Public outdoor stairwell utilization throughout Haifa, Israel: An observational study comparing geo-spatial environmental and demographic characteristics with outdoor stairwell use

Chelsea Beytas

University of Haifa

Abstract

Objective: There lacks current published articles on the utilization of public outdoor stairwell use. The objective of this study was to understand the utilization of outdoor stairwells among different neighborhoods throughout Haifa, Israel by comparing various geo-spatial environmental factors of the stairwell or its surrounding district. The results of this study should help establish a baseline survey of usage of the outdoor stairwells in Haifa, in relationship to several built environmental factors, and aid in future public health and urban planning interventions.

Study Design: Observational study of ten stairwells throughout Haifa, Israel conducted in February 2016.

Methods: The experiment utilized observational data. People count of the stairwell was obtained through direct physical observation. Topographic information (elevation, distance to nearest bus-stop, number of bus stops in 0.5-km radius) was extracted using Google Earth Pro. Haifa community district data was obtained through records from the Israeli Central Bureau of Statistics and the Haifa Municipality. The population-density adjusted stair use rate was compared to these geo-spatial and population demographic variables.

Results: Outdoor stairwell use is inversely related to geo-spatial features of the stairwell, including, the highest point of elevation, change in elevation, and the length of the stairwell, and proportionally related to the distance from the stairwell to the nearest bus stop. Additionally, outdoor stairwell use is proportional to the demographic features of the district communities including the percentage of residents that take the bus or walk to work, and inversely proportional to the percentage of district residents who own a car.

Conclusion: There is an indication that geo-spatial environmental and residential demographic factors influence outdoor stairwell use.

Introduction

Physical fitness is an essential component of individual health. The World Health Organization recommends that persons age 18 and older should accumulate at least 75 to 150 minutes of moderate to vigorous aerobic activity each week.[1] For children aged 5-17 years old it is recommended that they achieve 60 minutes of the same moderate to vigorous activity each day.[1] The US Centers for Disease Control and Prevention (CDC) declares that, **“**Regular physical activity is one of the most important things you can do for your health.”[2]

Engaging in the recommended quota of physical activity is a protective factor against developing many chronic disease such as: obesity, cardiovascular diseases, including stroke and hypertension, metabolic disorders, such as Type II-Diabetes-Mellitus, colon and breast cancers possible endometrial and lung cancers, osteoarthritis experiencing a hip-fracture and developing a mental health illness such as depression.[1,2,3] Regular physical activity has additional benefits of strengthening the muscular-skeletal system and bone density, increasing cognitive health such as thinking, learning, and judgment. It also increases life expectancy, the quality of one’s sleep, mood, balance, ability to perform physically demanding activities, and overall, quality of life.[2] Physical activity provides the same benefits to health as pharmaceuticals on minimizing chronic disease incidence and controlling the symptoms for those whom have developed the diseases. It has also been shown to be as effective as pharmaceuticals in reducing mortality outcomes.[4] Additionally, physical activity helps to provide symptom alleviation to rheumatic disorders such as arthritis[2] and among older adults with compromised mobility, can reduce the risk of falling by 30%.[1]

The CDC proclaims as a general remark that, “the health benefits of physical activity far outweigh the risks of getting hurt.”[2] This is taking into consideration the idea that most people’s health allows them to perform moderate to intense aerobic activity, including senior citizens with poor mobility.[1]

Physical inactivity is the chief cause of six percent of deaths worldwide, and the fourth leading cause of global mortality.[1] Physical inactivity is attributed to the development of 27% of all cases of diabetes, 21-25% of all cases of colon and breast cancer, and 30% of all cases of cardiovascular disease.[1] In 2012, around 31% of the world’s population at that time, were classified as physically inactive, with physical inactivity being defined as not meeting the WHO guidelines of performing physical activity.[5] Populations consisting of people who are older, female, and living in a high-income country have higher rates of physical inactivity than their counterparts.[5] Over the past 50 years physical activity demands in office environments have decreased, while over the past four decades the use of physically active transportation has also decreased. Over the past two decades, children's time spent being active in school physical education classes has decreased.[5]

There is little data on physical activity levels across Israel. In comparison to the Arab population, Jewish Israelis lead a less sedentary lifestyle (46.0% compared to 62.8%).[6] Israelis were more likely to be sedentary if they were older, female, less educated, married, and reported poorer subjected health. For Jewish Israelis additional risk factors for having a sedentary lifestyle were being young, a smoker, and having a high BMI.[6,7] Baron-Epel et al. found that those who had higher religious observance had greater risk of living a physically inactive lifestyle, but Merom et al., found that the unmarried Israeli orthodox women of Jerusalem had a lower prevalence of physical inactivity.[7] For Palestinian women being a housewife was a protective factor against becoming inactive compared to Palestinian women that held paid jobs.[7] As Palestinian women age, they shift from twice as likely to be physically inactive to three times as likely to be physically inactive as their Palestinian male counterparts.[7] There is a greater gender disparity in physical activity levels among the Arab population than the Jewish population.[6]

Incorporating active transportation (transportation powered by the exertion of human energy, such as walking and bicycling) into everyday behavior is an adequate means to increase daily physical activity expenditure, and reduce sedentary behavior. A common everyday choice of active transportation happens within the workplace- opting to use stairwells to navigate throughout a building instead of using the elevators. This study looks at stairwell use beyond the confines of office buildings, and into the public outdoors. This study hopes to understand how environmental geo-spatial factors, and community demographic characteristics influence individuals to choose to take the stairwells to navigate throughout the city.

A (public) outdoor stairwell is a series of constructed steps in a deliberate path that can be accessed for free by any passerby in the area. Typically the stairwell is constructed for the purpose of either accessing entities that would otherwise be difficult to access, or for a shortcut in commute distance and time from one location to another. In cities that have mountainous topography, such as Haifa, outdoor stairwells can provide transportation convenience to able-bodied individuals. They help them to bypass longer-less inclined street blocks, and to alternatively ascend or descend on steep, but short in distance, pathways.

In addition to taking less time and distance to travel to entities, climbing stairs is also more beneficial to one's health than walking. Men who achieved a daily attainment of eight or more climbed flights of stairs had an 11% lower mortality rate than men who averaged walking 1.3 miles on relatively level surface per day (22% compared to 33%).[8]

How walkable an area is, is judged by factors such as connectivity of streets, distance from residential areas to commercial areas, safety measures for pedestrians, automobile traffic, community residential density, and how the land is utilized. Walkability impacts transportation-related physical activity (walking, bicycling) within communities, while recreational walking is impacted by the sensory ambiance.[9,10] Adults had a greater tendency to use active transportation when they perceived an area to have high residential density, mixed-land use (single piece of land with multiple functions, including: residential, commercial, recreational, nature), and safe areas for bicycle riders.[9] Walkability has also been defined as being able to access an entity through transportation means of a ten-minute walk. The farther away a public area is, the less visitors it receives (half for every double in distance).[9] Among adults, the aesthetic and the total land area of the park were the greatest predictors of the frequency of which adults would use it. Children most frequently chose to utilize parks that had adequate sports facilities.[9] Areas that score lower on the walkability criteria mentioned above were associated with an increase of viewing television; while adults living in suburbs spent more time sitting in cars than their urban counterparts.[9] Wojan & Hamrick found that there was no association between varying levels of residential density and physical activity level among adults,[11] and when controlling for confounders while Eid et al**.** found no association between urban sprawl and higher rates of obesity.[12] Their conclusions were that less physically active populations prefer to reside in areas where the built landscape and transportation systems favor an automobile commute.[11,12]

There lacks current published articles on utilization of public outdoor stairwell use.

Methods

The researcher had two advisors for the practicum. One was Guy Shachar, an independent architect, geographer, and a resident of Haifa who has worked with the Haifa Municipality, the other, Dr. Eric (Yona) Amster of the University of Haifa. Shachar selected 11 different outdoor stairwells throughout the communities of Haifa to be observed for the study. He chose places of different land uses, communities, and demographic backgrounds. The location and path of the stairwells were marked on Google My Maps, and later made accessible to the researcher. These stairwells are identified in the Appendix. The observation took place in February 2016 during the weekdays of Sunday through Thursday on days forecasted without perception. There were two observation periods for each stairwell: a morning observation period, from 7:30am until 10:00am, and an afternoon one from 3:00pm until 6:00pm. The researcher was stationed at the bottom or top of the stairwell (available in the Appendix to which side was chosen for each stairwell), with the data tables and a pencil in their hand. The initial data that the researcher collected for each group of pedestrians utilizing the stairs was: time, direction, and perceived reason of travel, party size, perceived sex and age, ease of commute, carried items, and an "other" description category. Each person required multiple observations throughout their stairwell commute to collect each listed category of data.

The researcher also measured qualitative factors regarding personal impressions of the stairwells themselves: the surrounding streets and area, the openness of the stairwell and the feelings it invokes, the shade it provides, the vegetation surrounding it (on a 1-10 scale), the up-keeping of the stairwell (on a 1-10 scale), and the condition of the stairs. Quantitative measures were also taken for the stairwells, which included the total number of steps, total number of flat-tops, and the presence of a railing. In addition, the researcher rated the walking experience, both going up and down the stairwell.

The observable data for stairwell use was entered into an excel document. This data provides a descriptive profile of those who use it- answering the who, when, and where aspects of outdoor stairwell travel. The calculations that were chosen for analysis for the study included: frequency of travel per hour, percentage of stairwell users traveling in the down direction, total percentage of travelers who were female, percentage of women at night/ afternoon. Unweighted averages (average of the individual stairwell percentages), and cumulative averages (average using total sum of the combined 10-stairwell counts) were calculated for downward direction travel, and percentage of female stairwell users. For reasons mentioned in the Appendix (page 38, under the HaShiloah stairwell profile), the researcher chose not to observe the 11th stairwell for concerns of personal safety.

After gathering all the data, the environmental factors were then analyzed. Topographic information was retrieved from Google Earth Pro. The data of the 10 chosen stairwells marked in the Google My Maps were exported as a .kml file. This .kml file was then opened with Google Earth Pro (built 2013).

Many landscape features of the stairwells were determined using tools provided in Google Earth Pro. For each stairwell, Google Earth Pro measured the elevation at each point, the length, the distance to the closest bus stop (both from the top point and bottom point of the stairwell), and the number of bus stops in 0.5 kilometer (km) radius (measured from the center of the stairwell). The elevation at the top and bottom of the outdoor stairwells was measured by accessing the stairwell's "Elevation Profile." The ground distance measurements (distance of the stairwell to closest bus stop, number of buses in 0.5 km radius) were measured by the "Ruler" tool on Google Earth Pro. This data was entered into an Excel spreadsheet.

Haifa district data pertaining to the residents' demographic characterizes[13] was additionally added to the Excel spreadsheet. This data was provided by Guy Shachar, and translated from Hebrew to English by Mark Beytas. These data included percentage of district residents who: own at least one car, commute to work by walking, and commute to work by bus.

During the observation periods the number of users for each stairwell was measured as a count. To be able to compare the stair count data to other stairwells, the data had to be standardized, with a common unit denominator. Dr. Eric (Yona) Amster assisted in deriving a standard unit for the stairwell count. The population-density adjusted stairwell use is the total number of stairwell users during the observation periods per 1,000 residents, living within a 1 km radius of the stairwell. This standardized unit was derived by dividing the stairwell use count by the district's population density[14] (per km^2), and multiplying this value by 1,000.

Once the stairwell use was adjusted to reflect population density it was then compared to the district's residential demographics. The data from the Excel spreadsheet was then imported to SPSS (version 21). Ruchama Elad-Yarum of the University of Haifa assisted in determining which statistical tests and graphs would be appropriate to describe the collated data. Scatter plots and bar graphs were chosen as the best-fit means to highlight the results of the study.

Scatter plots were constructed individually for comparing population-density adjusted stairwell use to the data collected from Google Earth Pro, and the demographic characteristics of Haifa's various district communities. Each point on the scatter plot represents a stairwell. In addition to the scatter plots, bar graphs were constructed to categorize the individual stairwells and their surrounding district to the respected value of one of the mentioned measured variables. There are two bars in each graph. The bar on the left represents stairwells or community data that exist below the median value of the 10-stairwell group, and the bar on the right represents stairwells or community data that lay above the median value of the 10-stairwell group. The value of the bars is the mean value of the five stairwells below the median value (left), and the mean value of the five stairwells above the median value (right).

Results

Due to the low number of stairwells observed, most of the analysis will be descriptive. There were too few stairwell observations to conduct statistical analysis of the data collected, including linear regression models that could help to describe the parameter attributes of the stairwells throughout Haifa. There would need to have been at least 30 staircases observed to apply the Central Limit Theorem in order to make statistical inference of parameter data, and to generalize the findings to describe all of the staircases throughout Haifa. Objective data was preferred in data analysis due to the ambiguity in creating universally accepted ranking criteria. However, qualitative data of each staircase (vegetation of area, cleanliness of staircase), and quantitative data (stair count, flat-top count, presence of railing) is included in the Appendix of the study. Comparing outdoor stairwell use would be welcomed if an objective well-defined scale to measure the qualitative variables were established. Due to the small sample-size of observed stairwells and unknown or unaccounted for residential demographic data, the analysis was unable to make a collective adjustment for confounding variables, such as SES, full profile of ethnic background, and health of the specific districts. There may exist underlying factors that contribute to outdoor stairwell use that were not accounted for.

The total number of pedestrians counted on all ten-stairwells combined was 3,601. An average of 98.37%, and a median of 99.3% of pedestrians could be identified by gender. In total, there were 30 stairwell users whom were unable to be identified as male or female, for a cumulated total of 99.1% of stairwell users identifiable by gender.

As mentioned earlier, stairwell use was measured on a group-basis. The median percent for descending stair use is 69.7% (n=3,601). The unweighted average of all descending stair use was 68.9%, with a cumulative percentage (all stairwell down trips/all stairwell trips) of 63.4%. The proportion of stairwell use by female users was used as a proxy to measure community perceived safety (which is typically a reflection of actual or perceived violence against women crime rates.) Percentage of stairwell use by females was calculated with the numerator of all female identified stairwell users and the denominator of the sum of all gender identified stairwell users. The median percentage of women using the stairwell was 49.4% (n=3,571) for all observation hours, and 49.1% (n=1,920) for the afternoon observation period. The unweighted average of female stairwell users for all hours of observation was 47.7% of all users, and for the afternoon observation period was 47.3%. The cumulative percentage (all stairwell travelers whom were female/all stairwell users whom could be identified by sex) was 49.8% (n=3,571) during all observation hours, and 49.6% (n=1,920) for afternoon observation period. It would appear that female residents tend to use the stairwells at the same rate of male residents. Data regarding the sex ratio of the Haifa districts were unable to be located; it would be useful to compare female stairwell use in relation to the percentage of female district residents to see if stairwell use by females is proportional to the percentage of female residents.

The results of the study refer to data of the observed stairwells. Three aspects of physical properties of the stairwells were analyzed: the stairwell's length, its highest point of elevation, and the change in elevation from the bottom to the top.

The stairwell with the highest elevation point was 320.34 meters above sea level (Yearot), while the stairwell with the lowest elevation point was 46.63 meters above sea level (Shukri). The median highest elevation point of a stairwell was 112.47 meters above sea level. The highest point in elevation was used as a proxy variable to measure the average socio-economic status of the district within Haifa. In Haifa, the more affluent neighborhoods tend to reside on the top of the Mount Carmel. The stairwell in the district with the highest car ownership was Yearot (87.4%), while the stairwell in the district with the lowest car ownership was HaShiloah (15.4%).[13] The median car percentage of residential ownership in the observed districts was 37.7%.

There is an inverse relationship between car ownership and outdoor stairwell use (figures 1a, 1b). The greater the district's car ownership percentage, the less the people used the stairwells located in that district. Top elevation point of the stairwell is positively related to district residential car ownership (figures 2a, 2b), and inversely related to outdoor stairwell use (figures 3a, 3b). Those who live farther up on Mount Carmel (who earn a higher salary) are more likely to own a car, and less likely to walk or take the bus to work. There was greater stairwell usage in districts with lower elevation, and when fewer residents owned a car.

The change in elevation of the stairwell ranged from 10.97 meters (HaShiloah) to 53.64 meters (Yona Bugla), with a median change in elevation of 20.10 meters. The length of the stairwell ranged from 47.85 meters (Shukri) to 199.34 meters (Shifra), with a median length of 79.86 meters. Both the change in elevation (figures 4a,4b) and the length of the stairwell (figures 5a,5b) were inversely related to outdoor stairwell use. The greater the change in elevation from the bottom to the top of the stairwell and the greater the length of the stairwell, the fewer people who used it.

There was a positive relationship for percentage of district residents who walk to work (figures 6a, 6b), take the bus to work (figures 7a, 7b), and a combination of the two (figures 8a, 8b), and stairwell use. There was greater stairwell use in districts where a greater amount of people walk to work, talk the bus, or utilize a combination of the two the get to work. The percentage of people who walk to work ranged from 3.4% (Yona Bugla) to 38.7%(HaShiloah) with a median of 15.65%.[13] The percentage of people who commute to work by bus ranged from 8.8% (Yearot) to 61.7% (Yona Bugla), with a median value 33.8%.[13]

Population-density adjusted stairwell use was then compared to geographical factors such as the distance to the closest bus stop, and number of bus stops in a 0.5km radius. Stairwell use was inversely related to the distance from the closest bus stop (figures 9a, 9b, 10a, 10b). The less distance the stairwell was to the closet bus stop, the greater amount of users, the stairwell had. The range of the stairwell distance to bus stop from the bottom of the stairwell was 0.02 km (Hillel-Yafe) and 0.23 km (Shukri) with a median of 0.07 km. The range of the stairwell distance to bus stop from the top of the stairwell was 0.04 km (Shifra) and 0.37 km (Yearot) with a median of 0.205 km.

The median number of bus stops in a 0.5km radius from the center of a stairwell was 31.5. The number of bus stops in a 0.5km radius from the center of a stairwell ranged from 26 (Shifra) to 46 (Yona Bugla). There is a slight increase in the number of stairwell users when there is a higher amount of bus stops in a 0.5km radius from the center of the stairwell (figures 11a, 11b).

Discussion

The city of Haifa has a population of 270,300 residents with a population density of 4,146 residents per square km.[15] The city is built on Mount Carmel, and as a result, the topography dictates many aspects of daily life.

Outdoor stairwells can make navigating city life convenient if they are properly built and placed. Stairwells connect areas of low elevation to areas of high elevation, in either natural settings, or manmade settings (buildings). Public outdoor stairwells are an integral component to the way of life in mountainous regions. When a region has a diverse regional topography, including sharp changes in elevation points, outdoor stairwells are numerous and necessary. Outdoor stairwells are a fundamental element within cities that allow for the connection of different elevation regions, that would otherwise be automobile- dependent to reach, or inaccessible, all together. Although we are unsure of the total number of outdoor stairwells located throughout Haifa, we know there are at least 120, as documented by Dr. Nitza (including Yona Bugla, and Spinoza).[16] Our findings indicate that in Haifa the affluent residents live in areas of higher elevation, have higher car ownership, and use walking as a means of transportation less often than Haifa residents residing in the middle and lower regions of the Carmel mountain range. Newly constructed stairwells in Haifa will have greater utilization if built in the lower elevation regions of Haifa over those of higher elevation.

Dr. Nitza is not the only one to document a city's outdoor stairwells. The Public Stairs website is an online database that has satellite maps, descriptions, and rankings inputted voluntarily from its users. They have documented public outdoor stairwells throughout 84 cities in the United States, seven cities in Canada, and various stairwells in nine other countries.[17]

The availability of public outdoor stairwells increases land utilization by providing increase pedestrian accessibility throughout cities- connecting residential buildings and commercial buildings together, allowing entities to be built on hilly terrain, and to be accessible by foot. Stairwells can also help reduce some of the geographic isolation burden that has resulted from cities designed with an urban sprawl layout. Saelens & Handy found that the greatest predictor of walking rates among communities was the land use- with mixed-land use showing the greatest incidence of walking. They suggest mixed land creates an environment of greater accessibility, and closer proximity to different community destinations.[10]

Earned income and car ownership status shape personal lifestyle and health behaviors. This study's findings suggest that car ownership and earned income are factors that reduce outdoor stairwell use. These findings are in agreement with past studies. In London, persons living in a non-car owning household were over two to three times more likely not to achieve active transportation of 30 minutes a day, compared to persons living in a car owning household.[18] In the USA, car owners spent 54% less time participating in daily moderate to vigorous physical activity than non-car owners (20.7 minutes compared to 45.1 minutes), and Seychelles, Jamaica, South Africa, and Ghana, car owners spent 28% less time participating in daily moderate to vigorous physical activity than non-car owners (24.9 minutes compared to 34.6 minutes).[19]

There are mixed results for the relationship between earned income and physical activity. Shoham et al. found that earned income is negatively associated with active transportation in Seychelles, Jamaica, South Africa, and Ghana,[19] while Fairnie, Wilby, & Saunders found the opposite in London.[18]

All stairwells in this study that were observed had either residential or commercial buildings situated around it, which were accessible only through the stairwells. The increase in interconnectivity of a city increases its walkability, reducing the overall distance needed to travel for commutes, and can ultimately reduce transportation dependent on vehicles. Reduction in use of vehicular transportation reduces the roadway congestion, concentration of air pollution, and time spent in traffic. When commutes are less dependent on automobiles it also reduces the allowance spent on petroleum to fuel the cars, and the need to find a place to park. The influx of automobile use in Israel has led many major cities struggling to increase the number of parking spaces. It is not uncommon to see cars parked on the sidewalk, and cars parked on the sidewalks reduce sidewalk space, and reduces the walkability of communities.

Booth et al. (2001) examined agencies that impact physical activity levels in a neighborhood setting. They found that the proximal leverage points that impacts physical activity levels at the neighborhood behavioral setting were the city government and its developers through establishing community's public recreation facilities, and the created landscape of crime and perceived safety.[20] City developers ultimately configure the spatial arrangement of the cities- where roads, sidewalks, commercial areas, and even stairwells are built. Booth et al. declared that the walkability of a city affects all residents, and that the lower the walkability of a city, the lower the use of community members participating in active transportation.**Error! Bookmark not defined.**

The stairwells that were observed were located in perceived safe areas, all had hand railings, a decent amount of foliage, lamp-post lighting, and were observed for the most part, during sun-lit hours. Safety varies from district to district, from city to city. Generally, areas are viewed safest during hours of daylight, while dark-hours are perceived to have higher prevalence of dangerous behaviors. It is reasonable to conclude that areas that are perceived to be (or are in reality) safer are used by a greater proportion of the public and have higher rates of active transportation than areas that are viewed (or are in reality) to have higher rates of crime. Efforts to reduce crime rates and increase perceived safety should have a positive effect on outdoor use of public areas.

Every year, the Haifa Stairs organization hosts a stair climbing race – a 300-meter vertical and a three kilometer horizontal race, where the elite runners climb a total of 1,075 steps.[21] Haifa is a perfect example of how cities can integrate stairwells for communal festive activities. The popularity of San Francisco, California's Lombard Street is another example of how unique geo-spatial environments are embraced and become a point of interest to tourists and urban adventurists alike. Similarly, stairwells, like sidewalks, additionally aid in creating an environment that promotes human interaction. Human interaction, even on the passerby level, has been shown to have a positive impact on mental health.

Ascending and descending stairs provides a great form of physical activity. Daily use of stairs is a practical means to perform a healthy behavior at no additional personal monetary cost. A popular intervention to increase stairwell use is the point-of-choice- model, which places visual prompts near the entrances of elevators, escalators, or stairs to persuade individuals to choose more active transportation means to travel throughout the building. Multiple literature reviews found that stair use driven by an agenda of health promotion are not successful in encouraging people to use stairwells, as opposed to alternative passive transportation (elevators and escalators). Eves & Webb found that "point-of-choice" interventions increase indoor stairwell use were only successful when visual or audio art exhibitions were installed throughout the stairwell.[22]

Nicoll (2007) measured the impact that geo-social factors of using indoor stairwells has in college settings. She found stairwell aesthetic appeal, safety (maintenance and illumination of stairwell), and comfort (stair height, tread depth, and their ratio, and number of steps between landing platform), did not impact stairwell use.[23] The location of the stairwell and its proximity to entrances of buildings and the building's elevators has a greater impact on stairwell use than the stairwell's physical appeal.[23]

A promising means to increase the number of one-time or recurring stairwell users, would then be to set up captivating attractions that motivate people to interact with stairwells, in order to experience the installation. Cities can invite and subsidize local artists to create art installations, murals or statues. Upfest festival, an annual graffiti festival held in Bristol, England answers the call to create art throughout the city by bringing together artists from all over the world to paint murals over a total surface of 30,000 square feet throughout the city.[24] Cleveland, Ohio, the birthplace of Rock 'n' Roll, recently (July, 2016) completed the construction of the Rock Box installation that places seven large outdoor speakers along East 9th street to connect the social hub of downtown Cleveland to the Rock and Roll Hall of Fame, installations that "are visible, fun, [and] absolutely unique and different."[25]

The recently (July 2016) launched incredibly popular Nintendo mobile phone application, Pokémon Go, shows a measurable testament to the power of interactive attractions. In Pokémon Go, users must travel distances to catch wild Pokémon placed throughout cities. In the age of technology that has created sedentary behavior, the app has been applauded for its ability to encourage mobile phone users to engage in recreational physical activity. Its users provide personal testaments to how using the application has helped improved the mental health of those suffering from depression, bipolar disorder, and anxiety. These users have acknowledged that the app has been an effective mechanism in encouraging them to go outside, get exercise, interact with other application users, which would not have occurred otherwise.[26] The Pokémon Go application additionally has the approval of endocrinologist obesity solution specialist Dr. James Levine of the Mayo Clinic in Rochester, Minnesota, author of the 2014 published book, *Get Up*. He testifies that the application is successful in increasing physical activity levels in people that would otherwise remain sedentary.[27]

It would be wise to utilize art, music, wild Pokémon, or something meaningful to the individual community throughout stairwells accessible only by foot to motivate people to use them for both transportation and recreational use. A resonating example of how art and highly valued points of interest can aid in promoting stairwell use can be illustrated in the case of Rio de Janeiro's famous Christ Redeemer. The magnificent sculpture attracts Christian tourists from all over the world. Visiting the statue is a pilgrimage to the 1.8 million people that ascend to the top of the 710-meter Corcovado Mountain each year to view it.[28]

Kinset, Galea, & Lawrence's study remind us that the average person typically has a threshold on the number of stairs willing to travel (5-7 flights), that they would walk greater distances in the downward direction (67.4% downward travel only v. 5.9% upward travel only), and that they are less willing to take the stairs when an elevator is available when they are traveling in groups ((76-80%) versus from an individual use baseline (85-90%)).[29] When traveling in a group, individuals are willing to travel fewer flights of stairs when stair use is chosen as the means of travel over elevator use (4.8 floors in the down direction and 3.2 floors in the up direction compared to the baseline (of 6.7 floors in the down direction, and 4.2 floors in the up direction).[29] Efforts to increase stairwell use should be aimed at stairwells with a maximum of 5-7 levels. Any levels higher, may all together deter the general population from using the stairwell.

Adams, et al. (2006) found that in an airport setting, when one or two hired models used the stairwells placed next to an escalator, stair use increased by 102.6% for men and 61.8% for women compared to baseline (non-intervention).[30]

Adam's experiment highlights the impact of the influence that the Social-Ecological Theory has on stair use behavior, but we can also apply the Theory of Reasoned Action, and the Social Cognitive Theory to explain this behavior, and to look for ways to increase stairwell use. Motivation to choose to use the stairs when passive transportation is available is influenced by social norms, by the attitudes and actions of our surrounding peers. If the commuting norm was to engage in active modes of transportation throughout the city, walking and using outdoor stairwells as opposed to taking passive means of transpiration, could result in greater use of outdoor stair use. Mirroring is one of the constructs in the Social Cognitive Model.

Essentially, an individual's health behavior is impacted by how other people behave, and similarly, an individual will try to copy the practiced behavior of their peers. The greater the amount of people using outdoor stairs, the greater the probability that more people will use them.

The quintessential challenge of public health officials is changing lifestyle behaviors that are in discordance to good health. How can public health officials create the desire to and motivate high-risk populations that are inclined to unhealthy behavior to change and perform healthier behavior? Car ownership is essentially a necessity in populations living in the urban sprawl areas, or in areas of poor or no public transportation systems. There needs to be the means to complement passive transportation with active transportation, or to shift from passive transportation to active transportation, when feasible. Additionally, it is the duty for city planners to modify the current geo-spatial layout of cities to create cities that are more walkable, "bikeable", more conducive and enjoyable to active transportation.

In a world that continues to expect expedited services and response, devoting the extra time to use active transportation can create a social conflict. We have seen the devastating effects of how exchanging meals prepared from scratch, to pre-made fast-food has saved families and communities time in food preparation, but how as a consequence, worsened health biomarkers and health outcomes. When less value is placed on dedicating adequate time to physical activity and active transportation, including using the outdoor public stairwells, for cities that have the capacity to be walkable, the same outcome of exchanging saved time for worse health biomarkers and health outcomes poses a serious threat.

It should be noted that stairwells are designed as a mode of transportation for physically abled-bodied individuals and typically lack the means to accommodate people with physical impairment or disabilities. Using stairwells is physically demanding on the body, requiring sensory and motor systems to work in sync, throughout the constant change in ground level as one ascends or descends the stairs. The elderly population remains a vulnerable cohort prone to fatal and non-fatal injuries resulting from accidents while using stairwells. Constructing level stairs, level flat-top platforms, providing well-lit, and well-maintained stairwells that have handrails throughout the well, is crucial for reducing falling risk, and the hesitation of using stairwells among the elderly population.

Most high-income countries worry about the healthcare demands of an aging population, with larger proportion of the population in the 65 and older years of age category, and populations living more years in the 65 and older years category. Concerns of physical inactivity among the senior residents, yet failing to provide safe public land construction, such as stairwells and sidewalks will have detrimental consequences on the health of senior citizens, and might further incentivize senior residents to avoid active transportation in outside public spaces.

Conclusion

This study examined public outdoor stairwell use to various geo-spatial and community demographic characters in a topographically diverse city in Israel. There lacks published public-accessible articles on the subject of public outdoor stairwell utilization. The results suggests that outdoor stairwell use is inversely related to the highest point of elevation, change in elevation of the top and bottom points of the stairwell, the length of the stairwell, and the distance of the stairwell to the nearest bus stop. Outdoor stairwell use is proportional to the demographic characteristics of the district communities including the percentage of residents that take the bus or walk to work, and inversely related to the percentage of district residents who own a car. There is an indication that geo-spatial environmental and demographic factors influence outdoor stairwell use. This study would benefit from qualitative study that examines the motives for and barriers against using public outdoor stairwells.

With a low observation sample size, the results cannot be extrapolated to describe outdoor stairwell usage, throughout Haifa and other cities. This study is a first of its kind and additional studies are needed to understand the patterns of stairwell use in different cities across the world. The results in this study and further future studies can help assess the need and location to construct additional outdoor stairwells, or promote use in current public outdoor stairwells.

Limitations

Every now and then, a person would approached the researcher and ask what they were doing. The researcher did not want to be perceived as a threat to the community, and have the law enforcement intervene, so the researcher was transparent with the inquirers, explaining the project and answering their questions.

The researcher valued safety over getting an exact people count; recording people's movement and habits on hours end is inherently suspicious, stalker-like behavior. When these interruptions happened, it was difficult to record the data of the people that were using the stairs. Most of the time, the crowd density was manageable to record all data that the researcher was measuring. There was typically a "rush hour" crowd, and then a lull period, with occasional bursts of higher traffic. Occasionally, if a person was returning or leaving a resident, the researcher was unable to collect information such as age, and possibly gender.

For three locations, the researcher had significant difficulties in keeping up with recording data. At these locations, stair use has consistently highest frequency of travel, both in groups and in individual travel. On several occasions at each location, as the researcher was writing down information on one group, another group would then be passing by. This made it difficult to collect the exact total number of people using the stairs, and the demographic information of the people. As frequency increased, people count took priority over secondary measuring criteria. Given the steep incline of the Yona Bugla outdoor stairwell, the researcher was unable to see the bottom end of the stairwell. The school was located near the bottom, and thus users that used only the lower half of the staircase were unaccounted for The researcher can confidently say that for these three sites the observation data underrepresents the true utilization, both in number and demographic of the people traveling through Haifa.

A possible solution for this would be to install motion-detection sensors (such as infrared) to establish a more reliable count on the number of stairwell users. Other studies have used video recorders to track pedestrian use. It would be quite time consuming to review the video, and relevant only in comparing data to demographic characteristics of the passerby.

Additional limitation was that the data was collected at a point (short period) prevalence. All data, except for one staircase (Yearnot), was collect in one day, over two observation periods. The data for each staircase was collected on different weekdays. One would expect that for non-weekend, non-holiday days, the pedestrian traffic of the city would be similar day to day throughout a week, or month. This study was conducted in February, where the mean minimum temperature was 8.7° Celsius, and mean maximum temperature was 17.5° Celsius.[31] The pedestrian patterns can vary throughout the year. The daily traffic might vary from season to season.

Lastly, one should be mindful of the ecological fallacy that might occur from using the data from The Central Bureau of Statistics and the Haifa Municipality and comparing that to the stairwell users. We are also unaware of the residence of the stairwell users; whether or not they reside in the district where the stair they used is located. They do not necessarily live in the communities where they were observed walking.

Acknowledgements
The author would like to acknowledge Guy Shacher, Dr. Eric (Yona) Amster and Ms. Ruchama Elad-Yarum of the Universiy of Haifa, and Mark Beytas for their contributions to the project and report.

Conflicts of Interest
The author declares no conflicts of interest.

Funding
No outside funding was provided for this study.

Graphs

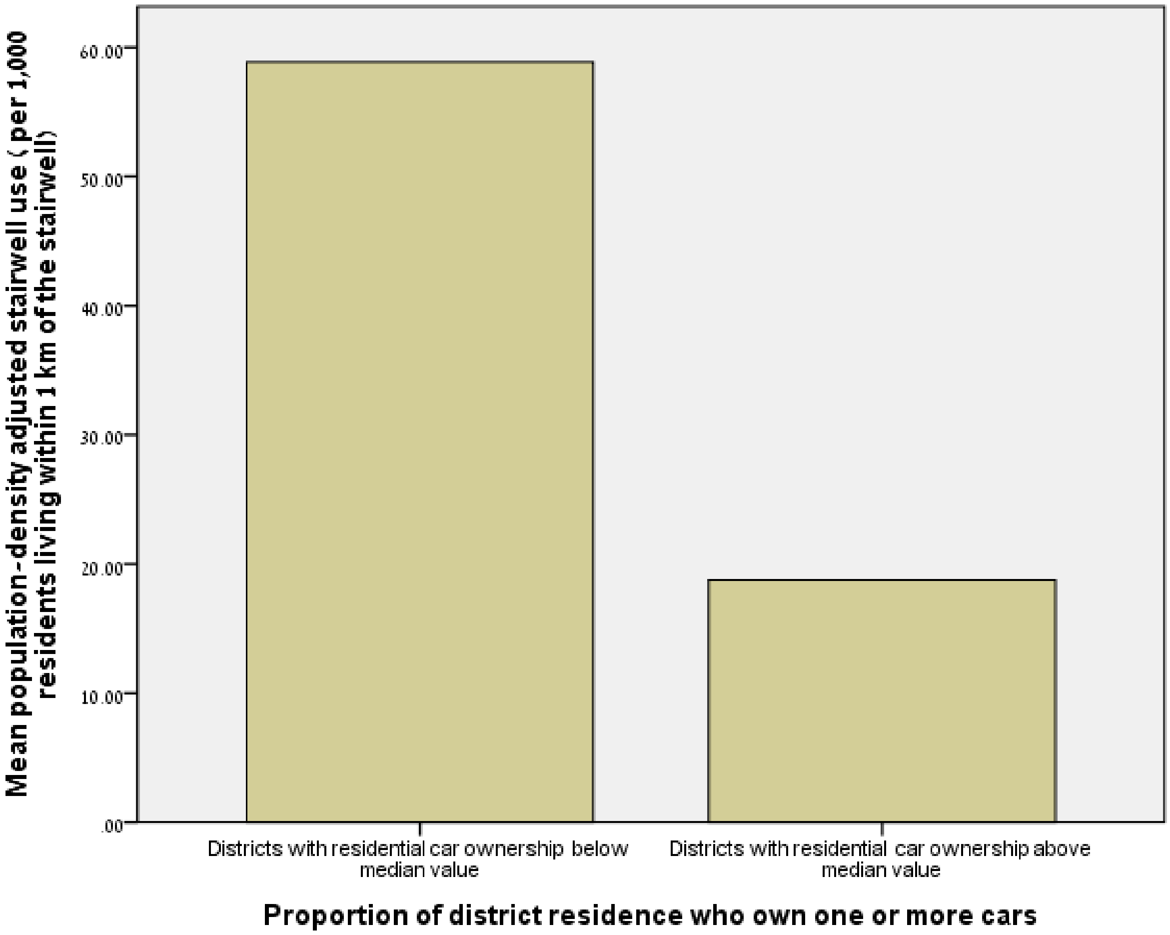

Figure 1a

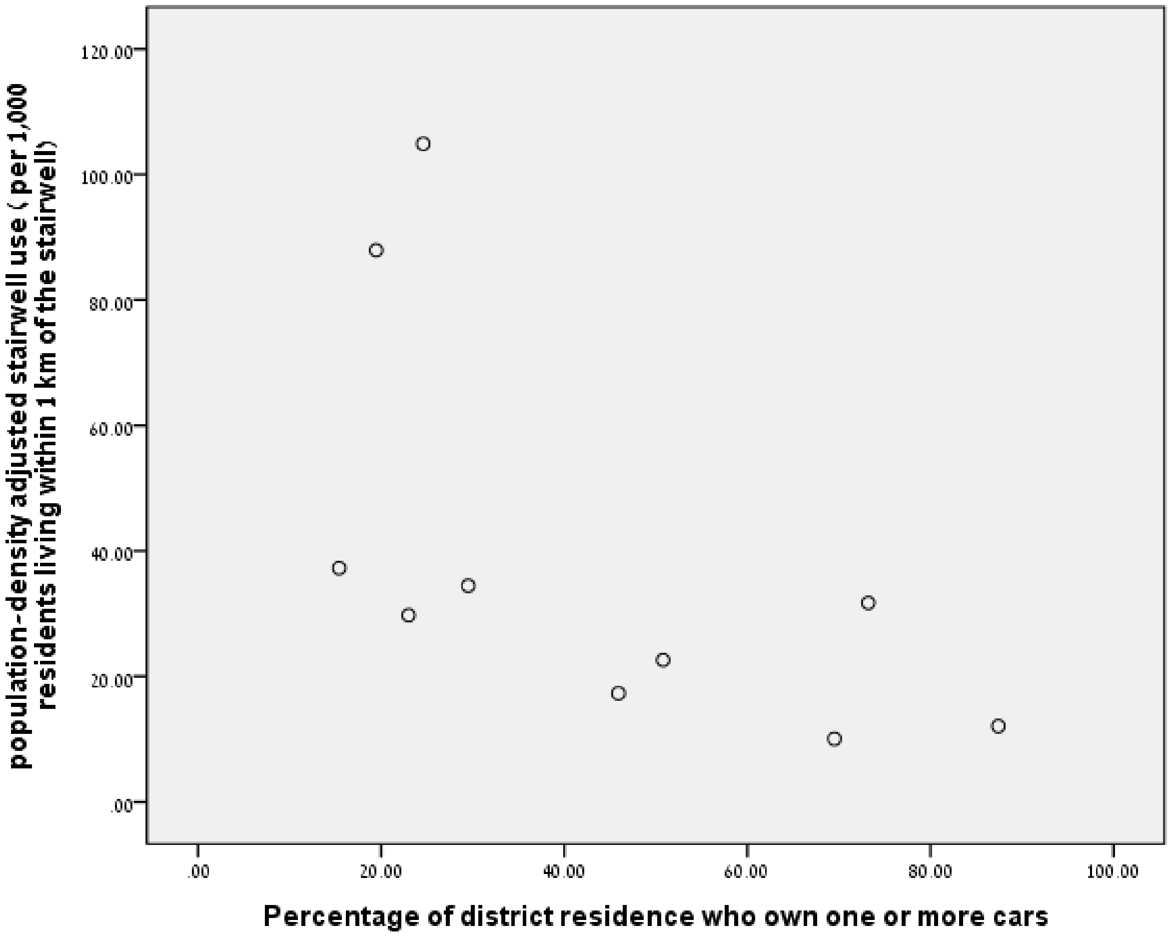

Figure 1b

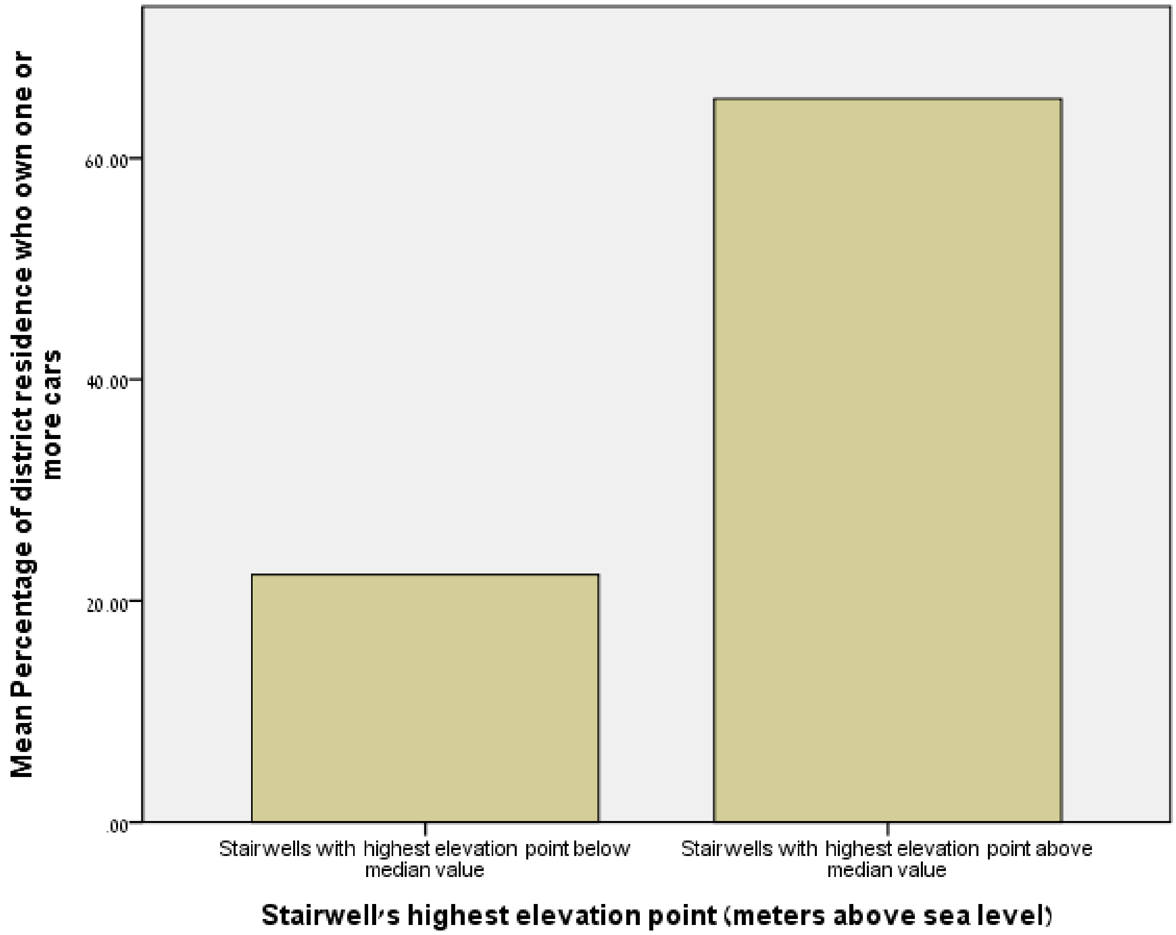

Figure 2a

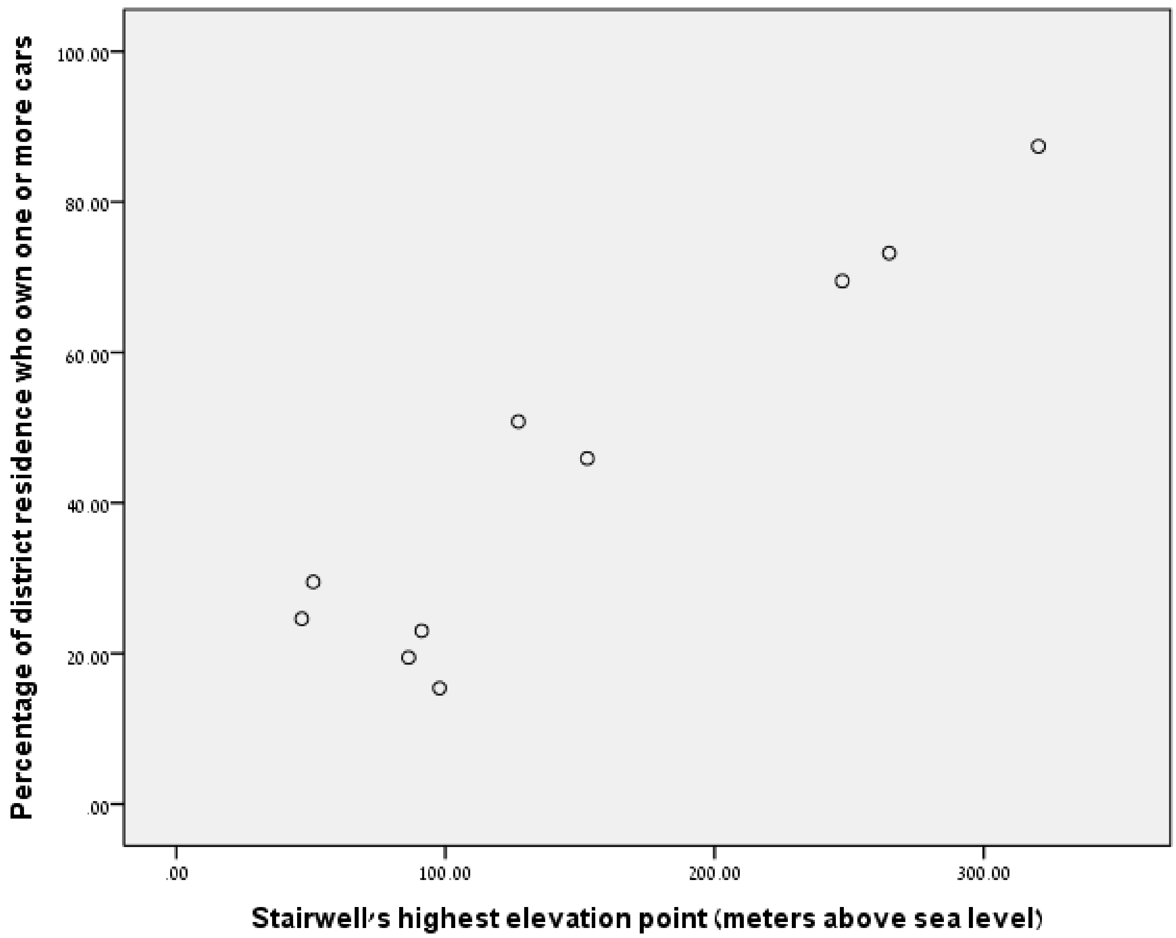

Figure 2b

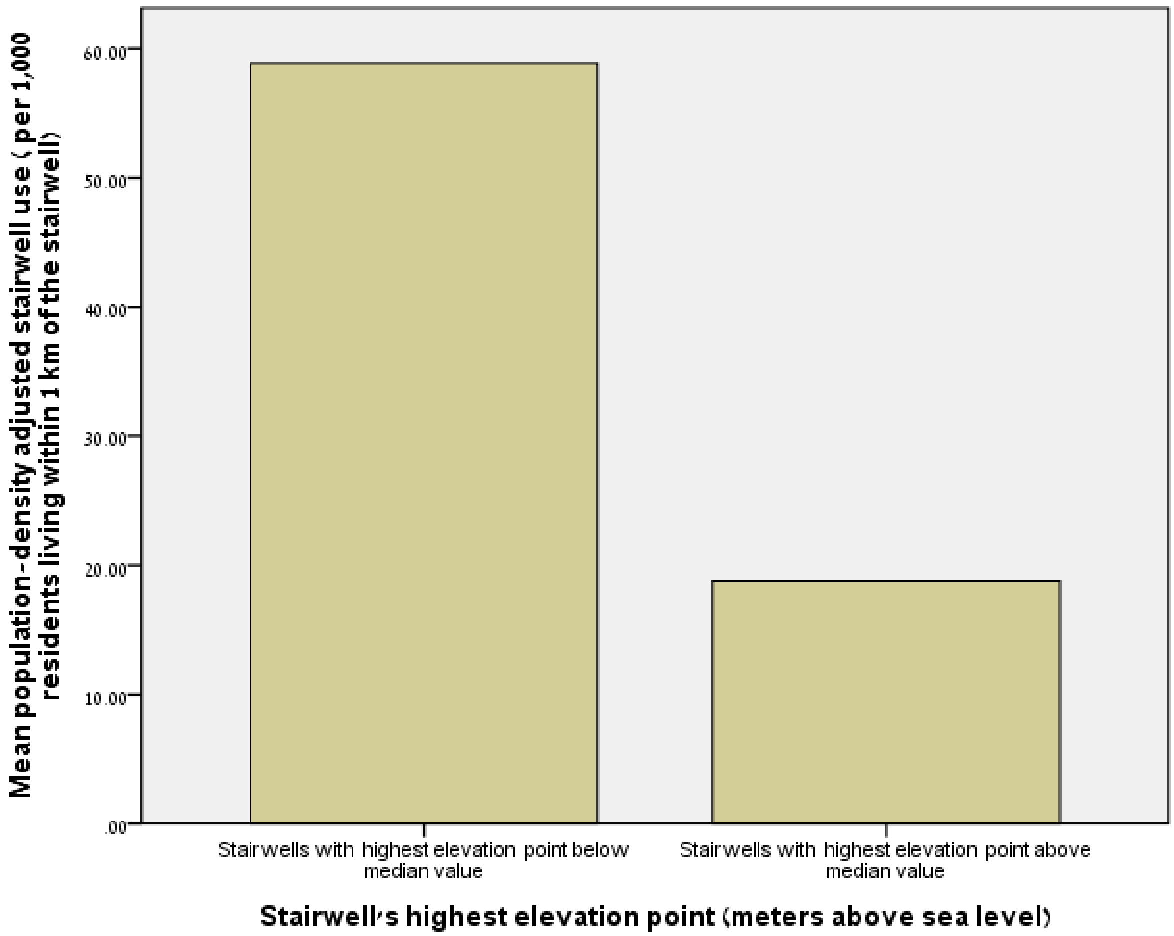

Figure 3a

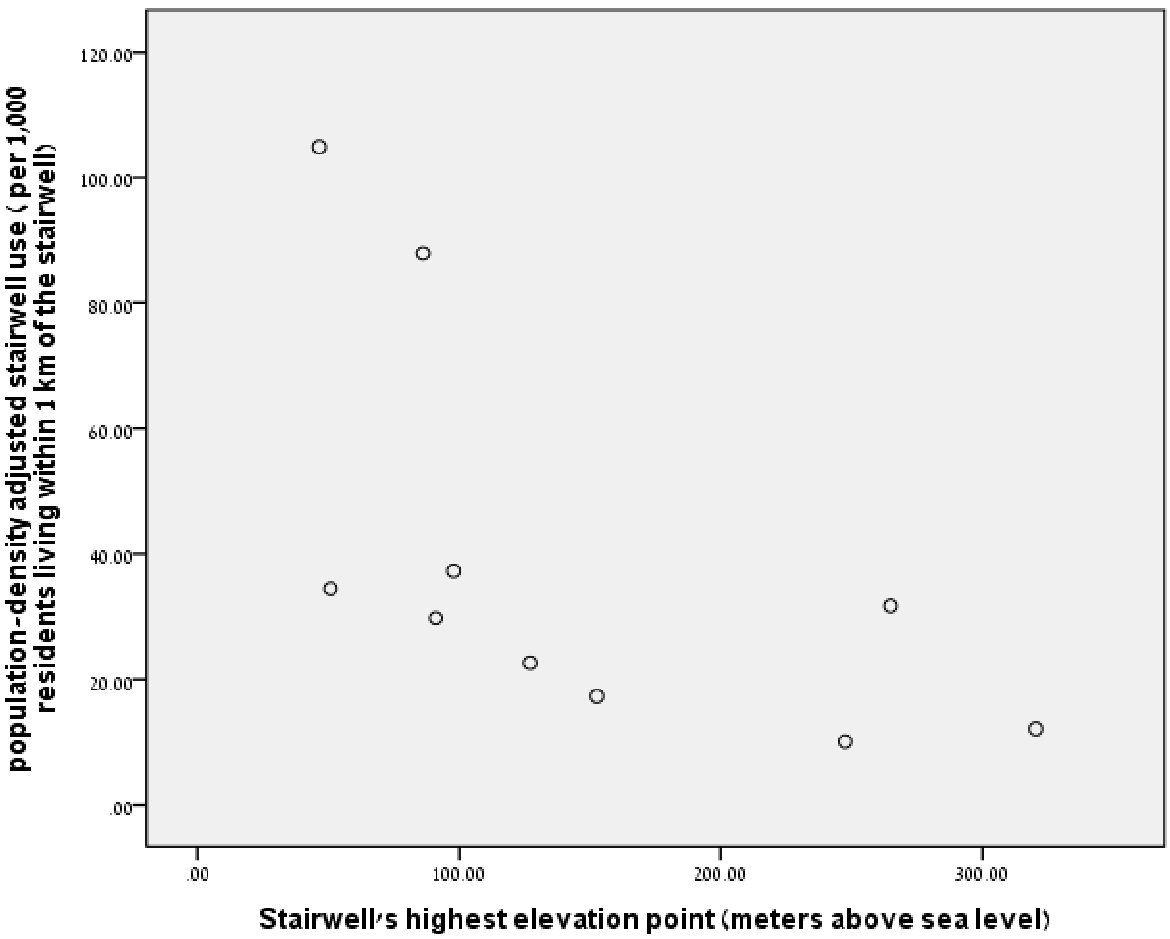

Figure 3b

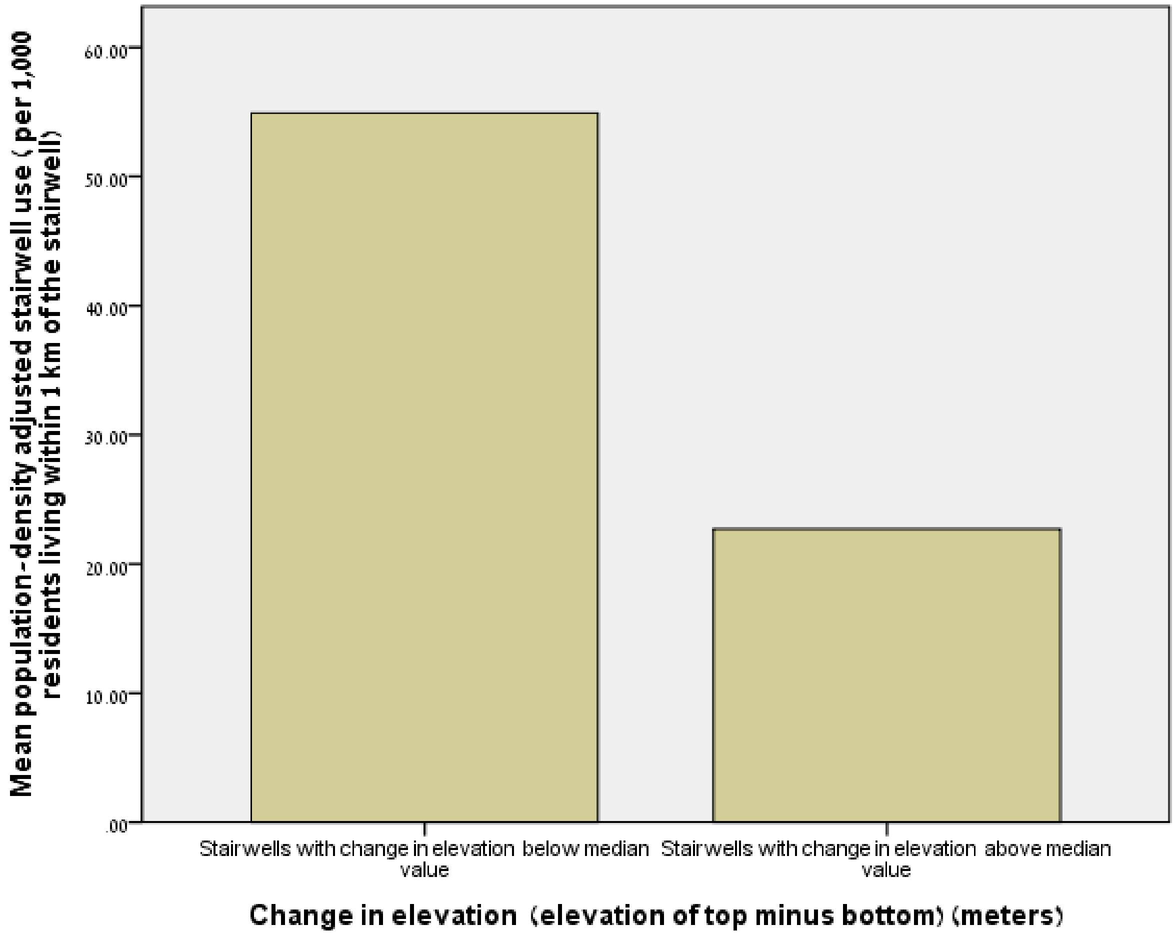

Figure 4a

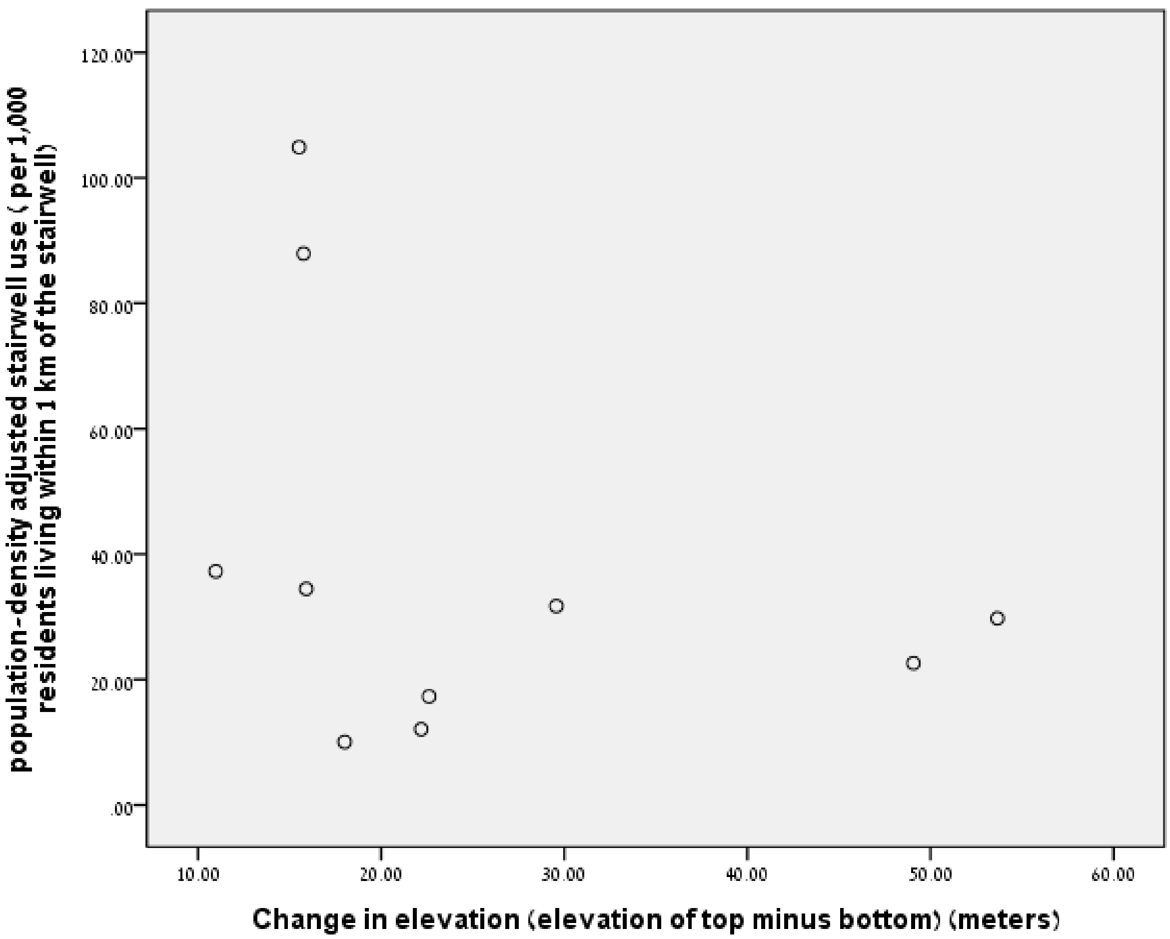

Figure 4b

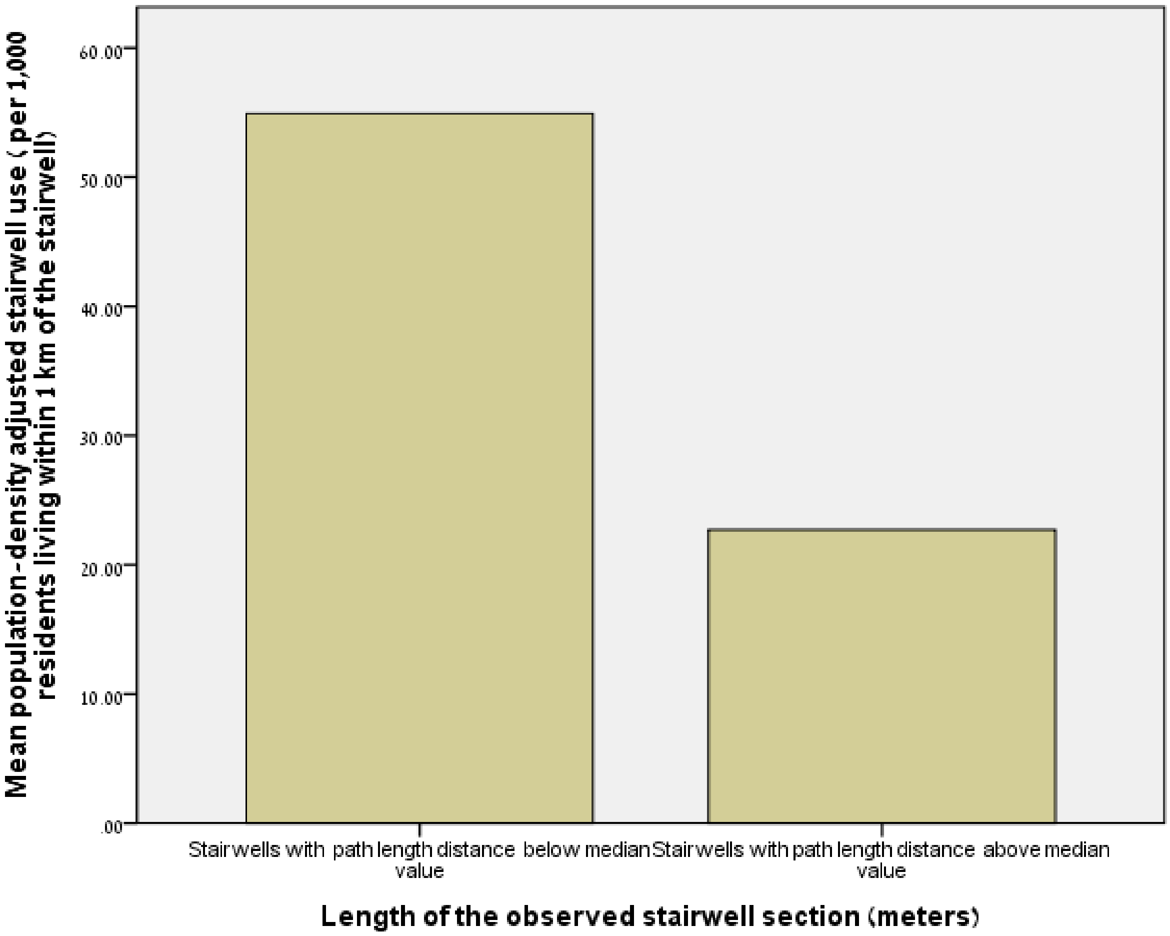

Figure 5a

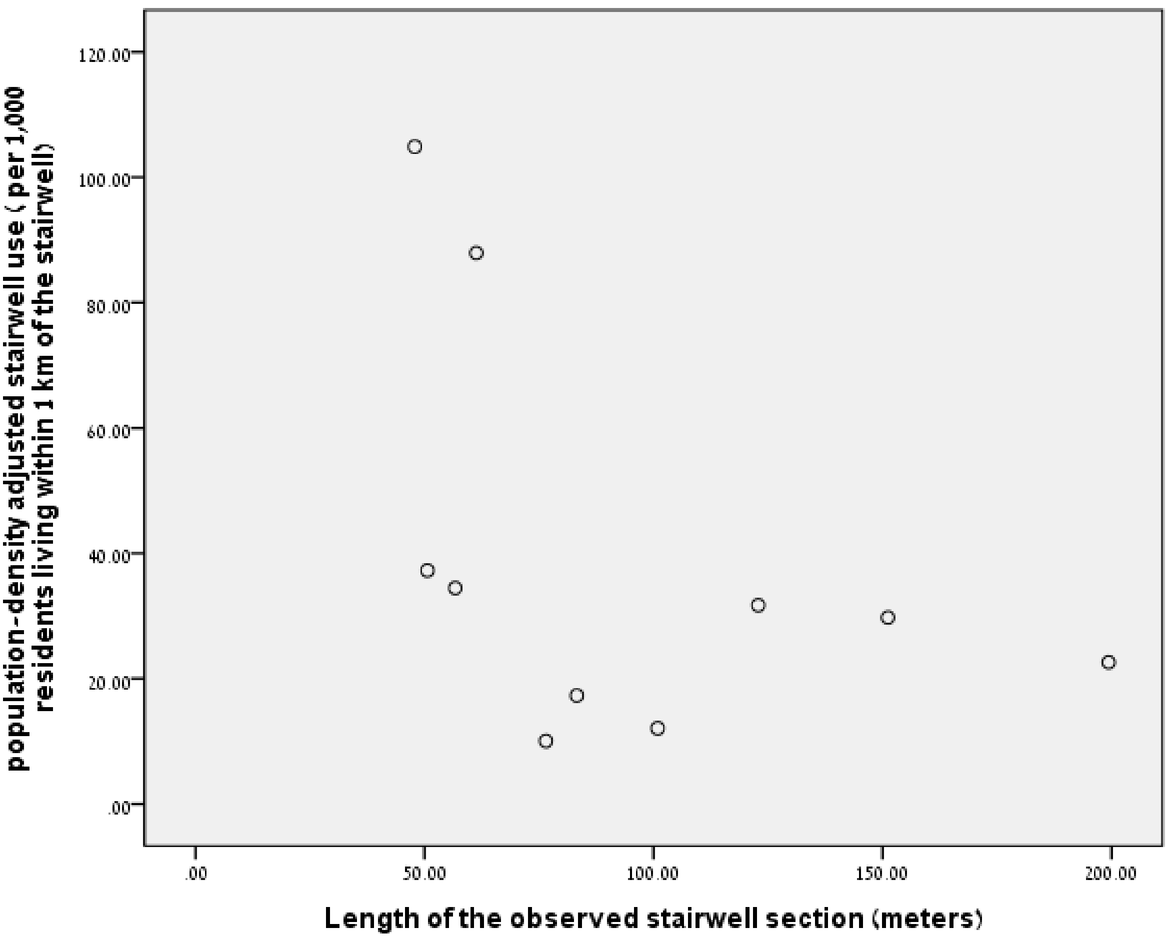

Figure 5b

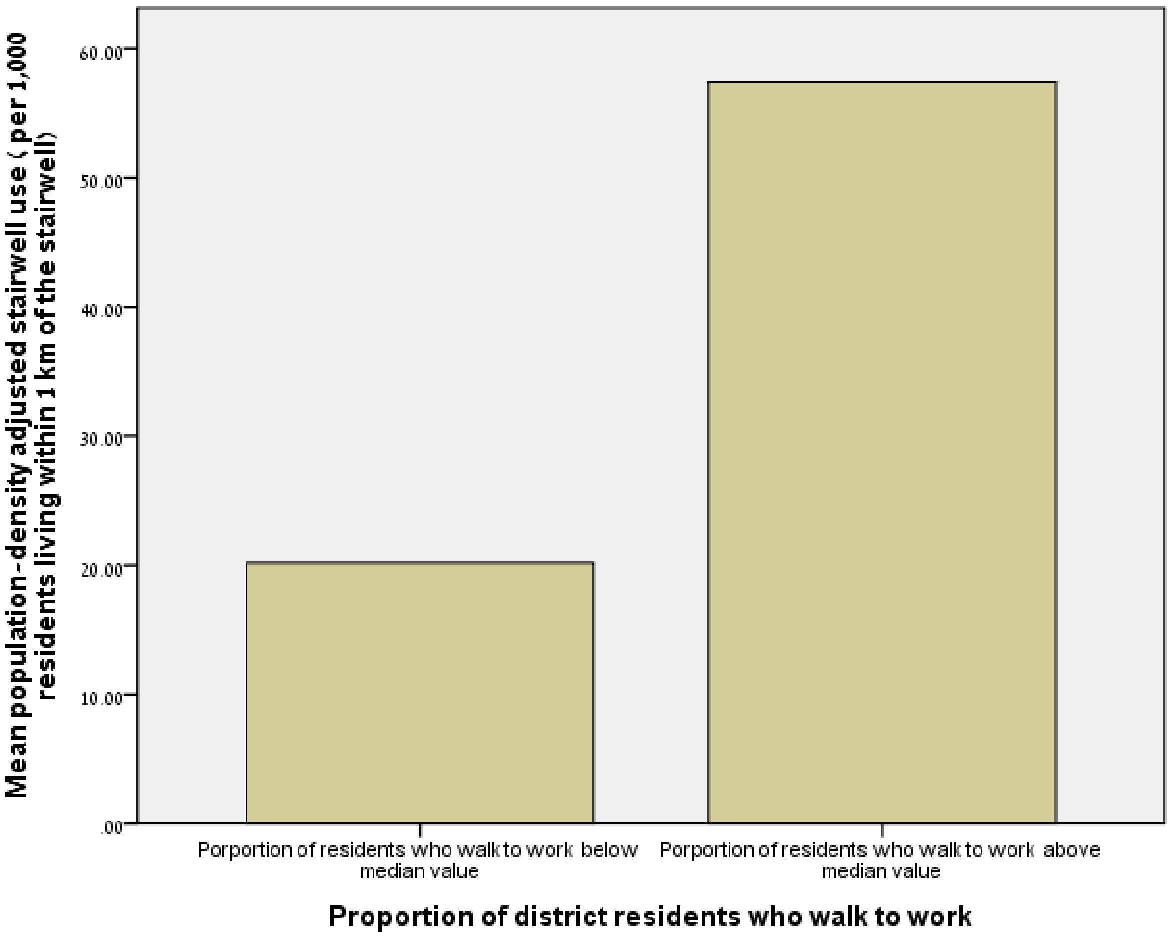

Figure 6a

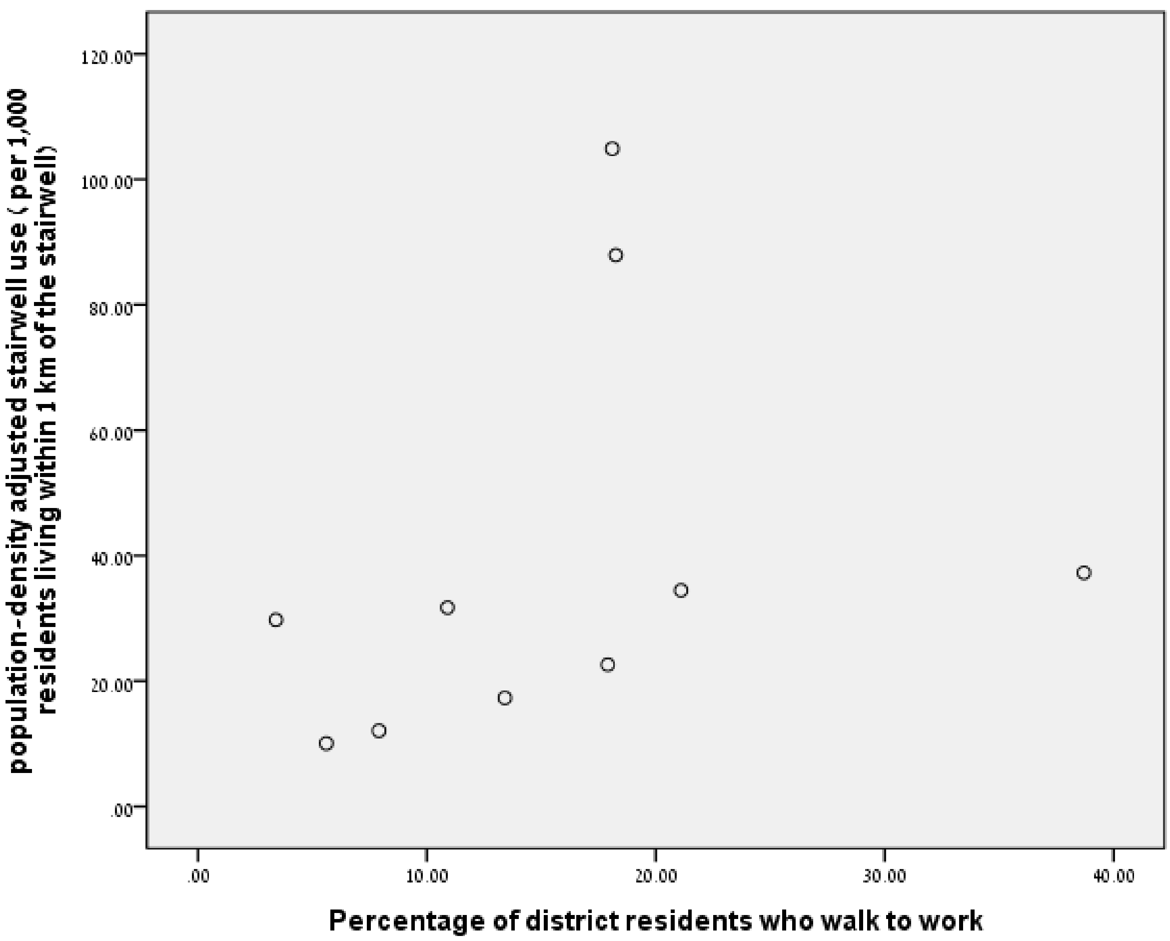

Figure 6b

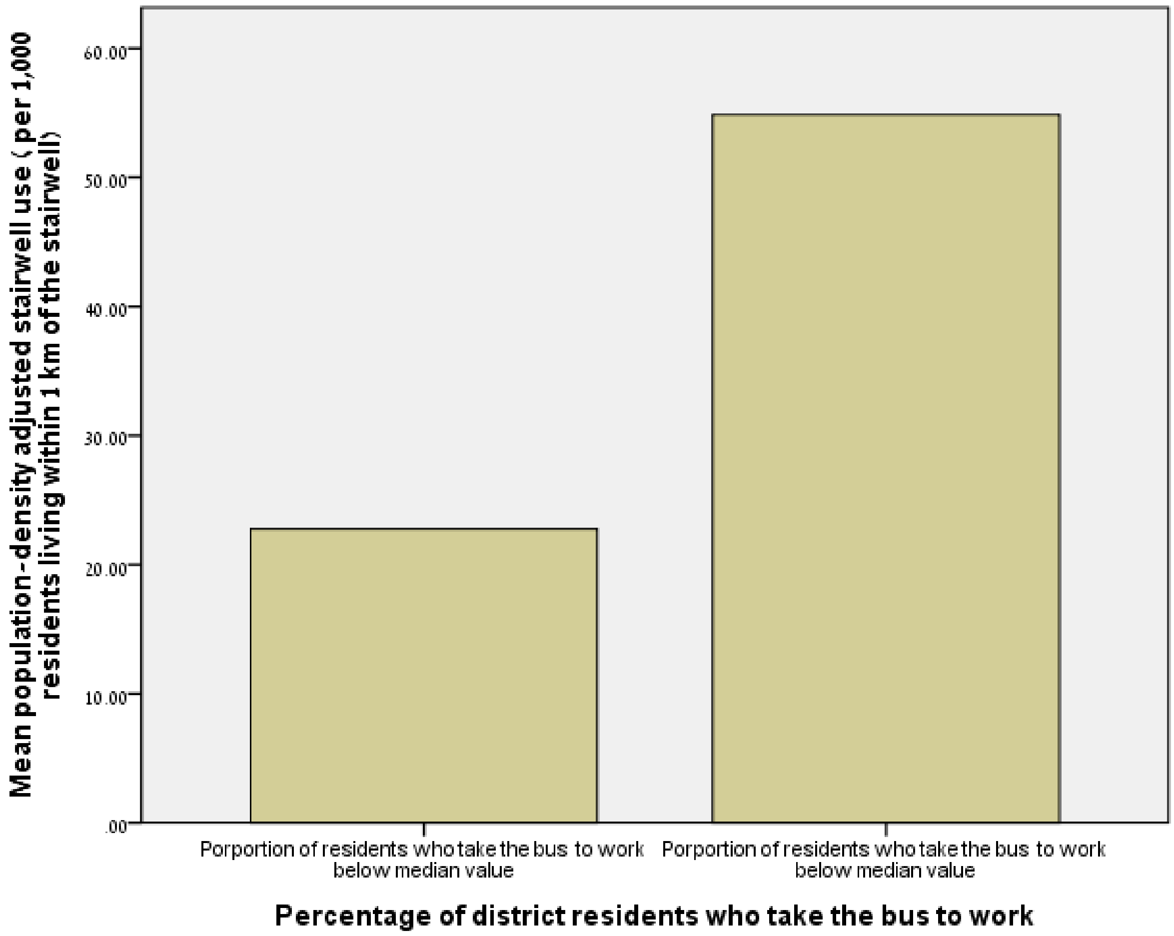

Figure 7a

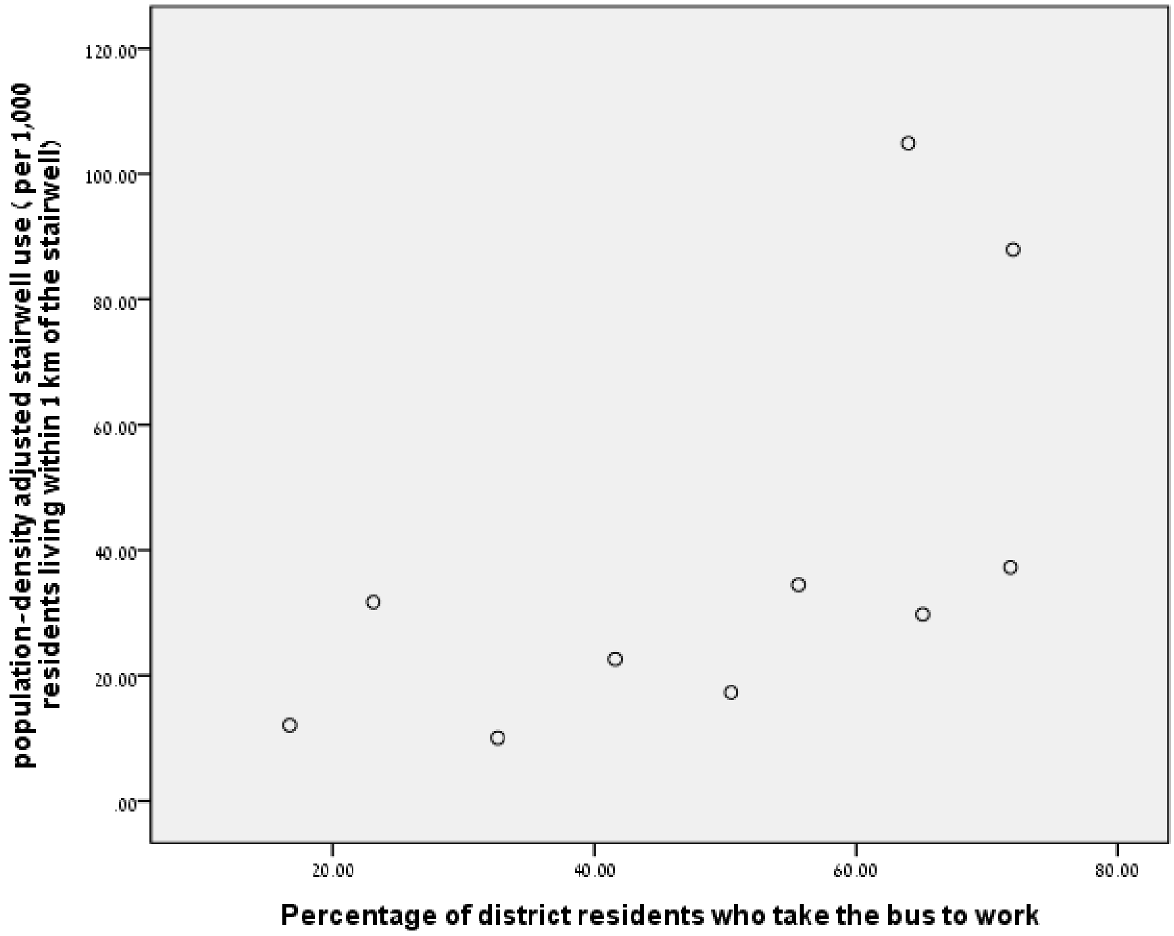

Figure 7b

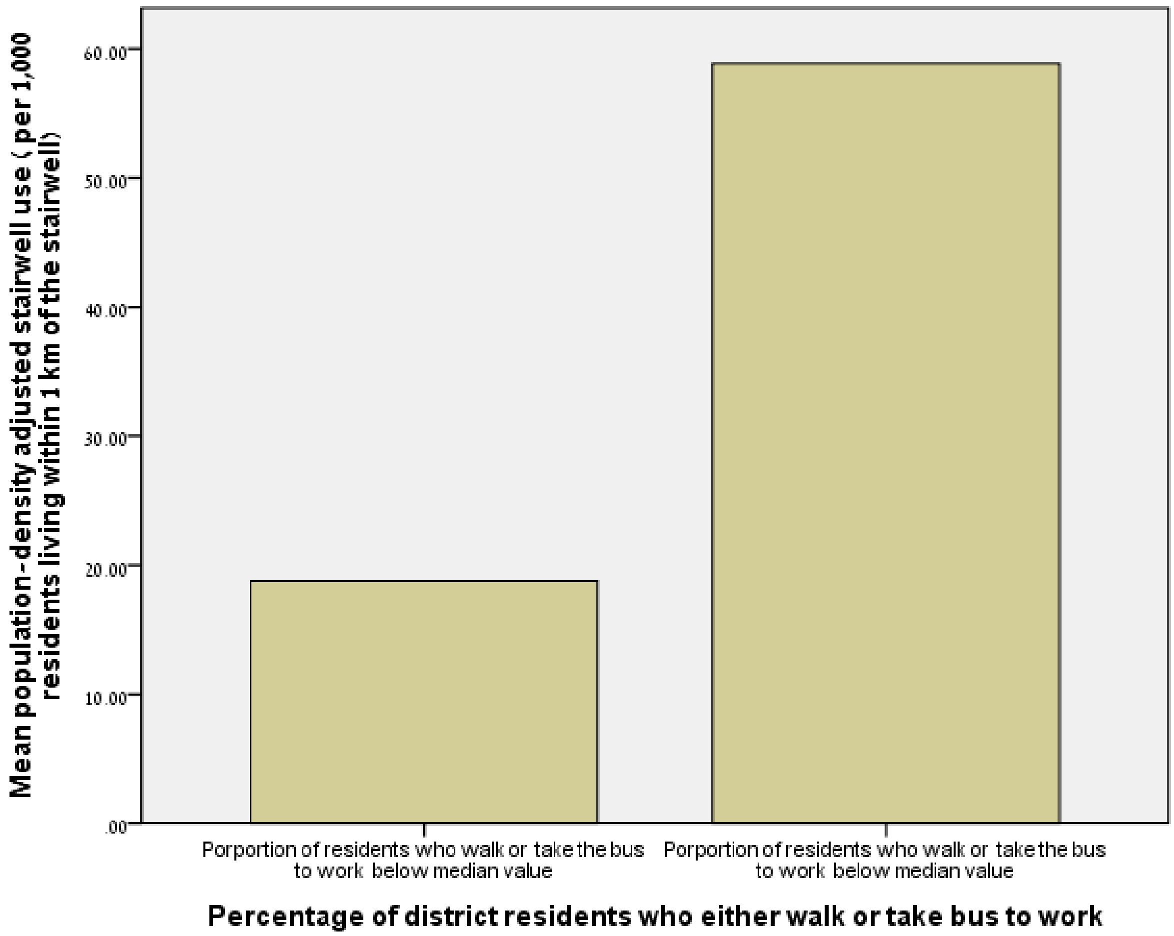

Figure 8a

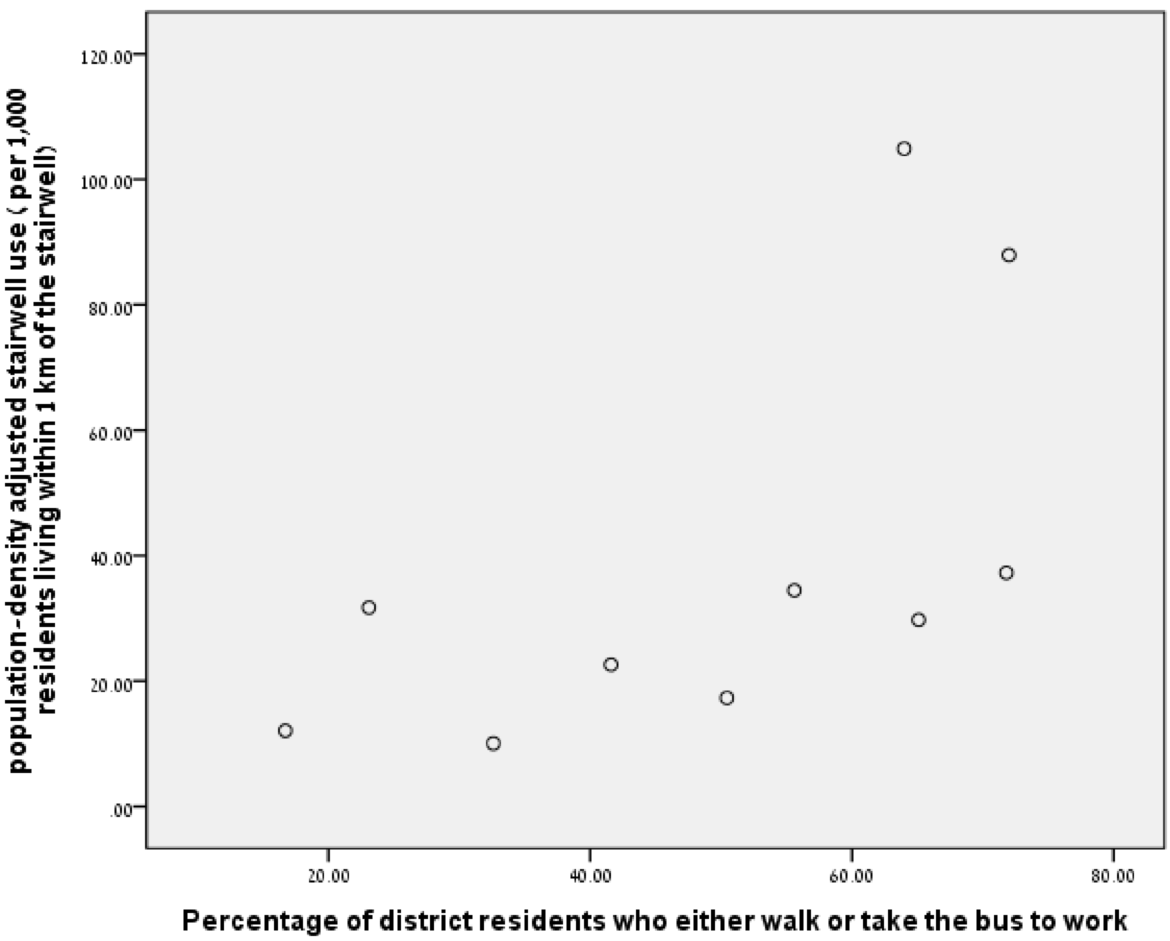

Figure 8b

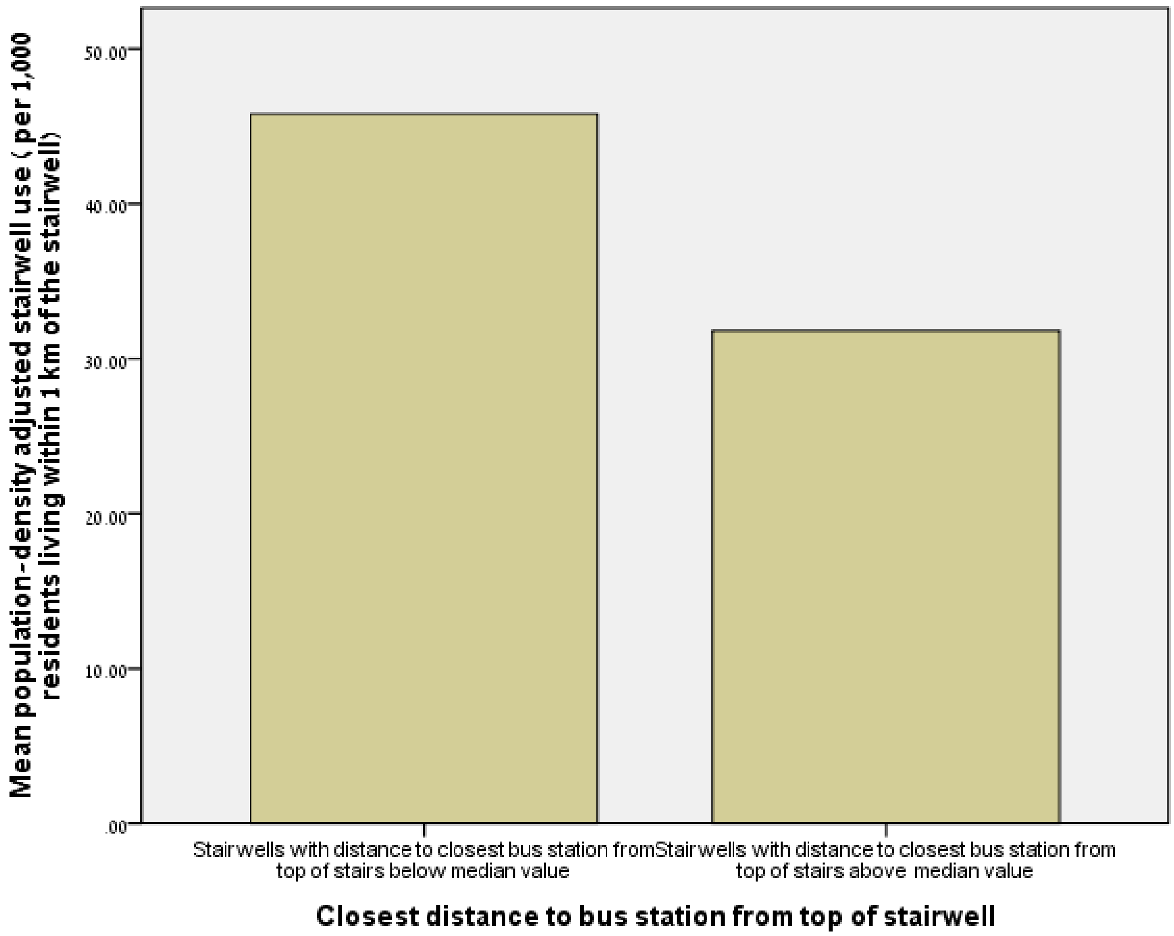

Figure 9a

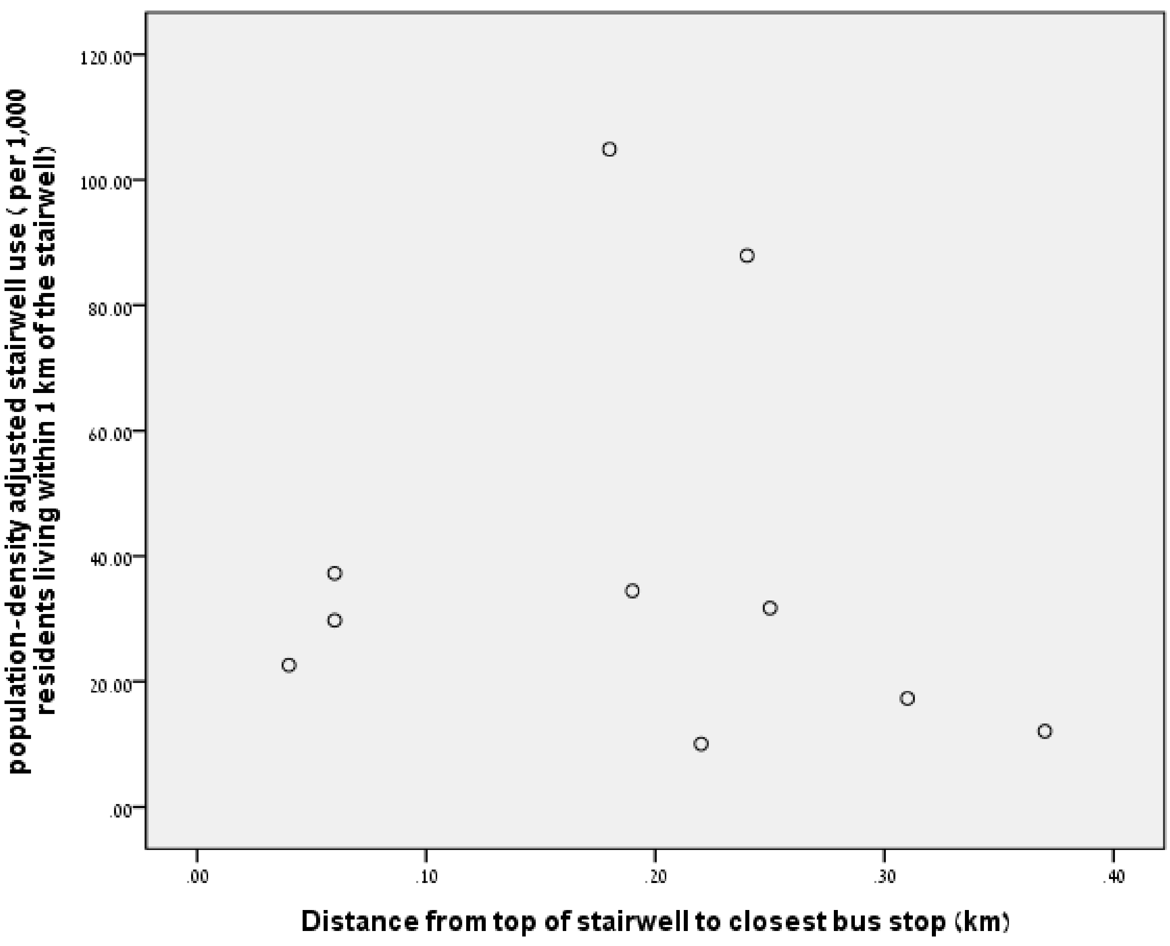

Figure 9b

Figure 10a

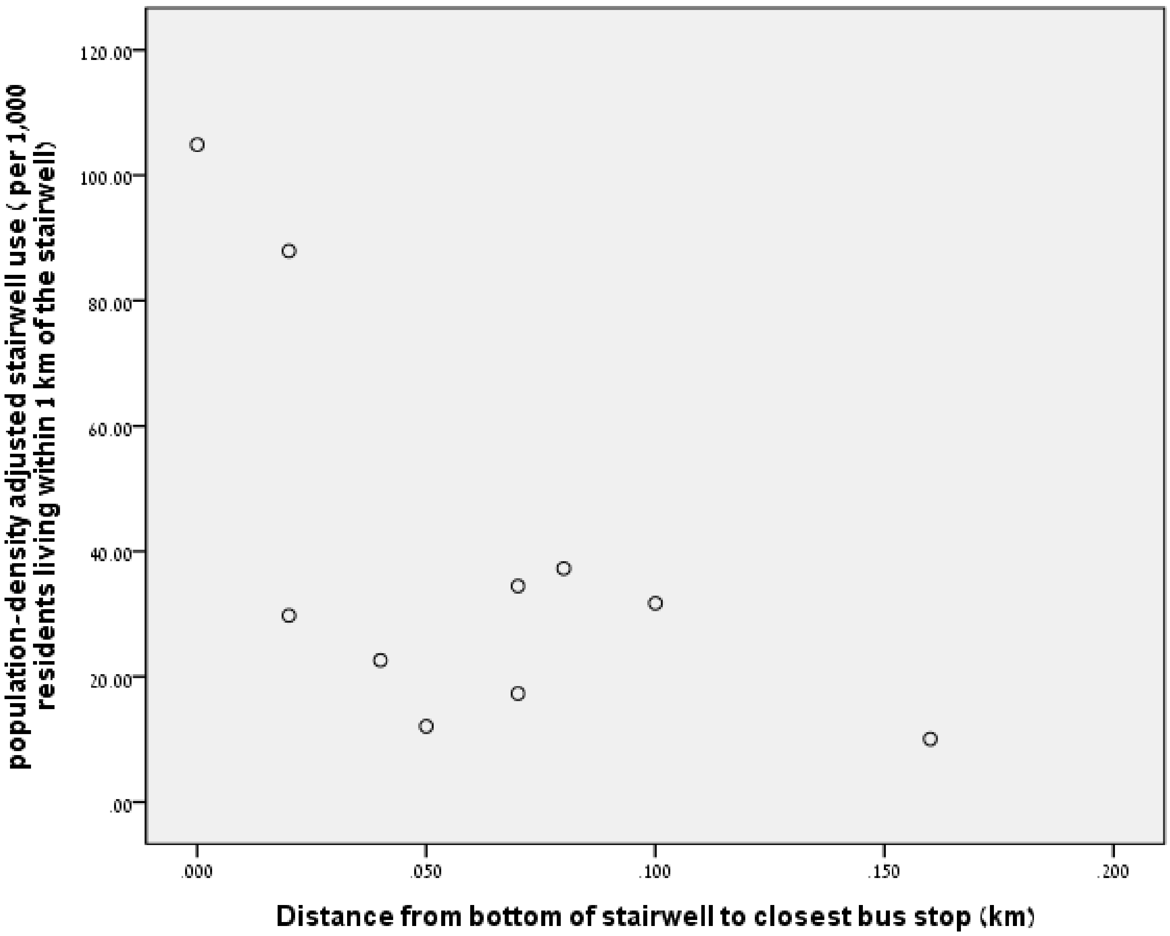

Figure 10b

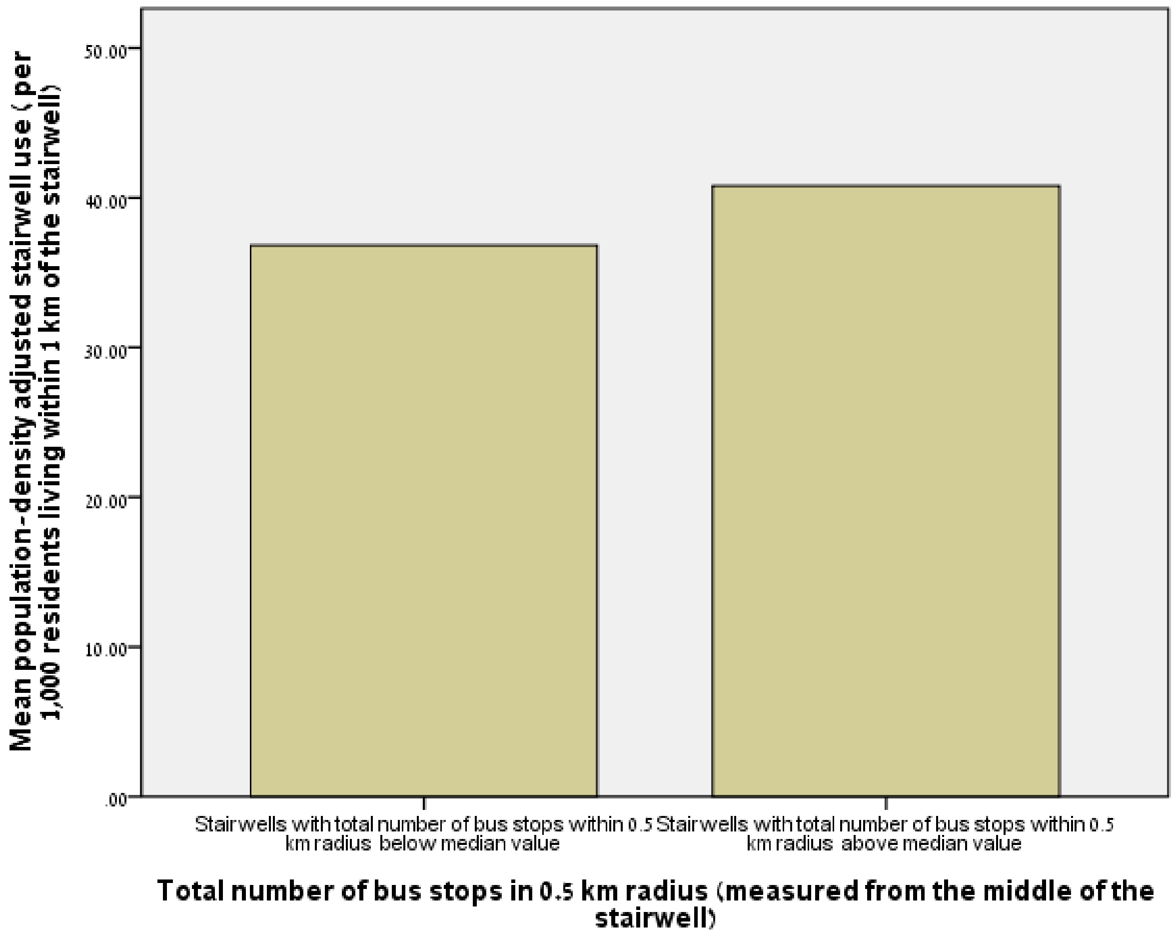

Figure 11a

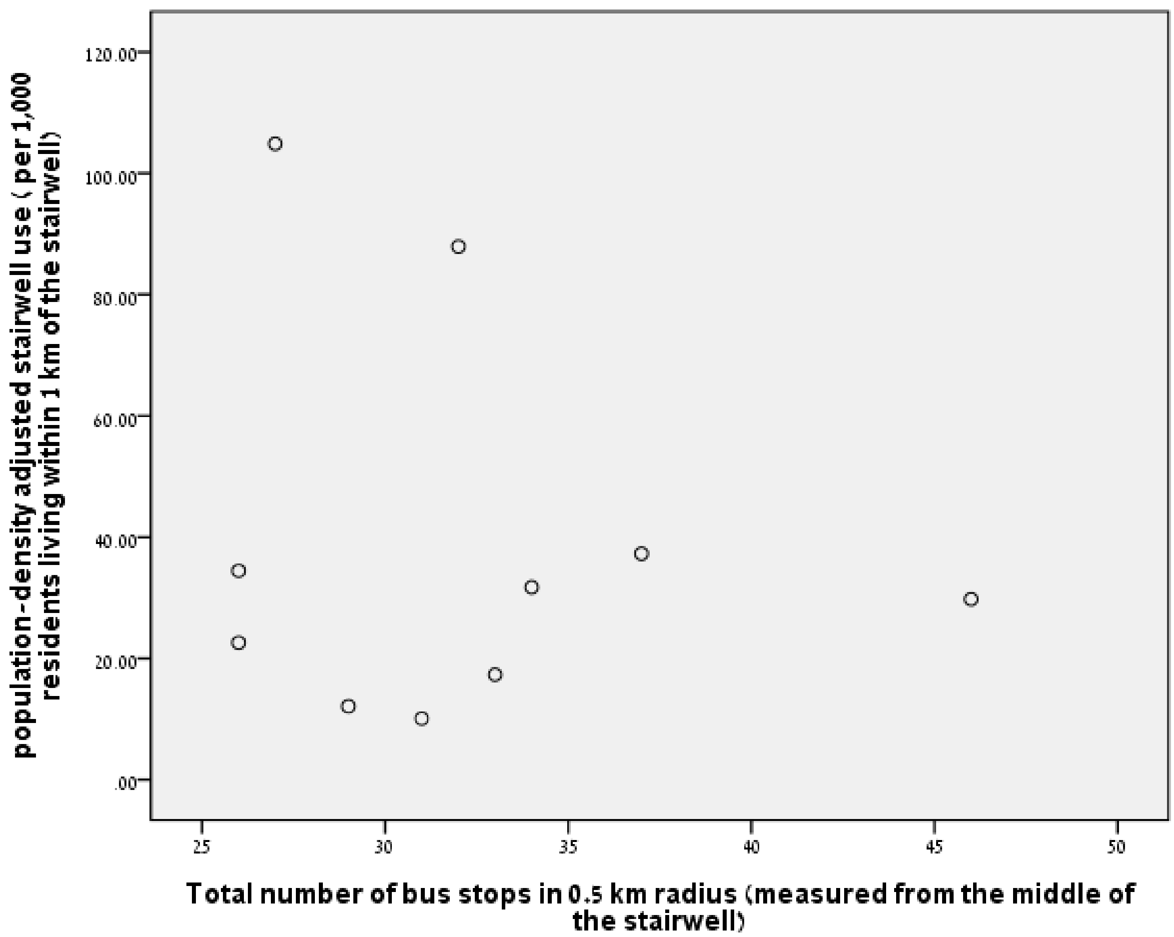

Figure 11b

References

[1] World Health Organization (WHO). (2010). Global recommendation on physical activity for health. 7-57. Retrieved from http://apps.who.int/iris/bitstream/10665/44399/1/9789241599979_eng.pdf

[2] Centers for Disease Control and Prevention (CDC). (2015, June 4). Physical activity and health. Retrieved from https://www.cdc.gov/physicalactivity/basics/pa-health/

[3] Organisation for Economic Co-operation and Development (OECD). (2015). *Health at a Glance 2015: OECD Indicators.* OECD Publishing, Paris. Retrieved from http://dx.doi.org/10.1787/health_glance-2015-en

[4] Hanson, S. & Jones, A. (2014). Is there evidence that walking groups have health benefits? A systematic review and meta-analysis. *British Journal of Sports Medicine*, *49*, 710-715. doi:10.1136/bjsports-2014-094157

[5] Hallal, P.C, Anderson, L.B., Bull, F.C., Guthold, R., Haskell, W., Ekelund, U., for the Lancet Physical Activity Series Working Group. (2012). Global physical activity levels: surveillance progress, pitfalls, and prospects. *The Lancet, 380*(9838), 247-257. doi http://dx.doi.org/10.1016/S0140-6736(12)60646-1

[6] Baron-Epel, O., Haviv, A., Garty, N., Tamir, D., & Green, M. (2005). Who are the sedentary people in Israel? A public health indicator. *Israel Medical Association Journal, 7*(11), 694-699.

[7] Merom, D., Sinnreich, R., Aboudi, V., Kark, J.D., & Nassar, H. (2012). Lifestyle physical activity among urban Palestinians and Israelis: a cross-sectional comparison in the Palestinian-Israeli Jerusalem risk factor study. *BioMed Central Public Health, 12, 90.* doi: 10.1186/1471-2458-12-90

[8] Harvard Health Publications. (2009). Walking: Your steps to health. *Harvard's Men's Health Watch.* Retrieved from http://www.health.harvard.edu/newsletter_article/Walking-Your-steps-to-health

[9] Owen, N., Salmon, J., Koohsari, M.J., Turrell, G., & Giles-Corti, B. (2014). Sedentary behaviour and health: Mapping environmental and social contexts to underpin chronic disease prevention. *Sports Medicine, 48*(3), 174–177. doi: 10.1136/bjsports-2013-093107.

[10] Saelens, B.E. & Handy, S.L., (2008). Built environment correlates of walking: A review. *Medicine and Science in Sports and Exercise*. *40*(7 Suppl), S550–S566. doi: 10.1249/MSS.0b013e31817c67a4

[11] Wojan, T.R. & Hamrick, K.S. (2015). Can walking or biking to work really make a difference? Compact development, observed commuter choice and body mass index. *PLoS One, 10*(7). doi: 10.1371/journal.pone.0130903

[12] Eid, J., Overman, H.G., Puga, D., & Turner, M.A. (2008). Fat city: Questioning the relationship between urban sprawl and obesity. *Journal of Urban Economics. 63*(2), 385–404. doi: 10.1016/j.jue.2007.12.002

[13] The Central Bureau of Statistics (CBS). (2008). [Profile charts 2008]. Retrieved from http://www.cbs.gov.il/census/?MIval=%2Fcensus%2Fpnimi_sub2_profiles.html&id_topic=11&id_subtopic=1&id_subtopic2=1&Semel=4000&Sug_Haluka=3&Pirut=1&SelectedArea=713

[14] Haifa Municipality. (2010). [Haifa characteristics by region]. Retrieved from http://www1.haifa.muni.il/spru/doc/Profile/y2008/Download/profileDL.pdf

[15] Haifa Municipality. (2012). Haifa. Retrieved from http://www1.haifa.muni.il/spru/doc/Fad/haifa_ENG.pdf

[16] Nitza. (2016). [Stairs index]. Retrieved from http://hirom.info/?page_id=1439

[17] Public Stairs. (n.d.) Stair Maps. Retrievd from http://publicstairs.com/index_000002.htm

[18] Fairnie, G.A., Wilby, D.J., & Saunders, L.E. (2016). Active travel in London: The role of travel survey data in describing population physical activity. *Jounral of Transport & Health, 3*(2), 161-172. doi:10.1016/j.jth.2016.02.003

[19] Shoham, D.A., Dugas, L.R., Bovet, P., Forrester, T.E., Lambert, E.V., Plange-Rhule, J.,…Luke,A. (2015). Association of car ownership and physical activity across the spectrum of human development: Modeling the Epidemiologic Transition Study (METS). *BioMed Central Public Health, 15*. 173. doi: 10.1186/s12889-015-1435-9.

[20] Booth, S.L., Mayer, J., Sallis, J.F., Ritenbaugh, C., Hill, J.O., Birch, L.L.,…Hays, N.P. (2001). Environmental and societal factors affect food choice and physical activity: Rationale, influences, and leverage points. *Nutrition Reviews, 59*(3), S21-S39.

[21] Haifa Stairs. (2016). [General information]. Retrieved from https://haifastairs.co.il/wp/speaker/מידע–כללי

[22] Eves, F.F. & Webb, O.J. (2006). Worksite interventions to increase stair climbing: Reasons for caution. *Preventative Medicine, 43*, 4-7. doi:10.1016/j.ypmed.2006.03.011

[23] Nicoll, G. (2007). Spatial measures associated with stair use. *American Journal of Health Promotion, 21*(4 supplement), 346-352.

[24] Upfest. (2016). Upfest festival. Retrieved from http://www.upfest.co.uk/page/upfest-festival

[25] Litt, S. (2015, December 3). 'Rock Box' public art project aims to link the Rock Hall – and rock music to downtown. Retrieved from http://www.cleveland.com/arts/index.ssf/2015/12/rock_box_public_art_project_ai.html

[26] Grohol, J.M. (2016, July 11). Pokémon Go reportedly helping people's mental health, depression. *Psych Central.* Retrieved from http://psychcentral.com/blog/archives/2016/07/11/pokemon-go-reportedly-helping-peoples-mental-health-depression/

[27] Mayo Clinic. [Mayo Clinic]. (2016, July 21). Active games a game changer? [video file]. Retrieved from https://www.youtube.com/watch?v=YOZ_O4G_GzM

[28] Araujo, M. (2016). How many people visit Christ the Redeemer statue in Rio de Janerio each year? *My Rio.* Retrieved from http://www.myriotravelguide.com/how-many-people-visit-christ-the-redeemer-statue-in-rio-de-janeiro-each-year/

[29] Kinsey, M., Galea, E.R., & Lawrence, P. (2012). Human factors associated with the selection of lifts/elevators or stairs in emergency and normal usage conditions. *Fire Technology, 48*(1), 3-26. DOI: 10.1007/s10694-010-0176-7

[30] Adams, M.A., Hovell, M.F., Irvin, V., Sallis, J.F., Coleman, K.J., & Liles, S. (2006). Promoting stair use by modeling: An experimental application of the behavioral ecological model. *American Journal of Health Promotion, (21)*2, 101-109. doi: 10.4278/0890-1171-21.2.101

[31] Israel Meteorological Services (IMS). (2016, July 4). Climate information: Haifa. Retrieved from http://www.ims.gov.il/IMSEng/CLIMATE