

Environmental Correlates of Active Travel to School, by Distance Ranges

Active Living Research
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Young-Jae Kim, PhD, MLA, **Chanam Lee**, PhD, MLA
Department of Landscape Architecture and Urban Planning
Texas A&M University, College Station, TX



Outline

- **Introduction**
 - Background, research gaps, objective and conceptual framework
- **Research design**
 - Study design, statistical methods, data collection and variables
- **Results**
 - Multivariate analyses
- **Summary**
- **Policy and Environmental Implications**
 - Strategies to promote children's active travel to school



Introduction

Child's health, Importance of ATS
identified subjects or findings related to ATS,
Unidentified subjects related to ATS

Introduction (Cont'd)

- **Active travel to school (ATS)** (i.e., walking or bicycling to school)
 - **“Potential” to help reduce childhood obesity**, but the research results have been inconsistent (Heelan et al. 2005, Rosenberg et al. 2006, Lee et al. 2008)
 - Most feasible way of acquiring **daily physical activity** among school-aged children (Sirard et al. 2005b, Tudor-Locke et al. 2002, Saksvig et al. 2007)
 - Broader health and other benefits including **mental health** (Tompsonski et al. 2011), **academic performance** (Kristjansson et al. 2010, Rees and Sabia. 2010)
 - Significant drop in ATS rates: 47.7% in 1969, 12.7% in 2009 (McDonald et al. 2011)



Introduction (Cont'd)

- **What have been done so far from previous studies**

- Direct relationships between the individual/social/environmental factors and ATS
 - **Personal factors:** income, ethnicity, walking behaviors/attitudes
 - **Social factors:** social cohesion, peer-influence, school program
 - **Built environmental factors:** home-to-school distance (a linear relationship with ATS), highways, street connectivity, intersections, traffic safety, residential density, sidewalk availability, etc.
 - **Natural environmental factors:** trees (Larsen et al. 2009), temperatures (insignificant, Robertson-Wilson et al. 2008)

Research Aims

- **Gaps in previous ATS studies that this study aims to address:**
 - **Potential variations in correlates of ATS among shorter vs. longer distance school commuters**
 - **Natural environmental predictors of ATS**, e.g., temperatures, tree canopy, grass coverage, tree heights, steep slopes, parks, etc.



Highway



Traffic Safety

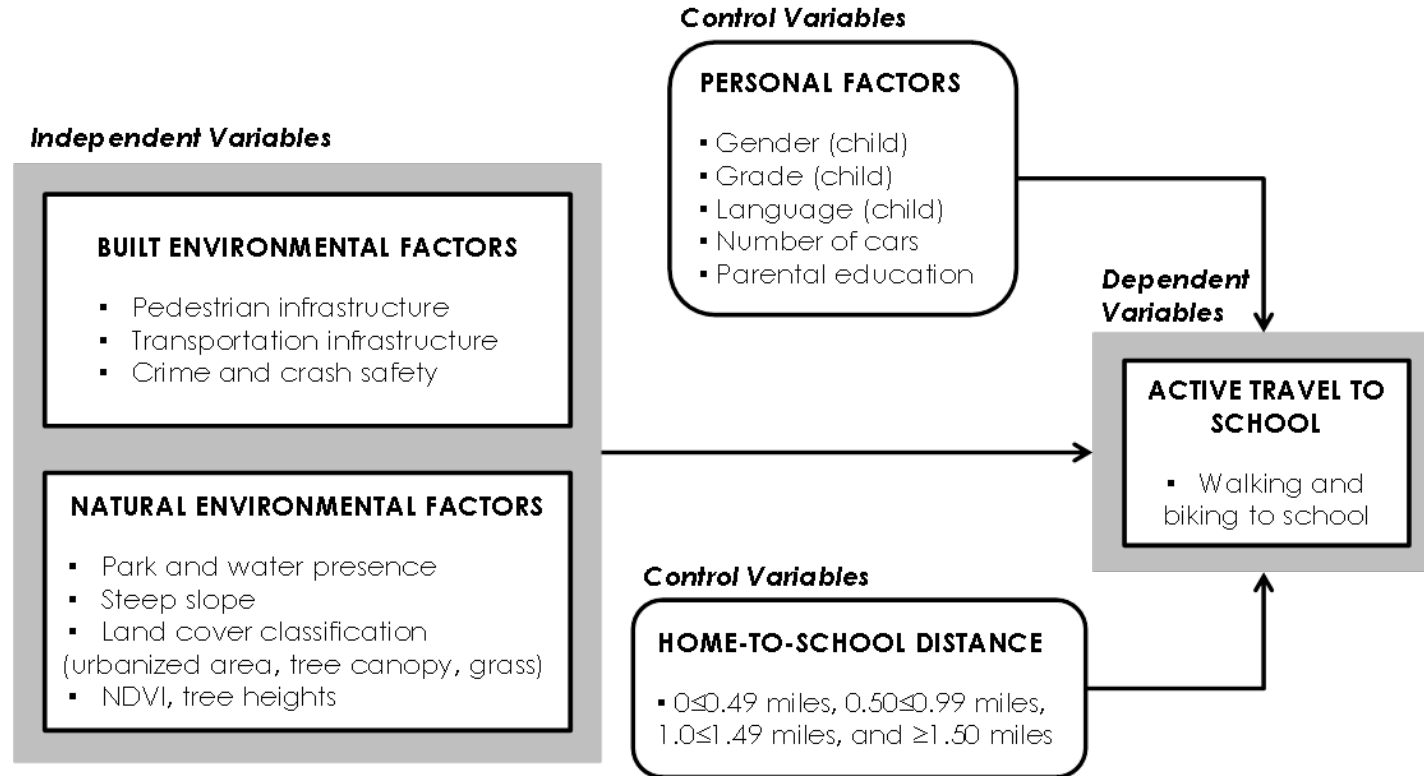


Residential Density



Street Trees/Grass

Conceptual Framework



Research design

Study area, data collection,
Survey and objectively-measured
environmental variables



Study 2: Methods

- **Study design and sample**

- **Sample:** 4,270 children from 20 schools in AISD
- **Data collection:** parental survey (2010) and GIS/Remote Sensing (2011-13)
- **Dependent variable:** ATS (a dummy variable)

Parents report of whether or not their children walked or biked to or from school on a normal day

- **Predictors:** built and natural environmental variables
- **Confounders:** personal variables and HTS distance
 - Child's gender, grade, language, number of cars, and parents' education level

Study 2: Methods

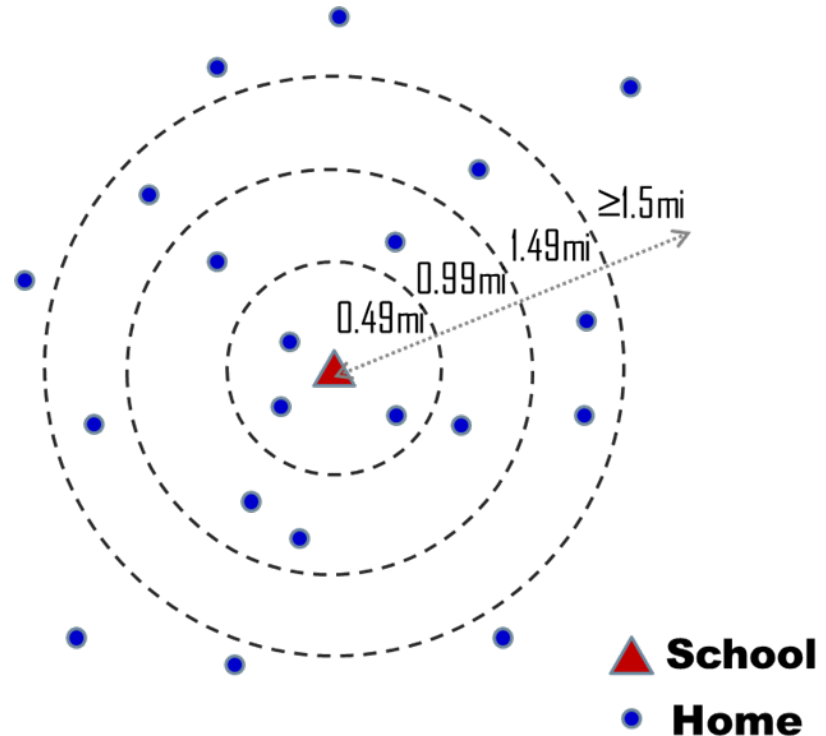
- **Analytical method**
 - **Mixed-effects logistic regression model**
(2nd level: School ID)
 - **HTS distance thresholds:**

$0 \leq 0.49$ miles

$0.5 \leq 0.99$ miles

$1 \leq 1.49$ miles

≥ 1.5 miles



Data collection and variables

- **Built Environmental Variables**

| Variables | Measures | Data Source | Variable Type |
|-------------------|---|---------------------------------|---------------|
| HTS distance | The shortest home-to-school distance measured by the network analysis in GIS | Network analysis | Continuous |
| Sidewalks | Length of sidewalks divided by total street length within HTS route buffer after multiplying by 100 | City of Austin | Continuous |
| Bike lanes | Whether the percentage of bike lanes within HTS route buffer is greater than the mean of total bike lane percentage (zero percentage excluded for the mean calculation) | City of Austin | Binary |
| Playgrounds | Presence of playgrounds within HTS route buffer | City of Austin | Binary |
| Intersections | Number of intersections per acre within HTS route buffer | City of Austin | Continuous |
| Highways | Whether the HTS route was intersected by highways | City of Austin | Binary |
| Railroads | Whether the HTS route was intersected by railroads | City of Austin | Binary |
| High speed street | Length of high speed streets (>30 mph) divided by total street length within HTS route buffer after multiplying by 100 | City of Austin | Continuous |
| Crime hotspots | Mean of crime hotspot z-scores within HTS route buffer | Austin Police Dept. | Continuous |
| Crash hotspots | Mean of all crash hotspot z-scores within HTS route buffer Mean of pedestrian- and biker-related crash hotspot values | Texas Dept. of Public Safety | Continuous |

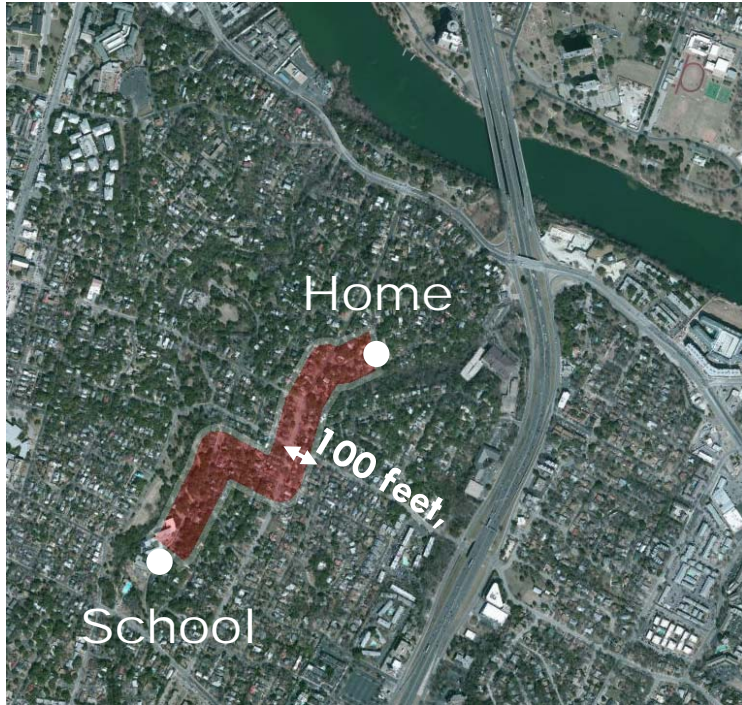
Data collection and variables

- Natural Environmental Variables**

| Variables | Measures | Data Source | Variable Type |
|------------------------|--|--|---------------|
| Park presence | Presence of a park within HTS route buffer | City of Austin | Binary |
| Water feature presence | Presence of a water feature within HTS route buffer | City of Austin | Binary |
| Steep slopes | Steep slope area (>5% or >8.33%) divided by total area of HTS route buffer area after multiplying by 100 (%) | Columbia Center (DEM data) | Continuous |
| Urbanized area | Urbanized area divided by total area of HTS route buffer area after multiplying by 100 (%) | National Agricultural | Continuous |
| Tree canopy | Tree canopy area divided by total area of HTS route buffer area after multiplying by 100 (%) | Imagery Program (DOQQ image, image classification) | Continuous |
| Grass coverage | Grass coverage area divided by total area of HTS route buffer area after multiplying by 100 (%) | | Continuous |
| Temperature | Mean of temperature measured within HTS route buffer (°C) | Landsat 5TM | Continuous |
| NDVI | Mean of NDVI measured within HTS route buffer (ranging from -1 to 1) | Landsat 5TM | Continuous |
| Tree heights | Mean of tree heights measured within HTS route buffer (feet) | TCAD (LiDAR) | Continuous |

Data collection and variables (Cont'd)

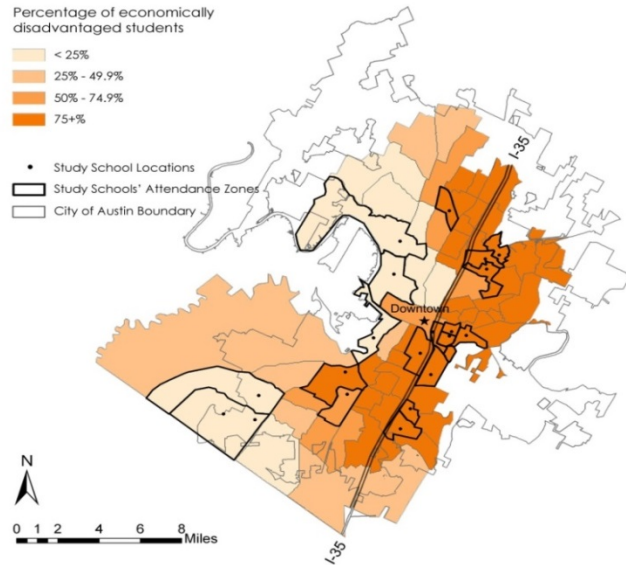
- **Measures for Environmental Variables**



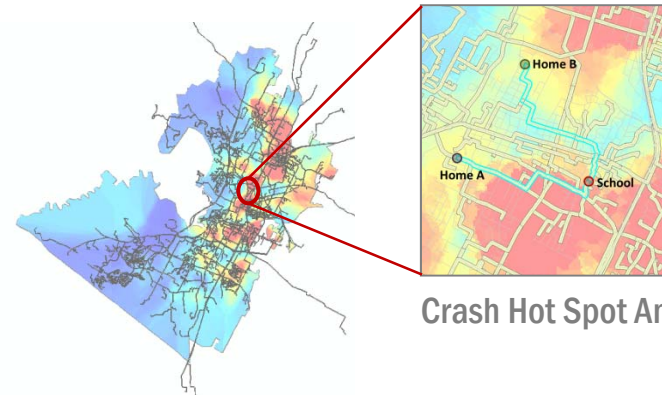
**Home-To-School (HTS) route
buffer measure (100 feet)**
(Won and Lee, 2013)

Data collection and variables (Cont'd)

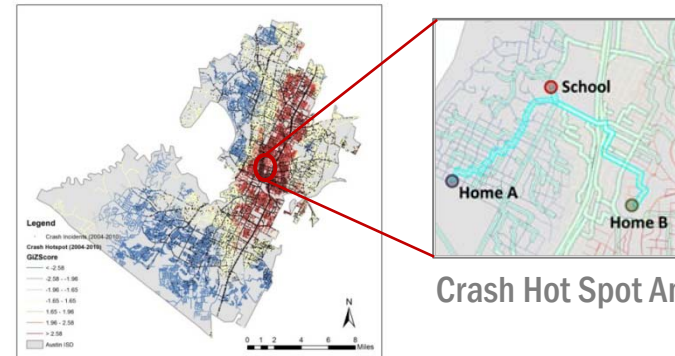
- **Crime and crash hotspots**



Percentage of **economically disadvantaged** students in AISD



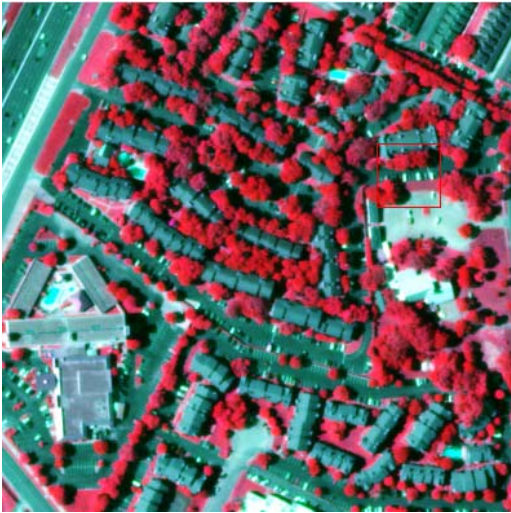
Crash Hot Spot Analysis



Crash Hot Spot Analysis

Data collection and variables (Cont'd)

- **Urbanized area, tree canopy, and grass coverage**



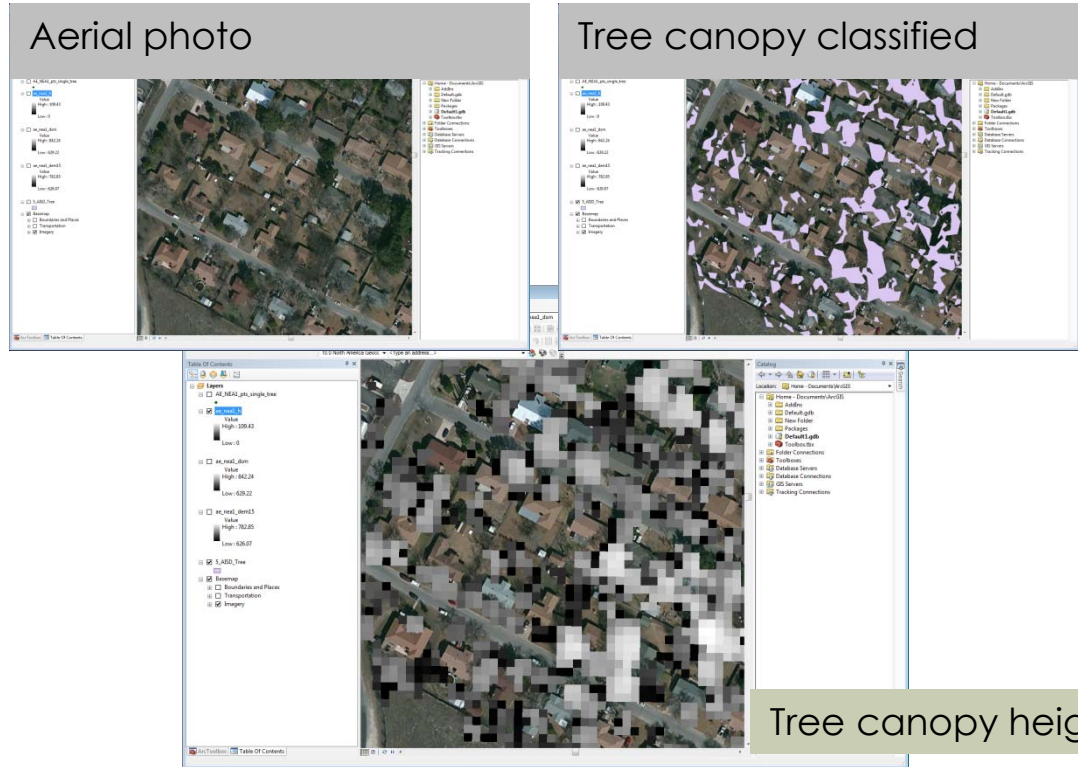
Aerial photo



Classified image
(Overall accuracy = 93.9%, kappa coefficient = 0.914)

Data collection and variables (Cont'd)

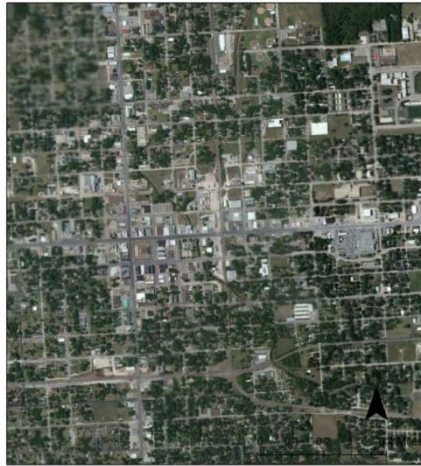
- **Tree height measurements**
(Light detection and ranging (LiDAR) data)



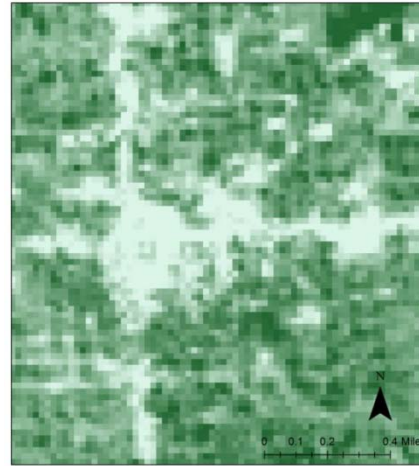
Data collection and variables (Cont'd)

- **NDVI & Temperature**

Aerial Photo



Normalized Difference
Vegetation Index (NDVI)



Legend

TB_Airline_Buffer_Area

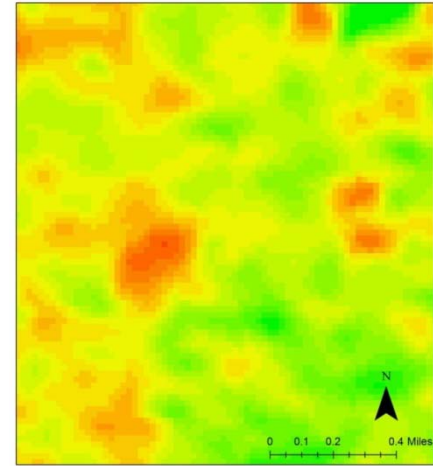
TB_NDVI

Value

High : 0.654135

Low : -0.272727

Temperature



Legend

TB_Airline_Buffer_Area

TB_Temperature

Value

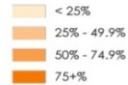
High : 38.5384

Low : 26.0372

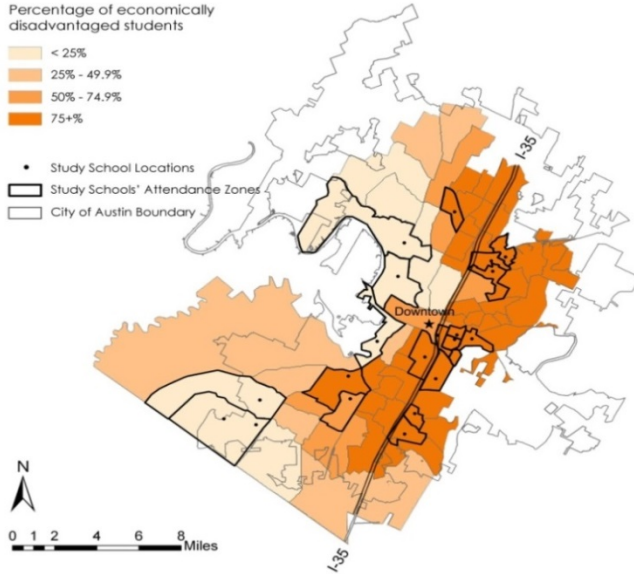
Data collection and variables (Cont'd)

Spatial Pattern of Natural Environment Data

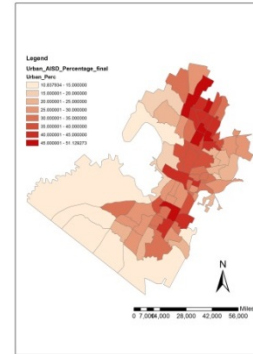
Percentage of economically disadvantaged students



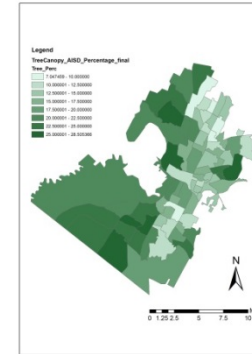
• Study School Locations
▭ Study Schools' Attendance Zones
▭ City of Austin Boundary



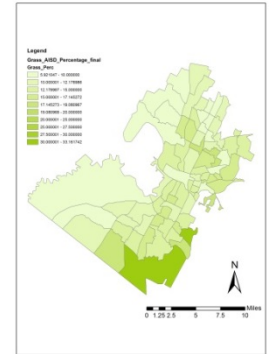
Percentage of **economically disadvantaged** students in AISD



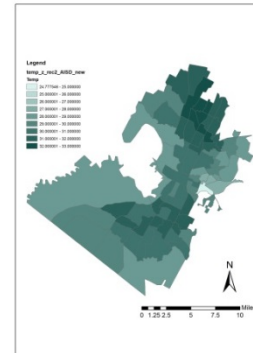
Urbanized Area



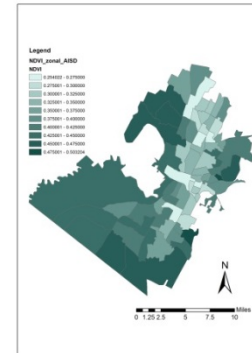
Tree Canopy



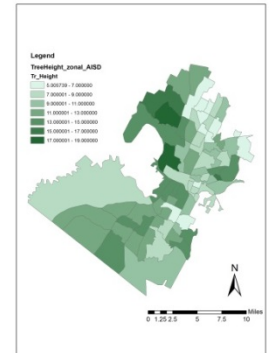
Grass Coverage



Temperature



NDVI



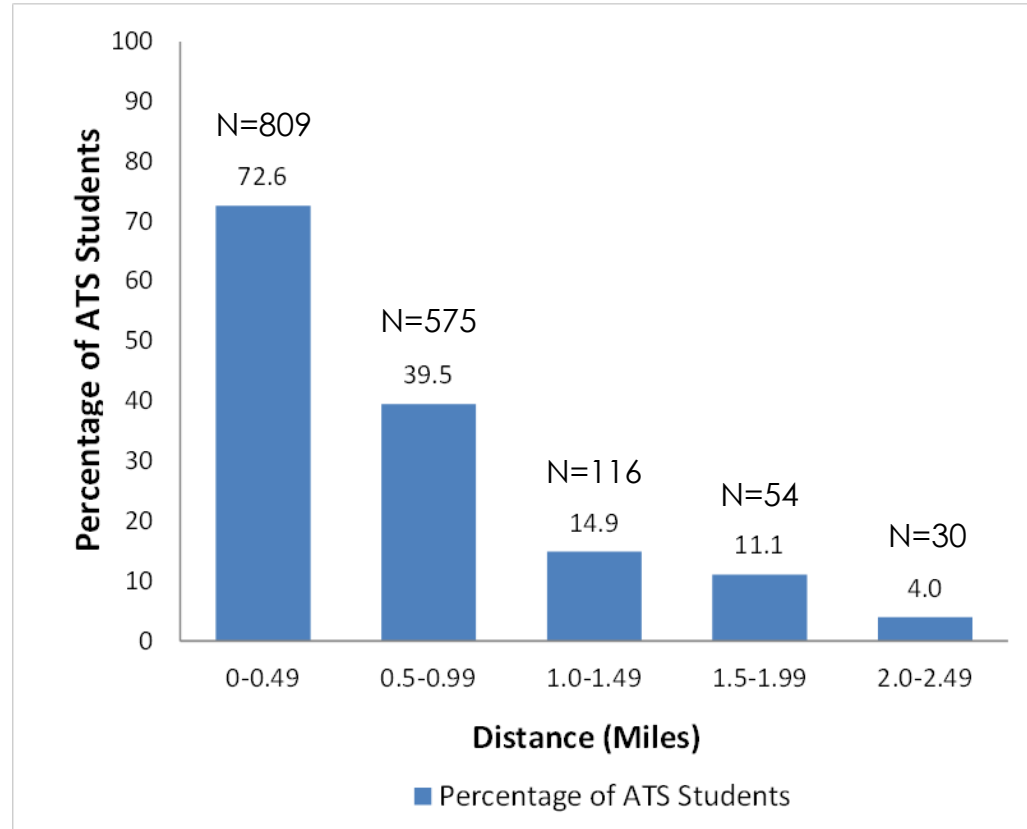
Tree Height

Results & implications

Multivariate Analyses

Results

- **Descriptive statistics 1**
 - Distance and Active Travel to School



Results (Cont'd)

- **Multivariate Analyses**
- **Mixed-effects logistic regressions by HTS distance ranges**

| Variables | ≤0.49 miles (N = 930, Pseudo R ² = 0.0976) | | 0.5≤0.99 miles (N=1241, Pseudo R ² = 0.1052) | | 1≤1.49 miles (N=677, Pseudo R ² = 0.0856) | | ≥1.5 miles (N=751, Pseudo R ² = 0.0664) | |
|--|---|--------------|---|--------------|--|--------------|--|--------------|
| | OR | P> z | OR | P> z | OR | P> z | OR | P> z |
| | Personal variables† | | | | | | | |
| Child's gender (1 = male) | 0.92 ^{***} | 0.621 | 1.11 ^{***} | 0.434 | 0.97 ^{***} | 0.881 | 1.25 ^{**} | 0.468 |
| Child's grade (Ref. PK-K) | - | - | - | - | - | - | - | - |
| 1 st - 3 rd | 1.41 [†] | 0.074 | 1.14 ^{***} | 0.408 | 0.70 ^{***} | 0.200 | 0.84 ^{***} | 0.633 |
| 4 th - 6 th | 1.86 ^{**} | 0.007 | 1.52 ^{**} | 0.025 | 0.93 ^{***} | 0.825 | 0.83 ^{***} | 0.650 |
| Child's language (Ref. English) | - | - | - | - | - | - | - | - |
| Spanish | 2.33 ^{***} | 0.000 | 1.37 [†] | 0.073 | 1.26 ^{***} | 0.521 | 1.30 ^{**} | 0.461 |
| Others | 1.05 ^{***} | 0.935 | 0.44 ^{***} | 0.231 | 0.45 ^{***} | 0.457 | 0.00 ^{***} | 0.986 |
| Number of cars (range: 0-3) | 0.68 ^{***} | 0.000 | 0.50 ^{***} | 0.000 | 0.67 ^{**} | 0.027 | 0.88 ^{**} | 0.531 |
| Parents' education level ^c (range: 1-7) | 0.86 [†] | 0.083 | 0.89 [†] | 0.088 | 0.79 ^{**} | 0.043 | 0.87 ^{**} | 0.295 |
| HTS distance† (unit: 100m) | 0.66^{***} | 0.000 | 0.78^{***} | 0.000 | 1.00^{***} | 0.987 | 1.01^{***} | 0.695 |
| Built environmental variables | | | | | | | | |
| Sidewalks (%) | - | - | - | - | 1.04 ^{***} | 0.000 | - | - |
| Bike lanes (0: ≤ mean, 1: > mean) | - | - | 1.46 ^{**} | 0.027 | 2.07 ^{**} | 0.005 | - | - |
| Playgrounds (1: presence) | 6.33 ^{**} | 0.009 | - | - | - | - | - | - |
| Intersections (no. of intersections per acre) | - | - | - | - | - | - | - | - |
| Highways (1 = intersected) | - | - | 0.43 ^{**} | 0.023 | 2.71 ^{**} | 0.024 | 0.36 ^{**} | 0.012 |
| Railroads (1 = intersected) | - | - | - | - | - | - | - | - |
| High speed streets (mph>30) (%) | - | - | - | - | - | - | - | - |
| Crime hotspots | - | - | - | - | - | - | - | - |
| Crash hotspots (total) | - | - | - | - | - | - | - | - |
| Crash hotspots (ped./bike) | 0.90 ^{**} | 0.005 | 0.92 ^{**} | 0.015 | - | - | - | - |
| Sex-offenders (1 = presence) | - | - | - | - | - | - | - | - |
| Natural environmental variables | | | | | | | | |
| Park (presence) | - | - | 2.33 ^{***} | 0.000 | - | - | - | - |
| Water feature (presence) | - | - | - | - | - | - | - | - |
| Steep slope > 5% (%) | - | - | - | - | - | - | - | - |
| Steep slope > 8.33% (%) | - | - | 0.98 ^{***} | 0.001 | 0.98 [†] | 0.070 | 0.91 [*] | 0.021 |
| Urbanized area (%) | - | - | - | - | - | - | - | - |
| Tree canopy (%) | - | - | 1.04 ^{**} | 0.022 | 1.07 ^{**} | 0.020 | 0.90 ^{**} | 0.007 |
| Grass (%) | - | - | - | - | - | - | - | - |
| Temperature (°C) | - | - | - | - | - | - | - | - |
| NDVI (min: -1, max: 1) | - | - | - | - | - | - | - | - |
| Tree height (feet) | - | - | - | - | - | - | - | - |

*p<0.05, **p<0.01, ***p<0.001, †: Marginally significant at 0.10 level

Multivariate Analyses

➤ Personal factors and HTS distance (control variables)

| Variables | ≤0.49 miles (N = 930, Pseudo R ² = 0.0976) | | 0.5≤0.99 miles (N=1241, Pseudo R ² = 0.1052) | | 1≤1.49 miles (N=677, Pseudo R ² = 0.0856) | | ≥1.5 miles (N=751, Pseudo R ² = 0.0664) | |
|---|---|-------|---|-------|--|-------|--|-------|
| | OR | P> z | OR | P> z | OR | P> z | OR | P> z |
| Personal variables† | | | | | | | | |
| Child's gender (1 = male) | 0.92*** | 0.621 | 1.11*** | 0.434 | 0.97*** | 0.881 | 1.25** | 0.468 |
| Child's grade (Ref. PK-K) | -*** | - | -*** | - | -*** | - | -** | - |
| 1 st – 3 rd | 1.41†*** | 0.074 | 1.14*** | 0.408 | 0.70*** | 0.200 | 0.84** | 0.633 |
| + 4 th – 6 th | 1.86*** | 0.007 | 1.52*** | 0.025 | 0.93*** | 0.825 | 0.83** | 0.650 |
| Child's language (Ref. English) | -*** | - | -*** | - | -*** | - | -** | - |
| + Spanish | 2.33*** | 0.000 | 1.37†*** | 0.073 | 1.26*** | 0.521 | 1.30** | 0.461 |
| Others | 1.05*** | 0.935 | 0.44*** | 0.231 | 0.45*** | 0.457 | 0.00** | 0.986 |
| - Number of cars (range: 0–3) | 0.68*** | 0.000 | 0.50*** | 0.000 | 0.67*** | 0.027 | 0.88** | 0.531 |
| Parents' education level ^c (range: 1–7) | 0.86†** | 0.083 | 0.89†** | 0.088 | 0.79*** | 0.043 | 0.87** | 0.295 |
| - HTS distance† (unit: 100m) | 0.66*** | 0.000 | 0.78*** | 0.000 | 1.00*** | 0.987 | 1.01** | 0.695 |

*p<0.05, **p<0.01, ***p<0.001, †: Marginally significant at 0.10 level

➤ Built environmental variables

| Variables | ≤0.49 miles (N = 930, Pseudo R ² = 0.0976) | | 0.5≤0.99 miles (N=1241, Pseudo R ² = 0.1052) | | 1≤1.49 miles (N=677, Pseudo R ² = 0.0856) | | ≥1.5 miles (N=751, Pseudo R ² = 0.0664) | |
|---|---|-------|---|-------|--|-------|--|-------|
| | OR | P> z | OR | P> z | OR | P> z | OR | P> z |
| | Built environmental variables | | | | | | | |
| + Sidewalks (%) | -*** | - | -*** | - | 1.04*** | 0.000 | -** | - |
| + Bike lanes (0: ≤ mean, 1: > mean) | -*** | - | 1.46*** | 0.027 | 2.07*** | 0.005 | -** | - |
| + Playgrounds (1: presence) | 6.33*** | 0.009 | -*** | - | -*** | - | -** | - |
| Intersections (no. of intersections per acre) | -*** | - | -*** | - | -*** | - | -** | - |
| + - Highways (1 = intersected) | -*** | - | 0.43*** | 0.023 | 2.71*** | 0.024 | 0.36** | 0.012 |
| Railroads (1 = intersected) | -*** | - | -*** | - | -*** | - | -** | - |
| High speed streets (mph>30) (%) | -*** | - | -*** | - | -*** | - | -** | - |
| Crime hotspots | -*** | - | -*** | - | -*** | - | -** | - |
| Crash hotspots (total) | -*** | - | -*** | - | -*** | - | -** | - |
| - Crash hotspots (ped./bike) | 0.90*** | 0.005 | 0.92*** | 0.015 | -*** | - | -** | - |
| Sex-offenders (1 = presence) | -*** | - | -*** | - | -*** | - | -** | - |

*p<0.05, **p<0.01, ***p<0.001, ‡: Marginally significant at 0.10 level

Multivariate Analyses

➤ Natural environmental variables

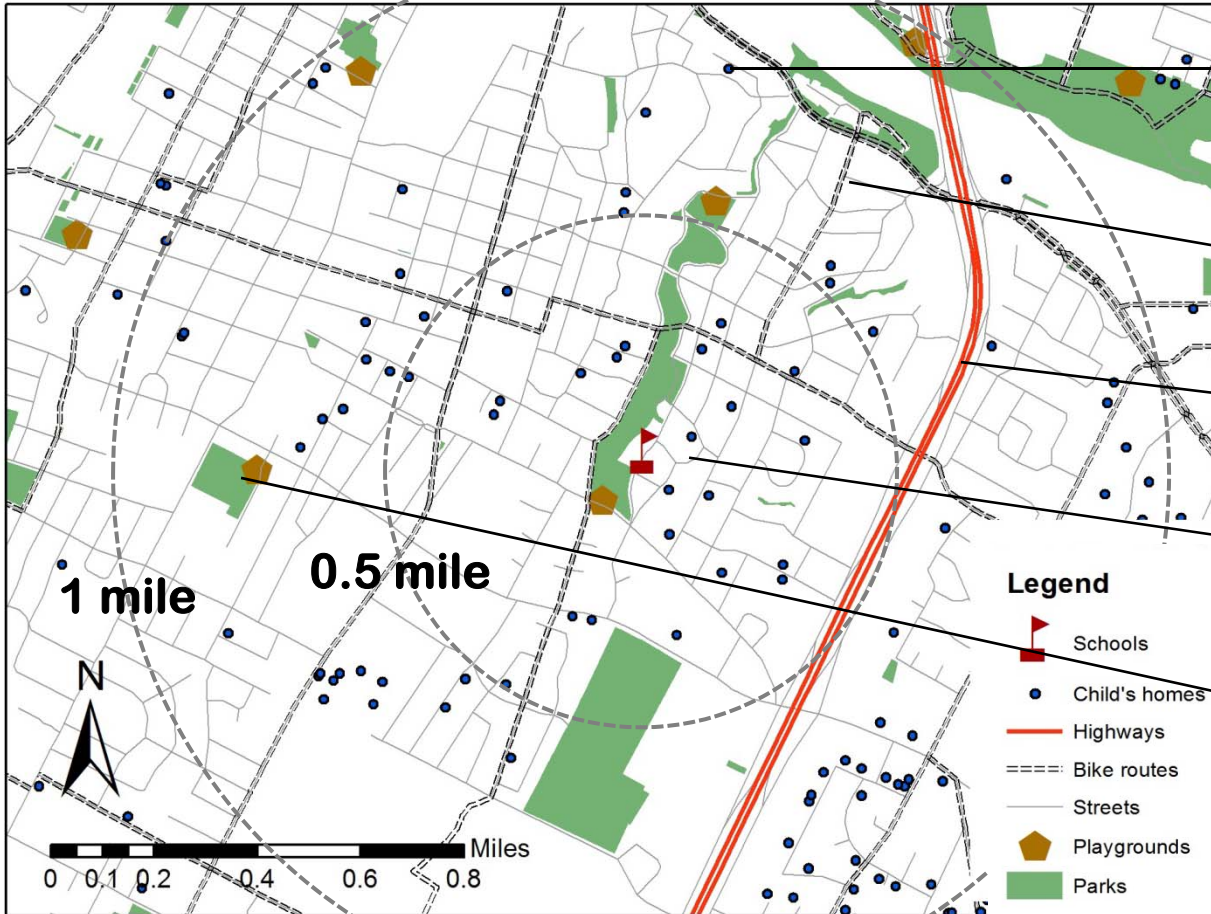
| Variables | ≤0.49 miles (N = 930, Pseudo R ² = 0.0976) | | 0.5≤0.99 miles (N=1241, Pseudo R ² = 0.1052) | | 1≤1.49 miles (N=677, Pseudo R ² = 0.0856) | | ≥1.5 miles (N=751, Pseudo R ² = 0.0664) | |
|--|---|------|---|-------|--|-------|--|-------|
| | OR | P> z | OR | P> z | OR | P> z | OR | P> z |
| Natural environmental variables | | | | | | | | |
| + Park (presence) | - *** | - | 2.33*** | 0.000 | - *** | - | - *** | - |
| Water feature (presence) | - *** | - | - *** | - | - *** | - | - *** | - |
| Steep slope > 5% (%) | - *** | - | - *** | - | - *** | - | - *** | - |
| - Steep slope > 8.33% (%) | - *** | - | 0.98*** | 0.001 | 0.98† | 0.070 | 0.91* | 0.021 |
| Urbanized area (%) | - *** | - | - *** | - | - *** | - | - *** | - |
| + - Tree canopy (%) | - *** | - | 1.04*** | 0.022 | 1.07* | 0.020 | 0.90** | 0.007 |
| Grass (%) | - *** | - | - *** | - | - *** | - | - *** | - |
| Temperature (°C) | - *** | - | - *** | - | - *** | - | - *** | - |
| NDVI (min: -1, max: 1) | - *** | - | - *** | - | - *** | - | - *** | - |
| Tree height (feet) | - *** | - | - *** | - | - *** | - | - *** | - |

*p<0.05, **p<0.01, ***p<0.001, †: Marginally significant at 0.10 level

Summary

- Few personal factors significant at longer distance ranges
- HTS distance within shorter distance ranges remained significant
- Varying roles of **NE** and **BE** variables on ATS across different HTS distance ranges
 - **Playgrounds (+), parks (+),** and **crash hotspots (-)** for **shorter** distance travelers
 - **Steep slopes (-)** for **medium-long** (>0.5 miles) distance travelers
 - **Tree canopy (+), bike lane (+),** and **sidewalk (+)** in medium distance ($0.5 \leq 0.99$ miles and $1 \leq 1.49$ miles) ranges, but **tree canopy (-)** for the ≥ 1.5 miles range.

Implications (strategies to promote ATS)



1. Latent active travelers within a **one mile** from school (school attendance zone policies)

2. **Sidewalks, bike lanes** and **tree canopy** (.5-1.5 miles)

3. **Highways** outside 0.5-1 mile from school

4. **Crash safety** improvements (<1 mile)

5. **Playgrounds** and **parks** around schools (<1 mile)

6. **School bus** service policies (from the current 2+ miles to 1.5 miles)

❖ Note:

This study was supported in part by a Robert Wood Johnson Foundation's Active Living Research Grant (Grant Number: 65539).

❖ More information:

- **Young-Jae Kim**, yjkim2011@tamu.edu
- **Chanam Lee**, chanam@tamu.edu



• Descriptive statistics 2-2

Built Environmental Variables by HTS distance thresholds

| Variables | Total (N=4239) | | ≤0.49 miles (N=1130) | | 0.5 – 0.9 miles (N=1470) | | 1 – 1.49 miles (N=785) | | ≥1.5 miles (N=854) | | Bivariate Test† | |
|--|-------------------|------|-------------------------|------|-----------------------------|------|---------------------------|------|-----------------------|------|-----------------|--------|
| | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Test | Sig. |
| | Mean | (SD) | Mean | (SD) | Mean | (SD) | Mean | (SD) | Mean | (SD) | | |
| Built Environment Characteristics | | | | | | | | | | | | |
| Sidewalks (%) | 0.71 (0.19) | | 0.73 (0.16) | | 0.74 (0.16) | | 0.67 (0.22) | | 0.65 (0.20) | | ANOVA | <0.001 |
| Bike lanes (0: < mean, 1: > mean) | 1420 | 33.5 | 344 | 30.4 | 381 | 25.9 | 335 | 42.7 | 360 | 42.2 | χ^2 | <0.001 |
| Playgrounds (presence) | 438 | 10.3 | 121 | 10.7 | 147 | 10.0 | 90 | 11.5 | 80 | 9.4 | χ^2 | <0.001 |
| Intersections (density) | 0.47 (0.14) | | 0.51 (0.17) | | 0.50 (0.13) | | 0.46 (0.10) | | 0.39 (0.13) | | ANOVA | 0.003 |
| Highways (presence) | 664 | 15.7 | 0 | 0.0 | 89 | 6.1 | 211 | 26.9 | 364 | 42.6 | χ^2 | <0.001 |
| Railroads (presence) | 401 | 9.5 | 16 | 1.4 | 69 | 4.7 | 63 | 8.0 | 253 | 29.6 | χ^2 | <0.001 |
| High speed streets (>30mph) (%) | 66.5 (25.6) | | 59.7 (31.0) | | 66.3 (23.3) | | 66.9 (25.0) | | 75.4 (18.0) | | ANOVA | <0.001 |
| Crime – hotspot | 0.03 (0.79) | | - 0.12 (0.55) | | 0.14 (0.81) | | 0.05 (0.89) | | -0.13 (0.87) | | ANOVA | <0.001 |
| Crash – hotspot | 1.11 (3.91) | | 1.71 (3.75) | | 1.00 (3.73) | | 0.63 (4.03) | | 0.95 (4.22) | | ANOVA | <0.001 |
| Crash – ped./bi. hotspot | 0.69 (3.84) | | 1.19 (4.09) | | 0.39 (3.00) | | 0.00 (3.93) | | 1.19 (4.51) | | ANOVA | <0.001 |
| Sex-offenders (presence) | 641 | 15.1 | 108 | 9.6 | 238 | 16.2 | 104 | 13.3 | 191 | 22.4 | χ^2 | <0.001 |

Freq.: frequency, ANOVA: analysis of variance, χ^2 : chi-squared test, ped./bi: pedestrians/bikers

†: bivariate tests examined the unequal variance of the built and natural environmental variables among the four different distance ranges.

• Descriptive statistics 2-2

Natural Environmental Variables by HTS distance thresholds

| Variables | Total (N=4239) | | ≤0.49 miles (N=1130) | | 0.5 – 0.9 miles (N=1470) | | 1 – 1.49 miles (N=785) | | ≥1.5 miles (N=854) | | Bivariate Test† | |
|--|-------------------|---------|-------------------------|---------|-----------------------------|---------|---------------------------|---------|-----------------------|---------|-----------------|--------|
| | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Freq. | % | Test | Sig. |
| | Mean | (SD) | Mean | (SD) | Mean | (SD) | Mean | (SD) | Mean | (SD) | | |
| Natural Environment Characteristics | | | | | | | | | | | | |
| Park (presence) | 2,688 | 63.4 | 458 | 40.5 | 830 | 56.5 | 618 | 78.7 | 782 | 91.6 | χ^2 | <0.001 |
| Water feature (presence) | 973 | 23.0 | 17 | 1.5 | 244 | 16.6 | 229 | 29.2 | 483 | 56.6 | χ^2 | <0.001 |
| Steep slope > 5% (%) | 24.13 | (24.84) | 16.54 | (26.37) | 22.56 | (26.37) | 28.63 | (20.02) | 32.75 | (20.16) | ANOVA | <0.001 |
| Steep slope > 8.33% (%) | 9.99 | (15.73) | 7.02 | (16.42) | 8.61 | (15.36) | 10.63 | (13.12) | 15.74 | (16.13) | ANOVA | <0.001 |
| Urbanized coverage (%) | 42.70 | (10.43) | 40.49 | (9.11) | 42.06 | (8.60) | 43.50 | (11.23) | 46.01 | (12.98) | ANOVA | <0.001 |
| Tree canopy coverage (%) | 11.83 | (5.50) | 11.47 | (5.50) | 11.72 | (5.56) | 12.49 | (6.89) | 11.86 | (5.50) | ANOVA | 0.002 |
| Grass coverage (%) | 10.87 | (3.38) | 11.04 | (4.17) | 11.02 | (2.83) | 10.65 | (3.44) | 10.60 | (2.97) | ANOVA | 0.002 |
| Mean temperature (°C) | 31.34 | (1.35) | 31.56 | (1.34) | 31.36 | (1.57) | 31.41 | (1.15) | 30.96 | (1.02) | ANOVA | 0.002 |
| NDVI (min:-1, max: 1) | 0.34 | (0.07) | 0.34 | (0.06) | 0.35 | (0.06) | 0.34 | (0.08) | 0.31 | (0.08) | ANOVA | <0.001 |
| Tree height (feet) | 7.93 | (3.55) | 7.98 | (3.29) | 8.09 | (3.36) | 8.18 | (4.18) | 7.34 | (3.53) | F | <0.001 |

Freq.: frequency, ANOVA: analysis of variance, χ^2 : chi-squared test, ped./bi: pedestrians/bikers

†: bivariate tests examined the unequal variance of the built and natural environmental variables among the four different distance ranges.