The Effect of Low-cost Incentives on Active Transportation to School Rates among Elementary School Students

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THE EFFECT OF LOW-COST INCENTIVES ON ACTIVE TRANSPORTATION
TO SCHOOL RATES AMONG ELEMENTARY SCHOOL STUDENTS

by

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Bachelor of Arts
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A thesis submitted in partial fulfillment of the requirements for the

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ABSTRACT

The Effect of Low-Cost Incentives on Active Transportation to School Rates Among Elementary School Students

by

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This study assessed the effectiveness of a school-based active transportation to school (ATS) encouragement program for elementary school students. ATS shows promise for increasing physical activity and preventing excessive weight gain in children. ATS rates were assessed through frequency counts at the control school (N=697) and intervention school (N=693). The intervention encouraged ATS through the distribution of low-cost incentives on one weekday each week. It also required helmet use for participation and included a Walking School Bus component. Findings from this study suggest that the intervention effectively increased ATS on both intervention and non-intervention days.
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CHAPTER 1

INTRODUCTION

The prevalence of childhood obesity has been increasing rapidly over the past several decades, both globally and in the United States (Lobstein, Baur, & Uauy, 2004). In the U.S. in the 1970s, 15% of children had Body Mass Index (BMI) measurements above the 85\textsuperscript{th} percentile (Dunton, Kaplan, Wolch, Jerrett, & Reynolds, 2009), a commonly used indicator for overweight (Lobstein et al., 2004). By 2006, 31.9% of American children had BMIs above the 85\textsuperscript{th} percentile, and 16.3% had passed the 95\textsuperscript{th} percentile and were considered obese (Ogden, Carroll, & Flegal, 2008). Childhood obesity is a public health concern because it is correlated with elevated risk for diseases such as type 2 diabetes, disordered sleep, skeletomuscular problems, lack of physical activity, menstrual abnormalities, and even cardiovascular disease in children (Lobstein et al., 2004).

The increased prevalence of these diseases impacts more than quality of life for overweight and obese children; it results in increased medical costs for the nation as a whole (Lobstein et al., 2004). Several researchers have attempted to estimate the impact of medical costs tied to the obesity epidemic in the U.S. Sturm (2002) analyzed healthcare utilization rates and concluded that obesity has a greater impact on healthcare costs than either nicotine abuse or alcohol abuse. In their analysis of medical spending, Finkelstein, Flebelkorn, and Wang (2003) estimated that treatment costs related to overweight and obesity account for 9.1\% of medical expenditures in the U.S. The federally-funded Medicare and Medicaid programs pay approximately 50\% of these costs, for a total outlay of approximately $40 billion. These estimated costs include both
adults and children, but if left unchecked, childhood obesity can only increase this financial burden as overweight children become overweight adults.

Research has established multiple contributing factors to childhood obesity. The American Dietetic Association (ADA) reports that children, like adults, gain excessive weight when their energy intake outpaces their energy needs (2008). Eating patterns in the U.S. have changed dramatically over the same period as the emergence of the obesity epidemic (Nicklas et al., 2004). Modern children eat more fast food, more food outside the home, more sugar-sweetened beverages, less milk, more pizza and French fries, and more snacks than a 1977 reference population (ADA, 2008). These dietary changes have been accompanied by changes in environmental influences such as food systems which may contribute to overweight and obesity (Neff, Palmer, McKenzie, & Lawrence, 2009).

As with energy intake, physical activity (PA) in childhood has undergone rapid change over the past several decades (Hill, 2003). Two-thirds of children in the U.S. now watch more than 2 hours of television each day, replacing time that formerly was spent in more active pursuits (Goran, Reynolds, & Lindquist, 1999). New technologies such as computers and gaming systems have also increased the quantity of choices for sedentary entertainment (Sturm, 2004). At the same time, many American children now live in a physical environment that discourages physical activity (Handy, Boarnet, Ewing, & Killingsworth, 2002). Daily physical education (PE) at schools has declined (Pate et al., 2006) as has active transportation to school (ATS) (McDonald, 2007). Combined with the rapid changes observed in the food environment, these reductions in physical activity have created fertile ground for the epidemic of childhood obesity.
The American Heart Association (AHA) recommends that all school age youth should participate in at least 60 minutes each day of PA (Pate, et al., 2006). “Significant numbers” of children do not meet this goal (p. 1215). Schools have been recognized as playing an important role in promoting PA in children. Pate (2006) calls on schools to “systematically and effectively provide and promote participation in physical activity” (p. 1291) to improve health and prevent overweight and obesity. His recommendations for specific areas for school-based interventions include the promotion of ATS.

ATS includes any non-motorized method of transportation that students use to commute to school – walking, cycling, skateboarding, scootering, etc. (Tudor-Locke, Ainsworth, & Popkin, 2001). Studies of elementary school age children in Russia indicated that ATS accounted for 40-50% of participants’ daily PA (Tudor-Locke, Neff, Ainsworth, Addy, & Popkin, 2002). Data from the U.S. National Personal Transportation Survey indicates that in 1969, 40.7% of students used ATS, but by 2001, only 12.9% of students commuted using ATS (McDonald, 2007). Similar decreases were observed in Canada, the U.K., and Australia (Buliung, Mitra, & Faulkner, 2009).

Since most students must attend school each day, researchers have concluded that ATS presents “a unique opportunity to impart multiple benefits of physical activity” (Tudor-Locke, et al., 2001, p. 312). Objective 22-14b of Healthy People 2010 establishes a national goal to increase ATS for trips of 1 mile or less from the 1995 baseline of 31% to a 2010 goal of 50% among children ages 5-15. The need for interventions targeting ATS has also been expressed by Tudor-Locke (2001), Morabia and Costanza (2009), Pate et al. (2006), and Jago and Baranowski (2004). Hill and Wyatt (2003) also suggest that changes in energy balance as little as 100 calories a day may prevent weight gain.
Problem of study

The frequency of ATS has fallen in the U.S. over the same time period that rates of childhood overweight and obesity have increased. ATS can provide a substantial portion of children’s daily PA, and may be protective against weight gain. There is an expressed need in the literature for effective interventions to increase ATS. Therefore the purpose of this study was to evaluate the effectiveness of an intervention to increase ATS at an elementary school in Las Vegas.

Justification for the study

Few American children currently meet the guidelines for recommended amounts of PA (Pate, et al., 2006). Interest has developed in ATS as a way to increase daily physical activity for students in the school setting without detracting from curriculum-based activities. A substantial amount of research has been completed on the determinants of walking and cycling to school, but ATS interventions remain less common, and often yield conflicting results. Interventions also frequently include built environment changes which require extensive planning and a substantial budget. This study evaluated a low-cost, community-based ATS intervention for elementary school students, and added information on its effectiveness to the literature.

Hypothesis

The following hypothesis was investigated:

Students who participated in the “Walking Wednesdays” intervention at Scherkenbach Elementary School (ES) used ATS more frequently than students from the control school.

Definition of terms

The following terms are defined relative to this study:
1. Active transportation to school (ATS): non-motorized methods of commuting to school for students. These methods include, but are not limited to, walking, jogging, cycling, and riding skateboards or scooters.

2. Safe Routes to School (SRTS): a nationally funded program which supports programs encouraging students to walk and cycle to school and supports a safe environment for their commute. More information on SRTS is available at http://www.saferoutesinfo.org/.

3. Walking school bus (WSB): a group of children and parents who walk a defined route to or from school at a scheduled time.

**Limitations**

For the purpose of this study, the following limitations were identified:

1. Use of a single study site limited the generalizability of the results of this study to demographically similar sites.

2. The study school and the control school were adjacent and drew their student population from the same neighborhoods. Students who appeared to be arriving at one school during observation periods may have been taking an alternate route to the other school. However these conditions were true at both locations and existed pre- and post-intervention.

**Summary**

There is an expressed need in the literature for effective interventions to increase active commuting in the school setting. ATS interventions offer mixed results and often involve expensive engineering improvements. This study reviewed the effectiveness of a low-cost, community-based ATS intervention for elementary school students, and
reviewed the hypothesis that students who participated in the intervention would choose active methods of commuting to school more often than students at the control school.
CHAPTER 2
LITERATURE REVIEW

This chapter includes a review of the literature on ATS. The determinants of ATS, its health benefits, and the role of ATS in daily PA are reviewed.

Determinants of ATS

As interest in ATS has developed over the past decade, a substantial amount of research has examined its determinants. Researchers have investigated elements of the built environment, such as street connectivity and distance between home and school, as well as the relationship between ATS and sociodemographic factors like gender, family income, and education level. Since parents influence the commuting choices of children, the knowledge, attitudes, and beliefs of parents about ATS have also been examined.

Built environment

Built environment has been defined as “the neighborhoods, roads, buildings, food sources, and recreational facilities in which people live, work, are educated, eat, and play” (Sallis & Glanz, 2006, p. 90). Associations have been established between built environment and various health behaviors, such as food choices and PA habits (Sallis & Glanz, 2006). Research into the relationship between built environment and ATS has revealed some strong associations, and some relationships with varying results.

The body of research into the relationship between ATS and distance from school supports a negative correlation between distance from school and the prevalence of ATS. McDonald’s 2007 analysis of National Personal Transportation Surveys conducted between 1969 and 2001 indicated that distance from school was the most influential factor for transportation decisions for school-aged children. A 2008 review article
(Panter, Jones, & van Sluijs) agreed, finding that ATS is associated with shorter routes for children ages 5-18. Pont, Ziviani, Wadley, Bennet, and Abbott reviewed studies of active transportation (AT) in youth for all purposes, and found a similar relationship, with AT rates decreasing as trip length increased (2009). Yeung, Wearing, and Hills surveyed 318 parents of primary school children in Australia and also found that longer commutes were associated with lower rates of ATS (2008). Their analysis indicated that only distance was significantly associated with increased odds of ATS (OR=0.29, $p<0.01$). Also in Australia, Timperio et al. found a positive relationship between commuting distance $<800$ m and ATS in their cross-sectional study of 235 5-6 and 10-12 year olds (2006).

Distance to school is an important area of analysis because the average distance between homes and schools has increased over the past few decades along with the prevalence of childhood overweight and obesity. In 1969, 85.9% of elementary school students lived within 1 mile of their school; by 2001, only 49.9% met that criteria (McDonald, 2007). A cross-sectional study of U.S. children ages 9-15 (n=2256) found that the average distance to school for participants was 3.9 miles. A 2007 analysis that attempted to determine the number of U.S. children ages 9-15 who lived within 1 mile of their school found that 35% of children met those criteria. Of that 35%, 47.9% used ATS at least once a week (Martin, Lee, & Lowry, 2007). The number of students in the U.S. has increased as the population grew over the decades in question, and the number of schools has decreased in the same time period (Martin & Carlson, 2005). Some of the increase in home-to-school distance may also be attributable to education policy trends toward consolidation and larger schools (McDonald, 2007), and some may be attributable
to the migration of school sites from the center to the edges of communities (Frank, Engelke, & Schmid, 2003, Chap. 6).

Another aspect of built environment that has been investigated in relation to ATS is walkability. Walkability is defined as “how a community’s design encourages (or discourages) its citizens to walk or cycle for transportation (rather than for recreation)” (Sallis & Glanz, 2006, p. 92). A single method for operationalizing walkability has not yet emerged, so walkability is assessed differently in different studies. Researchers use both subjective and objective measures. Connectivity, or the number of intersections in an area, also serves as a proxy for walkability (Frank, Engelke, & Schmid, 2003, Chap. 6).

Sallis and Glanz’s 2006 review article reports a positive association between walkability and PA in children, although “most such research has not focused on children” (p. 93). They also report that the availability of sidewalks increases ATS. A cross-sectional study of students in the Seattle area also found a positive correlation between ATS and walkability in higher income families (Kerr et al., 2006). In this study, walkability was an objective measure that included factors such as residential density, land use mix, and connectivity. A 2009 study of Utah high school students analyzed ATS and street connectedness within 4,000 feet of their schools, and found that students at the most connected school were 2.08 times more likely to choose ATS (Bungum, Lounsbery, Moonie, & Gast, 2008). Panter, Jones, and van Sluijs reviewed AT in youth for all purposes, and also found positive correlations with various definitions of walkability (2008).
Several studies examining ATS and walkability have found conflicting results. A 2010 cross-sectional study assessed 13 neighborhood characteristics to operationalize walkability, including the presence of sidewalks and indicators of socioeconomic deprivation (Panter, Jones, Van Sluijs, & Griffin, 2010). These researchers found a negative correlation between walkability and ATS, but theorized that more connected, more deprived neighborhoods may experience more traffic, which could decrease ATS due to safety concerns. A cross-sectional study of Australian school children by Timperio et al. (2006) also yielded a negative correlation between good connectivity and ATS. They assessed connectivity through pedestrian route directness (PRD) “by dividing the distance to school along the road network … by the ‘straight line’ or ‘crow-fly’ distance” (p. 47). ATS was negatively correlated with this measure. The researchers theorized that lower PRD scores may indicate busier roads, which may be considered less safe for active commuting by children. It is important to note that most studies of walkability and ATS are cross-sectional and do not establish causation.

Parental beliefs and concerns

Parents are frequently surveyed about their beliefs and concerns about ATS, as they play a key role in the transportation choices of their children. “Research in the U.S. and the U.K. demonstrates that the major barriers for children walking or cycling to school, apart from distance, were parents’ concern for their child’s safety” (Merom, Tudor-Locke, Bauman, & Rissel, 2006, p. 679). Parental concerns about perceived safety have been linked to decreased rates of ATS by multiple studies (Faulkner, Richichi, Buliung, Fusco, & Moola, 2010; Kerr, et al., 2006; McDonald & Aalborg, 2009; Merom, et al., 2006; Salmon, Salmon, Crawford, Hume, & Timperio, 2007; Yeung, et al., 2008).
through both quantitative and qualitative methods. Parental concerns about convenience have also been linked with decreased rates of ATS, as parents who escort their children to school must walk twice as far. This relationship has also been noted by multiple researchers (Faulkner, et al., 2010; Kerr, et al., 2006; McDonald & Aalborg, 2009; Salmon, et al., 2007).

Some parental attributes are associated with an increase in ATS. Merom et al. (2006) documented a positive correlation with parental belief in the health benefits of ATS, a parent who is also an active commuter, and commuting to school with a father. Another study surveyed 357 parents of 10-14 year olds in the San Francisco area and found a positive correlation between ATS and parental perception of high levels of social control in their neighborhood (McDonald, Deakin, & Aalborg, 2010).

**Does ATS increase PA levels?**

Many children do not meet guidelines for recommended amounts of physical activity. The 2003 Youth Risk Behavior Surveillance System (YRBSS) found that 37% of students did not participate in at least 20 minutes of vigorous PA on at least 3 days in the previous week. Traditionally interventions designed to increase PA in the school setting have focused on PE, but time spent by students in PE classes has declined over the past several decades. Students may also compensate for additional PA at school by reducing time spent in PA at home (Pate, et al., 2006). As public health professionals seek effective avenues to increase PA in children, ATS has emerged as an opportunity to help children accumulate MVPA.

A 2002 cross-sectional study of 1,094 Russian school children yielded data on physical activity in students aged 7-13 years in school, at home, and in active commuting
through parent reports. Over 90% of the participants used active methods of transportation to school. The researchers compared the reported minutes of PA with several guidelines for PA in youth. When the researchers included the time students spent on ATS, the number of students meeting the guidelines increased significantly. The researchers stated that ATS may be a “missed opportunity” (Tudor-Locke, et al., 2002, p. 507) to increase PA in children.

Several subsequent studies have also analyzed AT as a source of PA. Berrigan, Troiano, McNeel, DiSogra, & Ballard-Barnbash (2006) examined AT patterns in adults through data obtained in the California Health Interview Survey. Their analysis indicated that including AT, or non-leisure time walking and biking (NLTWB) in their calculations helped to eliminate some of the disparities in meeting PA guidelines in their population. In an analysis of the transportation patterns of 16,837 children ages 5-14 in Canada, Morency and Demers (Morency & Demers, 2010) translated reported short trips by car into a measurement of steps. When these accumulated steps totals were analyzed, the researchers found that the motorized trips represented an average of 2238 steps per day per child. If the trips in question used AT instead of motorized transportation, they would represent over 15% of the participants’ recommended levels of daily PA.

Sirard, Riner, McIver, and Pate (2005) focused more specifically on the relationship between ATS and total PA in elementary school students. They collected data through surveys as well as accelerometers worn by 219 5th grade students in Columbia, SC. Their analysis indicated that students who regularly used ATS (5 or more AT trips in a week) accumulated significantly more minutes of MVPA than their peers. Students using ATS did not have significantly more minutes of PA at school or at home,
so the increased amount of PA appears to be attributable to their transportation method. It is important to note that this study’s cross-sectional design cannot establish causality.

Abbott, Macdonald, Nambiar and Davies (2009) completed a similar study with Australian schoolchildren ages 5-17 and a larger sample (n=3197). Children in this study also reported their transportation method by survey, but recorded their PA with pedometers on both school days and weekends. The researchers compared step totals for their participants to recommended totals, and found no significant relationships in younger children. In older children, however, walking to school was associated with an increased number of steps. Children aged 9-11 who walked to school were also more likely to meet guidelines for daily step counts. Note that cycling was not included in this study since it cannot be effectively recorded by pedometers. Also, the cross-sectional design cannot establish if the active commuters chose their transportation method because they were accustomed to being more active, or if their choice increased their activity level.

Some researchers have found conflicting data on the relationship between ATS and PA level. For instance, Nilsson et al. (2009) studied PA and sedentary time in youth enrolled in the European Youth Heart Study. Participants (n=1327) were ages 9 and 15, and wore accelerometers for 4 consecutive days, including 2 weekend days. Their analysis found no significant increase in the amount of time spent in MVPA in participants who used ATS, indicating that children who walk or cycle to school may compensate for this activity with additional sedentary time at other times of the day. van Sluijs et al. (2009), however, found a dose-response relationship between travel mode and PA level in their 4688 participants in the U.K. The percentage of
students using ATS, 43.5%, was higher than similar populations in the U.S. Participants were members of a cohort study investigating determinants of childhood health, the Avon Longitudinal Study of Parents and Children (ALSPAC). Parents or caregivers reported the distance between their home and school by survey, and the students wore accelerometers for 7 consecutive days. The accelerometers yielded data on both total PA and MVPA. Analysis indicated only modest increases in MVPA for those students living within .5 miles of school, while those who walked .5 to 5 miles reported 5.98 to 9.77 minutes more of daily MVPA. These increases were only apparent on school days, appearing to indicate that ATS was responsible for the increase in MVPA.

Does ATS affect health indicators?

Some of the benefits of PA in children include preventing excessive weight gain and preventing or reducing insulin resistance (Maffeis & Castellani, 2007), and increasing cardiovascular fitness levels (Voss & Sandercook, 2010). If ATS increases levels of PA, then students who use active methods of transportation should experience improvements in these health indicators. Researchers have investigated these relationships in a variety of studies.

Gordon-Larsen, Nelson, and Beam (2005) studied the associations among AT, PA and body weight in U.S. adolescents by analyzing data from the National Longitudinal Study of Adolescent Health (NLSAH). Transportation data was collected by survey, and height and weight were assessed during in-home surveys. Weight status was operationalized through Body Mass Index (BMI) with a cutoff point of 25 used to define overweight BMIs. Fitness level was assessed by questionnaire. Participants who reported at least 5 episodes of MVPA were classified as physically active. The researchers found a
small percentage of young adults who used AT to travel to school (26.7%) and work (8.1%). Participants who used AT were significantly more likely to have BMIs below 25 and to report at least 5 episodes of MVPA, though the study was unable to establish the direction of causality because of its cross-sectional design.

A more recent study followed a cohort of elementary school students (n=924) through fourth and fifth grade. Transportation methods were assessed by questionnaire 4 times over the 2 year study period. The students were classified as active commuters if they used ATS at least 3 days per week. Students also wore accelerometers for 1 day in fourth grade, and their height and weight were assessed at the beginning and the end of each year. Skinfold measurements were also taken at those times. Height and weight were converted to age- and sex-adjusted BMIs. ATS was more prevalent among boys who were classified as non-overweight and more active based on their accelerometer readings. No significant change in BMI or skinfold measurements was noted over the study period for students who used ATS (Rosenberg, Sallis, Conway, Cain, & McKenzie, 2006).

A cross-sectional study of 6085 students in the U.K. was based on data from the East of England Healthy Hearts study. Researchers had measured height and weight for the participants and calculated BMI, and assessed fitness levels through a paced 20 meter shuttle run. Transportation method was evaluated by questionnaire, and students classified themselves as active commuters. Their results indicated that students who used ATS were significantly more likely to be categorized as fit. Girls who cycled to school were in fact 10 times more likely to be considered fit than girls who used passive methods of transportation. However, the study did not identify any relationships between...
active commuting and BMI. As with previous studies, the study design did not allow the researchers to draw any conclusions about the direction of causality (Voss & Sandercook, 2010).

Pabayo, Gauvin, Barnett, Nikiema, and Seguin (2010) were able to establish a relationship between BMI and ATS in their recent study of birth cohort in Quebec. Participants (n=1170) were followed from kindergarten through 2nd grade. Their parents reported their mode of transportation to school each year, and the students’ height and weight were collected yearly in the home by researchers. Height and weight were converted to BMIs and then to z-scores. Students who sustained active transportation through the first year of the study had an average BMI z-score that was .18 lower than students who used motorized transportation. For students who sustained their ATS into the second year, the decrease in average BMI z-scores was .30. Their results indicate that starting ATS at an early age and sustaining it over several years may have a protective effect against weight gain.

Other researchers investigating ATS and weight status have not observed the predicted relationship. Heelan et al. (2005) followed 320 elementary school children over 5 months. Height, weight, and skinfold measurements were taken at the beginning and end of the study period, and transportation method and PA level were assessed one day each month by questionnaire. Their results indicated that ATS was positively correlated with BMI, though the researchers theorized that this counterintuitive result may have been driven primarily by weight gain in already overweight students. Fulton, Shisler, Yore, and Caspersen (2005) analyzed telephone survey data from 1395 parent-child pairs. Their results indicated no relationship between BMI and transportation method.
How can we effectively increase ATS?

Given the potential for ATS to increase PA in students and improve health, public health professionals have begun to design and evaluate interventions to improve ATS rates in children. The designs of these interventions have varied, and the studies have had varying results.

A 2004 review article (Ogilvie) of walking interventions for all populations found mixed results in ATS interventions, but concluded that “targeted programmes can change the behavior of motivated subgroups” (p. 3). He established a 5% increase as a typical improvement in walking rates. A later review (Ogilvie et al., 2007) included 3 studies specific to school populations, and found significant results in one elementary intervention (McKee, Mutrie, Crawford, & Green, 2007), a curriculum-based intervention promoting active commuting for environmental reasons in the U.K. Another intervention in the U.K. (Rowland, DiGuiseppi, Gross, Afolabi, & Roberts, 2003) evaluated the impact of a school travel coordinator at 11 London schools, and found no significant increase in ATS rates after 1 year.

A SRTS intervention in Marin County, CA (Staunton, Hubsmith, & Kallins, 2003) has funded a multilevel project over several years. The intervention assesses routes to school and funds built environment projects to improve safety, sponsors regular Walk and Bike to School Days, provides staging areas where students who live too far from school for AT can be dropped off to use ATS for the remaining portion of their commute, organizes WSB routes, offers incentives to participating students, and provides newsletters and other PR materials. The data from this intervention was not presented as a formal intervention or compared to control sites, but the authors reported a 64%
increase in walkers and a 114% increase in bikers based on student surveys at participating schools. The participating sites self-selected which may bias these results.

Another group of researchers evaluated the impact of SRTS projects statewide in California (Boarnet, Anderson, Day, McMillan, & Alfonzo, 2005). This study focused on the impact of built environment changes funded by the SRTS legislation by surveying parents (n=1244) of third, fourth, and fifth grade students at project locations. The survey asked parents if their students used ATS more frequently after built environment improvements were completed, and if their students’ usual route to school passed the SRTS project. Analysis indicated that students whose routes passed the SRTS projects were significantly more likely to use ATS than those whose routes were not impacted by the improvements, but generally more parents reported a decrease in ATS (18%) than reported an increase (10.6%) after the improvements. The researchers theorized that construction hazards during the improvements may have changed ATS habits. A highly publicized child abduction also occurred in the area during the study time period.

ATS interventions also take place as part of a larger, community-wide effort to promote PA. A community campaign in Jackson, Michigan was evaluated by Hendricks, Wilkerson, Vogt, & TenBrink (2009). The Jackson intervention focused on improving active commuting rates for elementary school children and working adults through promotion, physical projects, and policy changes. ATS was promoted through an International Walk to School Day events. SRTS funds were used for built environment improvements like improving sidewalks, crosswalks, and signage. International Walk to School Day participation grew from 650 students at one school to 1254 students at 7 schools over 3 years, but these figures represent participation in an event more than an
actual increase in regular ATS. The researchers did report increases in walking to school at participating school sites, but did not calculate significance.

Another community-wide campaign in Columbia, Missouri was evaluated by Thomas, Sayers, Godon, and Reilly (2009). The project was based on a 5P model (partnerships, promotions, programs, policy changes, and physical projects). The elements of the project that involved ATS were a Walk to School Day promotional event, and a WSB program. The WSB was a daily program that grew consistently over 3 years, from a single school pilot with 30 children to 400 children from 14 schools. This WSB program also included an off-site “staging area” where students who lived too far to use ATS for their whole commute could be dropped off and use ATS for their final leg. The researchers did not report growth in total ATS or significance.

**Summary**

An extensive body of literature has developed around ATS. Research investigating determinants of ATS indicates that distance is the most influential factor in ATS rates. Studies on the impact of ATS on total PA in children has had mixed results, but several well-designed studies indicate that students who use ATS are generally more active than their peers. If this conclusion is supported, then students who commute to school by active methods should be more likely to meet PA guidelines and experience the associated health benefits. Interventions to increase ATS in elementary school students have had mixed results, and several programs that appeared successful have not been thoroughly evaluated.
CHAPTER 3

METHODOLOGY

A quasi-experimental design was used to evaluate the effectiveness of an intervention to increase ATS among elementary school students. A description of the sample, data collection methods, and program design are included in this section.

Sample

The target population for this intervention was students at a suburban elementary school (n=693). The students were enrolled in pre-kindergarten through fifth grade. The study site was matched with a sister school that draws students from the same geographic area. The first elementary school student in each family is assigned to one of the schools if they register before the school year begins. During the school year, new registrations alternate monthly between the schools. Subsequent students in a family attend the same school as the first student. This method of assignment creates a unique situation in which the sister school represents a natural control for the study site, as shown in Figure 1.

Fig. 1. Zoning map of intervention and control schools
Demographic data for both schools for the 2009-2010 school years was compared using $\chi^2$ analysis. The analysis resulted in no significant variation between the school population for gender or ethnic distribution, or for students with individualized education plans (IEPs), limited English proficiency (LEP), or students receiving free or reduced price lunches (FRL).

Table 1. $\chi^2$ analysis of demographic data

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Degrees of freedom</th>
<th>Sample size</th>
<th>$\chi^2$ value</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>1</td>
<td>697</td>
<td>.05</td>
<td>$p= .83$</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td>3</td>
<td>697</td>
<td>.60</td>
<td>$p= .90$</td>
</tr>
<tr>
<td>IEP</td>
<td>1</td>
<td>697</td>
<td>.84</td>
<td>$p= .36$</td>
</tr>
<tr>
<td>LEP</td>
<td>1</td>
<td>697</td>
<td>2.89</td>
<td>$p= .09$</td>
</tr>
<tr>
<td>FRL</td>
<td>1</td>
<td>697</td>
<td>2.45</td>
<td>$p= .19$</td>
</tr>
</tbody>
</table>

Data collection

SRTS parent survey

A survey on ATS was conducted at the intervention site in May, 2010. The survey was funded through and conducted by the school district’s SRTS program after the school’s principal volunteered to participate. (A copy of the survey instrument is attached in Appendix A). 227 of 693 surveys were returned for a 32.8% rate of return. The survey asked parents to estimate the distance between their home and the school, collected information on typical mode of arrival and departure at school, and assessed areas of concern that affected ATS decisions. Surveys were not distributed to fifth graders as those students were due to leave the school in a few weeks. This exclusion may have skewed the results as older students appeared to be more likely to use ATS as the intervention progressed.
SRTS Tally sheet

Teachers in 14 classrooms also completed a tally sheet on 3 consecutive days in the same month. Students were asked to raise their hands to indicate how they arrived at school, and how they planned to travel home. Separate counts were collected for walkers, bikers, bus riders, family vehicles, carpools, public transit, and other (skateboards, scooters, etc.) Participating classrooms were selected by the principal.

Use of SRTS data

SRTS survey data was used to plan the Walking Wednesdays intervention. The SRTS survey was not re-administered during the study period, so a pre- and post-intervention comparison of the SRTS data was not be performed.

Frequency counts

The number of students using ATS was also counted by the researcher at the intervention and control sites before the intervention began. The researcher counted students arriving on foot and on wheels from 8:15 – 9:15 am. Both campuses have a single access point, and the frequency counts were conducted at the last intersection before this access point. No students were visible on either campus before the frequency count period began. School begins at the study site at 9:00 am, and any students arriving after the count period were late. Data was collected at both sites on days with similar weather conditions, on September 28, 2010 at the control school, and on September 29, 2010 at the intervention school. A similar count was conducted at the end of the study period, but data was collected on three days at the control school, and on six days at the intervention school on days with similar weather conditions.
\( \chi^2 \) analysis of frequency counts

Frequency counts of students using ATS at the intervention school were compared to two different reported rates of ATS at Scherkenbach from the SRTS data collection process. The parent survey asked parents to report commuting method for one child in their household. The returned surveys indicated that 8% of students in the sample typically walked or biked to school in the mornings. This expected rate and the observed rate during the frequency count were used to perform a \( \chi^2 \) test. The results of this test indicated that the observed rate did not vary significantly from the expected rate \( (p > .05) \).

The observed rate was also compared to the results of the classroom tally from May 2010 with a \( \chi^2 \) test. The results of this comparison also indicated that the observed and expected rates did not vary significantly \( (p > .05) \). The data collected through frequency counts, parent surveys, and classroom tallies all yielded statistically similar results.

Sign in sheets

During the intervention, students who used ATS were asked to sign in upon arrival at campus. These sign-in sheets were separated by grade level. The total number of students using ATS was recorded each week by grade level. These weekly tallies were expected to be a data source for the study, but in practice their validity was questionable. Some older students chose not to participate in the sign-in process, so the weekly totals might not have been accurate. Also, volunteers occasionally assisted the teachers with the sign-in process, and providing training for all potential volunteers was not feasible. This data was used by the school’s PE teacher to track participation, and was also analyzed and reported by the school’s fifth grade classes, but was not used for research purposes.
Table 2 summarizes the various methods of data collection and their use in the study.

<table>
<thead>
<tr>
<th>Method</th>
<th>Timing</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRTS parent survey</td>
<td>Pre-intervention</td>
<td>Program planning Validation of frequency counts</td>
</tr>
<tr>
<td>SRTS classroom tallies</td>
<td>Pre-intervention</td>
<td>Program planning Validation of frequency counts</td>
</tr>
<tr>
<td>Frequency counts</td>
<td>Pre-intervention</td>
<td>Baseline for study</td>
</tr>
<tr>
<td>Sign in sheets</td>
<td>During intervention</td>
<td>Not used for study, questionable validity</td>
</tr>
<tr>
<td>Frequency counts</td>
<td>Post-intervention</td>
<td>Comparison to pre-intervention counts</td>
</tr>
</tbody>
</table>

**Program design**

**Walking Wednesdays**

The intervention implemented at the study site was called ‘Walking Wednesdays’. Students who used ATS on Wednesdays during the study period were asked to sign in at the entrance to campus. (Students who arrived by car and bus used different entrances.)

Students using ATS were met by teachers and parent volunteers who checked the students in and distributed stickers or other small incentives. Since the school administration wanted to ensure that students on bikes were riding safely, riders who arrived without helmets were eligible to receive a free helmet with parental permission.

Each time a student used ATS, his or her name was written on a paper footprint shape by the PE teacher, and the footprints were posted in a path on the school walls. The PE teacher challenged the students to “walk around the school” before the end of the
year. To accommodate students who arrive by bus or arrive for extended care too early for participation, the PE teacher allowed them to walk approximately 1 mile around the playground at recess, and distributed footprints to students who completed their laps. This element did not affect ATS rates, but allowed those students to increase PA and to feel included in the program.

Student use of ATS was tracked weekly, and students received small incentives for participating in 5, 10, or 15 weeks of the program. Incentives were distributed in PE. At 5 weeks, students received a rubber bracelet. After 10 weeks, they received a pedometer. After 15 weeks of participation, they received an “iWalk to Scherkenbach” t-shirt. The bracelets and pedometers were funded by the school district’s SRTS program, and the t-shirts were provided by the PTA’s Healthy Lifestyles committee. Fifth grade students at the school received the weekly participation totals, and maintained a bulletin board tracking participation by grade level to encourage healthy competition for the greatest number of participants per grade.

Walking school bus

Students zoned for the intervention and control schools may live more than 2 miles away from the campus. To encourage these students to use ATS, a WSB program was proposed. The program did not receive enough volunteer support in its initial phase to support multiple routes, so a “staging area” approach was adopted. On Wednesdays, students were encouraged to arrive at a community park ~.5 miles away from campus and walk with their classmates on the WSB for the final leg of their commute. The staging site offered ample parking for parents who chose to accompany the WSB, and the route from the staging site to the school only crossed intersections with marked crosswalks or
crossing guards. Efforts to enlist parent support for additional WSB routes continued throughout the intervention but remained unsuccessful.

**Summary**

This study utilized a quasi-experimental design, made possible by the use of sister schools with statistically similar populations. Students and parents at the intervention school participated in a CCSD-funded data collection effort with SRTS last spring. The data collected through SRTS was statistically similar to the active commuter frequency counts collected before the study period. The program at the intervention site encouraged students to walk or bike to school through the use of small incentives and school-based recognition for multiple trips. The program began in October and concluded in April. When the program ended, another set of frequency counts was conducted at the intervention and control sites. $\chi^2$ analysis for goodness-of-fit was used to compare pre- and post-intervention data from the intervention and control sites to determine if a statistically significant difference exists.
CHAPTER 4

RESULTS

The purpose of this quasi-experimental study was to examine the relationship between low-cost incentives and ATS rates among elementary school children. Descriptions of the sample and the findings are presented below.

Description of the sample

Participants in the study attended a suburban Las Vegas elementary school where the ATS incentive program was offered. Students in the control group attended the school’s sister campus which is located on the same piece of property but administered separately. No ATS or physical activity promotion programs were reported at the control school. The most recent demographic information available for both groups is from school accountability reports required by No Child Left Behind (NCLB) legislation and published on Clark County School District’s (CCSD) website. These reports also provide data on the entire population of CCSD’s students, allowing comparison of the sample and control groups with the general population of students enrolled in public school in Clark County. Descriptive characteristics are provided in Table 3.

$\chi^2$ analysis of the characteristics of the experimental and control schools in Minitab 15.1.30.0 found that both schools varied significantly from the school district population for the number of Hispanic students and white students, students with limited English proficiency, and students receiving free or reduced-price lunch. The results of the $\chi^2$ test for goodness-of-fit for these measures are presented in Table 4.
Table 3. Demographic, educational, and socio-economic characteristics of experimental group, control group, and population.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n (experimental group)</th>
<th>n (control group)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total enrollment</td>
<td>693</td>
<td>697</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>367</td>
<td>372</td>
</tr>
<tr>
<td>Female</td>
<td>326</td>
<td>325</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>62</td>
<td>60</td>
</tr>
<tr>
<td>Hispanic</td>
<td>113*</td>
<td>109*</td>
</tr>
<tr>
<td>Black/African American</td>
<td>83</td>
<td>82</td>
</tr>
<tr>
<td>White</td>
<td>427*</td>
<td>441*</td>
</tr>
<tr>
<td>Educational measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IEP</td>
<td>73</td>
<td>66</td>
</tr>
<tr>
<td>LEP</td>
<td>22*</td>
<td>30</td>
</tr>
<tr>
<td>ADA</td>
<td>95.8%</td>
<td>96.1%</td>
</tr>
<tr>
<td>SES measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRL</td>
<td>146*</td>
<td>130*</td>
</tr>
</tbody>
</table>

*Varies significantly from general CCSD population at α=.05.

1 Students with Individualized Education Plans

2 Students with Limited English Proficiency

3 Average Daily Attendance

4 Students receiving Free and Reduced Price Lunches

The control group and the experimental group, however, did not vary significantly on these measures. Although the two populations are not representative of the general population of the school district, they are similar to each other, as expected with random assignment of families to the two schools.
Table 4. Results of $\chi^2$ test for goodness-of-fit for experimental and control school when compared to school district population.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Degrees of freedom</th>
<th>Sample size</th>
<th>$\chi^2$ value</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race/ethnicity</td>
<td>3</td>
<td>309,335</td>
<td>152,412</td>
<td>$p&lt;.001$</td>
</tr>
<tr>
<td>LEP</td>
<td>1</td>
<td>309,335</td>
<td>226,543</td>
<td>$p&lt;.001$</td>
</tr>
<tr>
<td>FRL</td>
<td>1</td>
<td>309,335</td>
<td>95,019</td>
<td>$p&lt;.001$</td>
</tr>
</tbody>
</table>

Control school

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Degrees of freedom</th>
<th>Sample size</th>
<th>$\chi^2$ value</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race/ethnicity</td>
<td>3</td>
<td>309,335</td>
<td>168,629</td>
<td>$p&lt;.001$</td>
</tr>
<tr>
<td>LEP</td>
<td>1</td>
<td>309,335</td>
<td>144,565</td>
<td>$p&lt;.001$</td>
</tr>
<tr>
<td>FRL</td>
<td>1</td>
<td>309,335</td>
<td>127,601</td>
<td>$p&lt;.001$</td>
</tr>
</tbody>
</table>

Pre-intervention data collection

Frequency counts for ATS were conducted for the intervention and control schools in late September 2010. The results of frequency counts are presented in Table 5.

Table 5. Pre-intervention active transportation frequencies for intervention and control schools.

<table>
<thead>
<tr>
<th></th>
<th>Intervention school</th>
<th>Control school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walkers</td>
<td>40</td>
<td>16</td>
</tr>
<tr>
<td>Cyclers*</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Cyclers with helmets</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Cyclers without helmets</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>Total ATS students</td>
<td>57</td>
<td>29</td>
</tr>
<tr>
<td>Total school population</td>
<td>693</td>
<td>697</td>
</tr>
</tbody>
</table>

The category “cyclers” included students who rode bikes, scooters, or skateboards.

The active transportation frequency counts for the intervention and control schools differed significantly for the total number of students using ATS, the number of walkers, and the number of students cycling with helmets, but not for the total number of cyclers. The results of the $\chi^2$ test for goodness-of-fit for the pre-intervention frequency counts are presented in Table 6.
Table 6. Results of $\chi^2$ test for goodness-of-fit for pre-intervention frequency counts.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Degrees of freedom</th>
<th>Sample size</th>
<th>$\chi^2$ value</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ATS rate</td>
<td>1</td>
<td>697</td>
<td>16.35</td>
<td>$p&lt;.001$</td>
</tr>
<tr>
<td>Walkers</td>
<td>1</td>
<td>697</td>
<td>16.15</td>
<td>$p&lt;.001$</td>
</tr>
<tr>
<td>Cyclers with helmets</td>
<td>1</td>
<td>13</td>
<td>20.48</td>
<td>$p&lt;.001$</td>
</tr>
<tr>
<td>Total cyclers</td>
<td>1</td>
<td>697</td>
<td>1.01</td>
<td>$p=.32$</td>
</tr>
</tbody>
</table>

Frequency counts were repeated at the intervention school at a midpoint in the intervention in January 2011. The frequency data was collected at the same location and during the same time period as the initial counts, although weather conditions were more adverse (temperatures in 50s, winds gusting to 25 mph). These mid-point frequencies still represented a statistically significant increase in the number of active commuters, $\chi^2(1, N = 693) = 9.25, p = 0.002$.

Frequency counts were conducted at the end of the intervention at the experimental and control schools. Again, the frequency data was collected at the same locations and during the same time period as the initial counts and with similar weather conditions (sunny, temperatures in the high 60s and low 70s, and variable winds). Data was collected on three different days at each location. At the intervention school, ATS frequencies were counted both on intervention days (Wednesdays) and other weekdays. Results of the frequency counts are presented in Table 7.
Table 7. Mean post-intervention frequency counts at intervention and control schools.

<table>
<thead>
<tr>
<th></th>
<th>Intervention school</th>
<th>Control school</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wednesdays</td>
<td>Other weekdays</td>
</tr>
<tr>
<td>Walkers</td>
<td>77.33±14.5</td>
<td>43.33±3.79</td>
</tr>
<tr>
<td>Cyclers</td>
<td>44.67±4.04</td>
<td>30.67±3.21</td>
</tr>
<tr>
<td>Cyclers with helmets</td>
<td>33.33±1.53</td>
<td>4.33±1.15</td>
</tr>
<tr>
<td>Cyclers without helmets</td>
<td>11.33±3.06</td>
<td>26.33±2.08</td>
</tr>
<tr>
<td>Total ATS students</td>
<td>122±10.54</td>
<td>74±7</td>
</tr>
<tr>
<td>Total school population</td>
<td>693</td>
<td>693</td>
</tr>
</tbody>
</table>

The post-intervention frequency counts were compared to the pre-intervention baseline data at the experimental and control schools with the $\chi^2$ test for goodness-of-fit. The analysis indicated no statistically significant difference in ATS rates at the control school, $\chi^2(1, N = 697) = .59, p = .44$. At the intervention school, however, a statistically significant increase in ATS rates was observed on both intervention days, $\chi^2(1, N = 693) = 80.77, p < .001$, and non-intervention days, $\chi^2(1, N = 693) = 5.52, p = .02$. The increase on non-intervention days was less pronounced. Helmet use among cyclers, which is required to participate in the intervention, did not vary significantly at the control school, $\chi^2(1, N = 11) = 1.05, p = .31$, during the study period. The mid- and post-intervention frequency counts indicate that the intervention school experienced a significant increase in helmet use among cyclers on intervention days, but not on other weekdays. The results of the $\chi^2$ test for goodness-of-fit for helmet use are presented in Table 8.
Table 8. Results of $\chi^2$ test for goodness-of-fit for post-intervention helmet use among cyclers at experimental school.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Degrees of freedom</th>
<th>Sample size</th>
<th>$\chi^2$ value</th>
<th>Significance level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helmet use mid-intervention</td>
<td>1</td>
<td>26</td>
<td>212.04</td>
<td>$p&lt;.001$</td>
</tr>
<tr>
<td>Helmet use on intervention days</td>
<td>1</td>
<td>44.66</td>
<td>381.26</td>
<td>$p&lt;.001$</td>
</tr>
<tr>
<td>Helmet use on other weekdays</td>
<td>1</td>
<td>30.66</td>
<td>3.76</td>
<td>$p=.06$</td>
</tr>
</tbody>
</table>

**Findings**

The hypothesis formulated in this study was that the use of low-cost incentives would result in a higher rate of active transportation to school among elementary school students. When the pre- and post-intervention frequency counts were compared, a statistically significant increase in ATS rates was found in the experimental group, while no significant increase was found in the control group. Students at the intervention school appeared to be more likely to use ATS both on intervention days (Wednesdays) and non-intervention days, although the increase was more pronounced on days when the incentives were awarded. Helmet use among students at the control school did not vary. Helmet use increased significantly at the experimental school but only on intervention days.

**Summary**

Analysis of the pre- and post-intervention ATS frequency counts indicates that students at the intervention school were more likely to use ATS both on intervention and
non-intervention days. The increase was less pronounced but still significant on non-intervention days. No changes in ATS were noted at the control school.
CHAPTER 5
DISCUSSION AND CONCLUSIONS

Discussion of Findings

This study investigated the hypothesis that a school-based active transportation encouragement program would increase rates of ATS among elementary school students with its use of low-cost incentives. Results indicated that the program was effective, increasing ATS both on intervention and non-intervention days. The intervention also increased helmet use among students who cycled to school. This effect only appeared on intervention days.

Previous studies of efforts to increase ATS in students have yielded mixed results. Ogilvie’s 2004 review article established a 5% increase as a typical improvement in walking rates. The intervention school experienced an increase from 8% to 17% on intervention days, and to 13% on non-intervention days. This encouragement program meets the standard established by Ogilvie for intervention days, and approaches it for non-intervention days. A weighted average of 5 weekdays (one intervention and four non-intervention days) yields a 5.8% increase in weekly ATS rates at the intervention school.

Sirard et al. (2005) reported that students who used ATS accumulated approximately 24 minutes of MVPA than their peers each weekday. If students only participate in one day of ATS each week, this additional PA may not represent enough of an increase to convey the health benefits associated with increased PA. In its current format, this encouragement program may best serve as a method to increase self-efficacy for ATS. Future projects which seek to increase PA in student populations might consider
offering incentives more often, since rates of ATS did appear to effectively increase on intervention days. Although the change in ATS appears to be linked to the incentive program, the program also involved support and encouragement from school staff, including the principal, the PE teacher, and other classroom teachers. Children participating in the program received recognition and support as well as their low-cost incentives, and the current study design did not offer an opportunity to determine whether students were motivated by the incentives or the social support.

Students were required to use helmets to participate in the program if they rode bicycles, skateboards, or scooters to school. If a student arrived without a helmet, he or she was encouraged to wear one the next week to receive credit. This approach appeared to be effective, as helmet use increased significantly on intervention days. On other weekdays, however, helmet use was unchanged. Future implementations of the intervention may want to consider offering incentives and social support specifically for helmet use.

An appealing aspect of this study may be the low cost of the program. On a budget of less than $1000, the school’s program was able to increase ATS from 8% to 17% on intervention days. Unlike ATS interventions which focus on infrastructure and engineering issues, this program is relatively fast and easy to implement. It does rely on strong community support and volunteer time, so not all true costs are reflected in the budget, but even in a strict budgetary environment, such a program presents few barriers to implementation.
Conclusions

The following conclusions were drawn from this study:

1. The school-based ATS encouragement program appears to have increased the number of active commuters at the intervention school on days when the incentives were distributed.

2. The rates of ATS also significantly increased on non-intervention days, though the impact was less pronounced.

3. Requiring the use of helmets for students to participate in the intervention appears to have increased helmet use, but only on intervention days.

The results of this study imply that ATS interventions need not be expensive or involve large infrastructure changes to increase rates in elementary school students. A low-cost encouragement program can effectively increase ATS rates and thus PA in children.

Limitations

The generalizability of these results may be limited by the use of one intervention site and control site. Although a statistically significant increase occurred only at the intervention school, these results may not be reproducible at other schools in different types of communities. The pre-test data at the intervention and control schools was only collected on one day. This may be less robust than is desirable, but the frequency counts for the intervention school were validated against other data sources and found to be accurate. The data from this study includes only summary-level demographic information about potential participants. Since specific information on participants was not available, the researcher is unable to draw conclusions about the effectiveness of the program.
within sub-groups. The program also offered 3 kinds of incentives (pedometers, bracelets, and paper footprints), as well as the support and encouragement of school community leaders, but the study design could not identify which of these sources of encouragement were most effective for participants. Finally, rates of ATS at the intervention and control school showed statistically significant variation before the intervention began. ATS rates were already higher at the experimental school before the program began. The researcher is unable to explain this difference, although a recently opened highway off-ramp that is located closer to the control school may have served as a deterrent.

**Recommendations for further research**

ATS shows promise as a daily source of physical activity for children. Further research into ATS interventions should be conducted to establish the effectiveness of different approaches. Recommendations for further research include:

1. Reproduce this study in different populations, with and without the material incentives, and determine whether the incentives or the social support are more effective.
2. Perform a case-control study with participants and non-participants in the program and discover characteristics associated with participation.
3. Further investigate the relationships among incentives, social support, and helmet use.
4. Follow a cohort of elementary school students who use ATS as they grow to determine if use of ATS in elementary school predicts future transportation habits.
5. Assess the impact of ATS interventions such as this one on health indicators, such as BMI, cardiovascular fitness, and the prevention of excessive weight gain.
6. Further investigate the role a Walking School Bus can play in increasing ATS in elementary students.
APPENDIX 1

IRB APPROVAL

Biomedical IRB – Exempt Review
Deemed Exempt

DATE: February 28, 2011

TO: Dr. Tim Bungum, Environmental and Occupational Health

FROM: Office of Research Integrity – Human Subjects

RE: Notification of review by Cindy Lee-Tatascio, MS, Cindy Lee-Tatascio, RS, CIF, CIM
Protocol Title: An Evaluation of an Active Transportation to School Intervention
Protocol # 1102-1725M

This memorandum is notification that the project referenced above has been reviewed as indicated in Federal regulatory statutes 45 CFR 46 and deemed exempt under 45 CFR 46.101(b)2.

PLEASE NOTE:
Upon Approval, the research team is responsible for conducting the research as stated in the exempt application reviewed by the ORI – HSS and/or the IRB which shall include using the most recently submitted Informed Consent/Assent Forms (Information Sheet) and recruitment materials. The official versions of these forms are indicated by a footer which contains the date exempted.

Any changes to the application may cause this project to require a different level of IRB review. Should any changes need to be made, please submit a Modification Form. When the above-referenced project has been completed, please submit a Continuing Review/Progress Completion report to notify ORI – HSS of its closure.

If you have questions or require assistance, please contact the Office of Research Integrity Human Subjects at IRB@unlv.edu or call 895-2794.
# APPENDIX 2
## SRTS SURVEY

### Parent Survey About Walking and Biking to School

**Dear Parent or Caregiver,**

Your child’s school wants to hear your thoughts about children walking and biking to school. This survey will take about 5 - 15 minutes to complete. We ask that each family complete only one survey per child your children attend. If more than one child from a school brings a survey home, please fill out the survey for the child with the next birthday from today’s date.

After you have completed this survey, send it back to the school with your child or give it to the teacher. Your responses will be kept confidential and neither your name nor your child’s name will be associated with any results.

Thank you for participating in this survey!

**+ CAPITAL LETTERS ONLY – BLUE OR BLACK INK ONLY**

<table>
<thead>
<tr>
<th>School Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

1. What is the grade of the child who brought home this survey? [ ] Grade (PK, 1, 2, 3, 4, 5, 6, 7, 8, 9)  
2. Is the child who brought home this survey male or female? [ ] Male  [ ] Female

3. How many children do you have in Kindergarten through 8th grade? [ ]

4. What is the street intersection nearest your home? (Provide the names of two intersecting streets) ___________________________________________ and ___________________________________________  

5. How far does your child live from school?  
   - [ ] Less than 1/4 mile  
   - [ ] 1/4 mile to 1/2 mile  
   - [ ] 1/2 mile to 1 mile  
   - [ ] 1 mile to 2 miles  
   - [ ] More than 2 miles  
   - [ ] Don’t know  

6. On most days, how does your child arrive and leave for school? (Select one choice per column, mark box with X)  

   **Arrive at school**
   - [ ] Walk  
   - [ ] Bike  
   - [ ] School Bus  
   - [ ] Family vehicle (only children in your family)  
   - [ ] Carpool (Children from other families)  
   - [ ] Transit (city bus, subway, etc.)  
   - [ ] Other (carpool, bus, walk, bike, skateboard, etc.)  

   **Leave from school**
   - [ ] Walk  
   - [ ] Bike  
   - [ ] School Bus  
   - [ ] Family vehicle (only children in your family)  
   - [ ] Carpool (Children from other families)  
   - [ ] Transit (city bus, subway, etc.)  
   - [ ] Other (carpool, bus, walk, bike, skateboard, etc.)

7. How long does it normally take your child to get to/from school? (Select one choice per column, mark box with X)  

   **Travel time to school**
   - [ ] Less than 5 minutes  
   - [ ] 5 - 10 minutes  
   - [ ] 11 - 20 minutes  
   - [ ] More than 20 minutes  
   - [ ] Don’t know / not sure  

   **Travel time from school**
   - [ ] Less than 5 minutes  
   - [ ] 5 - 10 minutes  
   - [ ] 11 - 20 minutes  
   - [ ] More than 20 minutes  
   - [ ] Don’t know / not sure
8. Has your child asked you for permission to walk or bike to/from school in the last year?  
☐ Yes  ☐ No

9. At what grade would you allow your child to walk or bike to/from school without an adult?  
(Select a grade between K (K, 1, 2, 3...) ☐ grade ___ or ☐ I would not feel comfortable at any grade)

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

10. What of the following issues affected your decision to allow, or not allow, your child to walk or bike to/from school? (Select ALL that apply)
☐ Distance
☐ Convenience of driving
☐ Time
☐ Child's before or after-school activities
☐ Speed of traffic along route
☐ Amount of traffic along route
☐ Adults to walk or bike with
☐ Sidewalks or pathways
☐ Safety of intersections and crossings
☐ Crossing guards
☐ Violence or crime
☐ Weather or climate
☐ My child already walks or bikes to/from school

11. Would you probably let your child walk or bike to/from school if this problem were changed or improved? (Select one choice per line, mark box with 'X')

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

12. In your opinion, how much does your child's school encourage or discourage walking and biking to/from school?
☐ Strongly Encourages
☐ Encourages
☐ Neither
☐ Discourages
☐ Strongly Discourages

13. How much fun is walking or biking to/from school for your child?
☐ Very Fun
☐ Fun
☐ Neutral
☐ Boring
☐ Very Boring

14. How healthy is walking or biking to/from school for your child?
☐ Very Healthy
☐ Healthy
☐ Neutral
☐ Unhealthy
☐ Very Unhealthy

Place a clear 'X' inside box. If you make a mistake, fill the entire box, and then mark the correct box

15. What is the highest grade or year of school you completed?
☐ Grades 1 through 8 (Elementary)
☐ Grades 9 through 11 (Some high school)
☐ Grade 12 or GED (High school graduate)
☐ College 1 to 3 years (Some college or technical school)
☐ College 4 years or more (College graduate)
☐ Prefer not to answer

16. Please provide any additional comments below.


Morabia, A., & Costanza, M. C. (2009). On the way to school (what a lot of research to be done). *Preventive Medicine, 48*(6), 505-506. doi: 10.1016/j.ypmed.2009.05.008


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