# Associations of active transportation between childhood and adulthood (CADET)

by

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# Abstract

Insufficient physical activity (PA) is a growing issue throughout the world. Diabetes, chronic heart disease, and shortened life expectancy are among the comorbidities resulting from insufficient PA. Studies on the development of PA behaviors have highlighted parental and environmental influences as contributors that persist across the lifespan. Active transportation (AT) is one possible avenue for PA promotion. AT is any movement from place to place without the use of a motor for occupational, utilitarian and recreational trips. The purpose of this study was to examine factors of AT development across the lifespan, including parental influence variables, which included parental support and role-modeling for AT and neighborhood environment quality associations with child AT, as well as the associations between child AT and adult AT. Positive associations were hypothesized between the following variables: parental support and child AT, parental role-modeling and child AT, child neighborhood environment and child AT, as well as child AT and adult AT.

The cross-sectional survey was completed by participants (n = 98, predominately college-educated (93%), young (avg: 26±9.9 years), white (84%), females (72%) by providing recall data on their childhood (<18 years) AT behaviors, frequencies and destinations, as well as parental and environmental influences on AT. Respondents reported their current AT behaviors, frequencies and destinations, their current moderate-to-vigorous PA, and demographic information.

The association between parental influence and child biking was significant (OR = 0.13, P = 0.02, 95% C.I. = 0.02, 0.75), as well as the associations between child walking and adult walking (OR = 17.61, p = 0.01, 95% C.I. = 2.01, 154.05) child biking and adult biking (OR = 11.75, p = 0.001, 95% C.I. = 2.38, 58.07), and child public transportation and adult

transportation (OR = 6.92, p = 0.01, 95% C.I. = 1.79, 26.82). Findings suggested a more complex relationship between parental support behaviors and child AT than initially hypothesized and supported the hypothesized association between child AT and adult AT. The association of child AT behavior with adult AT behavior in specific AT sub-modes (walking, biking and public transportation) were supported.

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# Dedication

“A root cause of poverty in the sciences is presumptuous wealth.

Science's purpose is not to invoke infinite wisdom, but to curb unending folly.”

- Bertolt Brecht, *Life of Galileo*

# Chapter 1 - Introduction

Insufficient PA is a central health concern among adults and children. PA is any muscular movement that consumes energy (World Health Organization (WHO), n.d.). The United States Department for Health and Human Services have issued weekly PA guidelines for Americans, recommending either 150 minutes of moderate or 75 minutes of vigorous exercise, as well as at least two bouts of full-body muscle strengthening exercises per week (US Department of Health and Human Services, 2018). Insufficient PA has been identified as a contributing factor to the risk of excessive adiposity, chronic disease and mortality (World Health Organization (WHO), n.d.). In 2018, the World Health Organization estimated that ~25% of adults and ~80% of children are insufficiently physically active (World Health Organization, 2018).

One PA promotion strategy PA is active transportation (AT) in childhood. AT is movement from place to place without assistance from a motor, for example walking, biking, skating, or using public transport (Sallis, Frank, Saelens, & Kraft, 2004; Mueller, et al., 2015). AT may facilitate population-wide increases in low effort, high volume PA on a daily basis (Sallis, Frank, Saelens, & Kraft, 2004; Ekkekakis, Parfitt, & Petruzzello, 2011). AT may be subject to behavior tracking over time similarly to PA - that is the continuity of behaviors from childhood to adulthood (Carver A. , et al., 2011; Yang, et al., 2014). PA tracking across the lifetime has been supported in the literature (Yang, et al., 2014; Malina, 2001; Kremers & Brug, 2008; Trudeau, Laurencelle, & Stephard, 2004; Verplanken, 2006; Verplanken & Melkevik, 2008). Literature for PA and AT tracking across the lifespan suggest factors that increase the likelihood of continued PA from childhood to adulthood. Behavior development literature considers behavior frequency, familial and environmental influences as important during the

childhood development of behavior as they may later serve as the building blocks of behavior maintenance.

To guide the understanding of AT behavior development across the lifespan the Lifelong Physical Activity Model (LM) was utilized (Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018). The LM organizes skill development into connected developmental stages from simple to complex, and along a developmental timeline from infant to adult (Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018). The purpose of the LM is to incorporate behavioral approaches such as self-efficacy (i.e., one's confidence in one's ability to successfully complete a task) into a model of motor skill development (Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018). To incorporate thoughts about the role of parents into the model the addition of a "parental influence" factor was proposed. This parental influence is associated with fundamental movement skills, such as walking, running and biking during childhood.

Both parental influences and the neighborhood environment, represented by *geographical influences* in LM, may affect children's AT behavior (Panter, Jones, & van Sluijs, 2008; Giles-Corti, Kelty, Zubrick, & Villanueva, 2009; van Kann, Kremers, de Vries, de Vries, & Jansen, 2016). Parental influence may increase child PA, including AT, by improving children's self-efficacy for PA through verbal encouragement (Wing, 2015). Similarly, parent's self-efficacy to support their child for PA as well as interactions between parents and children, which include role-modeling, are associated with child PA, and apply to subsets of PA such as AT (Zerger, Normand, Boga, & Patel, 2016; Adkins, Sherwood, Story, & Davis, 2004). Role-modeling and parental influence for PA may also increase competence (i.e., feeling empowered and capable to complete a behavior) a construct from Self-Determination Theory, as well as PA behavior itself, applying to AT in the form of increased usage (Welk G. , 1999; Welk, Wood, & Morss, 2003;

van Kann, Kremers, de Vries, de Vries, & Jansen, 2016). Studies involving parental influence variables have been focused on generalized PA. Investigations of parental influence roles for types of PA such as AT are needed. Among literature on the role of the neighborhood environment of AT, there is evidence that perceptions of safety and risk of AT are relevant to both parents' and children's behaviors (Fulton, Shisler, Yore, & Caspersen, 2005; Kerr, et al., 2006; Côté-Lussier, Mathieu, & Barnett, 2015; Giles-Corti, Kelty, Zubrick, & Villanueva, 2009; Carver A. , Timperio, Hesketh, & Crawford, 2010; Gordon-Larsen, Nelson, & Beam, 2005). Parental perceptions of the neighborhood environment for safety from traffic and risk of injury may limit their willingness to allow children to use AT (Carver A. , Timperio, Hesketh, & Crawford, 2010; Côté-Lussier, Mathieu, & Barnett, 2015; Kerr, et al., 2006). Similarly, children may make their own decisions about AT safety and risk independent of their parents (van Loon, Frank, Nettlefold, & Naylor, 2014; Gordon-Larsen, Nelson, & Beam, 2005; Fulton, Shisler, Yore, & Caspersen, 2005; Forman, et al., 2008).

PA and AT behaviors are developed through practice and parental influence, highlighting the importance of childhood behaviors for their retention through adulthood (Anderssen, et al., 1996; Blair, et al., 1991; Malina, 2001; Telama, et al., 2005; Trudeau, Laurencelle, & Stephard, 2004; Wright, Wilson, & Evans, 2010). The persistence of AT behaviors across the lifespan has been accepted in the literature, and gives reason to investigations that seek to improve childhood AT behavior frequencies and outcomes due to the long-term health benefits of engaging in any form of PA (Anderssen, et al., 1996; Malina, 2001; Carver A. , et al., 2011; Itoh, et al., 2017). In the development of lifelong AT behaviors, questions remain about the role of parents and of the neighborhood environments on children's AT behavior, and the relationship between child and

adult AT. The purpose of this study was to investigate factors for AT development during childhood and adulthood.

**Research Questions**

Our study utilized the LM to investigate AT development within the context of parental and neighborhood influences over time. To this end, we asked the following research questions:

1. Is parental influence associated with child AT?
2. Is parental role-modeling of AT associated with child AT?
3. Is the child neighborhood environment for PA associated with child AT?
4. Is child AT associated with adult AT?

**Hypotheses**

We formulated hypothesis statements based on findings from the literature. To answer research question one, we drew from the literature exploring the connection between parental influence variables and child AT (Gustafson & Rhodes, 2006; Wright, Wilson, & Evans, 2010; Zerger, Normand, Boga, & Patel, 2016; Wing, 2015) and hypothesized that parental influence would be positively associated with child AT behaviors. For research question two, we were interested in testing the association between parental role-modeling of AT and child AT (Welk, Wood, & Morss, 2003; Welk G. , 1999; van Kann, Kremers, de Vries, de Vries, & Jansen, 2016) and hypothesized that parental role-modeling of AT would be positively associated with child AT behaviors. Extensive findings on the relationship between the neighborhood environment and AT led us to hypothesize that a child neighborhood environment supportive of PA would be positively associated with child AT (Côté-Lussier, Mathieu, & Barnett, 2015; Forman, et al., 2008; Fulton, Shisler, Yore, & Caspersen, 2005; Jones & Sliwa, 2016; Giles-Corti, Kelty,

Zubrick, & Villanueva, 2009; Gordon-Larsen, Nelson, & Beam, 2005; Kerr, et al., 2006; Mertens, et al., 2016; Panter, Jones, & van Sluijs, 2008; van Loon, Frank, Nettlefold, & Naylor, 2014). For research question four we drew from the body of literature concerned with PA and AT tracking across the lifespan and hypothesized that child AT would be positively associated with adult AT (Carver A. , et al., 2011; Malina, 2001; Telama, 2009; Telama, et al., 2005; Trudeau, Laurencelle, & Stephard, 2004; Yang, et al., 2014).

# Chapter 2 - Literature Review

Physical inactivity in children is a public health issue, with up to 80% of children not meeting PA guidelines (US Department of Health and Human Services, 2010). Rising rates of childhood and adult obesity indicate a growing need for the promotion of PA across the lifespan identified in Healthy People 2020 (US Department of Health and Human Services, 2010). Obesity is associated with co-morbidities, such as cardio-vascular disease, diabetes, and heart failure, all of which lead to increased utilization of financial and medical resources that strain both individuals and community health providers (Long, Reed, & Lehman, 2006).

## Active Transportation

AT is a mode of PA that unites equitable access, general appeal and low physical effort by encompassing behaviors that people are already doing throughout their days. AT can be defined as the movement from place to place without help from a motor, such as by walking, biking, skating or public transportation (Mueller, et al., 2015; Sallis, Frank, Saelens, & Kraft, 2004). AT encompasses both utilitarian and recreational uses, i.e. to use non-motorized transportation on the way to work and on the way to the gym. AT has the potential to increase the ambient levels of PA of many people by converting existing short-distance trips made by car to AT trips (Maibach, Steg, & Anable, 2009; Scheepers, et al., 2014). Currently, only ~1-3% of adults bike to work (McKenzie, 2014; Whitfield, Paul, & Wendel, 2016) and <20% of children use AT for their school commute (Jones & Sliwa, 2016).

### *Parental Influence on Active Transportation*

Parental influence on AT has been previously studied. Parents influence child behavior both by allowing and forbidding AT based on their perceptions of risk and safety (Adkins, Sherwood, Story, & Davis, 2004; Alderman, Denham-Deal, & Jenkins, 2010; Carver A. ,

Timperio, Hesketh, & Crawford, 2010; Côté-Lussier, Mathieu, & Barnett, 2015; Gustafson & Rhodes, 2006; Sallis, et al., 1992; Welk, Wood, & Morss, 2003; Welk G. , 1999). Parental influence also encompasses support behaviors, such as social support, verbal encouragement, instrumental support and role-modeling of AT (Wing, 2015; Zerger, Normand, Boga, & Patel, 2016). Social support encompasses behaviors that help children overcome barriers for AT behavior and recover from setbacks and challenges to AT (Prochaska, Rodgers, & Sallis, 2002). Verbal encouragement takes the form of parents giving children advice and positive feedback for AT behaviors (Quirk, Blake, Dee, & Glazebrook, 2014; Ortega, Ruiz, & Sjostrom, 2007; Beets, Vogel, Chapman, Pitetti, & Cardinal, 2007). Instrumental support includes providing adequate equipment and logistic support to the child so they can engage in AT (e.g., buying a bicycle, scheduling activities in such a way that non-motorized transport is an attractive choice) (Hohepa, Scragg, Schofield, Kolt, & Schaaf, 2007). Role-modeling of AT can occur both in the presence of children, such as on family walks or rides, and also in the absence of children (e.g., a parent regularly riding their bike to work). Parental influence may be associated with children's self-efficacy, increasing children's beliefs in their ability to engage in AT (Wing, 2015).

Competence, a Self-Determination Theory psychosocial need, has been associated with child AT (Welk G. , 1999; van Kann, Kremers, de Vries, de Vries, & Jansen, 2016; Ryan & Deci, 2000). Competence encompasses practice-related confidence (i.e., proficiency in a behavior derived from knowing and understanding the behavior innately). Self-Determination Theory organizes behavior acquisition around the individual's development from external regulation to internal regulation by way of three psychosocial needs: competence, relatedness and autonomy (Ryan & Deci, 2000). Regulation and motivation are seen as the reasons to engage in a behavior, while the psychosocial needs are behavior-specific properties of the individual (Ryan & Deci, 2000).

Relatedness can be described as the perceived acceptability and relevance of the behavior to the individual, influenced by their social environment, while autonomy can be described as perceived control over behavioral choice (Ryan & Deci, 2000).

***Environmental Influence on Active Transportation***

Previous studies have highlighted the potential of environmental interventions to influence AT (Mertens, et al., 2016; Scheepers, et al., 2014; Holt, et al., 2009; Eichinger, Titze, Haditsch, Dorner, & Stronegger, 2015; Lau, 2012; Sarmiento, et al., 2010; Quirk, Blake, Dee, & Glazebrook, 2014), but little is known about individual influences and perceptions of AT that are associated with establishing childhood PA behaviors (Telama, 2009). Studies on environmental interventions have investigated both real-world changes and the potential of changes to population-level perceptions of environment properties (e.g., safety from traffic, risk of injury, relative utility of AT compared to motorized transport) (Broberg, Salminen, & Kyttä, 2013; Cervero, Denman, & Jin, 2018; Forman, et al., 2008; Ghekiere, et al., 2014; Gunn, Lee, Geelhoed, Shiell, & Giles-Corti, 2014). Combinations of the two – coupling real world changes with perceptual changes – are an additional, innovative program type. One of these intersecting programs is *Open Streets*. In a review of Open Streets – best described as temporary built environment interventions that provide recreational space to inner-city residents - researchers surveyed 38 programs from 11 countries and found wide-ranging benefits of programs across geographies and cultures (Sarmiento, et al., 2010). Alongside providing recreational space, Open Streets are experientially meaningful as they showcase AT in environments usually dominated by motorized transport. The need for individually-relevant messaging, highly accessible and inclusive activities in the promotion of AT on the population level were underlined in the discussion of the programs (Sarmiento, et al., 2010). Insights about event promotion and

messaging from Open Streets programs, as well as their near universal appeal and cross-cultural acceptance underline the potential for built environment interventions for childhood AT promotion.

In other instances, researchers utilized survey data to study the role and cost-effectiveness of building sidewalks to improve AT and health (Gunn, Lee, Geelhoed, Shiell, & Giles-Corti, 2014). Their findings support the important role of the neighborhood environment for AT decision making and the cost-effectiveness of sidewalks for urban environments with sufficient residential density, short distances between residential neighborhoods and points of interest. Research has also highlighted the diversity of environmental properties associated with transport decisions, pointing to complex decision-making processes based on a variety of factors that vary from individual to individual (Cervero, Denman, & Jin, 2018).

### *Implications for Research*

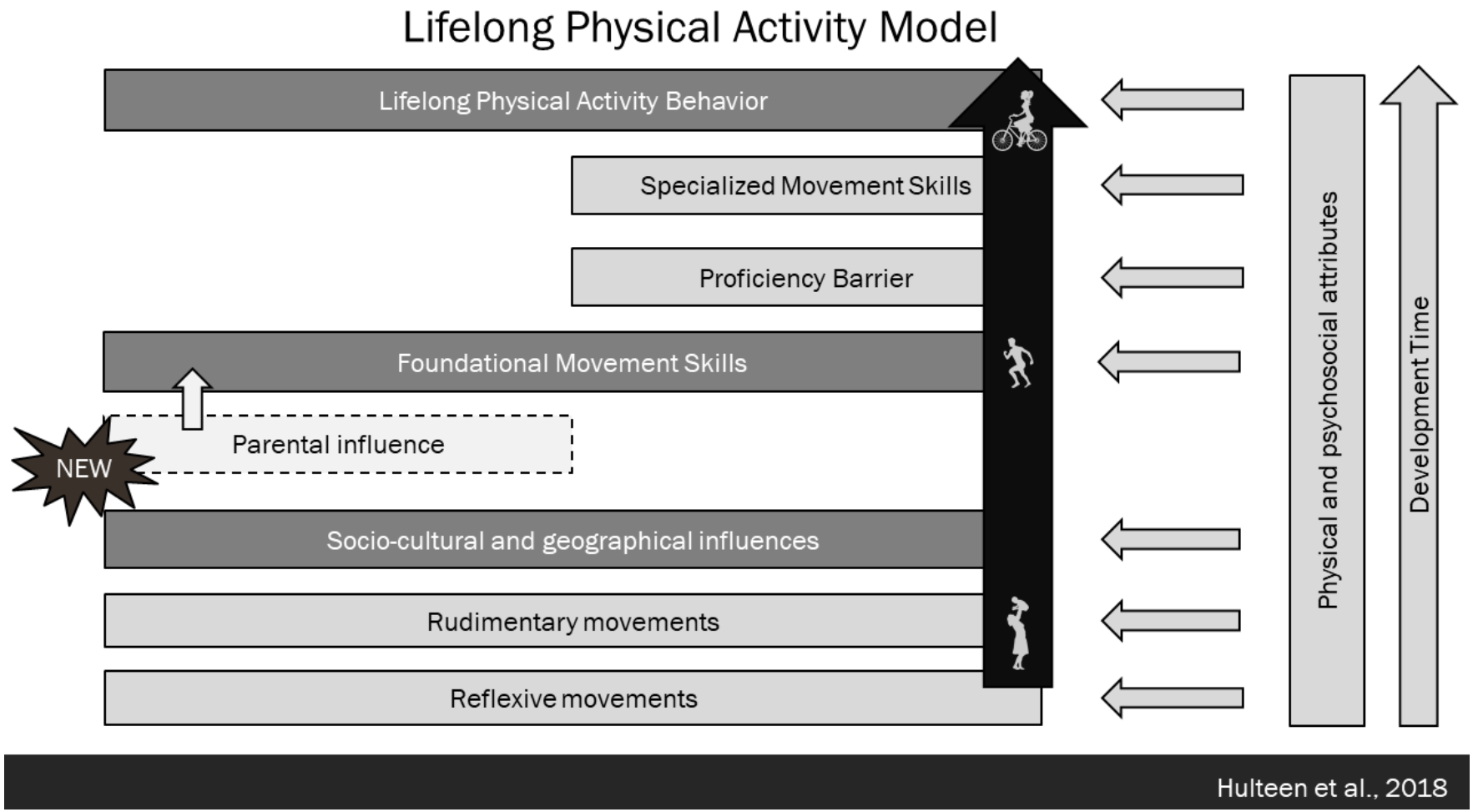
Both parental and environmental influences may be associated with the development of lifelong AT behaviors (Malina, 2001; Gordon-Larsen, Nelson, & Beam, 2005; Telama, 2009). Insights from behavioral literature point to a possible relationship between AT occurrence and AT tracking from childhood to adulthood (Kremers & Brug, 2008; Verplanken, 2006; Verplanken & Melkevik, 2008). Existing knowledge on the factors in child AT behavior development calls for a closer investigation of the association between the familial and environmental AT behavior influences.

## Lifelong Physical Activity Model (LM)

LM is a conceptual behavioral framework (Figure 1) designed to bridge the gap between insights from behavioral research and public health practice (Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018). Within the LM, PA behaviors are divided into four levels of skill: reflexive,

rudimentary, foundational and specialized, arranged in order of complexity and developmental stage across the lifespan (Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018). Childhood behaviors that successfully develop persist into adulthood as lifelong PA behaviors. At all developmental stages, skill-building processes are influenced by physical and psychosocial attributes, such as self-efficacy (Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018). The model also includes socio-cultural and geographic influences, e.g., the neighborhood environment as a possible contributor to development (Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018). In addition to neighborhood influences, we proposed the addition of parental influences to LM. Parental influences included social, verbal and instrumental support, as well as role-modeling. An example of social support could be having parents that emotionally support choices around AT, while an example of verbal support could take the form of encouragement to use AT for daily trips or praise for using AT. Instrumental support could include purchasing of equipment and gear needed to use AT (e.g. shoes, a bicycle, a skateboard, or a bus pass) and role-modeling could consist of doing AT regularly, both with the child and without them.

**Figure 1: Lifelong Physical Activity Model**




LM provides a framework for charting behaviors that persist across the lifespan (Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018).

## Tracking of Physical Activity Across the Lifespan

Childhood habits for AT may influence long-term adherence (Malina, 2001; Verplanken & Melkevik, 2008; Verplanken, 2006; Telama, 2009; Kremers & Brug, 2008). 'Habits' are understood as the result of behavioral conditioning to respond to environmental and social cues, and might originate from parents or the environment (Verplanken, 2006). Sedentary behavior habits are a barrier to the adoption of AT in children (Verplanken & Melkevik, 2008). The literature suggests that exposure to beneficial characteristics for AT in childhood may lead to increased AT behavior in childhood, and greater likelihood of engaging in AT later in life (Alderman, Denham-Deal, & Jenkins, 2010; Anderssen, et al., 1996; Itoh, et al., 2017; Kremers & Brug, 2008). Different research designs can be used to collect data with regard to long-term AT adherence and can include prospective cohorts, that use recall measures in incremental intervals and direct assessment, as well as cross-sectional recall studies that survey a sample only once (Malina, 2001)

### *Physical Activity Tracking in Prospective Cohorts*

Telama et al. (2005) conducted secondary data analysis on yearly recall data from cardiovascular risk assessments of young individuals (ages 3 to 28). Questions for PA were administered alongside a medical exam and covered the frequency and intensity of leisure-time physical activity (LTPA). Similar to research by Anderssen et al. (1996), moderate and vigorous LTPA were used to identify individuals adherent to PA over the course of the study period (Telama, et al., 2005). Results suggest an association between individual experiences and PA adherence, pointing towards a low to moderate (for males) and low (for females) correlation between youth PA and adult PA (Telama, et al., 2005). Researchers note that the type of sport or activity in which participants took part during youth did not play as important of a role as

hypothesized; instead, continued participation in any type of PA over several years was associated with adult PA participation (Telama, et al., 2005). These findings suggest a relationship between behavior frequency and long-term adherence to PA which warrants investigation in sub-modes of PA, such as AT. Uses for secondary population-level data can also include census tracts level analysis of environmental properties with corresponding PA/AT levels.

As mentioned, Anderssen et al. (1996) studied the influence of race and gender on PA tracking in a similar multi-year prospective study using recall data over a 7-year period with primary data collection (Anderssen, et al., 1996). Respondents recalled participation in moderate and vigorous intensity PA (Anderssen, et al., 1996). Between racial groups, Black men saw the largest decrease in PA measured by exercise minutes over the 7-year study period, followed by white men, black women and finally white women (Anderssen, et al., 1996). Interesting to note here is that attrition occurred unequally among study populations, with individuals who were younger or had lower educational attainment less likely to return for another response year (Anderssen, et al., 1996). Selective attrition suggests that extraneous factors may influence the acquisition and maintenance of PA behaviors. Men reported more PA than women at all points, suggesting the presence of a PA gender gap. Black men had the highest PA levels, while black women had the lowest PA levels (Anderssen, et al., 1996). The study investigated the presence of PA tracking across the lifespan, but did not collect data on the contexts in which PA occurs, or possible influences or differences associated with the incidence of PA in a population and age group. Differences in PA levels over time were proposed to be associated with secular and popular changes in PA behavior between the beginning and end of the 21-year- study period.

A third prospective cohort study enrolled two groups of children, one cohort aged 5-6 years and the second aged 11-12 years, and collected information at baseline, and at follow-up after 3 and 5 years (Carver A. , et al., 2011). Unlike the previous two studies, researchers utilized accelerometers to study moderate to vigorous PA (MVPA) via direct measurement (Carver A. , et al., 2011). Results show that MVPA tracked moderately in the younger cohort, and not at all in the older cohort (Carver A. , et al., 2011). AT was not associated with MVPA for the young cohort but was associated with older boys' MVPA at all measurement points, and with older girls' MVPA at the 5-year follow-up (Carver A. , et al., 2011). Researchers recommend the promotion of AT behavior as a means to increase MVPA during childhood. Applying these findings to AT research offers the following insights: behavior frequency and skill may play a role in adherence to AT over time; social and geographic influence may change AT competence; and both frequency of child AT behavior and social-geographic influence may have long-term effects on AT adherence.

### *Physical Activity Tracking in Cross-Sectional Recall of the Distant Past*

While prospective cohorts have proven useful in investigating influences on individual behavior, they are time-consuming and costly. Cross-sectional recall measures attempt to address these concerns is by consolidating data collection into a single time-point and asking respondents to recall across long periods of time. In a 2017 study of PA recall, researchers investigated the relationship between leisure-time PA during adolescence and adulthood (Itoh, et al., 2017). Researchers surveyed staff members from different industrial sectors in the Tokai region of Japan (Itoh, et al., 2017). Respondents answered questions about LTPA during childhood and recalled the intensity at which LTPA typically occurred, as well as current LTPA in adulthood

(Itoh, et al., 2017). Respondents recalled activity at ages twelve and twenty years to study the tracking of PA from prepubescent to late adolescence, and to adult PA levels measured relative to Japanese national physical activity guidelines, which consist of 60 minutes of moderate to vigorous physical activity per day (Itoh, et al., 2017). Results suggest that participation in strenuous PA at age twelve was associated with a greater likelihood of being regularly physically active at vigorous intensity during adulthood in males (Itoh, et al., 2017). At age twenty, both moderate and vigorous intensity PA were associated with a greater likelihood of reporting similar LTPA intensities in males and females during adulthood (Itoh, et al., 2017). Researchers suggested an association between childhood activity and adult LTPA based on the development of habits for PA and the tracking of PA across the lifespan (Itoh, et al., 2017). The study is notable in that the recall protocol was used to recall over a long period of time (up >40 years).

**Gaps in the Literature**

The overview of literature provided above presents a strong case for a possible relationship between child and adult AT behaviors, and the need to investigate this relationship further. Of special interest are the role of parental influences on child AT behavior in the context of child and adult PA, the role of the neighborhood environment for AT behavior during childhood, and supporting the association between child AT and adult AT. The investigation of parental and environmental influences on child AT behavior, as well as the relationship between child and adult behavior serves as an extension of the existing body of knowledge, and as analysis of proposed relationships from the literature.

# Chapter 3 - Method

## Data Collection and Participants

Data were collected in spring 2020 via a cross-sectional recall and self-report survey administered via Qualtrics, an online survey tool. Participants 18 to 65 years old were recruited from social media, email and snowball-sampling techniques. Participants were recruited in the study and consented to participate when they clicked to continue on the survey landing page and were excluded only if they did not complete the survey or completed less than 10% of the questions. The survey can be found in Appendix A. Snowball-sampling occurred through project partners with social and professional connections to bicycle advocacy and action groups in the US (e.g. BikeWalkMHK, bike shops, health departments, academics, etc.). Emails asked participants to aid snowball sampling by forwarding the email on to others who may be interested. Kansas State University Institutional Review Board reviewed and approved all study procedures.

Respondents viewed promotional materials or heard about the study purpose prior to visiting the survey landing page. An example promotional image can be viewed in Appendix B. Promotional images were designed to convey basic information about study purpose, target audience and survey length. Promotional images included a uniform resource locator (URL) and contact information. The survey landing page offered similar information on survey content, expected risks and benefits and anticipated duration of the survey in greater detail. The survey was available for 4 weeks in Spring 2020. Participants were not incentivized to participate.

## Measures

Respondents answered questions regarding their childhood AT behavior and recalled parental influences as well as their childhood neighborhood environment. Participants also

reported current AT behavior, PA, height, weight, and demographic information, which included gender, marital status, number of children in household, ethnicity, race, level of education, household income and age. To prompt recall to childhood, participants read the following context prompt: "Thinking about the time and place that had the most influence on your understanding of AT behavior as a child: […]". The context prompt mimicked practices from epidemiological research and served to lend detail to participants' recall (Friedenreich, 1994).

### *Childhood Active Transportation Recall and Adult Active Transportation Survey*

AT questions were asked both as childhood recall and as adult self-report measures. Questions were created for this survey and reviewed by both expert and lay reviewers for face and content validity. Participants were presented with the context prompt, after which they indicated the AT modes in which they regularly participated. Answer options included walking, bicycling, skating and public transportation. Participants were able to check all that applied. Following their selection, participants indicated how many days per week they typically used each mode of AT as well as their most common destinations during childhood (e.g., home, school, playground). The questions were repeated for the adult self-report measure without the recall prompts, now asking respondents about their current AT behaviors, frequencies and most common destinations during a typical week.

### *Parental Influence*

Parental influence was captured via recall. Respondents were asked key questions about their parents' PA support behaviors during childhood. These included recall of parents discussing the benefits of PA, providing verbal encouragement, inquiring about prevalence of PA in the respondent's social network, discussing the health risks of not participating in PA, engaging in role-modeling behavior for AT, and providing access to AT through equipment

(such as a bicycle, tennis shoes, a skateboard, etc.). Respondents answered multiple choice questions indicating if they had, had not, or were not sure if they had experienced their parents engaging in these behaviors. Participants responses were capture as no (0), yes (1) or don't know/unsure (2). Parental influence questions were derived from suggested parental influences from the literature, and split into parental support and parental role-modeling questions (Quirk, Blake, Dee, & Glazebrook, 2014; Wright, Wilson, & Evans, 2010; Hohepa, Scragg, Schofield, Kolt, & Schaaf, 2007; Beets, Vogel, Chapman, Pitetti, & Cardinal, 2007; Tucker, Van Zandvoort, Burke, & Irwin, 2011; Garriguet, Colley, & Bushnik, 2017).

***Childhood Physical Activity Neighborhood Environment Survey Recall***

Childhood neighborhood environment properties were assessed using a modified version of the Physical Activity Neighborhood Environment Survey (PANES) (Sallis, et al., 2010; Sallis, et al., 2009). PANES uses seven self-report environmental characteristics answered by residents to evaluate perceived neighborhood quality for PA: presence of single-family homes, proximity of shops to the home, presence of transit stops near the home, presence of sidewalks, perceived infrastructure for bicycling, availability of public recreational amenities and safety from crime. Questions asking about the main type of housing in the neighborhood, number of household motor vehicles, presence of four-way intersections in the neighborhood, sidewalk maintenance in the neighborhood, and bicycle infrastructure maintenance in neighborhood were excluded. Responses to PANES were captured on a five-point-scale: respondents rated their agreement with statements regarding their childhood neighborhood, indicating agreement between "strongly disagree" (1) and "strongly agree" (4), or don't know/unsure (5). For PANES scoring, participant responses between 1 and 4 were averaged. Greater PANES scores indicate a neighborhood environment more supportive of PA. To translate qualitative difference in neighborhood

supportiveness, groups were created. PANES scores below 2 were coded as low PA friendly environments (1), scores between $2 - 2.\overline{9}$ were coded as moderately PA friendly environments (2), scores of $3 - 3.4\overline{9}$ were coded as highly PA friendly environments (3), and scores 3.5 or greater were coded as very highly PA friendly environments (4). Table 1 provides a scoring table. After initial analyses, the decision was made to add a 'very high' category to add greater detail to environmental quality distinction.

**Table 1: PANES Scoring Table**

| **PANES Score** | **Environment PA friendliness** |
|---|---|
| $1 - 1.\overline{9}$ | Low |
| $2 - 2.\overline{9}$ | Moderate |
| $3 - 3.4\overline{9}$ | High |
| $3.5 - 4$ | Very High |

***International Physical Activity Questionnaire – Short Form (IPAQ-SF)***

The IPAQ-SF was used to assess weekly minutes of vigorous, moderate and walking PA (Lee, Macfarlane, Lam, & Stewart, 2011). We assessed adult PA using IPAQ-SF because of ease of use and previous validation (Lee, Macfarlane, Lam, & Stewart, 2011). Data from IPAQ-SF were used to calculate weekly PA minutes and determine participants' adherence to national PA guidelines for aerobic PA (US Department of Health and Human Services, 2018) which consist of 150 minutes of moderate or 75 minutes of vigorous PA per week. MVPA was calculated via IPAQ. Values were calculated and truncated using the following criteria: daily vigorous, moderate or walking activity were recoded as 180 minutes if the individual reported >180

minutes so as not to exceed the maximum of 21 hours per activity (Lee, Macfarlane, Lam, & Stewart, 2011).

### *Demographics*

Demographic questions were derived from US census questions (US Census Bureau, 2020). Questions included information about gender, relationship status, number of children, ethnicity, race, educational attainment, household income, age, height and weight. For analyses, only gender was utilized as a control variable. We selected gender as a control variable due suggestions from a recall based study of PA (Azevedo, Araújo, da Silva, & Hallal, 2007). Height was reported in feet (‘) and inches (“), which were converted to meters (m). Weight was reported in pounds (lbs.) and ounces (oz), which were converted to kilograms (kg). BMI values were calculated for each individual by dividing the body weight (in kg) by the squared height (m^2) of the participant.

## Analyses

Descriptive statistics encompassed mean and standard deviation for age, height, weight, MVPA and BMI, as well as percentages for gender, educational levels and race. The AT use statistics included AT participation by age, mean days of AT per week, and most common destinations using AT by age. Mean days of AT were calculated, with values representing averages for the entire sample. Respondents’ results from the IPAQ-SF were used to determine whether or not they met PA guidelines for Americans (US Department of Health and Human Services, 2018).

Analyses for the four research questions consisted of binomial regression analyses. Gender was used as a control variable, with individuals without gender data available excluded from analyses. The first research question investigated the association between recalled parental

influence variables (all variables in the statistical model; yes/no) and overall child AT behavior (yes/no), controlling for gender (female/male). To answer the second research question, we investigated the association of recalled parental role-modeling (e.g. did parents role-model AT behaviors; yes/no) with overall child AT (yes/no), controlling for gender (female/male). Mode-specific analyses of AT were also conducted (walk, bike, skate, public transport). Research question three investigated the association between recalled child neighborhood environments measured via PANES (low, moderate, high and very high environment for PA) and mode-specific child AT (yes/no) using the low PA friendliness group in PANES as the references category for categorical comparisons within the binomial regression model. The fourth research question investigated the association between recalled child and adult AT, controlling for gender (female/male). Secondary analyses investigated the association between child AT and meeting PA guidelines as an adult (yes/no), as well as mode-specific analyses of child AT (walk, bike, skate, public transport) and its ability to predict mode-specific AT (walk, bike, skate, public transport) during adulthood. All analyses were performed using IBM SPSS 26 (Armonk, NY).

# Chapter 4 - Results

## Sample Characteristics

Respondent demographic information is shown in Table 2. Overall, 98 responses were included for analysis. We excluded participants who had completed<10% of survey questions. Of the 98 respondents, 61 (70.9%) were female, and 13 did not indicate their gender. The age distribution showed a mean age of 26 and a standard deviation (SD) of 8.9 years, with 16 respondents not volunteering age information. Very few respondents only reported high school education as their highest level of education (6.1%). The most common level of education was *Some College* with 28 (28.6%) responses, followed by *Graduate Degree* with 22 (22.4%) responses, and 12 individuals not selecting any education level. We collected responses from 8 Asian (9.4%), 6 (7.1%) Black/African American and 71 (83.5%) White volunteers, while 14 respondents did not indicate their race. Ten respondents reported Hispanic ethnicity. The average height was 1.7m (SD = 0.24m, n=82). Average weight was 69.9kg (SD = 14.2, n=83).kg Respondents reported an average of 464 (SD = 416, n=87) minutes of MVPA per week, with 96% meeting aerobic PA guidelines. Calculated BMI averaged 24.1 $kg/m^2$ (SD = 4.4, n= 82) with a range of 17.4 to 40. PANES scores averaged 2.93 (SD = 0.5, median = 3, n = 90). PANES groups were assigned after coding. Three respondents had lived in neighborhoods with low PA supportiveness (PANES <2), 40 had lived in neighborhoods with moderate PA supportiveness (PANES 2 to <3), 35 had lived in neighborhoods with high PA supportiveness (PANES 3 to <3.5) and 12 had lived in neighborhoods with very high PA supportiveness (PANES 3.5 to 4).

**Table 2: Participant Demographic Information**

| **Gender** | **n** | **%** | **M** | **SD** |
|---|---|---|---|---|
| Male | 24* | 28.2 | - | - |
| Female | 61* | 71.8 | - | - |
| Age | 82* | - | 26 | 8.9 |
| **Education** | | | | |
| High school graduate | 6* | 7.0 | - | - |
| Some college | 28* | 32.6 | - | - |
| 2-year degree | 12* | 14.0 | - | - |
| 4-year degree | 18* | 20.9 | - | - |
| Graduate degree | 22* | 25.6 | - | - |
| **Race** | | | | |
| Asian | 8* | 9.4 | - | - |
| Black/African American | 6* | 7.1 | - | - |
| White | 71* | 83.5 | - | - |
| **Descriptive Statistics** | | | | |
| Height (in m) | 82* | - | 1.7 | 0.24 |
| Weight (in kg) | 83* | - | 69.9 | 14.2 |
| MVPA/week (in min) | 87* | - | 464 | 416 |
| BMI | 82* | - | 24.1 | 4.4 |

*Note*: * = indicate *n* smaller than the total number of responses in the survey (survey n = 98). Missing response numbers are as follows: Gender = 13, age = 16, education = 12, race = 13, height = 16, weight = 15 missing, MVPA = 11 and BMI = 16.

Figure 2 shows the breakdown of responses to AT participation questions for both childhood recall and adult self-report. Overall, 98% of respondents recalled any AT during childhood and 89% of adults self-reported any AT. For walking, 88% of respondents recalled regularly walking for AT during childhood and 86% of adults reported regularly walking for AT. For biking, 67% of respondents recalled childhood biking and 32% reported adult biking. For public transportation, 27% reported child public transportation use and 15% reported adult public transportation use. For skating, 24% of respondents recalled skating during childhood regularly and 3% reported skating regularly as adults.

**Figure 2: Active transportation participation by age (n = 85)**

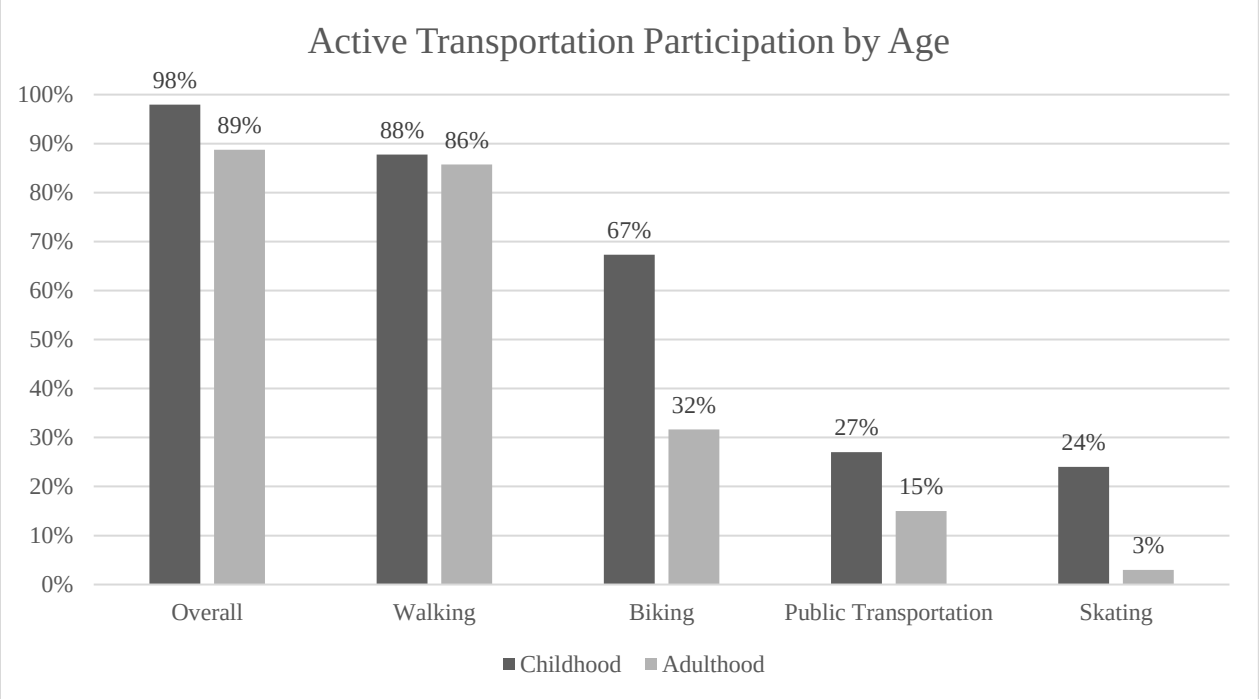


**Figure 3: Mean days of active transportation per week (n=85)**

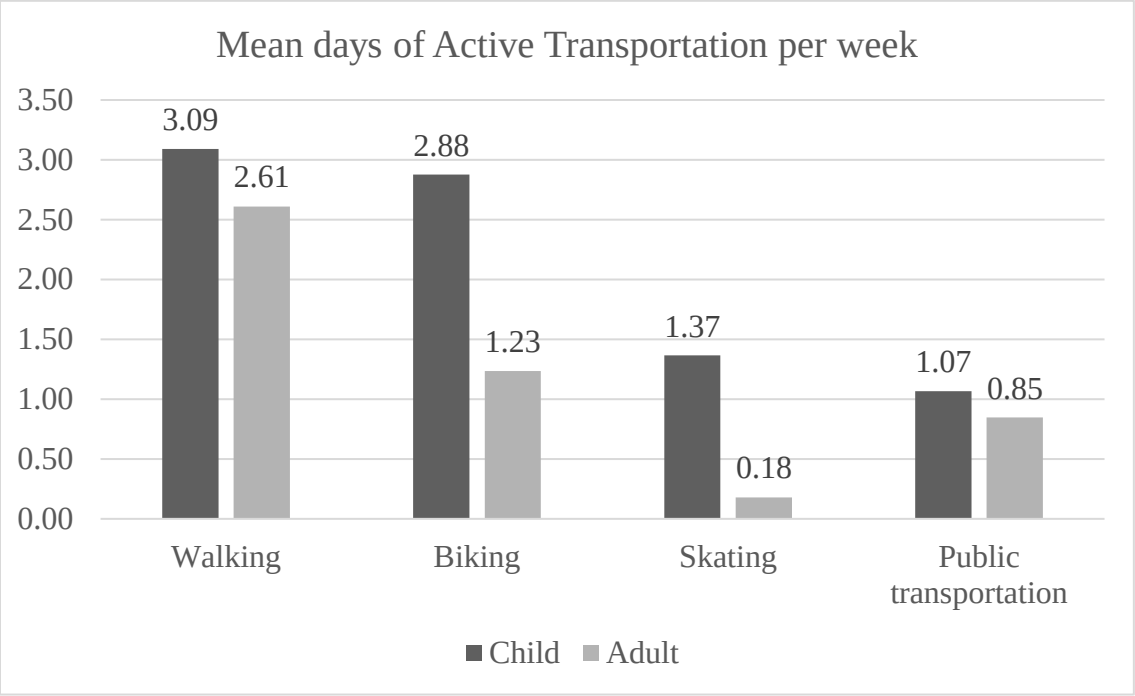



Figure 3 shows average days of AT use per week. During childhood, respondents in the sample walked an average of 3.1 days per week, and 2.6 days as adults, biked 2.9 days per week as children and 1.2 days as adults, skated 1.4 days per week as children and 0.2 days as adults, and used public transportation 1.1 days per week as children and ~0.9 days as adults. Values are adjusted to account for the frequency of the AT behavior across the population. The averages were calculated for children (n = 84) and adults (n = 85) reporting walking; children (n = 53) and adults (n = 29) reporting biking, children (n = 18) and adults (n = 4) reporting skating, and children (n = 22) and adults (n = 15) reporting public transportation use. Table 3 shows AT destinations for both childhood recall and adult self-report. The most frequently selected destination in both childhood and adulthood was school, followed by the respondent's home.

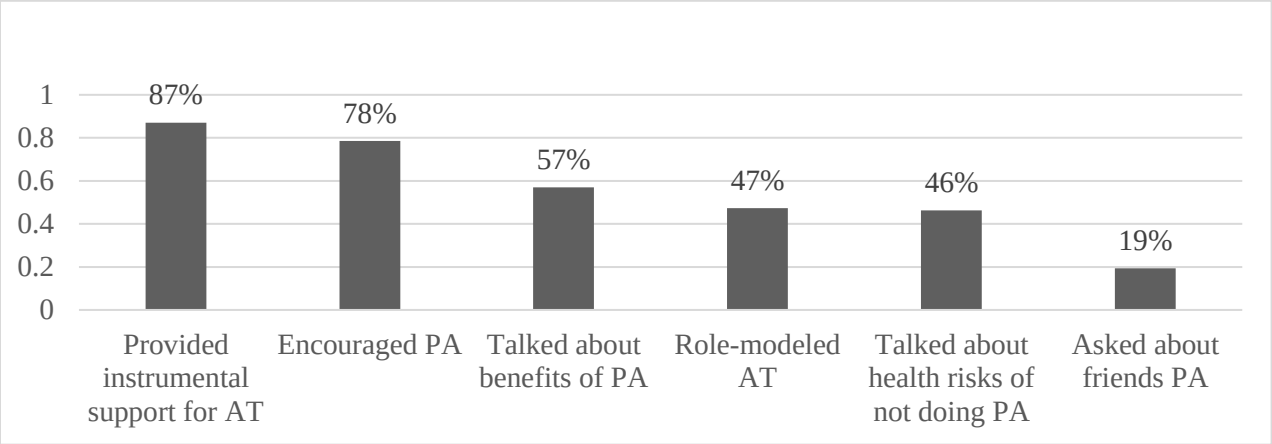
**Table 3: Top destinations for active transportation by age**

| Age | AT Type | Home | School | Work | Park | Friend's Home | Gym | Shops | Library | Community center | Church | Playground |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Child** | Walking (n = 88) | 48 | 57 | 3 | 40 | 47 | 5 | 32 | 16 | 5 | 8 | 44 |
| | Biking (n = 64) | 34 | 26 | 5 | 41 | 42 | 7 | 20 | 9 | 3 | 5 | 32 |
| | Skating (n = 19) | 10 | 1 | 0 | 13 | 14 | 0 | 1 | 0 | 0 | 0 | 10 |
| | Public Transportation (n = 24) | 10 | 17 | 2 | 2 | 6 | 1 | 6 | 4 | 1 | 0 | 0 |
| **Adult** | Walking (n = 88) | 47 | 63 | 29 | 18 | 14 | 20 | 25 | 22 | 1 | 4 | 11 |
| | Biking (n = 31) | 20 | 19 | 14 | 7 | 9 | 6 | 12 | 7 | 3 | 3 | 4 |
| | Skating (n = 19) | 3 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | Public Transportation (n = 22) | 7 | 7 | 4 | 1 | 2 | 1 | 6 | 2 | 1 | 0 | 0 |

*Note*: Participants answered questions about destinations in a *check all that apply* format. Missing responses included respondents skipping the question, and respondents who did not use the AT sub-mode in question.

Figure 4 shows the frequencies for recall of parental influence on AT. Respondents most frequently recalled parental instrumental support (87%), followed by encouragement to engage in PA (78%), talking with parents about the benefits of PA (57%), parental role-modeling of AT (47%), talking with parents about the health risks of being inactive (46%) and parents asking about friends' PA (19%).

**Figure 4: Frequencies for recall of parental influence for active transportation (AT)**



**Research Question 1**

Tables 4, 5, 6 and 7 present results from binomial regression analyses. Data are reported as Odds Ratios (OR), with a significance of $p<0.05$ along with 95% confidence intervals (C.I.). OR are the odds of a behavior outcome (for example biking in childhood) given a condition (for example has a bike or does not have a bike). OR then calculate the likelihood of the outcome (for example biking) given that the respondent has a bike compared to not having a bicycle. OR greater than 1 indicate greater likelihood of the outcome, while OR less than 1 indicate lower likelihood of the outcome. Parental influence associations were investigated with each sub-mode of AT (walking, biking, skating and public transportation). Gender was included as a control variable. Table 4 presents parental influence associations with childhood walking, which did not return significant statistical results. Table 5 presents parental influence associations with childhood biking, revealing a significant negative association between parental instrumental support and childhood biking (OR: 0.13, $p = 0.02$, 95% C.I. = 0.02, 0.75), such that respondents who recalled receiving parental instrumental support during childhood were less likely to report child biking behavior than respondents who did not recall receiving instrumental support in childhood. Table 6 presents parental influence associations with childhood skating. Table 7 presents parental influence associations with childhood public transportation. Neither analyses on childhood skating or public transportation returned significant results.

**Table 4: Research Question 1 – Parental influence association with child walking (N = 59)**

| Parental influence association with child walking | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Benefits of PA Talk | 0.39 | 0.40 | 0.04 | 3.57 |
| Promote PA Talk | 7.42 | 0.14 | 0.53 | 104.05 |
| Display Interest in child PA | 4.71 | 0.28 | 0.28 | 79.08 |
| Health Risks of no PA Talk | 0.20 | 0.23 | 0.02 | 2.73 |
| Instrumental Support | 0.30 | 0.27 | 0.03 | 2.55 |
| Gender | 0.98 | 0.98 | 0.15 | 6.24 |

*Note*. Benefits of PA Talk refers to parental verbal interaction with child regarding positive health effects of engaging in PA regularly. Promote PA Talk refers to parental verbal interaction encouraging child to be physically active. Display interest in child PA **refers** to parental attention to child's social network PA. Health risks of no PA Talk refers to parents discussing negative health outcomes of insufficient PA with child. Instrumental support refers to parents supporting child AT by providing equipment necessary for AT, such as shoes, bicycles, skateboards, etc.

**Table 5: Research Question 1 – Parental influence association with child biking (n= 59)**

| Parental influence association with child biking | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Benefits of PA Talk | 0.44 | 0.37 | 0.07 | 2.68 |
| Promote PA Talk | 2.13 | 0.42 | 0.34 | 13.12 |
| Display Interest in child PA | 1.10 | 0.92 | 0.19 | 6.41 |
| Health Risks of no PA Talk | 1.62 | 0.59 | 0.28 | 9.19 |
| **Instrumental Support** | **0.13** | **0.02*** | 0.02 | 0.75 |
| Gender | 0.89 | 0.86 | 0.23 | 3.43 |

*Note*. Benefits of PA Talk refers to parental verbal interaction with child regarding positive health effects of engaging in PA regularly. Promote PA Talk refers to parental verbal interaction encouraging child to be physically active. Display interest in child PA **refers** to parental attention to child's social network PA. Health risks of no PA Talk refers to parents discussing negative health outcomes of insufficient PA with child. Instrumental support refers to parents supporting child AT by providing equipment necessary for AT, such as shoes, bicycles, skateboards, etc.

* Significant at $p<0.05$

**Table 6: Research Question 1 – Parental influence association with child skating (N = 59)**

| Parental influence association with child skating | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Benefits of PA Talk | 1.01 | 0.99 | 0.17 | 6.18 |
| Promote PA Talk | 0.82 | 0.84 | 0.13 | 5.25 |
| Display Interest in child PA | 0.34 | 0.23 | 0.06 | 2.03 |
| Health Risks of no PA Talk | 1.08 | 0.93 | 0.20 | 5.90 |
| Instrumental Support | 0.62 | 0.62 | 0.09 | 4.22 |
| Gender | 3.78 | 0.11 | 0.74 | 19.41 |

*Note*. Benefits of PA Talk refers to parental verbal interaction with child regarding positive health effects of engaging in PA regularly. Promote PA Talk refers to parental verbal interaction encouraging child to be physically active. Display interest in child PA refers to parental attention to child's social network PA. Health risks of no PA Talk refers to parents discussing negative health outcomes of insufficient PA with child. Instrumental support refers to parents supporting child AT by providing equipment necessary for AT, such as shoes, bicycles, skateboards, etc.

**Table 7: Research Question 1 – Parental influence association with child public transportation (N = 59)**

| Parental influence association with child public transportation | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Benefits of PA Talk | 0.22 | 0.16 | 0.03 | 1.79 |
| Promote PA Talk | 0.38 | 0.44 | 0.03 | 4.44 |
| Display Interest in child PA | 0.65 | 0.66 | 0.10 | 4.40 |
| Health Risks of no PA Talk | 4.23 | 0.15 | 0.58 | 30.80 |
| Instrumental Support | 0.64 | 0.73 | 0.05 | 8.32 |
| Gender | 8.47 | 0.06 | 0.89 | 80.74 |

*Note*. Benefits of PA Talk refers to parental verbal interaction with child regarding positive health effects of engaging in PA regularly. Promote PA Talk refers to parental verbal interaction encouraging child to be physically active. Display interest in child PA refers to parental attention to child's social network PA. Health risks of no PA Talk refers to parents discussing negative health outcomes of insufficient PA with child. Instrumental support refers to parents supporting child AT by providing equipment necessary for AT, such as shoes, bicycles, skateboards, etc.

**Research Question 2**

Table 8 presents results from the binomial regression analyses intended to answer research question 2. Regression analyses investigated the odds of any AT (yes/no) as well as the odds of each mode of AT (walk, bike, skate, public transport) given parental role-modeling behavior (yes/no). No statistically significant results were found, likely due to the fact that 98% of respondents reported at least some AT during childhood.

**Table 8: Parental role-modeling association with child active transportation (N = 59)**

| Parental role-modeling association with child AT | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Overall (any AT*) | 1.25 | 0.88 | 0.73 | 21.32 |
| Walking | 1.50 | 0.57 | 0.37 | 6.14 |
| Biking | 0.59 | 0.30 | 0.22 | 1.60 |
| Skating | 0.81 | 0.69 | 0.30 | 2.22 |
| Public Transport | 0.48 | 0.16 | 0.17 | 1.33 |

*Note.* * Active transportation

**Research Question 3**

Binomial regression analyses explored neighborhood environment quality associations with child AT (walking, biking, skating and public transportation). Results are presented in tables 9, 10, 11 and 12. The "low" PANES score group served as the reference category for group analyses (i.e., moderate, high and very high). No mode-specific AT behaviors were significantly associated with the recalled neighborhood environment scores.

**Table 9: Research Question 3 – PANES association with child walking (n = 85)**

| Child PANES* association with Child Walking | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| PANES Low PA** Environment (Reference) | | 0.53 | - | - |
| Moderate PA** Environment | 0.00 | 1.00 | 0.00 | - |
| High PA** Environment | 0.00 | 1.00 | 0.00 | - |
| Very High PA** Environment | 0.78 | 1.00 | 0.00 | - |
| Gender | 1.62128 | 0.53 | 0.36 | 7.34 |

*Note.* * Physical Activity Neighborhood Environment Survey
** Physical activity

**Table 10: Research Question 3 – PANES association with child biking (n = 85)**

| Child PANES* association with Child Biking | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| PANES Low PA** Environment (Reference) | - | 0.71 | - | - |
| Moderate PA** Environment | 1.03 | 0.98 | 0.08 | 13.03 |
| High PA** Environment | 1.37 | 0.81 | 0.11 | 17.58 |
| Very High PA** Environment | 2.72 | 0.50 | 0.15 | 48.97 |
| Gender | 0.84 | 0.75 | 0.30 | 2.39 |

*Note.* * Physical Activity Neighborhood Environment Survey
** Physical activity

**Table 11: Research Question 3 – PANES association with child skating (n = 85)**

| Child PANES* association with Child Skating | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| PANES Low PA** Environment (Reference) | | 0.43 | | |
| Moderate PA** Environment | 0.36 | 0.44 | 0.03 | 4.83 |
| High PA** Environment | 0.63 | 0.73 | 0.05 | 8.36 |
| Very High PA** Environment | 1.10 | 0.95 | 0.07 | 16.92 |
| Gender | 1.72 | 0.36 | 0.55 | 5.39 |

*Note.* * Physical Activity Neighborhood Environment Survey
** Physical activity

**Table 12: Research Question 3 – PANES association with child public transportation (n = 85)**

| Child PANES* association with Child Public Transportation | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| PANES Low PA** Environment (Reference) | | 0.60 | | |
| Moderate PA** Environment | 3.6E+08 | 1.00 | 0.00 | - |
| High PA** Environment | 5.4E+08 | 1.00 | 0.00 | - |
| Very High PA** Environment | 9.5E+08 | 1.00 | 0.00 | - |
| Gender | 1.49 | 0.49 | 0.48 | 4.64 |

*Note.* * Physical Activity Neighborhood Environment Survey
** Physical activity

**Research Question 4**

Tables 13, 14, 15, 16, 17 and 18 show the binomial regression results for research question 4, which tested the association between child AT behavior and adult AT and PA behaviors. Table 13 shows results for the association between child AT sub-modes (walking, biking, skating and public transportation) plus gender and adult overall AT, none of which returned significant results. Table 14 shows results for the association between child AT sub-modes plus gender and adult meeting PA guidelines, none of which were significant. Table 15 shows results for the association between child AT sub-modes plus gender and adult walking,

revealing a significant positive association between child walking and adult walking (OR = 17.61, p = 0.01, 95% C.I. = 2.01, 154.05), while no other analyses for adult walking returned significant ORs. Table 16 shows results for the association between child AT sub-modes plus gender and adult biking, revealing a significant positive association between child biking and adult biking (OR = 11.75, p = 0.001, 95% C.I. = 2.38, 58.07), but no other child AT mode. Table 17 shows results for the association between child AT sub-modes plus gender and adult skating behavior, revealing no significant associations. Table 18 shows results for the association between child AT sub-modes plus gender and adult public transportation behavior, revealing a significant positive association between child public transportation behavior and adult public transportation (OR = 6.92, p = 0.01, 95% C.I. = 1.79, 26.82).

**Table 13: Research Question 4 – Child active transportation association with adult active transportation (n=86)**

| Child active transportation association with adult overall active transportation | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Walk | 6.7E+15 | 0.99 | 0.00 | - |
| Bike | 2.1E+15 | 1.00 | 0.00 | - |
| Skate | 0.00 | 1.00 | 0.00 | - |
| Public Transport | 9.9E+14 | 1.00 | 0.00 | - |
| Gender | 1.62 | 1.00 | 0.00 | - |

**Table 14: Research Question 4 – Child active transportation association with meeting physical activity guidelines (n=86)**

| Child active transportation association with adult meeting physical activity guidelines | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Walk | 0.00 | 1.00 | 0.00 | - |
| Bike | 1.94 | 0.29 | 0.57 | 6.58 |
| Skate | 5.96 | 0.10 | 0.70 | 50.77 |
| Public Transport | 3.09 | 0.18 | 0.59 | 16.24 |
| Gender | 0.72 | 0.59 | 0.21 | 2.39 |

**Table 15: Research Question 4 – Child active transportation association with adult walking (n=86)**

| Child active transportation association with adult walking | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| **Walk** | **17.61** | **0.01*** | 2.01 | 154.05 |
| Bike | 2.86 | 0.33 | 0.34 | 23.81 |
| Skate | 0.33 | 0.34 | 0.03 | 3.31 |
| Public Transport | 2.52 | 0.48 | 0.19 | 32.84 |
| Gender | 0.08 | 0.11 | 0.00 | 1.83 |

*Note.* * Significant at $p<0.05$

**Table 16: Research Question 4 – Child active transportation association with adult biking (n=86)**

| Child active transportation association with adult biking | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Walk | 0.85 | 0.86 | 0.14 | 5.03 |
| **Bike** | **11.75** | **0.001*** | 2.38 | 58.07 |
| Skate | 0.59 | 0.38 | 0.18 | 1.91 |
| Public Transport | 2.50 | 0.14 | 0.75 | 8.40 |
| Gender | 0.34 | 0.05 | 0.12 | 0.99 |

*Note.* * Significant at p<0.05

**Table 17: Research Question 4 – Child active transportation association with adult skating (n=86)**

| Child active transportation association with adult skating | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Walk | 6.4E+07 | 1.00 | 0.00 | - |
| Bike | 0.49 | 0.63 | 0.03 | 8.84 |
| Skate | 2.42 | 0.55 | 0.13 | 44.06 |
| Public Transport | 1.6E-08 | 1.00 | 0.00 | - |
| Gender | 0.21 | 0.22 | 0.02 | 2.53 |

**Table 18: Research Question 4 – Child active transportation association with adult public transportation (n=86)**

| Child active transportation association with adult public transportation | Odds Ratio | p | C.I. (95% Exp(B)) | |
|---|---|---|---|---|
| | | | **Lower** | **Upper** |
| Walk | 5.6E+08 | 1.00 | 0.00 | - |
| Bike | 1.23 | 0.77 | 0.30 | 5.00 |
| Skate | 0.77 | 0.72 | 0.18 | 3.21 |
| **Public Transport** | **6.92** | **0.01*** | 1.79 | 26.82 |
| Gender | 0.30 | 0.09 | 0.08 | 1.20 |

*Note.* * Significant at p<0.05

# Chapter 5 - Discussion

The purpose of this study was to investigate factors for AT development between childhood and adulthood. Research questions were designed to test hypotheses about the associations between parental support and child AT, parental role-modeling of AT and child AT, environmental influence and Child AT, and child AT and adult AT. Research question 1 found that parental instrumental support was associated with an 87% decrease in child biking for AT, but no other significant associations for other parental support behaviors or AT sub-modes were found. Research question 2 did not return significant associations on the relationship between role-modeling and child AT behavior in any sub-mode. Research question 3 did not return significant associations between the childhood neighborhood environment and child AT in any sub-mode. Research question 3 returned a significant positive association with the AT sub-modes of walking, biking and public transportation. Child walking behavior for AT was associated with a 18 times greater likelihood of adult walking behavior, child biking behavior was associated with a 12 times greater likelihood of adult biking, and child public transportation was associated with a 7 times greater likelihood of adult public transportation. Child AT behavior was not associated with any other adult indicator of PA, or adult skating for AT.

Our findings contradicted the hypothesized positive association between instrumental support and child AT via biking for research question 1. Instrumental support may require more in-depth analysis in future investigations to understand perceptual differences between parental influence intentions and child perceptions of support. Otherwise, reports of parental influence variables were not significantly associated with child AT. Additional deliberation on the types, forms, motives and perceptions of parental influence may be necessary to lend context to parental influence on child AT. While the cross-sectional recall design presented a convenient

and prudent measure given the time constraint of the investigation, long-term recall may decrease the reliability of participant responses. Previous research suggested the feasibility of recall studies for estimation of AT in the distant past, but this may not extend to parental influence variables (Itoh, et al., 2017; Blair, et al., 1991). Recall designs may offer the ability to sample large swaths of set groups with relative ease, and provide meaningful and useful information so long as sufficient response rates are met (Itoh, et al., 2017). The limited reach of sampling method, and the lack of maturity of parental influence questions included in the survey and subsequent limitations on sample size and response validity made it difficult for the study at hand to seize on the advantages of recall methodology.

Statistical analyses for research question 2 did not return significant results. Findings in the literature suggested a positive association between parental role-modeling of AT and child AT which we were unable to support (Beets, Vogel, Chapman, Pitetti, & Cardinal, 2007; Tucker, Van Zandvoort, Burke, & Irwin, 2011; Wing, 2015; Parschau, et al., 2014). Issues arose in our collection of data for role-modeling of AT among parents through possibly insufficiently valid questions, issues with the recall method for assessing parental role-modeling in the distant past, or through insufficiently diverse sampling of respondents.

Research question 3 results did not reveal statistically significant associations between the neighborhood environment and child AT. The neighborhood environment has been identified in several studies as a factor in the development of AT behaviors (Carver A. , Timperio, Hesketh, & Crawford, 2010; Giles-Corti, Kelty, Zubrick, & Villanueva, 2009). The use of PANES as a means for long term recall of neighborhood environment properties may have resulted in invalid data due to the nature of decreased memory accuracy over long periods of time.

Findings for research question 4 supported the presence of AT behavior tracking between childhood and adulthood in walking to walking, biking to biking, and public transport to public transport associations. We were able to support the association between mode-to-mode tracking of AT behavior in childhood and adulthood for each of our mode-specific sub-analyses, except for skating behavior. To the author's knowledge, this is the first study of its kind to link specific AT behaviors in childhood with AT behavior as an adult. An association between childhood and adult AT may make sense given the formative nature that childhood behaviors have on lifelong PA patterns (Anderssen, et al., 1996; Trudeau, Laurencelle, & Stephard, 2004). These insights highlight the need for AT promotion efforts among children, and an improved understanding of the long-term effects of promotional programs on AT behavior across the lifespan. The absence of evidence for a connection with skating may be explained by the low number of skating behaviors reported overall in our sample. AT tracking across the lifespan may be measurable via long-term recall and could be investigated through a relatively short response time survey in a wide variety of populations. Utilizing this information to improve our understanding of factors that contribute to AT, such as changing life circumstance, income, educational and lifestyle changes, may be feasible. Secondary data sources, such as national behavioral health surveys like the Behavioral Risk Factor Surveillance Systems (BRFSS) may be useful in further studying AT behavior in communities over time.

**Lifelong physical activity model (LM) and parental influence**

The LM informed the associations between child and adult AT behaviors by structuring insights from the literature in relation to the outcome of lifelong physical activity as a systematic and predictable process, which made it possible for the present study to investigate child determinants of AT, and test associations between child and adult AT. LM may be useful to

guide future investigations into AT behaviors across the lifespan with parental influence in mind. In the present study, two aspects of LM were analyzed: the association between environmental influences and child AT behavior, and the association between child AT and adult AT. Additionally, we proposed the addition of parental influence as a factor in the development of child AT. Parents are important agents in the development of AT and health behaviors in children, and the need to understand the differential interactions between parent, child and environment may be crucial to expanding our understanding of AT promotion. This study yielded results contrary to assumptions within the literature about the association between parental instrumental support and child biking behavior (Telama, 2009). Results permit general recommendations for future investigations into the tracking of AT across the lifespan.

It may be crucially important to allow participants to explore their own AT habits over time and pinpoint the origin of their "reasons" for AT in the current day through interview methods and how these motivations are modified. Qualitative designs could be more useful in exploring individual affect in the space around child AT behavior acquisition and determination than survey protocols. Researchers interested in long-term AT trajectories should focus on prospective cohort studies and recall designs to further understand AT tracking between childhood and adulthood. Additional information is needed to understand the development of competence and habits for AT, informed by the processes and developmental stages presented in LM. Demographic, economic and social factors may be important building blocks of both child and parent decision-making-processes for AT.

**Limitations**

Three central limitations of the study stand out. A recall design was chosen to study AT tracking over the lifespan. The choice for a recall design was made because of budgetary and time constraints placed on the project. Alternatives would have required either more intensive interviewing and data analysis techniques than were feasible, i.e. a focus group or interview study, or would have consisted of long-term prospective cohort protocols that track participants over the course of several years. Neither was feasible in the time frame allotted for the study, and efforts were instead focused on understanding the relationships between child and adult AT behavior from a long-term recall perspective.

The number of responses were too low and insufficiently diverse. The study was unable to sample a diverse sample in sufficient numbers and was therefore unfit to pursue important sub-analyses for racial and ethnic differences in PA behavior acquisition. Race, ethnicity, class and income have been identified as important factors in individual's experience's around PA. Survey sampling tactics targeted physically active individuals, and survey promotional materials (see Appendix B) may have had adverse effects on the marketability of the survey to non-active individuals. Because of budgetary limitations, our study was promoted primarily via email and social media, as well as snowball sampling from person to person. We did not offer an incentive to participate, which may have significantly affected our response rate with important population groups who may be uninterested to participate in AT research without some incentive, including individuals who are not physically active.

The study was unable to recruit a sufficient number of inactive individuals for childhood recall. As above, sampling method and recruitment may be to blame for the low number of physically inactive individuals who responded to the survey. Additional complications included

recruitment media, which were focused on academic settings, and media sources consumed and frequented by college students.

**Implications**

The study investigated the associations between parental influence variables, neighborhood environments and child AT behavior, as well as the association between recalled child and self-reported adult AT behaviors. The focus on AT sub-modes in childhood and adulthood presented a novel approach to PA tracking from childhood to adulthood, as did the study of parental influences using questions aimed directly at types of parental influence provided and role-modeling of AT. Results include a negative association between parental instrumental support and childhood biking behavior, in which instrumental support was associated with a 87% lower likelihood of child biking behavior among respondents. Evidence for the presence of tracking of AT behaviors between childhood and adulthood was provided in the form of AT sub-mode to sub-mode specific findings. Child walking behavior was positively associated with adult walking behavior among respondents, with respondents who recalled child walking 18 times more likely to also report adult walking behavior. Child biking behavior was positively associated adult biking behavior, with respondents who recalled child biking behavior 12 times more likely to also report adult biking behavior. Child public transportation behavior was positively associated with adult public transport behavior, with respondents who recalled child public transportation behavior 7 times more likely to also report adult public transportation behavior.

Study implications can be separated into recommendations for research and recommendations for practice. Future research studies should apply LM to study the processes and determining factors in the acquisition and development of AT behavior. Researchers should

examine the role of equipment availability and neighborhood infrastructure on AT behavior in children. Such investigations can utilize qualitative methodology to capture insights from children directly (Ghekiere, et al., 2014; Broberg, Salminen, & Kyttä, 2013). For public health practice, results that support the association between childhood and adulthood AT behavior tracking may be useful in advocacy for greater and higher quality AT focused PA programs for children. The study supports notions for the long-term benefits of programs that encourage exposure to AT.

# Chapter 6 - References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## Appendix A

# CADET Main

# Survey Flow

**Block: 1 Introduction (1 Question)**
**Standard: 2 Childhood PA Recall (18 Questions)**
**Standard: 3 Childhood Parental Support Recall (8 Questions)**
**Standard: 4 Childhood PANES Recall (3 Questions)**
**Standard: 5 Adult AT (18 Questions)**
**Standard: 6 IPAQ-SF (11 Questions)**
**Standard: 7 Demographics (11 Questions)**

Page Break

Start of Block: 1 Introduction

Q1.1

**Childhood Active Transportation Determinants and their Effect on Adult Active Transportation (CADET)**

Thank you for your interest in our survey. This research is intended to study the influences on adult active transportation behavior. Active transportation is any travel from place to place without a motor. Active transportation includes walking, running, biking or skating. For this study you will answer questions about your active transportation during childhood and your current active transportation. You will be asked for demographic information. Researchers will remove any information that could be used to identify you. Your cleaned data may be shared with other investigators. No risk or benefit comes from the survey. You may volunteer to answer the survey. You consent to take part by clicking the arrow to the next page. You may withdraw consent at any time by exiting the survey.

If you have questions, comments or concerns regarding the contents of this survey please contact Daniel Winslow at drwin@ksu.edu. If you have questions about your rights as a subject, you may contact: Rick Scheidt, Chair, Committee on Research Involving Human Subjects at (785) 532-3224 or Cheryl Doerr, Associate Vice President for Research Compliance at (785) 532-3224 located in 203 Fairchild Hall, Kansas State University, Manhattan, KS 66506.

By clicking to the next page I certify that I am between the ages of 18 and 64.

End of Block: 1 Introduction

Start of Block: 2 Childhood PA Recall

Q2.1

The following questions ask about details during your childhood (<18 years). Think about the time and place that had the most influence on your active transportation behavior.

When thinking about active transportation, think about any movement from place to place that was achieved without the assistance of a motor. This includes activities such as walking, riding a bicycle, or riding a skateboard. Active transportation also includes the use of public transportation, park and ride systems or bike-sharing systems.

Q2.2
Thinking about the time and place that had the most influence on your understanding of active transportation behavior as a child (<18 years):

What modes of active transportation did you engage in? (check all that apply)

- [ ] Walk (1)
- [ ] Bicycle (incl. bike-sharing) (2)
- [ ] Skate (Push Scooter, Roller-skate, Skateboard, etc.) (3)
- [ ] Public Transport (Bus, Train, Park-and-Ride, etc.) (4)
- [ ] Other (5)
- [ ] None (7)

*Display This Question:*
*If Q2.2 = Other*

Q2.3 Please explain your choice of 'other' mode of active transportation.

_____

*Display This Question:*
*If Q2.2 = Walk*

Q2.4
Thinking about the time and place that had the most influence on your understanding of active transportation behavior as a child (<18 years):

How many days per week did you **walk** from place to place?

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- Less than 1 day (8)

---

*Display This Question:*

*If Q2.2 = Walk*

Q2.5
Thinking about the time and place that had the most influence on your understanding of active transportation behavior as a child (<18 years):

What were your most likely destinations when **walking**?

- [ ] Home (147)
- [ ] School (148)
- [ ] Work (149)
- [ ] Park (150)
- [ ] Home of a friend or family member (151)
- [ ] Gym/Fitness Center (152)
- [ ] Shops/Stores (153)
- [ ] Library (154)
- [ ] Community Center (155)
- [ ] Church (156)
- [ ] Playground (157)
- [ ] Other (158)

*Display This Question:*

*If Q2.5 = Other*

Q2.6 Please describe your 'other' destination.

_____

Page Break

*Display This Question:*

*If Q2.2 = Bicycle (incl. bike-sharing)*

Q2.7
Thinking about the time and place that had the most influence on your understanding of active transportation behavior as a child (<18 years):

How many days per week did you **bike** from place to place?

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- Less than 1 day (8)

*Display This Question:*

*If Q2.2 = Bicycle (incl. bike-sharing)*

Q2.8
Thinking about the time and place that had the most influence on your understanding of active transportation behavior as a child (<18 years):

What were your most likely destinations when **biking**?

- [ ] Home (9)
- [ ] School (10)
- [ ] Work (11)
- [ ] Park (12)
- [ ] Home of a friend or family member (13)
- [ ] Gym/Fitness Center (14)
- [ ] Shops/Stores (15)
- [ ] Library (16)
- [ ] Community Center (17)
- [ ] Church (18)
- [ ] Playground (19)
- [ ] Other (20)

*Display This Question:*

*If Q2.8 = Other*

Q2.9 Please describe your 'other' destination.

_____

Page Break

*Display This Question:*

*If Q2.2 = Skate (Push Scooter, Roller-skate, Skateboard, etc.)*

Q2.10
Thinking about the time and place that had the most influence on your understanding of active transportation behavior as a child (<18 years):

How many days per week did you **skate** from place to place? (Push Scooter, Roller-skate, Skateboard, etc.)

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- Less than 1 day (8)

---

*Display This Question:*

*If Q2.2 = Skate (Push Scooter, Roller-skate, Skateboard, etc.)*

Q2.11
Thinking about the time and place that had the most influence on your understanding of active

transportation behavior as a child (<18 years):
What were your most likely destinations when **skating**?

- [ ] Home (9)
- [ ] School (10)
- [ ] Work (11)
- [ ] Park (12)
- [ ] Home of a friend or family member (13)
- [ ] Gym/Fitness Center (14)
- [ ] Shops/Stores (15)
- [ ] Library (16)
- [ ] Community Center (17)
- [ ] Church (18)
- [ ] Playground (19)
- [ ] Other (20)

*Display This Question:*

*If Q2.11 = Other*

Q2.12 Please describe your 'other' destination.

_____

Page Break

*Display This Question:*

*If Q2.2 = Public Transport (Bus, Train, Park-and-Ride, etc.)*

Q2.13
Thinking about the time and place that had the most influence on your understanding of active transportation behavior as a child (<18 years):

How often did you use **public transportation**?

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- Less than 1 day (8)

---

*Display This Question:*

*If Q2.2 = Public Transport (Bus, Train, Park-and-Ride, etc.)*

Q2.14
Thinking about the time and place that had the most influence on your understanding of active

transportation behavior as a child (<18 years):
What were your most likely destinations when using **public transportation**?

- [ ] Home (1)
- [ ] School (2)
- [ ] Work (3)
- [ ] Park (4)
- [ ] Home of a friend or family member (5)
- [ ] Gym/Fitness Center (6)
- [ ] Shops/Stores (7)
- [ ] Library (8)
- [ ] Community Center (9)
- [ ] Church (10)
- [ ] Playground (11)
- [ ] Other (12)

*Display This Question:*

*If Q2.14 = Other*

Q2.15 Please describe your 'other' destination.

_____

*Display This Question:*

*If Q2.2 = Other*

Q2.16
Thinking about the time and place that had the most influence on your understanding of active transportation behavior as a child (<18 years):

How often did you use **public transportation**?

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- Less than 1 day (8)

*Display This Question:*

*If Q2.2 = Other*

Q2.17

Thinking about the time and place that had the most influence on your understanding of active

transportation behavior as a child (<18 years):
What were your most likely destinations when using **public transportation**?

- [ ] Home (1)
- [ ] School (2)
- [ ] Work (3)
- [ ] Park (4)
- [ ] Home of a friend or family member (5)
- [ ] Gym/Fitness Center (6)
- [ ] Shops/Stores (7)
- [ ] Library (8)
- [ ] Community Center (9)
- [ ] Church (10)
- [ ] Playground (11)
- [ ] Other (12)

*Display This Question:*

*If Q2.14 = Other*

Q2.18 Please describe your 'other' destination.

_____

**End of Block: 2 Childhood PA Recall**

**Start of Block: 3 Childhood Parental Support Recall**

Q3.1
The next set of questions asks about your parents' support for your physical activity behavior.

To answer these questions, continue thinking about the time and place that had the most influence on your active transportation behavior as a child (<18 years).

Page Break

Q3.2

Thinking about the time and place that had the most influence on your active transportation behavior as a child (<18 years):

Do you recall your parents talking with you about the benefits of physical activity?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure/Don't know (3)

---

Q3.3 Do you recall your parents encouraging you to be more physically active?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure/Don't know (3)

---

Q3.4 Do you recall your parents asking if your friends were physically active?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure/Don't know (3)

Page Break

Q3.5
Thinking about the time and place that had the most influence on your active transportation behavior as a child (<18 years):

Do you recall your parents talking about the health risks of NOT being physically active?

- Yes (1)
- No (2)
- Unsure/Don't know (3)

---

Q3.6 Do you recall your parents role-modeling active transportation behavior to you?

- Yes (1)
- No (2)
- Unsure/Don't know (3)

---

Q3.7 Did your parents enable you to participate in active transportation by providing equipment (such as a bicycle, tennis shoes, skateboard, etc.)?

- Yes (1)
- No (2)
- Unsure/Don't know (3)

---

Q3.8 Did your family have access to a motor vehicle?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure/Don't know (3)

**End of Block: 3 Childhood Parental Support Recall**

---

**Start of Block: 4 Childhood PANES Recall**

Q4.1 Now we would like you to think about the different facilities in and around your neighborhood

in the time and place that had the most influence on your active transportation behavior as a child (<18 years). By this we mean the area ALL around your home that you could walk to in 10–15 minutes.

The next items are statements about your neighborhood related to walking and bicycling. Choose those answers that were true most of the time during your childhood (<18 years), or that you found most influential.

Q4.2 Thinking about the time and place that had the most influence on your active transportation behavior as a child (<18 years):

| | Strongly disagree (1) | Somewhat disagree (2) | Somewhat agree (3) | Strongly agree (4) | Does not apply to my neighborhood (5) |
|---|---|---|---|---|---|
| Many shops, stores, markets or other places to buy things I need were within walking distance of my home. Would you say that you... (1) | ○ | ○ | ○ | ○ | ○ |
| It is within a 10- to 15-min walk to a transit stop (bus stop, train, subway, etc) from my home. Would you say that you... (2) | ○ | ○ | ○ | ○ | ○ |
| There were many places to go within easy walking distance of my home. Would you say that you... (3) | ○ | ○ | ○ | ○ | ○ |
| There were sidewalks on most of the streets in my neighborhood. Would you say that you... (4) | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| There were facilities to bicycle in or near my neighborhood, such as special lanes, separate paths or trails, shared use paths for cycles and pedestrians. Would you say that you... (5) | ○ | ○ | ○ | ○ | ○ |
| My neighborhood had several free or low cost recreation facilities, such as parks, walking trails, bike paths, recreation centers, playgrounds, public swimming pools, etc. Would you say that you... (6) | ○ | ○ | ○ | ○ | ○ |

Page Break

Q4.3 Thinking about the time and place that had the most influence on your active transportation behavior as a child (<18 years):

| | Strongly disagree (1) | Somewhat disagree (2) | Somewhat agree (3) | Strongly agree (4) | Does not apply to my neighborhood (5) |
|---|---|---|---|---|---|
| The crime rate in my neighborhood made it unsafe to go on walks at night. Would you say that you... (1) | ○ | ○ | ○ | ○ | ○ |
| I saw many people being physically active in my neighborhood doing things like walking, jogging, cycling, or playing sports and active games. Would you say that you... (2) | ○ | ○ | ○ | ○ | ○ |
| There was so much traffic on the streets that it makes it difficult or unpleasant to walk in my neighborhood. Would you say that you... (3) | ○ | ○ | ○ | ○ | ○ |
| There were many interesting things to look at while walking in my neighborhood. Would you say that you... (4) | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| There was so much traffic on the streets that it makes it difficult or unpleasant to ride a bicycle in my neighborhood. Would you say that you... (5) | ○ | ○ | ○ | ○ | ○ |
| The crime rate in my neighborhood made it unsafe to go on walks during the day. Would you say that you... (6) | ○ | ○ | ○ | ○ | ○ |

**End of Block: 4 Childhood PANES Recall**

**Start of Block: 5 Adult AT**

Q5.1 The following questions ask about your **current** physical activity.

Q5.2 What are your most common modes of active transportation?

- [ ] Walk (1)
- [ ] Bicycle (incl. bike-sharing) (2)
- [ ] Skate (Push Scooter, Roller-skate, Skateboard, etc.) (3)
- [ ] Public Transport (Bus, Train, Park-and-Ride, etc.) (4)
- [ ] Other (5)

---

*Display This Question:*

*If Q5.2 = Walk*

Q5.3
How many days per week do you **walk** from place to place?

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- None (8)

---

*Display This Question:*

*If Q5.2 = Walk*

Q5.4 What are your most likely destinations when **walking**?

- [ ] Home (21)
- [ ] School (22)
- [ ] Work (23)
- [ ] Park (24)
- [ ] Home of a friend or family member (25)
- [ ] Gym/Fitness Center (26)
- [ ] Shops/Stores (27)
- [ ] Library (28)
- [ ] Community Center (29)
- [ ] Church (30)
- [ ] Playground (31)
- [ ] Other (32)

*Display This Question:*

*If Q5.4 = Other*

Q5.5 Please describe your 'other' destination.

_____

*Display This Question:*

*If Q5.2 = Bicycle (incl. bike-sharing)*

Q5.6
How many days per week do you **bike** from place to place?

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- None (8)

*Display This Question:*

*If Q5.2 = Bicycle (incl. bike-sharing)*

Q5.7 What are your most likely destinations when **biking** from place to place?

- [ ] Home (21)
- [ ] School (22)
- [ ] Work (23)
- [ ] Park (24)
- [ ] Home of a friend or family member (25)
- [ ] Gym/Fitness Center (26)
- [ ] Shops/Stores (27)
- [ ] Library (28)
- [ ] Community Center (29)
- [ ] Church (30)
- [ ] Playground (31)
- [ ] Other (32)

*Display This Question:*

*If Q5.7 = Other*

Q5.8 Please describe your 'other' destination.

_____

*Display This Question:*

*If Q5.2 = Skate (Push Scooter, Roller-skate, Skateboard, etc.)*

Q5.9
How many days per week do you **skate** from place to place?

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- None (8)

*Display This Question:*

*If Q5.2 = Skate (Push Scooter, Roller-skate, Skateboard, etc.)*

Q5.10 What are your most likely destinations when **skating**?

- [ ] Home (21)
- [ ] School (22)
- [ ] Work (23)
- [ ] Park (24)
- [ ] Home of a friend or family member (25)
- [ ] Gym/Fitness Center (26)
- [ ] Shops/Stores (27)
- [ ] Library (28)
- [ ] Community Center (29)
- [ ] Church (30)
- [ ] Playground (31)
- [ ] Other (32)

*Display This Question:*

*If Q5.10 = Other*

Q5.11 Please describe your 'other' destination.

_____

*Display This Question:*

*If Q5.2 = Public Transport (Bus, Train, Park-and-Ride, etc.)*

Q5.12
How many days per week do you **use public transportion** to get from place to place?

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- None (8)

*Display This Question:*

*If Q5.2 = Public Transport (Bus, Train, Park-and-Ride, etc.)*

Q5.13 What are your most likely destinations when **using public transportation**?

- [ ] Home (21)
- [ ] School (22)
- [ ] Work (23)
- [ ] Park (24)
- [ ] Home of a friend or family member (25)
- [ ] Gym/Fitness Center (26)
- [ ] Shops/Stores (27)
- [ ] Library (28)
- [ ] Community Center (29)
- [ ] Church (30)
- [ ] Playground (31)
- [ ] Other (32)

*Display This Question:*

*If Q5.13 = Other*

Q5.14 Please describe your 'other' destination.

_____

*Display This Question:*

*If Q5.2 = Other*

Q5.15
You previously put 'Other' when asked about your most common mode of active transportation.

Please describe this 'other' mode of active transportation.

_____

*Display This Question:*

*If Q5.2 = Other*

Q5.16
How many days per week do you use an **'other' means of active transportation** to get from place to place?

- 7 days (1)
- 6 days (2)
- 5 days (3)
- 4 days (4)
- 3 days (5)
- 2 days (6)
- 1 day (7)
- None (8)

---

*Display This Question:*

*If Q5.2 = Other*

Q5.17 What are your most likely destinations when using an **'other' means of active transportation?**

- [ ] Home (21)
- [ ] School (22)
- [ ] Work (23)
- [ ] Park (24)
- [ ] Home of a friend or family member (25)
- [ ] Gym/Fitness Center (26)
- [ ] Shops/Stores (27)
- [ ] Library (28)
- [ ] Community Center (29)
- [ ] Church (30)
- [ ] Playground (31)
- [ ] Other (32)

*Display This Question:*

*If Q5.17 = Other*

Q5.18 Please describe your 'other' destination.

_____

**End of Block: 5 Adult AT**

**Start of Block: 6 IPAQ-SF**

Q6.1 We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport. Think about all the Vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

Q6.2 During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling? (Leave blank if unknown)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Days per week (1-7): () | | | | | | | |

Q6.3 How much time did you usually spend doing **vigorous** physical activities on one of those days?
(Leave blank if unknown)

○ Hours per day: (1) _____

○ Minutes per day: (2) _____

Page Break

Q6.4 Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

Q6.5 During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking. (Leave blank if unknown)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Days per week (1-7): () |  | | | | | | |

Q6.6 How much time did you usually spend doing **moderate** physical activities on one of those days?

○ Hours per day: (1) _____

○ Minutes per day: (2) _____

Page Break

Q6.7 Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

Q6.8 During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

1 2 3 4 5 6 7

| | |
|---|---|
| Days per week (1-7): () |  |

Q6.9 How much time did you usually spend **walking** on one of those days?

○ Hours per day: (1) _____

○ Minutes per day: (2) _____

Page Break

Q6.10 This question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

Q6.11 During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

- Hours per day: (1) _____
- Minutes per day: (2) _____

**End of Block: 6 IPAQ-SF**

**Start of Block: 7 Demographics**

Q7.1 Does your current household have access to a motor vehicle?

- Yes (1)
- No (2)
- Unsure/Don't know (3)

Q7.2 What is your gender?

- Male (1)
- Female (2)
- Other (3)

Q7.3 What best describes your relationship status?

- Married (1)
- Widowed (2)
- Divorced (3)
- Separated (4)
- Never married (5)

Q7.4 How many children live in your household?

_____

Q7.5 Are you of Hispanic or Latino origin?

- Yes (1)
- No (2)

Q7.6 How would you best describe yourself?

- ○ American Indian or Alaska Native (1)
- ○ Asian (2)
- ○ Black or African American (3)
- ○ Native Hawaiian or Other Pacific Islander (4)
- ○ White (5)

Page Break

Q7.7 Please select your highest level of education.

- Less than high school (1)
- High school graduate (2)
- Some college (3)
- 2 year degree (4)
- 4 year degree (5)
- Graduate degree (6)

---

Q7.8 Please indicate your household income.

- Less than $20,000 (1)
- $20,000 - $39,999 (2)
- $40,000 - $59,999 (3)
- $60,000 - $79,999 (4)
- $80,000 - $99,999 (5)
- More than $100,000 (6)

---

Page Break

Q7.9 How old are you?

_____

Q7.10 What is your height?

- Feet (') (1) _____
- Inches (") (2) _____

Q7.11 What is your body weight?

- Pounds (1) _____

**End of Block: 7 Demographics**

## Appendix B

Description: Promotional image sample for social media.