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Short Communication

Are single entry communities and cul-de-sacs a barrier to active transport to school in 11 elementary schools in Las Vegas, NV metropolitan area?

Courtney Coughenour [a,*], Sheila Clark [a], Ashok Singh [b], Joshua Huebner [a]

[a] School of Community Health Sciences, University of Nevada, Las Vegas, 4505 S. Maryland Parkway box 3064, Las Vegas, NV 89154, United States
[b] William F. Harrah College of Hotel Administration, University of Nevada, Las Vegas, 4505 S. Maryland Parkway box 6021, Las Vegas, NV 89154, United States

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ABSTRACT

Single entry communities (SECs) and cul-de-sacs minimize route choices and increase trip distance. Las Vegas' built environment facilitates the examination of these variables and active transport to school (ATS) rates. The purpose of this study was to examine the influence of SECs and cul-de-sacs on ATS rates in Las Vegas, NV elementary children. Parental-reported data was collected from 11 elementary schools on ATS rates (n = 1217). SECs and cul-de-sacs were quantified for each school zone. Logistic regression models were used to predict ATS. 23.9% of students reported ATS all of the time and 31.4% some of the time. SECs per school zone ranged from 0 to 25 (mean = 11.9). Cul-de-sacs ranged from 12 to 315 (mean = 138.3). Some ATS use was predicted by distance from school ($p \le 0.001$;OR = 0.61), parental education (high school: $p = 0.004$;OR = 0.53, some college: $p = 0.001$;OR = 0.50, 4 year degree: $p = 0.004$;OR = 0.52) and cul-de-sacs ($p \le 0.001$;OR = 0.99). A separate model using distance from school ($p \le 0.001$;OR = 0.61), parental education (high school: $p = 0.002$;OR = 0.51, some college: $p \le 0.001$;OR = 0.45, 4 year degree: $p \le 0.001$;OR = 0.45) and SECs ($p \le 0.001$;OR = 0.96) predicted some ATS. All ATS use was predicted by distance from school ($p \le 0.001$;OR = 0.58), parental education (Grades 9–11: $p = 0.05$;OR = 0.61, high school: $p \le 0.001$;OR = 0.45, some college: $p \le 0.001$;OR = 0.41, 4 year degree: $p \le 0.001$;OR = 0.38) and SECs ($p \le 0.001$;OR = 0.97). A separate model using distance from school ($p \le 0.001$;OR = 0.58), parental education (Grades 9–11: $p = 0.041$;OR = 0.59, high school: $p \le 0.001$;OR = 0.47, some college: $p \le 0.001$;OR = 0.44, 4 year degree: $p \le 0.001$;OR = 0.43) and cul-de-sacs ($p \le 0.001$;OR = 0.99) predicted all ATS. Current findings reveal that both SECs and cul-de-sacs were predictors of ATS beyond distance. Students with more SECs and cul-de-sacs in their school zone were less likely to utilize ATS.

1. Introduction

With a dramatic increase in childhood obesity over the past several decades, increasing physical activity rates in youth has become critical. One method to increase levels of physical activity (PA) in youth is through active transport to school (ATS). Studies show that children who use ATS accumulate significantly more physical activity and expend significantly more kilocalories than children who use passive transport (being driven in a motor vehicle) (Faulkner et al., 2009). Perceptions of physical activity, self-efficacy, social influences and parental and peer support are known to be influencing factors for childhood PA. Additionally, youth who are physically active are more likely to engage in new activities (Surgeon General, 1996) and to remain physically active into adulthood (Telama et al., 2005).

ATS rates have declined significantly over the last four decades, with 12.7% of kindergarten through 8th grade students walking or biking to school in 2009 compared to 47.7% in 1969 (McDonald et al., 2011). Efforts have been made to increase levels of physical activity through active transport in youth. Both the White House Task Force on Childhood Obesity and Healthy People 2020 initiatives recommend increasing the amount of trips made through active transport.

Research suggests that adults who live in communities with land use patterns that facilitate active transport attain more minutes of walking and physical activity per day (Rundle et al., 2016; Adams et al., 2015; Frank et al., 2006). However, research that explores the relationship between community design and active transport in youth has been limited. Understanding correlates of active transport behaviors in youth is critical to effectively increase the number of children who actively commute to school.

Trip distance has been shown to be the primary influencing factor in parental decisions regarding ATS (Nelson et al., 2008; Schlossberg et al., 2006; Timperio et al., 2006). Trip distance is reduced with greater street connectivity, or more intersections, as intersections enable the shortest

* Corresponding author.
E-mail addresses: Courtney.Coughenour@unlv.edu (C. Coughenour), Sheila.Clark@unlv.edu (S. Clark), Ashok.Singh@unlv.edu (A. Singh), Joshua.Huebner@unlv.edu (J. Huebner).

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route to be chosen and offer a wider range of routes to choose from (see Fig. 1). Studies examining the relationship between street connectivity and ATS have shown somewhat mixed results. Braza et al. (2004) examined ATS in California elementary schools and found that the number of intersections per street mile was significantly correlated with ATS in pairwise correlations, but not in regression models. They suggest that the effect of street connectivity may be masked due to its correlation with population density and low power of the model. Schlossberg et al. (2006) examined the influence of urban design characteristics for ATS in middle school children in Oregon and found that "students whose walking areas had high intersection densities had a 10% probability of walking, compared with only 3% and 2% if they had medium or low intersection densities, respectively (Schlossberg et al., 2006)." Giles-Corti et al. (2011) reported that regularly walking to school was higher in children whose school zone had high street connectivity and low traffic volume. In an observational study, Rothman et al. (2014) found that higher intersection densities were positively correlated with walking. Though not specific to school transport, Grow et al. (2008) examined neighborhood environmental factors associated with active transport to recreational sites for adolescents. Multivariate regression models showed a positive association between parental and adolescent self-report of high street connectivity and active transport (Grow et al., 2008). Similarly, a study of youth aged 5 to 20 years in Atlanta reported that higher street connectivity was associated with more walking (Frank et al., 2007). However, Timperio et al. (2006) found that in 10 to 12 year olds street connectivity was negatively associated with ATS.

Coughenour and Bungum (2015) found that the presence of single entry communities (SECs), or single-land use housing developments that have only one entrance into and out of the development, significantly decreased street connectivity. A design feature commonly associated with SECs and single-use housing developments are cul-de-sacs. Cul-de-sacs result in a non-through street network which also increase overall trip distance (see Fig. 1). While these design features are associated with decreased street connectivity, few studies have examined the role of cul-de-sacs and single entry communities directly on ATS. The authors located two studies which assessed these features and found mixed results. A study of 9 to 10 year olds in the United Kingdom found that students with more direct routes measured by more intersections and fewer cul-de-sacs were less likely to walk to school (Panter et al., 2010). However, a study in Oregon found that fewer dead ends in the neighborhood were predictive of walking; students "with low dead-end densities had an 8% probability of walking to school, holding other factors constant, compared to 3% and 2% for those with medium and high dead-end densities, respectively" (Schlossberg et al., 2006).

Like many other metropolitan areas in sunbelt states, Las Vegas began to experience significant population growth at the peak of urban sprawl (Barrington-Leigh and Millard-Ball, 2015). As such, the dominant form of development moved from traditional neighborhoods connected through a grid-like street design, to auto-dominant suburban neighborhoods characterized by single-use developments and SECs. Because trip distance and street connectivity influence ATS (Nelson et al., 2008; Schlossberg et al., 2006; Timperio et al., 2006), and SECs and cul-de-sacs increase trip distance and minimize street connectivity, yet few studies have examined this effect on active transport, Las Vegas metropolitan area presents an opportunity to examine the influence of this urban form on youth ATS rates. The purpose of this study was to examine the influence of SECs and cul-de-sacs on parental-reported ATS rates of elementary school children in Las Vegas, NV.

2. Materials and methods

Surveys were collected in a large, ethnically and geographically diverse school district in the Las Vegas metropolitan area in 11 elementary schools which chose to participate in the Safe Routes to School (SRTS) program in the fall of 2013. The survey was sent home in English and Spanish with each student. If a parent or caregiver had more than one child attending the school, he or she was asked to complete it only for the child with the next birthday from the date it was received. Surveys were returned to school by the students (n = 1439).

The SRTS survey was developed by the National Center for Safe Routes to School and has been administered throughout the U.S. since 2008. As of 2013, over 525,000 surveys have been collected by the National Center (Nicholas, 2013). The survey does not collect identifying information and was designed to be completed within five to 10 min. The 50 items contained in the survey include information on child's grade level, gender, parental education, and family size, as well as the home's nearest cross streets. It also requests the distance to school in quarter- to half-mile increments and information on the usual commuting method separately for the morning (to school) and afternoon (from school) trips. This survey was assessed for reliability and validity by McDonald et al. (2011). Two week test-re-test reliability for parental report of child's usual mode of travel to and from school was reliable (98.2% agreement (kappa = 0.97) and 92.9% agreement (kappa = 0.85), respectively), and parental report of distance child lives from the school was reliable (72.3% agreement (kappa = 0.65) unweighted and 93.3% agreement (kappa = 0.77) weighted) (full results presented

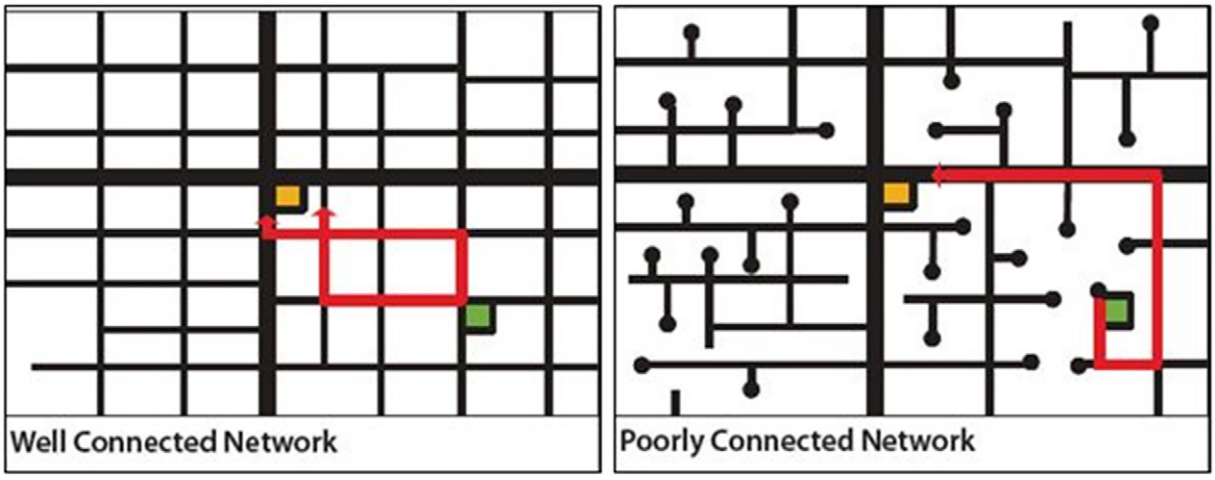

Fig. 1. A well connected street network with more intersections reduces trip distance and makes active travel more convenient.
Source: City of Las Vegas, 2013.