelhor, Hammer, & Schultz, 2002), only 2% of child abductions were the result of non-family abductions. To ease parental safety concerns and promote ATS, programs such as the walking schools bus (WSB) have shown some promise (Johnston, 2008, Mackett et al., 2005). The WSB consists of an adult chaperone that walks with children along a specified route to or from school, picking up or dropping off children along the way. The adult monitors children, providing regular encouragement of proper pedestrian skills (Johnston et al., 2006). The WSB program may also promote social capital within a neighborhood by forming circles of trust, networks, and walking and biking behavior among residents.

This study confirmed a common conclusion that elements of the physical, socio-cultural, and safety environments all impact the behavior of walking and biking to school. Therefore, programs to promote ATS should involve multi-level strategies. Specifically, interventions (such as Safe Routes to School) should target change across levels. While the impact of distance and safety are significant, it is important to consider the many other variables that impact ATS. The role of the social neighborhood environment has the potential to influence safety perceptions, which could contribute to alleviating a major concern with regard to ATS. Future research, programming, and policy efforts should take this into consideration.

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APPENDIX A

PARENT SURVEY OF SCHOOL TRAVEL BEHAVIORS

Parent Survey of School Travel Behaviors

Dear Parent or Guardian,

Your child's school wants to learn your thoughts about children grades 3 -8 walking and biking to school. This survey will take about 10 minutes to complete. We ask that each family complete only one survey per school your children attend. If you have more than one child attending the same school, please fill out the survey for the child with the next birthday from today's date.

Your responses will be kept confidential and neither your name nor your child's name will be associated with any results. After completing this survey, you will have a chance to enter a random raffle for a $25 gift card. If you would like to enter the raffle, please provide us with an email address. We will contact you only if you win the gift card.

Thank you for participating in this survey!

Please tell us:

1a. What is your child's age? ______ Years

1b. What is your child's birthday? ______ Month ______ Day

1c. What is the grade of the child who brought home this survey? ______ Grade

2. What is your child's gender? *(Please ☑ ONE)* ❐ Male ❐ Female

3a. What is your child's height? ______ Feet ______ Inches

3b. What is your child's weight? ______ Pounds

4. How many children do you have in Kindergarten through 8th grade? ______ Children

5. What is the street intersection nearest your home? (Provide the name of two intersecting streets)

____

6. What is the name of your child's school? ______________________________

7. Does your district provide a bus for your student?
❐ Yes
❐ No
❐ I don't know

8. Do you have a car available to drive your child to school?
❐ Yes
❐ No

9. In a typical week, on how many days is your child physically active fro a total of at least 60 minutes per day? (Please circle one)

0 1 2 3 4 5 6 7

In an average school week, how many days does your child use the following modes of transportation to get to and from school? (e.g. if your child rides the bus to and from school every day, you would circle a 5 next to "go by car or bus" in both columns)

9a. Days per week **TO** school:

a. Walk	0 1 2 3 4 5
b. Bicycle	0 1 2 3 4 5
c. Go by bus	0 1 2 3 4 5
d. Go by car or other vehicle	0 1 2 3 4 5

9b. Days per week **FROM** school:

a. Walk	0 1 2 3 4 5
b. Bicycle	0 1 2 3 4 5
c. Go by bus	0 1 2 3 4 5
d. Go by car or other vehicle	0 1 2 3 4 5

10. How far does your child live from school? *(Please ☑ ONE)*

❒ Less than ¼ mile
❒ ¼ - ½ mile
❒ ½ - 1 mile
❒ ❒ 1 – 2 miles
❒ ❒ More than 2 miles
❒ ❒ Don't know

11. How long does it normally take your child to get to/from school? *(Please ☑ ONE)*

❒ Less than 5 minutes
❒ 5 – 10 minutes
❒ 11 – 20 minutes
❒ ❒ More than 20 minutes
❒ ❒ Don't know/Not sure

12. What is the furthest distance that you would feel comfortable for your child to <u>walk</u> to school? *(Please ☑ ONE)*

❒ Less than ¼ mile
❒ ¼ - ½ mile
❒ ½ - 1 mile
❒ 1 – 2 miles
❒ More than 2 miles
❒ Don't know

13. What is the furthest distance that you would feel comfortable for your child to <u>bike</u> to school? *(Please ☑ ONE)*

❒ Less than ¼ mile
❒ ¼ - ½ mile
❒ ½ - 1 mile
❒ 1 – 2 miles
❒ More than 2 miles
❒ Don't know

14. Has your child asked you for permission to walk or bike to/from school in the last year? ❒ Yes ❒ No

15. At what grade would you allow your child to walk or bike to/from school without an adult?

______ Grade (or) ❒ I would not feel comfortable at any grade.

16.	Please indicate your level of agreement with the following statements. *(Please **circle** a response for each statement below)*						
	Strongly Disagree			Neutral			Strongly Agree
a.	Other kids my child's age walk or bike to school by themselves	1	2	3	4	5	6	7
b.	Other kids my child's age walk or bike to school with a parent or other adult	1	2	3	4	5	6	7
c.	My child enjoys walking or biking to school	1	2	3	4	5	6	7
d.	My child enjoys walking or biking to school with friends	1	2	3	4	5	6	7
e.	My child enjoys walking or biking to school with a parent or other adult	1	2	3	4	5	6	7
f.	My child's school encourages walking and biking to/from school	1	2	3	4	5	6	7
g.	My child has fun walking or biking to/from school	1	2	3	4	5	6	7
h.	It is healthy for my child to walk or bike to/from school	1	2	3	4	5	6	7

17.	Please indicate your level of agreement with the following statements. *(Please **circle** a response for each statement below)*							
	It is difficult for my child to walk or bike to school (alone or with someone) because…	Strongly Disagree			Neutral			Strongly Agree
a.	There are no sidewalks or bike lanes	1	2	3	4	5	6	7
b.	There is one or more dangerous crossings	1	2	3	4	5	6	7
c.	The route does not have good lighting	1	2	3	4	5	6	7
d.	There is too much traffic along the route	1	2	3	4	5	6	7
e.	The traffic speeds are too high along the route	1	2	3	4	5	6	7
f.	It is too far	1	2	3	4	5	6	7
g.	There is not enough time	1	2	3	4	5	6	7
h.	The weather makes walking or biking difficult	1	2	3	4	5	6	7
i.	There are no other children to walk or bike with	1	2	3	4	5	6	7
j.	There are no other adults to walk or bike with	1	2	3	4	5	6	7
k.	There are no crossing guards	1	2	3	4	5	6	7
l.	It is easier for my child to take the bus to school	1	2	3	4	5	6	7
m.	It is easier for me to drive my child to school	1	2	3	4	5	6	7
n.	There are unsafe animals along the way	1	2	3	4	5	6	7
o.	It is unsafe because of crime (strangers, gangs, drugs)	1	2	3	4	5	6	7
p.	My child gets bullied, teased, harassed	1	2	3	4	5	6	7
q.	There is nowhere to leave a bike safely	1	2	3	4	5	6	7

APPENDIX B

IRB Approval

EXEMPTION GRANTED

Allison Ross
Community Resources and Development, School of
-
Allison.Poulos@asu.edu

Dear Allison Ross:

On 10/24/2013 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Active transportation to school: Influences from a parent's perspective.
Investigator:	Allison Ross
IRB ID:	STUDY00000191
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Consent for Survey, Category: Consent Form; • IRB Protocol (Ross), Category: IRB Protocol; • Questionnaire (Ross), Category: Measures (Survey questions/Interview questions /interview guides/focus group questions); • IRB (Ross), Category: Other (to reflect anything not captured above); • Recruitment Letter (Ross), Category: Recruitment Materials;

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 10/24/2013.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,