Physical (in)activity by school students as a result to the built environment

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Master's thesis Spatial Planning

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PREFACE

This document is my master's thesis on the topic of built environment in relation to physical activity of Dutch school students. This thesis is the final report for the my master Spatial Planning at the Radboud University Nijmegen. In the past months have I worked with passion on this study as I am intrigued by the possibilities for building (urban) environments that stimulate active behavior. Two years ago did I graduate from the study Landscape design. In this research was it possible for me to combine my practical knowledge as a designer and academic knowledge as a spatial planner. It was a pleasure to do so in cooperation with various professionals. I want to thank everybody that I have been in contact with regarding my thesis topic. A special thanks goes out the researchers, Kris Bevelander and Thabo van Woudenberg, from the Behavioral Sciences Institute of the Radboud University for sharing the data from the MyMovez project and their help during the study. I also want to thank Jan Willem van Eck and Richard Vermeeren from ESRI for helping me with gathering spatial data in the ArcGIS software. Finally I want to thank Peter Ache and Erwin van der Krabben for their guidance during the study as thesis supervisor and second reader.

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SUMMARY

On a global level is sedentary behavior increasing. Our daily activities and environments stimulate inactivity. The car is the predominant mode of transportation and children play games inside behind a computer instead of outside with friends. Recent studies show the importance of the built environment (BE) in light of public health and diseases. A healthy environment increases a person's health and potentially decreases the mortality rate among a countries population. A healthy environment stimulates physical activity (PA). The Dutch Health Council (2017) introduces a Dutch standard for healthy physical activity. This includes a prescription for a daily amount of moderate to vigorous physical activity (MVPA) and other forms of exercises. In conclusion is the given statement saying that more physical activity is better. Nevertheless are there different prescribed amounts of PA for specific social groups, based on age. The Dutch standard for healthy physical activity states that an adult person should at least perform thirty minutes of moderate to vigorous physical activity per day, for five days per week. Only 44% of the Dutch population meets this recommendation. For children and adolescents is this number higher. They are recommended to perform at least sixty minutes of MVPA per day, for seven day per week. Youth has a lot to gain by performing this amount of physical activity. From the ages 2 to 10 will PA increase the child's physical growth, motor skills, biological maturation and the general ability to perform physical activities. From the ages 11 to 18 will PA increase an adolescent's fitness, bone density, and decrease the chances of cardiovascular diseases and overweight. In addition to this is youth likely to maintain an adapted (healthy) lifestyle over time, resulting in health benefits on an older age. The Dutch Health Council (2017) indicates that 55% of Dutch children does not meet the recommended amount of MVPA and that 72% of the Dutch adolescents does not meet the recommended amount. The built environment is a potential factor that can stimulate physical activity among youth. This research indicates the value of structural built environment characteristics for stimulating healthy lifestyles.

Research methodology

This research makes use of data that is gathered in the MyMovez project. This research project is executed by the Behavioral Sciences Institute of the Radboud University in Nijmegen, the Netherlands. In the MyMovez project are Dutch school students, from 21 different primary and secondary schools throughout the Netherlands, asked to participate in an inquiry and to wear a wearable accelerometer to measure their performed amount of physical activity. This thesis study uses this gathered data and links the respondents to spatial data by GIS software. A linear regression analysis is used to explain the performed amount of MVPA by the Dutch school students. A multinomial logistic regression analysis is executed to explain the travel mode choice for travelling to school. This is a quantitative, positivist, approach for gaining knowledge on this specific topic. The researcher evaluates objective BE characteristics from a distance. The following research question is answered:

In what way do structural elements in the built environment of home en school locations influence the performed amount of physical activity outside of school by Dutch school students?

Three environment levels that influence PA

In a literature review on this specific topic is derived that there are three different environment levels that stimulate or demotivate physical activity among school

students. These three levels are the individual environment, the social/cultural environment and the built environment. As the MyMovez project gathered data on the individual and social environment of the school students is this included in the conceptual model. The research outcomes indicate the difference in influence that each environment has on the performed amount of MVPA by school students.

School students are for a large part of their days at school. Outside of school hours are they mostly active in their home location. For this reason does this research distinguish BE characteristics in the home and school locations. The same goes for the choice for a specific travel mode to school.

Research outcomes

The research indicates that the individual environment influences physical activity the most. School students are more likely to choose an active transportation mode over travelling by car when they are boys, they have a Dutch nationality and when they get older. Also the absence of an injury makes that school students are more likely to choose an active mode of travel. The outcomes of the linear regression analysis do also indicate that school students are more likely to perform MVPA when they perceive themselves as good athletically skilled. Overall do boys perform more physical activity and do school students perform in general less MVPA when they get older. The social/cultural environment shows the least significant relations with both the dependent variables. This is contradictory to the existing literature. The travel mode choice is influenced by the amount of cars in the household and by the presence of a siblings. School students are more likely to pick an active form of transportation when there are more cars in the household and when they have one or more siblings. The only direct significant relation between a social/cultural environment characteristic and the performed amount of MVPA is the amount of computers in the household. School students perform less MVPA when there are more computers in the household. There are no significant relations found between structural BE characteristics in home locations and the performed amount of MVPA by school students. This is contradictory to the existing literature as it mentions various relations. The built environment in school locations does however indicate a relation with the MVPA. When more greenery or forestry is present in the direct school surroundings are students less likely to perform physical activity. This might be related to the fact that schools with more greenery and forestry are located in a more rural area and that the travel distance is longer. The literature indicates that people tend to choose for passive modes of travel (by car) when the distance to the destination increases.

In conclusion can be stated that structural built environment elements will have a minimal effect on the choice for an active mode of travel or the performed amount of MVPA by Dutch school students. The active behavior of school students is largely influenced by their individual environment. The relation between built environment and physical activity is potentially found on a more detailed scale. Further qualitative case study research could potentially provide quality insides on this matter.

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KEYWORDS AND ACRONYMS

Keywords

BUILT ENVIRONMENT, CHILDREN & ADOLESCENTS, PHYSICAL ENVIRONMENTAL LAW (OMGEVINGSWET), MODERATE OR VIGOROUS PHYSICAL ACTIVITY (MVPA), PHYSICAL ACTIVITY, THE NETHERLANDS.

Acronyms used

MVPA – Moderate or Vigorous Physical Activity

NNGB – Nederlandse Norm voor Gezond Bewegen (Dutch standard for healthy physical acitivty)

BRT – Basisregistratie Topografie (Loosely translated: Basis registration topography)

SDLOC – School District Location

SSLOC – School Student (home) Location

1. RESEARCH FRAMEWORK

1.1. PROJECT FRAMEWORK

Sedentary behavior is getting more common and is stimulated in our daily activities and community environments (Dunton et al., 2009). People tend to perform less physically activity because of this. Less than fifty percent of the population in western countries meets the recommendations for amounts of physical activity (WHO, 2010; Sallis et al., 2016). The same goes for The Netherlands where 56% percent of the population does not meet the recommended amount of PA (Health Council of the Netherlands, 2017. For adolescents is this number even lower. Only 28% of the Dutch population between the ages of 12 and 17 meets the Dutch Standard for Healthy Physical Activity (*Nederlandse Norm voor Gezond Bewegen)* (Health Council of The Netherlands, 2017). Researchers are calling the increase of sedentary behavior a global pandemic with a critical need for change (Ferreira et al., 2005; Sallis et al., 2016) as the number of children and adults with obesity is increasing rapidly (Krizek, Birnbaum & Levinson, 2004; Hunter et al., 2014).

Physical activity has various positive health consequences and can prevent diseases such as obesity. It decreases the chance of cardiovascular disorders, the risk of obesity and overweight, a low bone density but also influences a person's level of fitness, a higher self-esteem, lower stress levels and other emotional and physical benefits (Giles-Corti- et al., 2005; Davison & Lawson, 2006; Huber, 2014). The Dutch research institute for environmental assessments, the RIVM, presents twelve determinants for diseases and mortality rates among the Dutch population (2018). An unhealthy built environment, too less physical activity, obesity and low bone density are mentioned as influential factors. As curative care and care expenditure is rising in the Netherlands (CBS, 2019b) is the need for preventive measures growing. Dutch policy is changing accordingly and public health and quality of life topics are explicitly mentioned in new policy documents such as the new Dutch physical environment law (*Omgevingswet) and in de new national physical environment vision (NOVI) (Ministry of Internal Affairs, 2019)*. The Dutch government strives to construct more healthy physical environments that stimulate or enforce healthy behavior.

In the previous decades many researchers focused on the relation between the physical built environment and physical activity. The research can be categorized into four main target groups which are adults (age 18-64), elderly (age 65+), children (age 4 to 11) and adolescents (age 12-17 (Sallis et al., 2012; Handy et al., 2002; Krizek, Birnbaum & Levinson, 2004; Davison & Lawson, 2006; Davison, 2008; Sallis et al., 2008; Aarts, 2011; Sallis et al., 2016; Hooper et al., 201). All social groups differ in their daily needs and activities (Krizek, Birnbaum & Levinson, 2004) but also in the need for various forms of physical activity (Huber, 2014; Dutch Health Council, 2018). The Dutch Standard for Healthy Physical Activity prescribes for every social group a different set of activities per week (Dutch Health Council, 2018). For adults is the recommended amount of physical activity 30 minutes of Moderate or Vigorous Physical Activity (MVPA) for five days a week with the comment to avoid long periods of time sitting down. For elderly, the recommended amount is similar to adults with additional bone and muscle strengthening exercises. For children between the ages of 4 and 18 the recommended amount is at least 60 minutes of MVPA for seven days a week, the comment to avoid long periods of sitting down and activities that strengthen the bones and muscles. Preventive care measures that stimulate these amounts of physical activity could potentially have a large effect on the public health of a population. Especially when targeted at children and adolescents. Research shows that children are likely to maintain the adopted healthy lifestyles later on in their lives

(Krizek, Birnbaum & Levinson, 2004; Aarts, 2011). A built environment that stimulates the amount of executed PA of youth is therefore an strongly integrated goal for contemporary Dutch spatial policy. The relation between elements in the BE that stimulate PA among adults differ from elements that stimulate PA among children and adolescents (Davison & Lawson, 2006; Krizek, Birnbaum & Levinson, 2004). Children spend most of their time either at home, in their neighborhood or at school (Krizek, Birnbaum & Levinson, 2004). In addition to this do youth have a relatively large amount of time for recreational activities, are they not allowed to drive motorized vehicles and are their actions influenced by the rules and restrictions introduced by their parents (Krizek, Birnbaum & Levinson, 2004). This research therefore focuses on the elements in the built environment that are of influence to children's and adolescents' behavior and tries to identify in what way these elements stimulate or demotivate physical activity.

1.2. RESEARCH AIM AND QUESTIONS

This research aims provide insights on the relation between the built environment (BE) and physical activity (PA) by Dutch school students between the ages of 9 and 14 years old. The research focuses on this specific target group in line with the MyMovez project which is executed by the Behavioral Sciences Institute, Radboud University Nijmegen (Bevelander et al., 2017). This thesis study uses the data that is gathered in the MyMovez project by an elaborate survey and wearable accelerometers to measure physical activity. The survey is executed at 21 different primary and secondary schools throughout the Netherlands. By linking the survey data to geographical spatial data of the home and school locations of the students new insights can be provided on the relation between the BE and PA.

This research strives to show the potential relation between spatial characteristics of the home and school locations and the amount of physical activity performed by the Dutch school students.

The research question presents more focus on what is researched and indirectly indicates what is not researched. The research question influences other decisions within the structure of the study and the results that will be achieved at the end (Farthing, 2016). This inquiry tends to answer the following research question:

In what way do structural elements in the built environment of home en school locations influence the performed amount of physical activity outside of school by Dutch school students?

This question will be answered by answering the following sub questions:

- *What factors are related to the performed amount of physical activity by youth and what elements in the built environment stimulates or demotivates physical activity according to existing literature?*
- *What is the performed amount of physical activity by the school students that participated in the MyMovez project and what are differences per home and school location?*
- *In what way is active commuting to school of influence on the total amount of performed physical activity by school students?*

- *Is there a significant relation between structural elements in the built environment of home and school locations and the daily physical activity that is performed by the Dutch school students outside of school?*

1.3. RELEVANCE

1.3.1. Scientific relevance

The relation between the built environment and health has been broadly researched over the last decades. It has become a hot topic in the academic circle since 2002 as overweight numbers grew on a global level (Ding & Gebel, 2011). The literature shows clear insights on different aspects of the built environment that influence a person's health such as effects of heatstress, sound nuisance, air quality and stimuli towards physical activity (Giles-Corti et al., 2005; RIVM, 2011; Huber, 2014; Sallis et. al., 2016). This last factor is researched in various manners by quantitative and qualitative inquiries (Sallis et al., 2012; Handy et al., 2002; Krizek, Birnbaum & Levinson, 2004; Davison & Lawson, 2006; Davison et al., 2008; Sallis et al., 2008; Aarts, 2011; Sallis et al., 2016; Hooper et al., 201). It shows different specific objects in the BE that potentially increase or decrease the amount of physical activity that is performed by the population. These inquiries focus on a large urban areas where recreational and transportation (commuting) activities are researched for various of social groups.

This thesis study focuses on place specific urban areas which are the school districts of 21 schools in the Netherlands in combination with 951 home locations of the school students. It studies the relation between objective BE characteristics and objectively measured performed daily physical activity by the school students. This focus of the thesis will create new insights for the academic debate on how to stimulate youth to be more physically active by the arrangement of (objects in) the built environment. It also provides new insights to test contemporary spatial interventions of urban designers on efficiency and effectiveness.

1.3.2. Societal relevance

On a global scale do trends occur where inactivity and sedentary behavior is becoming more common and even stimulated (Sallis et. al, 2016). There is a global increase in sedentary behavior and a decrease in physical activity (Aarts, 2011). Community environments, such as work places and school, stimulate inactive sedentary behavior (Dunton et al., 2009). More people have a desk-job which results in sitting the larger part of their time at work and car use is still the most popular mode of transportation (Dutch Health Council, 2017). This sedentary behavior has a negative effect on a person's health. RIVM (2018) state twelve determinants for the public health that can be regulated by the Dutch government. Quality of the physical environment, overweight and physical inactivity are in the top five of largest determinants. The determinant physical inactivity is for 2,3% the cause of Diseases in the Netherlands according to the RIVM (2018) which can be translated to the cause for circa 5.600 deaths, 6% of all fatalities, per year (Dutch Health Council, 2018). This thesis study focuses specifically on the physical (in)activity of Dutch school students. Dutch public health institutions have a yearly monitor for health among the Dutch youth (ages 4-17). The latest statistics show that only 28% of the Dutch adolescents meets the norm for physical activity. Loosely interpreted does this mean that 72% of the Dutch youth between ages 12 and 17 are less physically active than sixty minutes per day (Dutch Health Council, 2017). The Dutch government anticipates on this with the revision of Dutch physical environmental law. The new Physical environment law introduces public health as one of the evaluating factors for new spatial development plans and vision documents. In the Netherlands is the need for curative care regarding diseases among society growing (CBS, 2019b). Preventive care policies and interventions have a large potential to decrease these numbers, especially when targeted at youth. Adapted (healthy) lifestyles tend to be maintained by a person when they are older (Krizek, Birnbaum & Levinson, 2004; Aarts, 2011). The insights provided by this study can potentially be used for choices regarding policy and spatial interventions that tend to achieve higher numbers of physical activity among youth and indirectly have a positive influence on their health at a later age.

2. THEORETICAL FRAMEWORK

2.1. THE BUILT ENVIRONMENT & PUBLIC HEALTH

The relation between the built environment (BE) and physical activity (PA) is largely debated in the last decades in light of public health improvements (Ding & Gebel, 2011; Sallis et al., 2016). On a global level is sedentary behavior getting more and more common. This physical inactivity has a negative effect on personal health of inhabitants (Strong et al., 2005). The Netherlands is showing the same trend. The car is still the predominant modality, the amount of office jobs is increasing and children are playing games inside behind a computer instead of outdoor games (Dunton et al., 2009). As the amount of performed physical activity declines do numbers of obesity, cardiovascular diseases and mental health problems increase (De Vet et al., 2011). It is particularly getting important to evaluate unhealthy lifestyles of children. In western countries more than half of the population between the ages of four and seventeen does not meet the recommended amount of physical activity (Aarts, 2011). This is also the case for the Netherlands. A recent study of the Dutch Health Council (2017) shows that 45% of children between ages 4 and 11 and 72% of children between the ages 12 and 17 does not meet the recommended amount of PA. Children are specifically in need for PA to develop motor skills, biological maturation and their behavioral development (Strong et al., 2005). In addition to this do studies show that children maintain incorporated lifestyles when older (Krizek, Birnbaum & Levinson, 2004; Aarts, 2011). Acquiring a healthy lifestyle on a younger age may therefore have a large influence on a person's health in time.

There is a growing body of literature on the relation between the built environment and public health (RIVM, 2018). The studies vary in their focus to specific elements in the BE as the built environment is a multidimensional concept (Handy et al., 2002). Handy et al. (2002) state that there are three main aspects where researchers often refer to when the term built environment is used. Frequently mentioned aspects are 1) Urban design: with a focus on the physical elements found in an geographical area and its arrangement; 2) Land use: that refers to the allocation of activities and facilities; and 3) Transportation structures: regarding physical infrastructure and transport services. The variety of aspects creates a level of difficulty for assessing the BE in academic research as research findings are not easily comparable to other studies. In addition to this does the BE influence public health in different ways (RIVM, 2018). The BE has been proven to have an direct effect on a person's health in different ways. The RIVM (2018) shows twelve determinants for diseases among society in the Netherlands. This study shows to what level the different determinants are partly responsible for disease and mortality rates, separated over four categories: behavior, personal features, labor circumstances and living environment [see figure 1]. An unhealthy environment (3,5%), physical inactivity (2,3%), overweight/obesity (3,7%) and high blood pressure (6,7%) are also mentioned as determining factors. It is not possible to sum the different percentages as they are interconnected with each other (RIVM, 2018). For example does the outdoor (built) environment influence a person's physical (in)activity, overweight and blood pressure (Huber et al., 2014; Van Woudenberg, 2018). All determinants that are presented by the RIVM are adaptable by governmental policy and interventions and have a large potential for increasing the overall health levels of the population.

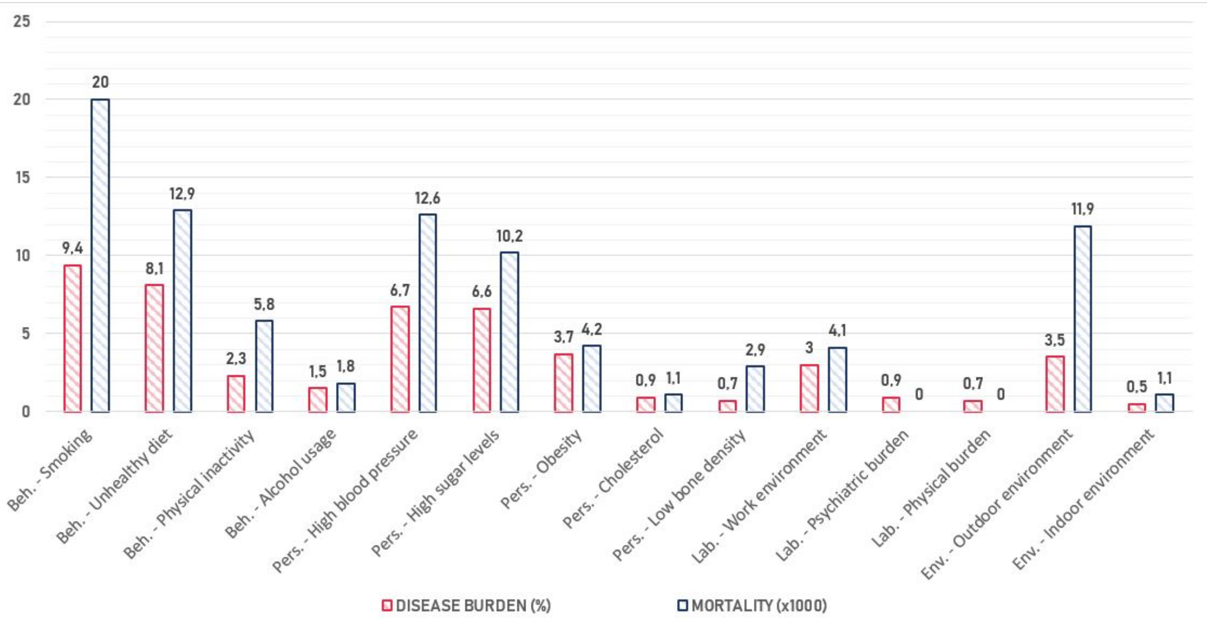

Figure 1. Determinants for public diseases (RIVM, 2018). Adjusted by author

2.2. DEFINING THE TERM 'HEALTH'

The term 'health' is not that easily definable. It is defined by various institutions over the world that are associated with public health (Sartorius, 2006). The different views on health can be gathered into three different definitions. Sartorius (2006) defines the three definitions as 1) the absence of diseases and impairment; 2) being able to cope with demands of daily life for an individual; and 3) a balance between a person's social and physical environment and him or herself. The first is regarding the definition of the World Health Organisation [WHO] that defines health as "the state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organisation, 2019). The second definition are a continuation of the philosophy of Antonovski and his Salutogenesis model and later modern theories on public health to work towards a 'quality of life' instead of merely the absence diseases and impairment (Lindström & Ericson, 2006). The WHO definition is argued to be too ambitious for contemporary medical achievements. The definition of the WHO would even imply that a large part of today's population is not healthy at all (Institute for Positive Health, 2019). The Salutogenesis theory presents a change in perspective from disease treatment in curative ways towards health promotion in preventive ways. The also goes for the third definition which is introduced by a Dutch movement against the definition of the WHO. This theory, called Positive Health, explains how the term health is impossible to be expressed as a statistical given number and shows it to be a dynamic situation with various dimensions (Huber, 2014). Health is defined as: *"Health as the ability to adapt or take control over social, physical and emotional challenges of life"* (Huber, 2014; p:58). It is directed at the resilience and functioning of an individual more than the presence or absence of diseases

(Huber, 2014). The definition of the Institute for Positive Health (IPH) is recently adapted into Dutch policy documents and the mission statements of medical and public health related institutions: *"Gezondheid als het vermogen om je aan te passen en je eigen regie te voeren, in het licht van de sociale, fysieke en emotionele uitdagingen van het leven"* (GGD, 2016). A person's health can be defined based on six dimensions. Figure 2 shows the six different dimensions in the theory of Positive Health.

Bodily functions	Mental functions & perception	Spiritual/ existential dimension	Quality of Life	Social & societal participation	Daily functioning
Medical facts Medical observations Physical functioning Complaints and pain Energy	Cognitive functioning Emotional state Esteem/ self-respect In control/ manageability Self-management Resilience, SOC (sense of coherence)	Meaning/ meaning-fulness Striving for aims Future prospects Acceptance	Quality of life/ well-being Happiness Enjoyment Perceived health Flourishing Zest for life Balance	Social and communicative skills Social contacts Meaningful relationships Being accepted Community involvement Meaningful work	Basic ADL Instrumental ADL Ability to work Health literacy

Figure 2. Dimensions of positive health (Huber, 2014)

2.3. PHYSICAL ACTIVITY & HEALTHY LIFESTYLES OF CHILDREN

Physical activity is shown to be related to all dimensions of the positive health concept. It decreases the health risks related to chronic diseases, life expectancy, mental

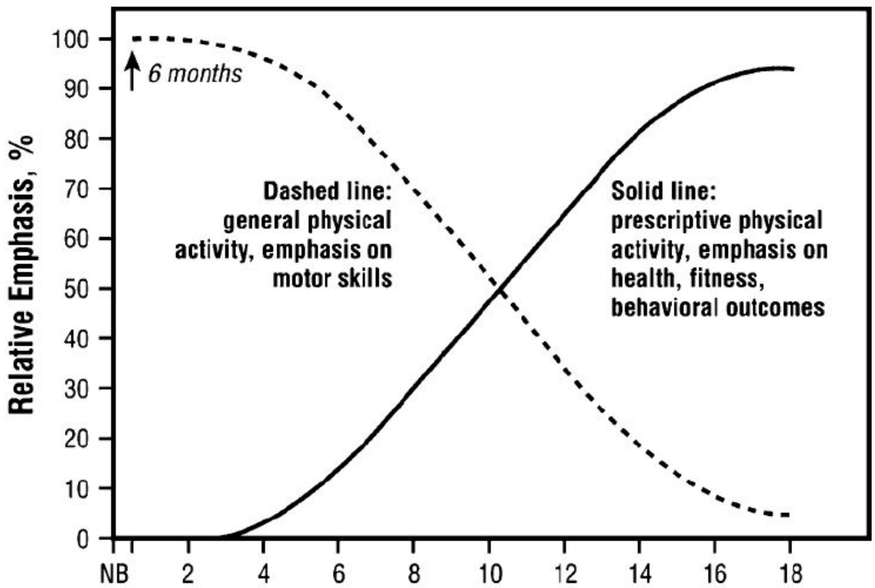

Figure 3. A change in positive effects of physical activity (Strong et al., 2005)

diseases, and overall quality of life perception (Sallis et. al., 2016; Huber, 2014; Giles-Corti et al., 2005). Researchers call the trend of sedentary behavior a global pandemic (Ferreira et al., 2005; Sallis et. al, 2016). Children have an even more specific need for enough physical activity. PA helps children between the ages of 3 and 10 increase their physical growth, motor skills, biological maturation and behavioral development (Strong et al., 2005). At the age of ten there is a tipping point where PA is less necessary for the abovementioned factors and where PA is more so related to overweight, physical health, cardiovascular health, bone density and blood pressure (Strong et al., 2005).

The amount of children and adolescents that meet the recommended amount of physical activity is declining. The Dutch government acts on this matter by informing the public on the necessary amount of PA which is monitored in a four year annual questionnaire by the Dutch Public Health Services (GGD). Th prescribed amount of physical activity is called the Dutch standard for healthy activity (Nederlandse Norm voor Gezond Bewegen, NNGB) which is derived from the prescribed amount of physical activity by the WHO (WHO,). The standard differs per moment in life. The prescribed amount for children is: 1) *“physical activity is good for you – the more, the better” (Health Council of the Netherlands, 2017; p.6);* 2) a minimum of 60 minutes of moderate or vigorous physical activity (MVPA) per day; 3) activities that strengthen muscles and bones for at least three times per week and; 4) try avoiding long periods of sedentary behavior (Health Council of the

	TEN ADVANTAGES OF WALKING AND CYCLING BY CHILDREN	
1	More experience in traffic situations; sentience & judgement	**Traffic**
2	Better cycle skills	
3	Better condition	**Health**
4	Better ability to concentrate and study	
5	Better eat and sleep behavior	
6	Less overweight	
7	Lower chances for asthma	
8	More contact with neighborhood friends	**Social**
9	Discovering the world by foot or by bike	
10	Better ability to solve arguments	

Figure 4. Advantages of walking and cycling (CROW, 2016). Adjusted by author.

Netherlands, 2017). As mentioned before does only 55% of the children meet this recommended amount and just 28% of adolescents (see figure 5). Alongside the positive effect on a child’s health does physical activity affect a child’s skills and mental abilities. CROW (2016) presents a list of advantages that children gain from walking an cycling. Next to various elements of a child’s health does the amount of walking and cycling relate to traffic factors and social factors. Especially for children will active behavior increase their personal development physically and emotionally. The Health Council of the Netherlands (2017) explains what forms of activity have a positive effect on a person’s health. Figure 4 shows that a lot is gained by being moderately active. Moderately active activities are for example walking and cycling. This is different from light and vigorous active activities such as doing laundry (light) or exercising (vigorous) (Health Council of the Netherlands, 2017). The prescribed amount of activity is presented as Moderate or Vigorous Physical Activity (MVPA).

Figure 5. The Dutch standard for healthy physical activity (Health Council of the Netherlands, 2017).

2.4. BUILT ENVIRONMENT & ACTIVE BEHAVIOR AMONG YOUTH

Research regarding the relation between the built environment and physical activity has largely expanded since 2002 (Ding & Gebel, 2011). This research focuses often on the influence of the built environment on physical activity of adults (Owen et. al., 2004; Sallis et. al., 2008; Giles-Corti et al., 2005; Hooper et al., 2018; Sallis et al., 2016). Nevertheless are many studies executed that focus on the physical activity by children and adolescents between the ages of 4 and 17 (Davison & Lawson, 2006; Dunton et al, 2009; Ding et al., 2011; Aarts, 2011; Zaltauske & Petrauskiene, 2016). Sallis et al. (2016: p 1) state for example that "*People who live in walkable neighborhoods that are densely populated, have interconnected streets, and are close to shops, services, restaurants, public transport, and parks, tend to be more physically active than residents of less walkable areas*". In contrast to this does Aarts state that low-walkable neighborhoods and road safety will positively influence PA by youth (Aarts, 2011). Aarts also mentions that social factors are more important for stimulating physical activity among youth than environmental factors (2011). Research outcomes that focus on the amount of physical activity by adults are not interpretable for children or adolescents as they perform different activities, have different interest and are differently influenced by social factors (Krizek et al., 2004). Active behavior of youth is largely subject to be influenced by their parent's norms, beliefs and actions (Krizek, Birnbaum & Levinson, 2004; Bevelander et al, 2017). A neighborhood that fulfills the idea of being child-friendly will lead to more social support of parents to let their child play outside on their own (Aarts, 2011). Home and school locations arranged for walking, cycling and outdoor play are the place with easy and free access for being physically active. Especially for children as this is the location where they spend the most of their time (Krizek et al., 2004). This chapter will elaborate on the physical elements in the built environment that research shows to be of influence on the performed physical activity by children and adolescents with regard to influences of their individual and social environment.

2.4.1. Trends of physical activity among children in the Netherlands

The discussion of the relation between the built environment and physical activity is shows a difference with regard to age. Studies generally take four different age groups into account which are children (ags 4-11), adolescents (12-17), adults (18-64) and seniors/elderly (65 years and older) (Ding et al., 2011). All groups have different daily interests, daily activities and different possibilities to act physically (Krizek, Birnbaum & Levinson, 2004; Davison & Lawson, 2006). Children and adolescents are for a large part of the day at school. Dunton et al. (2009) explain how community environments nowadays encourage sedentary behavior. Classrooms and leisure locations arranged for sedentary behavior and infrastructure around schools that is primarily focused on car-use are part of these community environments (Sallis et al., 2008; Zaltauske & Petrauskiene, 2016). Also school programs are such constructs of community physical and social environments that are of influence on the amount of physical activity that is executed during school hours (Sallis et al., 2008). Especially for children is the combination of the physical environment that motivates or demotivates physical activity with policies of their parents and school of big influence (Krizek et al., 2004; Aarts, 2011). The social environmental and home or school policies play an important role for a child's behavior (Sallis et al., 2008). Aarts (2011) mentions that these factors of the social environment are even of bigger influence on the performed PA by children than elements in the built environment. Influential factors related to this are for example the availability of cars by parents (Sallis et al. 2008), their perspective towards being physically active and their objective amount of performed physical activity (Gattshall et al., 2008; Aarts, 2011).

2.4.2. Socio-ecological model for physical activity among children

There are various levels of social and built environments that influence a person's or child's behavior. One example of a theoretical model is the socio-ecological model presented by Sallis, Owen and Fisher (2008) that shows different levels that influence healthy behavior. The model shows five levels: intrapersonal, interpersonal, organizational, community and policy. Ecological models are best applied in science when it is carefully made behavior specific (Sallis et al., 2008). *"The availability of condoms in nightclubs has little relevance to dietary behaviors, the presence of cycling trails in suburban neighborhood is unlikely to affect alcohol intake.." (Sallis et al., 2008: p. 471).* This also goes for elements in the built environment that for example influence recreational jogging instead of walking to school on a daily basis. Sallis et al. (2012) present a model that is focused on physical activity. They state that on an individual level a child or adolescent is affected by biological qualities and personal skills. A child's or adolescent's perception of their athletic skills differs, mention Hendriks & Zomervrucht (2009). Sallis et al. (2012) further elaborate on the social/cultural environment level which is related to social influences on a person. For children and adolescents this would include the social support and policies towards being physically active (Sallis et al. 2008). Gattshall et al. (2008) & Aarts (2011) also highlight the effect of parental social norms and policies on the performed PA by children. Gattshall et al (2008) explain for example how children tend to be more physically active when their parents are more supportive of PA or are frequently performing physical activity themselves. An example of these parental policies that influence PA of youth is the choice of parents to drop their kids off at school. 20% of Dutch school students are dropped off at school by car (CROW, 2016; Van Goeveren en De Boer, 2008). Zaltauske & Petrauskiene (2016) state that in Europe this number

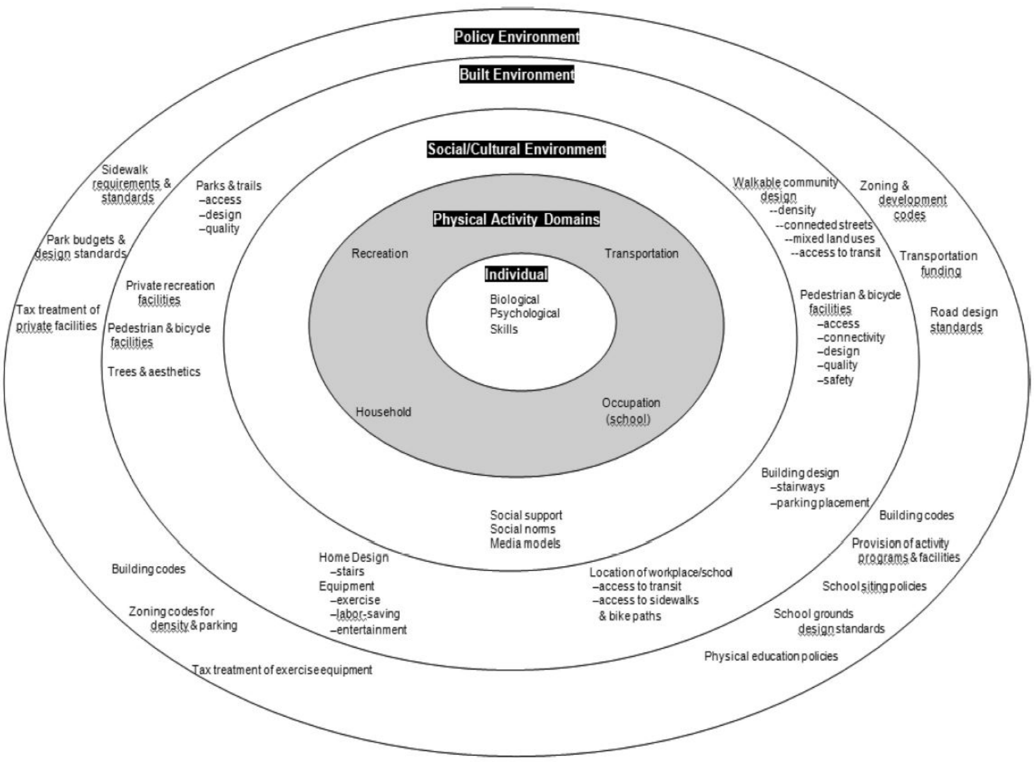

Figure 6. Peels of different influencial environments to healthy activity (Sallis et al., 2012).

is even rising as parent's take a more negative stand towards traffic safety due to the increase of motorized traffic. More parents that think the traffic situation is not safe, will eventually lead to more transportation of kids by cars (Zaltauske & Petrauskiene, 2016). The car is also still the predominantly used modality in the Netherlands and is still growing (CBS, 2019a). Even though the bigger part school students goes to school by foot or by bike is the amount of children that gets dropped off at school by car still considerable in the Netherlands (CROW, 2016). A study executed in 2008 shows that over 20% of all children (ages 4-11), living within a range of five kilometers of their school, are driven to school or use inactive modes of transport (Van Goeverden & De Boer, 2008). For adolescents (ages 12-17) is a percentage of 7% dropped off at school. When the distance between home and school is higher than five kilometers these numbers will increase to 86% for children and 36% for adolescents (Van Goeverden & De Boer, 2008).

A factor that is not included in the ecological model of Sallis et al. (2008) is playing video games in relation to the amount of physical activity by children. An average of 35% of Dutch primary school students does play videogames on a daily bases. For Dutch school students of middle school is this percentage 27% (Nederlands Jeugdinstituut, 2019). Eleven percent of these gaming school students plays videogames for over four hours per day (Stevens et al., 2018). Next to consequences such as addiction, sleep shortages and rather willing to play games than spending time with friends (Dorsselaer et al., 2016) is this trend also related to less performed amounts of physical activity as Aarts (2011) shows that the presence of electronic devices at home is negatively related to the amount of PA performed by youth.

2.5. BUILT ENVIRONMENT THAT INFLUENCES PHYSICAL ACTIVITY AMONG YOUTH

Researchers define different forms of physical activity in their studies related to the influence of BE (Sallis et. al., 2008; Giles-Corti et al., 2005; Hooper et al., 2018). In ecological models are four different forms of activity present which are categorized in as active recreation, household activities, occupational activities and active transportation (Sallis et al., 2008). Other studies mention just two forms of PA which are recreational activity and transportation activity (Giles-Corti et al., 2005; Sallis et al.,2016;). All these activities are influenced by a physical environment and other related factors such as intrapersonal factors, governmental policy and the social cultural environment (Sallis et al., 2008). Many studies regarding the physical activity of adults are directed at active transportation or commuting (Handy et al., 2002). The choice for adults to inactively or active commute is part of their lifestyle. Stimulating active commuting could therefore potentially increase healthy lifestyles of adults in a large way. As mentioned earlier is it not possible to address the relation between the BE and physical activity of adults and children or adolescents in the same way (Krizek et al., 2014). Van Goeverden & De Boer (2008) show that active commuting is just a small part of the total amount of performed physical activity by children. Outdoor play and other forms of activity such as sports are much easier available for them for a longer period. In 2008 was 63% of Dutch school students living within a range of 500 meters from their school (Van Goeverden en De Boer, 2008). However especially in light of the trend regarding indoor game activities and the increase of the amount of children that gets dropped off by car is active commuting getting more important for healthy lifestyles among children and an underrated part of youth's potential physical activity (De Vries et al., 2010). In addition to this is youth that actively commutes to school more likely to perform other forms of physical activity in their free time (Panter et al., 2006; De Vries et al., 2010)

2.5.1. Locations for physical activity by children

Krizek et al. (2004) explain that we can distinguish different forms of activity that is performed by children based on location. Children generally spend their time in three different locations which can be categorized as home, school and other. The combination of activities at these locations in combination with their choice for a specific travel mode will present their active behavior [see figure 7]. This theory shows the importance of the home and school locations in light of active behavior among youth. Also Panter et al. (2006) and Aarts (2011) mention the importance of attributes in the direct BE surrounding the home and school. The research of Van Goeverden and De Boer (2008) shows that Dutch children often live within a range of 500 meter from their school.

			ACTIVITIES AT LOCATION	
LOCATION	TRAVEL MODE		ACTIVE ACTIVITY	SEDENTARY ACTIVITY
HOME	Sedentary travel mode (car, bus etc.)	Active travel mode (walking, cycling, etc.)	Playing outside the house Walking	Sleeping or eating Watching television
SCHOOL			Activity during recess Physical Activity course	Classroom learning
OTHER			Sports (f.e. soccer or tennis) Family group activity	Playing videogames at a friend Spending time at restaurant
		ACTIVE ACTIVITIES		

Figure 7. Locations for physical activity among youth (Krizek et al., 2004).

2.5.2. The home and school locations and PA by youth

The BE attributes present in the residential neighborhoods influence the amount of physical activity that is performed by youth (Davison & Lawson, 2006; Dunton et al., 2009; Aarts, 2011; Zaltauske & Petrauskiene, 2016). We can look at the built environment on two scales. One is the direct surrounding built environment of the home location which is the street level and the second is the neighborhood scale (Aarts, 2011). As children are more dependent on their parents than adolescents do we also see that studies distinguish different influential objects per age group (Aarts, 2011). For children are the direct surroundings of a child's home of primary importance for playing outdoor. This age group (ages 4-11) has less autonomy to travel further than the direct surrounding and are therefore often not allowed to do so. Playing outdoor is one of the main, free, activities for children on a daily bases (Brockman, Jago & Fox, 2010; Aarts, 2011; Zaltauske & Petrauskiene, 2016). Studies show that the availability of areas for recreational activities, including facilities such as playgrounds, greenery, parks and for example football courts, will positively influence a child's PA (Davision & Lawson, 2006; Dunton et al., 2009; Aarts, 2011; Zaltauské, 2016). Other less objective elements of the built environment are also shown to be of influence. Traffic safety, social cohesion and (social) safety on the street are often mentioned to be of importance to the performed PA (Dunton et al., 2009; Kips & Schepel, 2009; Aarts, 2011; Zaltauske & Petrauskiene, 2016). Kips & Schepel (2009) state six dimensions of the BE that potentially influence a child's active behavior in a neighborhood based on Dutch research. They mention social safety, traffic safety, (*wandelbaarheid*) walkability, (*fietsbaarheid*) cyclability, (*belevingswaarde*) appeal, (*beweegvrijheid*) freedom to move, and (*bespeelbaarheid*) playability. These factors are closely related to outcomes from different studies that show social safety, traffic safety, walkability, connectivity, playgrounds and other areas for recreation of importance to physical activity of children (Davison & Lawson, 2006; Dunton et al., 2009; Aarts, 2011; Zaltauske & Petrauskiene, 2016). What is interesting is that Kips & Schepel (2009) highlight the importance of two different levels which are the street level and the neighborhood level with regard to the Dutch built environment. In the past decades researchers focused on the effects of parks and public open spaces (POS) on the amount of PA by society (Wilkinson, 1985; Hooper et al., 2018) and the walkability of a neighborhood (Owen et. al., 2004; Giles-Corti et al., 2005). As children need to be guided to these POS or parks is it necessary to look at the research that studied the relation between the BE and PA of adults. Hooper et al. (2018) state that it is 23% more likely for somebody to walk towards an area of recreation when it is within a range of 400 meter walking distance. Aarts (2011) states that a reasonable distance for a parent to guide their children is better prescribed in minutes of walking distance and cycle distance. In their study are the survey questions related to 10 to 15 minutes of walking distance (circa 1 km distance) and 5 to 8 minutes of cycling distance (circa 2,5 km distance). Travel distance is well argued to be of influence on PA by different researchers (Giles-Corti et al., 2005; Kaczynski et al., 2008; Hooper et al, 2018).

On a neighborhood level are different elements found to be of influence on PA of youth. Research shows the relation with urban density, land use mix and street connectivity and public transport (Handy et al., 2002; Sallis et al., 2016) and street scale aesthetics and functions (Handy et al., 2002; Hendriks & Zomervrucht, 2009). The degree of urbanization is shown to be an influential factor (Sallis et al., 2016; Aarts, 2011). This has a negative effect on the outdoor play by boys (Aarts, 2011). A home location in a city green area is positively related to the amount of outdoor play by girls. In addition to this does the study of Aarts et al. (2010) show that elements such as high rise buildings, greenery, presence of water, traffic situation and sidewalks / bicycle paths are related to the performed amount of outdoor play in specific subgroups based on gender and age. The amount of water has for example a positive effect on outdoor play by boys and diversity of routes on outdoor play by girls.

As is mentioned before does the parental perception to road safety relate to the amount of PA performed by children (Zaltauske & Petrauskiene, 2016). Especially for children that are still dependent on the rules of their parents is this of importance. The perception of traffic safety is related to the amount of (motorized) traffic in the street, separation of different modalities (car-free places), the speed limit and the presence of quality sidewalks or space for pedestrians (Hendriks & Zomervrucht, 2009). In addition to this does the perception of the built environment not always comply with the objective truth (Heath et al., 2006; Gezondheidsraad, 2010; Ding & Gebel, 2011). The perception does not necessarily project the right objective information. The presence of a crossing or playground in the neighborhood of a school might not be visible to school students. The school student will perceive the neighborhood as one without playground even though this is not the case.

Children and adolescents spend a large part of the day at school. Schools in The Netherlands are increasingly directing school policy towards creating more healthy school students (Van den Bogaard & Both, 2009). One of the topics is active behavior. Schools anticipate on this matter by introducing more physical education programs (Sallis et al., 2008). This happens also in the Netherlands (Van den Bogaard & Both, 2009). Nevertheless do studies show that the average Dutch child does not compete with the norm for physical activity (Health Council of the Netherlands, 2017). The Dutch standard prescribes a minimum of 60 minutes slightly intensive physical activity for every day of the week which is not easily met by physical education programs. A part of the physical activity takes place outside of school or on the trip to and from school. The choice for a certain kind of transportation to school is related to the physical environment. Aspects as the presence of sidewalks, traffic safety, traffic density, traffic speed, travel distance and other infrastructure for specific modalities are of an influence (Davison & Lawson, 2006; Dunton et al., 2009; Sallis et al., 2012).

2.6. CONCEPTUAL FRAMEWORK

This paragraphs elaborates on the conceptual model for this inquiry. The conceptual model is based on the theoretical backings that are provided in the previous chapters. It will present insights on the different variables that influence the performed physical activity of Dutch school children as well as the operationalization of those variables for this study.

2.6.1. Three levels of environment for explaining physical activity

Existing literature shows that the performed amount of physical activity by children is influenced by various environments. The (socio-)ecological model of Sallis et al. (2008) distinguishes four different environments or levels. Within all levels of the model is it necessary to identify behavior specific factors (Sallis et al, 2008). In the case of this inquiry is this regarding the physical activity by Dutch school students. The ecological model is therefore composed by behavior specific influential factors, derived from various literature on this topic.

The primary focus of this research is put on the physical built environment characteristics that influence a person's behavior. Sallis et al. (2008) and Sallis et al. (2012) show that there are four domains of physical activity. The conceptual model for this research focuses on active transportation and recreational activities. These two domains are related to the built environment in several ways. The conceptual model defines the different influential factors for both of these forms of activity. The built environment characteristics influence both the recreational activities as the active transportation which take place outside of the school's premises. Takes research does not tend to explain the physical activity of youth that is executed during school hours based on school characteristics such as physical education programs and built environment characteristics of schoolyards. The dependent variable in this research is therefore specifically the performed physical activity of youth outside of school.

Based on the literature study of this research can some control variables be established. Firstly we acknowledge the individual or intrapersonal environment based on the ecological model of Sallis et al. (2012). A person's demographics (Ajzen, 1991; Sallis et al, 2008; Dunton et al., 2009; Health Council of the Netherlands, 2010),

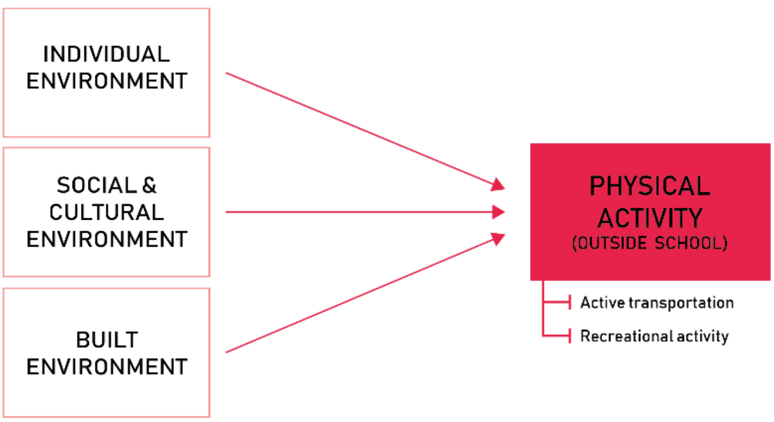

Figure 8. Conceptual model environments and physical activity.

biological and psychological situation (Sallis et al., 2012) and (athletic) skills (Van den Bogaard & Both, 2009; Sallis et al., 2012) are related to active behavior by youth. In addition to this do we take the social/cultural environment into account (Sallis et al. 2012). This part of the model is directed at social norms and support from the social environment of the school student. The final influential level on active behavior, according to Sallis et al. (2012), is the policy level. This level is not taken into account for this research as we tend to provide insights on the objectively measured built environment characteristics that are present at this moment. Outcomes of the analyses will be respectively discussed according to the policy level variables which are presented by Sallis et al. (2012).

2.6.2. Conceptual model

This research tends to provide insights on the total amount of performed physical activity outside of school. Literature shows that active transportation to and from school is associated with the total amount of physical activity that is performed. School students that actively commute to school tend to have more active lifestyles and perform more active behavior (De Vries et al., 2010). The conceptual model for this research has incorporated this relation between the two variables. The individual and social/cultural environment are associated with both dependent variables that are active transportation and the total amount of performed PA outside of school.

When we take a closer look do we distinguish different features from the built environment that influence the dependent variables AT and PA. As the literature review showed can BE characteristics of the home and school locations be associated with both AT and PA. This is also the case for BE characteristics of the school location as this can be seen as a destination of (active) transportation. The choice for a specific mode of travel is nevertheless related to total amount of PA outside of school. This is also shown in the conceptual model [see figure 9] which shows two different models: one for explaining active transportation; and one for explaining the total amount of PA. Underneath follows a clearer definition of the different independent and dependent variables.

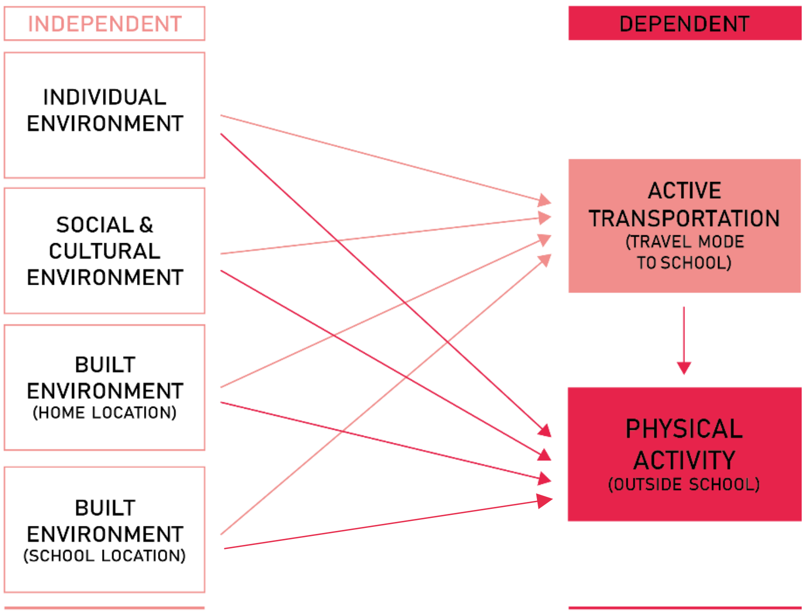

Figure 9. Conceptual model for active transportation and physical activity outside of school.

2.6.3. Dependent variables

The conceptual model shows two different dependent variables. The primary dependent variable is the performed physical activity by the school students outside of school. The other dependent variable is the choice of a specific travel mode or active transportation. Both dependent variables are influenced by factors from the personal, social/cultural and built environment (Sallis et al., 2012).

Physical activity outside of school

Physical activity that takes place during school hours on the schoolyard or in physical education programs is not related to the built environment outside of the school premises. This research has a specific focus on the performed amount of *physical activity outside of the school* site. The physical activity of participants in the survey are measured with a wearable accelerometer that shows the amount of PA on a specific moment of the day. This research separates the PA performed during school hours from the PA outside of school to provide clearer insights on the relation between the built environment characteristics outside of the school areas and physical activity.

Active transportation (travel mode to school)

The choice for a specific *mode of travel to school* or (active) transportation is taking two roles in the conceptual model of this research. In a first model is active transportation related to the personal, social/cultural and built environment. In another analysis is the active transportation taken into account as one of the independent variables that is associated with the total amount of performed PA by school students.

2.6.4. Independent variables

The independent variables for this research consist of loose variables related to the three environments shown in the conceptual model. The individual environment and the social/cultural are both associated with AT and PA. For the built environment variables do we distinguish variables that are associated with AT and with the total amount of performed PA outside of school.

Built environment

The built environment is a multidimensional concept which is interpreted in various ways by researchers (Handy et al., 2002). This research provides theoretical backings from these different perspectives towards the built environment. Handy et al. (2002) elaborate on three different categories of physical elements. The variables of the conceptual model of this study are categorized accordingly by: 1) Urban setting; 2) Transport structures; and 3) Facilities.

Kips & Schepel (2009) state that there are two geographical scales of importance when distinguishing physical elements in the built environment related to PA among youth. There is the street level which is directly adjacent to the home location where children and adolescents are autonomously can play or perform other physical activities (a 200 meter radius). The second scale is the neighborhood scale which shows to be influence. Research of Aarts (2011) suggests that other facilities and recreational areas within a range of 10 to 15 minutes walking should make it possible for a parent to guide their child. This walking distance is equal to 1600 meter and this is, based on walking forth and back, equal to 30 minutes of MVPA (Hooper et al., 2017).

Built environment – home location

Literature shows various of physical elements in the home location to be associated with physical activity among youth. The literature study executed for this research showed that *urban density* is found to be of influence on the PA by youth. Aarts (2011) states that urban density might be positively related to Pa by girls but is negatively related to PA by boys. In addition to this are land uses such as *greenery* and *forestry* frequently mentioned as positive factors to the performed amount of physical activity (Davision & Lawson, 2006; Dunton et al., 2009; Aarts, 2011). Aarts (2011) points out that also specifically the *presence of water* is associated with higher amounts of PA by various subgroups in the Netherlands. Some researchers point out the positive relation between street aesthetics and PA among youth (Handy et al., 2002; Hendriks & Zomervrucht, 2009) which is closely related to the amount of greenery and *trees* on a specific location (De Vries et al., 2010). For this does the conceptual model also take the amount of trees into account.

Besides factors that are related to urban arrangement does literature show *transportation structures* to be of influence on the amount of performed PA (Handy et al., 2002). This is for one related to the presence of different forms of infrastructure designated for different modalities. *Connectivity* and *walkability* of the neighborhood will have a positive effect on the performed amount of PA (Handy et al., 2002; Davison & Lawson, 2006; Dunton et al., 2009; Aarts, 2011; Zaltauske & Petrauskiene, 2016 Sallis et al., 2016). Another feature that is frequently mentioned in existing literature is the perceived traffic safety by parents (Dunton et al., 2009; Kips & Schepel, 2009; Aarts, 2011; Zaltauske & Petrauskiene, 2016). Factors that are closely related to this are *speed limits*, *crossings* primarily designated for motorized traffic and the amount of *surface designated for pedestrians* such as sidewalks and car-free areas (Hendriks & Zomervrucht, 2009). It leads up to a spatial situation where children can play autonomously and where parents feel that they do not constantly need to observe their kids (Hendriks & Zomervrucht, 2009).

Finally are facilities associated with the performed amount of PA. Kips & Schepel (2009) appoint that playability of an area is a factor that is positively related to PA. Other research also shows that the amount of *playgrounds* and *sport facilities* is related to higher levels of PA among youth (Davison & Lawson, 2006; Dunton et al., 2009; Aarts, 2011; Zaltauske & Petrauskiene, 2016). There is a difference of facilities that are directly reachable for kids on a street scale and on a neighborhood scale (Kips & Schepel, 2009). Sometimes do parents need to guide their kids towards a certain recreational area (Aarts, 2011).

Built environment - school location

The built environment of a school location is not directly related to the total amount of performed PA by school students. The school location is nevertheless of influence of the choice for active transportation to and from school. Especially in the Netherlands where 63% of the primary school children and 17% of the adolescent school students live within 1500 meters from their school (van Goeverden & de Boer, 2008). Zaltauske & Petrauskiene (2016) elaborate that the number of children that gets dropped off by car in Lithuania is growing due to a lower perceived traffic safety on the road from home to school as the amount of motorized traffic is growing. This is also the case in the Netherlands (CROW, 2016; CBS, 2019a). The literature study shows the importance of direct surroundings of the school location on a street scale. Specific elements in the BE that are related to perceived traffic safety are the *availability of sidewalks*, *infrastructure designated for cyclists*, traffic *speed limits* in front of the school and the amount of *space designated for motorized modalities* (Davison & Lawson, 2006; Dunton et al., 2009; Sallis et al., 2012). Besides BE characteristics is also *travel distance* shown to be of influence on the choice of a specific travel mode. This variable will also be taken into account in the analyses.

Individual environment

Research indicates that the choices on behavior is influenced by personal demographic factors (Merom et al., 2006; Dunton et al., 2009; Health Council of the Netherlands, 2010; Huber, 2014). Influential factors could be *gender*, *age*, *education levels*, *household structure* and *socioeconomic status* (SES). Sallis et al. (2008) and Sallis et al. (2012) elaborate on the relation between the individual environment and performed amounts of PA. They state that biological and psychological factors are also of importance. Examples of these factors are the possibility to act physically and the attitude towards the (active) behavior (Sallis et al., 2012). Also Van den Bogaard & Both (2009) explain that the perception to youth's athletic competence differs per individual. This research acts on this matter by introducing a variable that shows if a participant has an *injurie* at the time of the survey, the participant's *attitude towards physical activity* and their *perceived barriers* and *athletic competence*.

Social / cultural environment

Youth is specifically dependent on influences from their social or cultural environment (Gattshall et al., 2008; Bevelander et al., 2018). Influential factors related to this are for example the *perspective towards being physically active of their parents* and the *physical activity performed by their parents* as role models (Gattshall et al., 2008; Aarts, 2011). Sallis et al. (2008) explain how factors related to the household can be of influence to the performed PA. The *availability of cars* by parents (Sallis et al. 2008; Merom et al., 2006), and the *presence of computer devices* (Aarts, 2011) are also shown to be of influence.

2.6.5. Operationalization

Here follows a further elaboration on the operationalization of variables in the analyses in table 1.

Physical activity outside of school

The dependent variable physical activity outside of school is objectively measured in the MyMovez project. During the MyMovez project were participants asked to wear a wearable accelerometer (*the Fitbit Flex*). The accelerometer measured the performed amount of physical activity in minutes and steps. All data that was gathered is linked to a timestamp. It provides us with the opportunity to distinguish the performed physical activity at school and outside of school.

Built environment

The built environment is a multidimensional term. Nevertheless do we pragmatize this term into different variables that can be analyzed in statistical analysis. For this research are two geographical scales taken into account for various physical elements in the built environment. Elements on a street scale will be distinguished based on a 100 meter radius from the home location. Neighborhood scale elements will be measured based on a radius of 500 meter from the home location. For the school location is a radius of 200 meter taken as the parameter for the BE characteristics. This provides a radius slightly larger than the street level.

ENVIRONMENT LEVEL	OPERATIONALISATION	DATA SOURCE
INDIVIDUAL ENVIRONMENT		
Gender	*Gender participant (female/male)*	*MyMovez data*
Age	*Age participant*	*MyMovez data*
Injury	*Injury at time of survey (yes/no)*	*MyMovez data*
Attitude towards PA	*Attitude and perceived barriers*	*MyMovez data*
Athletic competence	*Perceived athletic competence*	*MyMovez data*
SOCIAL / CULTURAL ENVIRONMENT		
Family Affluence Score (SES)	*Family Affluence Score - indication of wealth by material in possession*	*MyMovez data*
Social support to PA by parents	*Ways in which parents support and stimulate PA of the participants*	*MyMovez data*
Parent participation in PA	*Participation of parents in PA performed by school students*	*MyMovez data*
Cars in household	*Total number of cars in household*	*MyMovez data*
Computer devices in household	*Total number of computer devices in household*	*MyMovez data*
Travel mode choice to school	*The choice for walking, cycling or other inactive forms of travel to and from school.*	*MyMovez data*
BUILT ENVIRONMENT - HOME LOCATION		
URBAN ARRANGEMENT		
Urban density (street level)	*Urban density of the neighborhood measured by surface are for buildings*	*TOP10NL*
Area of greenery (street level)	*Total amount of greenery (m2), except area for forestry*	*TOP10NL*
Area of forestry (street level)	*Total amount of forestry (m2)*	*TOP10NL*
Presence of water (street level)	*Total amount of surface water (m2)*	*TOP10NL*
Area of greenery (neighborhood level)	*Total amount of greenery (m2) in the neighborhood, except area for forestry*	*TOP10NL*
Area of forestry (neighborhood level)	*Total amount of forestry (m2) in the neighborhood*	*TOP10NL*
Presence of water (neighborhood level)	*Total amount of surface water (m2) in the neighborhood*	*TOP10NL*
TRANSPORT STRUCTURES		
Walkability (street level)	*Total surface (m2) designated for pedestrians (sidewalks)*	*TOP10NL*
Number of infrastructural crossings (street level)	*Total area for mixed use crossings including motorized traffic*	*TOP10NL*
BUILT ENVIRONMENT – SCHOOL LOCATION		
Walkability (street level)	*Total surface (m2) designated for pedestrians (sidewalks)*	*TOP10NL*
Area of greenery (street level)	*Total amount of greenery (m2), except area for forestry*	*TOP10NL*
Area of forestry (street level)	*Total amount of forestry (m2)*	*TOP10NL*
Number of infrastructural crossings (street level)	*Total area for mixed use crossings including motorized traffic*	*TOP10NL*
Cyclability (street level)	*Total infrastructure (m2) specifically designated for cyclists.*	*TOP10NL*

Table 1. Operationalization of variables.

3. RESEARCH DESIGN

Research design is more than a selection of methods, data and analysis (Farthing, 2016). The research design influences the validity and trustworthiness of the research finding. This research tends to present valid findings on the topic of built environment and physical activity. The outcomes of this research can be used as argumentation for Dutch evidence-based policies, and especially in the case of this study, spatial strategies and interventions. Therefore an incomplete or invalid research design would potentially create false argumentation for these documents (Farthing, 2016). The importance of well conducted studies as evidence for governmental policies and interventions is discussed by Fischer (2003) & Healey (2007). Farthing (2016) states that a clear research design is the start of a valid and trustworthy inquiry. He explains the process according to the Cycle of Research Design. Besides presenting a research question must a researcher think of logical approaches to analyzing the data for presenting valid outcomes, ethical implications and methods for generating the data.

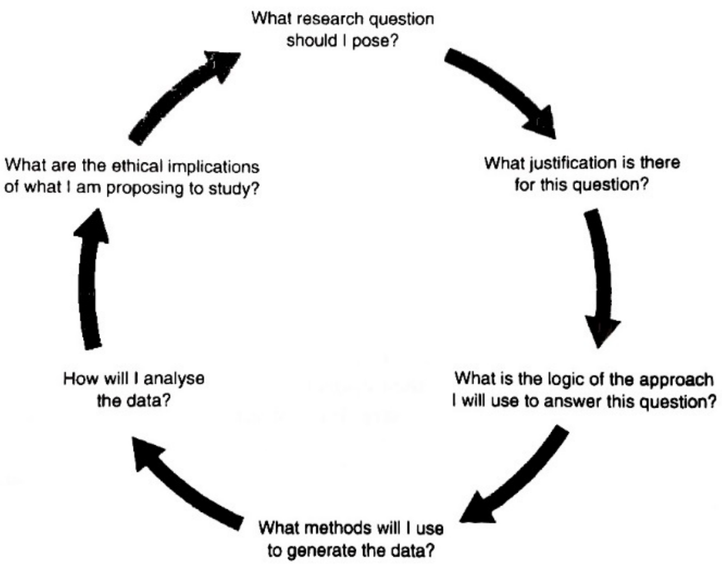

Figure 10. The cycle of Research Design (Farthing, 2016).

3.1. RESEARCH STRATEGY

3.1.1. Theoretical perspective

This inquiry is executed from a positivists perspective towards conducting research. The research question will be answered based on objective empirical observations of the world. The researched is something that is true by laws of nature and value free on its own. This is a realist approach to social science (Guba & Lincoln, 1994). It forms, together with an epistemological stand towards the relation between the researcher and the researched, the framework on which the positivist school of thought or theoretical perspective is founded (Guba & Lincoln, 1994). For this research the researcher is positioned distant from the researched. This way the effects of the built environment on the performed amount of physical activity can be researched objectively. Guba & Lincoln (1994) call this perspective towards science the paradigm of positivism. Bryant & Bailey (1997) describes this stand to conducting research as quantitative research. A researcher is then searching for the truth or facts about reality by empirical research (Guba & Lincoln, 1994). The researcher is distant from the researched and does not have contact to provide, context and bias free, truthful findings. Contradictive to realism we find constructivism where behavior is configurated by a person's reasoning based on the relation to the acquired evidence (Guba & Lincoln, 1994). This ontological perspective takes into account that there is a difference between the natural world and the human or social world (Fischer, 2003; Creswell & Poth, 2018). Reality is socially constructed by a person's own perception to this reality (Fischer, 2003; Farthing, 2016). Therefore objective observations are not sufficient to provide a nuanced answer to the research question. Guba and Lincoln (1994) call this constructivism. Bryant & Bailey (1997) present a different set of paradigms that exist out of quantitative and qualitative research approaches. The quantitative paradigm presented by Bryant and Bailey can be seen as the equivalent of the positivism paradigm. Qualitative research approaches take into account that there is a difference between the natural world and the social world, constructed by human interpretation and meaning (Fischer, 2003; Creswell & Poth, 2018).

This research is executed from a positivist perspective. The data is gathered from a distance to the researched and objectively studied on patterns and relations. Data collection is done by a digital application which presents a survey to lower school students. It gives insights on the behavior and lifestyles of the school students which are then linked to geographical data of physical elements in the environment. In this research is no qualitative inquiry taking place that extracts information about how the school students give meaning to specific objects in their physical environment except for their perception of presence of elements in their BE and their perspective towards personal and social pressure for their (in)active behavior.

3.1.2. Research strategy

This inquiry is taking a quantitative approach towards gathering knowledge. A deductive research is executed that will test theories which have been established earlier by different researchers. The construction of deductive research is based on several steps to test a theory and afterwards reflect on the theory at hand (Farthing, 2016). It is therefore explanatory of nature. This research tends to explain the effects of different spatial elements in home and school locations on the (in)active behavior of the school students based on objective geographical data and an elaborate survey.

This inquiry is using data that is derived in an earlier executed study. The project is called MyMovez. In the gathered data is information on the school student's behavior conducted through a survey on a digital application. The method Survey research is broadly explained by Doorewaard & Verschuren (2010). They elaborate on the approach based on seven different characteristics (Figure 11). The essence of a survey research is found in the extensiveness of the research by a broad variety of different research units and the use of quantitative data-analysis methods. This way the researcher derives insights on the comprehensive phenomena (Doorewaard & Verschuren, 2010). This method is relatively low time consuming and therefore presents the possibility to acquire a broad database with information within a small amount of time. This approach can be argued to give to broad insights but also to lack in a more in-depth elaboration of the researched (Creswell & Poth, 2018; Doorewaard & Verschuren, 2010). A preset questionnaire or survey is limited to the data that is derived to the presented questions. This is different to qualitative methods where much more in-depth information is gathered on the researched like for example in interviews. This is a limitation of quantitative methods that is argued to make some outcomes of a study invalid or incomplete from a more relativist approach towards conducting research (Guba & Lincoln, 1994). Another limitation to this pre-structured approach of acquiring data is the possibility to act on changing circumstances (Doorewaard & Verschuren, 2010). In survey research the researcher is less flexible to adapt the survey on changing circumstances such as changes in the built environment. This is also the case for this inquiry as it is not possible to add questions/variables to the existing dataset of the MyMovez survey. Nevertheless is the MyMovez survey equipped with a broad variety of questions on BE and PA and is it applicable for this thesis study. It will be used for evaluating the statistical relations between different variables. The statistical analysis will be argued according to existing theories.

3.2. DATA COLLECTION AND ANALYSIS

3.2.1. Data collection

The data for this inquiry exists out of two parts. It is a combination of absolute data on spatial characteristics and objective data derived from a questionnaire. The spatial data is gathered from various open source geographical datasets. The 'ArcGIS Online' or 'Living Atlas' platform is used to give insights on the data and to execute spatial analysis when necessary. The data is uploaded in the ArcGIS Desktop interface and

Characteristics
A survey is characterised by:

1. a substantial domain, consisting of a *large number* of research units;
2. *extensive* data generation;
3. more *breadth* than depth;
4. a *random* sample rather than a strategic sample;
5. an assertion which consists of variables and the relationships between these variables;
6. preferably *remote, closed* data generation;
7. *quantitative data* and *quantitative data-analysis.*

Figure 11. Characteristics of a survey research (Doorewaard & Verschuren, 2010).

exported to Excel-files which are used for statistical analyses in SPSS. The used data is further clarified in chapter 4.4. Operationalization.

This study tends to provide an elaborate model which includes spatial and personal or social factors to explain physical activity. The primary data source for this personal and social data is gathered in the MyMovez project. This project is executed in 2016 by the Behavioral Science Institute of the Radboud University and commissioned by the European Research Council. The MyMovez project has a primary focus on exploring the effects social influencing agents among school students in the Netherlands (Bevelander et al,. 2018). The survey that is used within this project is however more extensive and includes a number of variables directed at the performed amount of physical activity and environmental factors in relation to personal and social factors. The executed survey took place on a digital application (the *MyMovez Wareable Lab)* in combination with a wearable accelerometer (the *Fitbit Flex*). In the survey are various questions asked regarding the student's personal situation, health, social situation, (perception to) physical environment aspects, and physical (in)activity (Bevelander et al,. 2018). Physical activity is measured by the accelerometer and noted in the amount of steps taken, the duration of an activity and the intensity of an activity. This data does not provides geographical data. Therefore is it impossible to executed spatial (geographical) analysis for explaining the relation between BE characteristics and performed PA. It does however indicate at what time the participant performed the physical activity. It is therefore possible to separate the PA at school and PA outside of school hours which is done for this study.

The survey is executed among school students of 21 different school in the Netherlands. These schools are located in various municipalities and provinces and present a random set of schools in the Netherlands. School students from 97 classes were informed on the procedure and asked to participate. Also their parents or legal guardians were informed and approached with the same question as the survey is also partly directed at them. Underneath are the 21 different schools shown in figure 12.

Figure 12. MyMovez project school locations in the Netherlands (MyMovez, n.d.).

3.2.2. Data analysis

For this research are the *SPSS Statistics 24, ArcGIS Pro* and *ArcMap 3.10.1*. software used. ArcGIS is used for the gathering of data related to BE characteristics and structures. The software enables the researcher to link (spatial) data to geographical

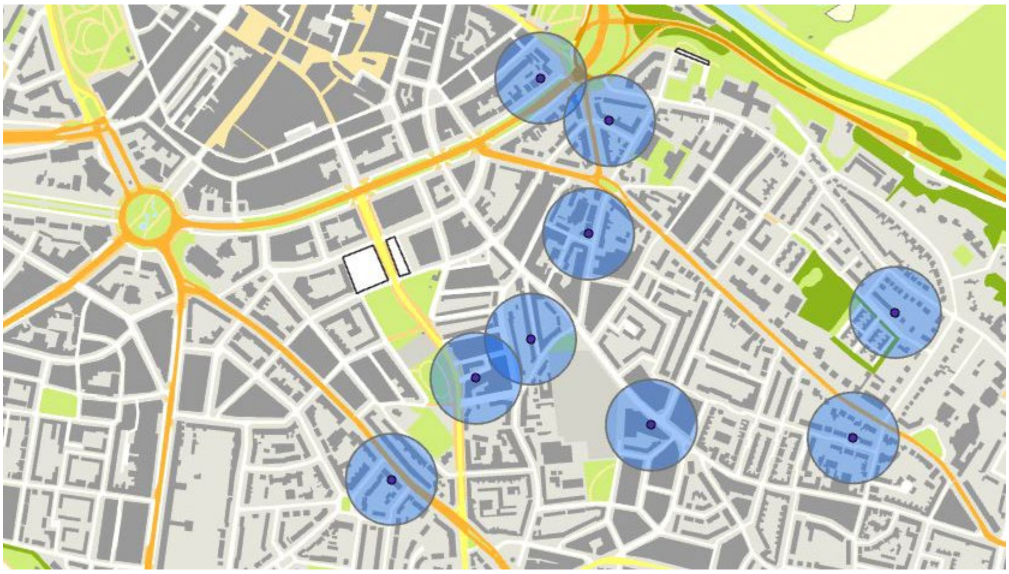

Figure 13. Buffer zones (100 meter radius) around home locations.

coordinates and to present variables visually on spatial maps. It provides a clear image of the distribution of the various participants and the surrounding BE characteristics. The SPSS software is used for the overall statistical analyses such as linear and logistical regressions.

Built environment data

The ArcGIS software is used for locating different features in the physical environment. Based on point, line and polygon attributes can objects be located and projected in a geographical map. A tree for example is added as a point attribute, street as line attributes and parks as a polygonal attribute. ArcGIS is linked to various (semi) open source geographical databases of the Netherlands. For example is it possible to load the *TOP10 NL* dataset from the *BRT* (*Basisregistratie Topografie, freely translated: Basic registration topography*) which presents spatial features of the Netherlands as shown in figure 13. This dataset indicates features such as roads, greenery and other land uses of various parcels in the Netherlands. In addition to this are these features labeled with other indicators such as typologies of roads and greenery. It functions as one of the main sources of geographical data for this research. Spatial analysis tools are used to link the different spatial features to the home and school locations of the school students. Two different scales are studied with regard to the home and school locations. The first scale is on a street level of the home location and is based on a radius of 100 meters from the center of the postal code. The second scale is related to the neighborhood level which is operationalized at a radius of 500 meters. The spatial analysis tool '*buffer'* is used to project the circles which indicate the different scales. For every school or home location are two spatial 'buffers' made and the specific adjacent spatial features located and clipped as is shown in figure 14. By the use of the analysis tool 'identity' are the spatial features of a specific buffer zone linked to the students ID. All features are exported in Excel tables which can be used for the statistical analysis in SPSS. The same tools are used to provide information on the built environment surrounding all school locations. The radius for the buffers is put on 200 meter which provides insights just outside of the street scale level.

Figure 14. BE characteristics clipped by buffer zone.

Statistical analysis
To provide a quality dataset for the statistical analysis in SPSS are the variables rearranged. It is necessary to organize the data according to the chosen analysis methods. The choice for analysis methods is based on the dependent variable in the analysis. The dependent variables for this study are the travel mode to school and the amount of performed physical activity outside of school. To explain each of these dependent variables are different analysis methods necessary. The used methods are a multiple linear regression analysis and a multinomial logistic regression analysis.

The variable travel mode choice is a nominal categorical variable. It is constructed by the MyMovez survey in which there are four different possible answers to the question related to travel mode choice. The categories are: 'by car', 'by public transport', 'by bike', 'by foot' and 'other'. These are nominal ordered categories and can be analyzed and explained by a multinomial logistic regression. The other dependent variable is the performed amount of PA outside of school. This variable is measured by the amount of minutes that a school student has performed a moderate or vigorous physical activity (MVPA) and the amount of steps taken per day. These are both metric, continuous variables with a ratio scale. A multiple linear regression analysis is used to analyze these variables. For both regression analyses are a set of assumptions presented that provide guidelines for a quality analysis (De Vocht, 2017). All regression models will be evaluated on the mentioned assumptions and adapted when necessary in order to present quality outcomes.

For the multinomial logistic regression:

- *is the dependent variable a nominal, non-ordered, variable and have all independent variables either a interval/ratio scale or presented as nominal or dichotomic variables;*
- *are all relations between the independent and the dependent variable, which is the choice for active transportation, theoretically proven to be causal; and*
- *is there no multicollinearity found between the independent variables.*

For the multiple linear regression:

- *are all variables presented in an interval or ratio scale or defined as dummy variables with the labels '0' or '1';*
- *are all relations between independent variables and the dependent variable, which is the performed physical activity, theoretically proven to be causal;*
- *Is the regression model linear;*
- *is there no multicollinearity found between the independent variables;*
- *is the model homoscedastic; and*
- *are residuals normally distributed.*

Before both regression analyses are executed are all variables analyzed descriptively. Each variable is evaluated on frequency distributions, standard deviations and statistical groups based on the different scores.

3.3. VALIDITY AND TRUSTWORTHINESS

This study tends to provide quality outcomes that represent a good reflection of the population. To increase the validity of the research are the next measures taken. The research outcomes are interpreted without a bias of the researcher. In the case of this study is the focus directed at the relation between the BE characteristics and the performed PA. This chosen topic is related to a specific personal interest of the researcher and the available data. Nevertheless is the data gathered and analyzed objectively and presented accordingly in a transparent manner. This goes for the descriptive data as well as the outcomes.

The use of the MyMovez data and the open source spatial data, available through ArcGIS, is of influence on the research validity. The use of existing data from other studies directly influences what can be researched in this study. Specific choices for the research design are made accordingly. It is not possible to evaluate the variables that are not in the dataset. In order to present quality outcomes is a more elaborate literature study executed and are various other influential factors on PA taken into account. For example are variables from the personal and social environment taken into account to provide a more complete model. In addition to this are extra spatial analysis used for acquiring the necessary spatial data. This is based on various geographical scales, derived from the literature study, and ArcGIS spatial analysis for routes, distances and walkability to provide new variables to fill the dataset with variables from the conceptual model.

External validity is increased by the ability to generalize the research outcome and the possible to re-use the data in different research trajectories and locations (Korzillius, 2000). In the next chapter are the descriptive analysis shown transparently. Also are the various used datasets presented in the chapter 3.4. Operationalization. To further increase the external validity is the size of the sampling built up of school students from 21 schools and 951 specific home locations, distributed randomly over the Netherlands. School locations are found in various municipalities and provinces throughout the Netherlands. All school students from 97 classes are asked to participate with the intention to have a most random selection of participants.

Coincidental mistakes and missing values

Respondents can manipulate the outcome of the research by presenting untruthful answers. This is not totally unusual as respondents tend to give the most socially respected answer (Korzillius, 2000). These coincidental mistakes can be abolished by a quality size of sampling. This research includes 951 respondents related to a broad variety of locational, personal and social environment characteristics. It is also possible that respondents do not answer survey questions accidentally or on purpose. SPSS provides statistical analyses to fill in the gaps of missing values. These analyses are use when more than 5% percent of the answers (units) are missing in the dataset. The spatial data is absolute and therefore not as sensitive to missing values or the coincidental mistakes. All outcomes are discussed according to the matter of validity in chapter 8. Discussion.

4. DESCRIPTIVE STATISTICS

This research takes a closer look at various environments that are potentially related to the performed amount of physical activity by school students. In this chapter are the outcomes of the MyMovez survey displayed in a descriptive manner. It shows the performed amount of PA by the school students that participated as well as the individual environment characteristics, the social/cultural environment characteristics and their home and school environment characteristics. This is done by frequency distributions per variable and by descriptive analyses regarding the means and the distribution of variables.

4.1. MISSING VALUES AND SAMPLE SIZE

This research relies on the data that is derived from the MyMovez project. For conducting a quality statistical analysis is the basis found in the dataset. Before any quality insights from the data can be provided are some quality checks necessary (Vocht, 2017). These checks are related to the total dataset of 951 respondents in wave 2 of the MyMovez project. The first check is related to amount of participants that indeed wore the wearable accelerometer during the project. This amount of respondents does not comply to the full extent of the dataset. From the 951 respondents did 851 respondents actually wear the FitBit bracelet. The second check is related to the postal codes. 32 of the respondents did not provide their postal code in the survey answers. These cases are also deleted from the dataset and leave 819 participants of which data regarding their physical activity and home location is available.

4.1.1. Missing values and value imputation of independent variables

The missing values of independent variables are also analyzed. This is done by the tool *Analyze patterns* in SPSS. The first analysis shows seven variables from the conceptual model with missing values in the complete dataset. Two specific noticeable variables are related to parental support (parental encouragement of physical activity and parental participation in physical activity). For both of these cases are the number of response under 50% of the dataset. This can be due to differences in questionnaires per class or malfunctioning of the application during the MyMovez study. These two variables are deleted from the dataset as the number of missing values is above 15% of the total dataset and a too small number for value imputation. Imputation of values is possible when the number of missing values per variable is lower than 15%. There are five variables that show missing values and are under this limit. These variables are 'nationality respondent' (N 17), 'nationality mom' (N 17), 'nationality dad' (N 17), 'perceived athletic competence' (N 120, 14,1%) and 'attitude to physical activity' (N 88, 10,3%). The missing values of these variables can be imputed by simple or multiple imputation. To test if the missing values are distributed at random is the Little's MCAR test executed in SPSS. The result of this analysis is statistically significant. This indicates that the null hypothesis is not rejected and the missing values are not distributed at random. This eliminated the possibility of a simple imputation (Jakobsen et al., 2017).

Nevertheless is it still possible to execute a multiple imputation as the number of missing values does not cross the limit of 15%. For these three variables is a multiple imputation executed. The imputed values are in different combinations predicted by the variables gender, age, nationality (of respondent, mom & dad), cars in household, computers in household, attitude towards PA, Athletic competence. The variables that are established by multiple imputation are evaluated in a single linear regression with Minutes of MVPA as the dependent variable. The imputed model with the highest model fit results is included into the full dataset of this study. This resulted in a dataset with 819 cases with no missing values in any of the independent variables.

4.1.2. Missing values in dependent variables

To study the performed PA outside of school is the variable 'minutes of MVPA' altered. We distinguish two different timespans in which physical activity is executed. One is the performed amount of PA during school and the second is the performed amount of PA outside of school. The second one is used in this research as the dependent variable. This also goes for the chosen travel mode to school. Both variables are different from the original dependent variable which is the total performed amount of PA. The last check on missing values is related to these dependent variables. Both variables show a number of missing values that exceeds the limit of multiple imputation (PA outside of school (N 169, 20,1%) and Travel mode choice (N 152, 18,1%) (Jakobsen et al., 2017). All cases with missing values related to PA outside of school and Travel mode choice are therefore deleted from the total dataset. This leaves a total number of 654 cases in the dataset for this study. The reason for these large numbers of missing variables could be related to different types of measurements during the MyMovez project. The deletion of the cases does lead to deletion of three different school from the total dataset. This indicates that different measurements and questions are asked at the school that participated in the project.

Figure 15. School locations minus deleted schools (in blue).

4.2. THE PERFORMED PA BY THE SCHOOL STUDENTS

In this research are school students from 18 different schools studied on their performed amount of physical activity. Figure 16 shows how the number of students are distributed per school. The number of students that participated in the project, wore a wearable accelerometer and provided a postal code of their home locations differs per school. The lowest number of participating students is 5 in school 'J' and the highest is 99 in school 'R'. The schools that participated in the project are located in various municipalities and provinces of the Netherlands. The map in figure 15 shows the location of the different schools in the dataset. The schools that are presented in blue visualize the schools that are deleted out of the dataset due to missing values in the dependent variables.

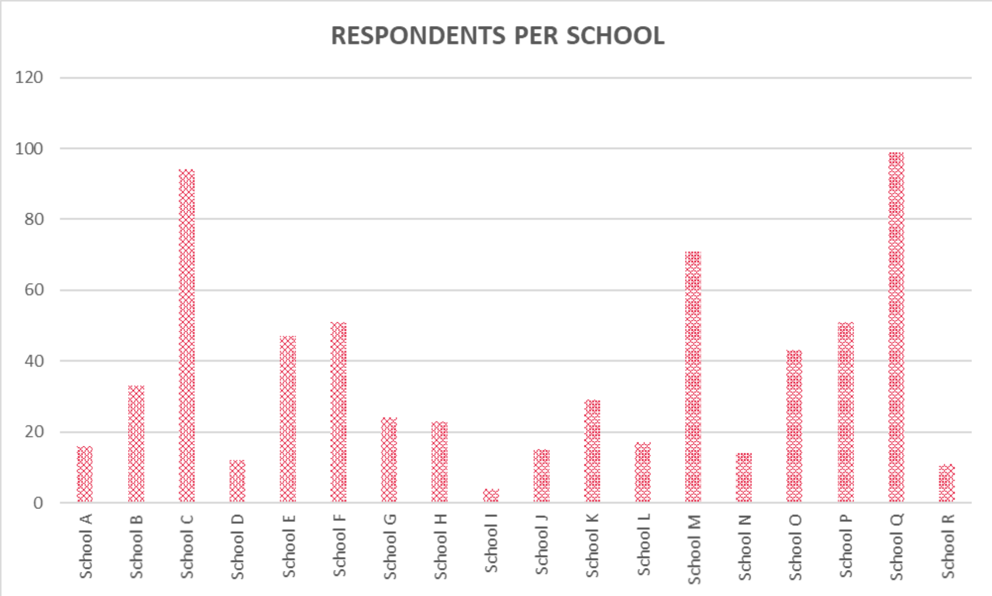

Figure 16. Respondents distribution per school.

4.2.1. Descriptive statistics of individual environment variables

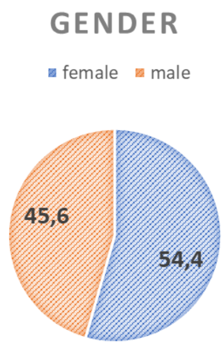

Figure 17. Gender distribution.

In table 2 is shown how the frequencies are distributed in the independent variables related to the individual environment level. The presented variables are gender, age, nationality, having an injury, the attitude towards PA and the perceived athletic competence. All variables are theoretically proven to be of influence on physical activity among youth and their choice for a specific travel mode to school. As the table shows is 54,4% of the participating school students a girl and 45,6% a boy between the ages of 9 and 14. The age group of nine years old is showing a low number of 5 respondents. In the regression analysis is the age variable inserted as a continuous variable. The other variables are introduced by dummy variables where codes of 0 and 1 are given to the specific categories. For the variable gender is female or girl is equal to '0' and male or boy is equal to '1'. This is also done for the nationality variable where Dutch is equal to '0' and other nationality is equal to '1'. When more categories are present are more dummy variables added to the regression analysis (De Vocht, 2015). Each category is introduced by a dummy variable except for one reference category. This is the case for the perceived athletic competence.

The nationality of most respondents is Dutch (91,9%). This is not an unusual number as the survey is only executed in the Netherlands. The variable regarding having in injury is showing a more unusual number distribution as the number of respondents with an injury is 127 and 19,4% of the total amount of participants. The justification for this is related to the question in the survey which asks if the participant was not able to act physically due to certain circumstances. This can be related to an injury or other factors. It provides an indication of a participant's perception towards situations in which he or she was not able to perform physical activity as he or she would have liked to. The final two variables indicate that the larger part of the respondents is positive towards performing physical activity and perceive themselves as a person who is good at executing physical activity or sports. Still 82 persons have a relatively negative attitude towards performing PA which is 12,5% of the total group.

FREQUENCIES INDIVIDUAL LEVEL VARIABLES				
	Frequency	Percent	Valid Percent	Cumulative Percent
GENDER				
female	356	54,4	54,4	54,4
male	298	45,6	45,6	100,0
Total	654	100,0	100,0	
AGE				
9	5	0,8	0,8	0,8
10	164	25,1	25,1	25,8
11	147	22,5	22,5	48,3
12	116	17,7	17,7	66,1
13	189	28,9	28,9	95,0
14	33	5,0	5,0	100,0
Total	654	100,0	100,0	
CULTURAL BACKGROUND				
born in the Netherlands	601	91,9	91,9	91,9
born in other country	53	8,1	8,1	100,0
HAVING AN INJURY				
not having injury	527	80,6	80,6	80,6
having injury	127	19,4	19,4	100,0
Total	654	100,0	100,0	
ATTITUDE TO PHYSICAL ACTIVITY				
overall negative attitude	82	12,5	12,5	12,5
overall positive attitude	572	87,5	87,5	100,0
Total	654	100,0	100,0	
PERCEIVED ATHLETIC COMPETENCE				
not good at sports	33	5,0	5,0	5,0
neutral	131	20,0	20,0	25,1
good at sports	490	74,9	74,9	100,0
Total	654	100,0	100,0	

Table 2. Frequencies of individual environment variables.

DESCRIPTIVE STATISTICS INDIVIDUAL ENVIRONMENT VARIABLES						
	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Variance Statistic
Gender	654	0	1	0,46	0,498	0,248
Age	654	9	14	11,64	1,289	1,661
Nationality	654	0	1	0,08	0,273	0,075
Injury_YesNo	654	0,00	1,00	0,1942	0,39588	0,157
Attitude_PA_PosNeg	654	0,00	1,00	0,8746	0,33141	0,110
Athletic_Competence	654	1,00	3,00	2,6988	0,55846	0,312

Table 3. Descriptive statistics of individual environment variables.

4.2.2. Descriptive statistics of social/cultural environment variables

The table 4 presents the frequencies of all variables related to the social/cultural environment level. All presented variables are discrete and ordinal in nature. This means that all variables related to the social/cultural environment are introduced in the regression analysis as dummy variables.

The nationality of the participant's parents show to be Dutch in most of the cases. Nevertheless is a large number of the mums (18,7%) and dads (18,2%) born in another country. When we take a look at the amount of computers and cars in the household do we see that most household have three computers in their possession. The amount of cars is mostly one or two. Almost 10% of the household is not in possession of a car. Just 5 households do not have a computer, which is just 0,8% of all the respondents. From the participating school students is 82,4% an only child and does 17,6% have one or more brothers and sisters. The Family Affluence Score (FAS) is a variable that indicates the wealth of a family. It is categorized by three levels and is introduced in the regression analysis by two dummy variables.

FREQUENCIES SOCIAL/CULTURAL LEVEL VARIABLES				
	Frequency	Percent	Valid Percent	Cumulative Percent
NATIONALITY MOM				
Dutch	532	81,3	81,3	81,3
other	122	18,7	18,7	100,0
Total	654	100,0	100,0	
NATIONALITY DAD				
Dutch	535	81,8	81,8	81,8
other	119	18,2	18,2	100,0
Total	654	100,0	100,0	
TOTAL NUMBER OF COMPUTERS IN HOUSEHOLD				
0	5	0,8	0,8	0,8
1	40	6,1	6,1	6,9
2	92	14,1	14,1	20,9
3	517	79,1	79,1	100,0
Total	654	100,0	100,0	
TOTAL NUMBER OF CARS IN HOUSEHOLD				
0	64	9,8	9,8	9,8
1	268	41,0	41,0	50,8
2	322	49,2	49,2	100,0
Total	654	100,0	100,0	
SIBLINGS YES OR NO				
No	539	82,4	82,4	82,4
Yes	115	17,6	17,6	100,0
Total	654	100,0	100,0	
FAMILY AFFLUENCE SCORE CATEGORIES				
Low score (0-5)	47	7,2	7,2	7,2
Medium score (6-9)	413	63,1	63,1	70,3
High score (10-13)	194	29,7	29,7	100,0
Total	654	100,0	100,0	

Table 4. Frequencies of social/cultural environment variables.

DESCRIPTIVE STATISTICS SOCIAL/CULTURAL ENVIRONMENT VARIABLES						
	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Variance Statistic
Nationality mom	654	0	2	0,19	0,395	0,156
Nationality dad	654	0	2	0,19	0,406	0,165
Total computers in hh	654	0	3	2,71	0,611	0,373
Total cars in hh	654	0	2	1,39	0,660	0,435
Siblings_YesNo	654	0,00	1,00	0,1758	0,38098	0,145
FAS_cat	654	1,00	3,00	2,2248	0,56433	0,318

Table 5. Descriptive statistics of social/cultural environment variables.

4.2.3. Descriptive statistics of built environment variables

All built environment characteristics are presented per 100 square meter. Table 6 shows the mean of every BE variable and the minimum and maximum amount that is found in these continuous variables. There is a difference in SSLOC and SDLOC location characteristics. The variables that start with SSLOC are related to the school students home location. The variables that start with SDLOC are related to the school districts or locations. The highest means are found in the 500 radius variables with greenery, water and forestry. The total surface for the different buffers is 31.416 m2 for the radius of 100m around the home locations, 785.398 m2 for the radius of 500m around home locations and 125.663m2 for the 200 radius around school locations.

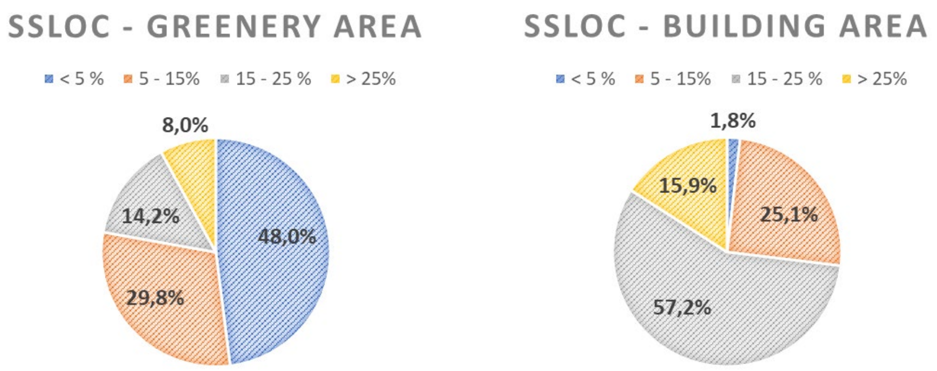

Figure 18. Distribution of area for greenery and buildings in home locations.

Figure 18 shows the distribution of the area for greenery and buildings on the street level of the home locations. Multinomial logistic regression are the continuous variables related to BE characteristics translated into categorical variables. In the case of these two variables are the categories: < 5%, 5 -15%, 15 – 25% and >25%. The figure 18 indicates that circa 57% of the home location buffer areas (100 radius, 31.416m2 total) are filled 15 to 25% of building surface. This means that the building surface area around home locations is between 4.712m2 and 7.854m2. The mean of this variable is 6.118m2 as is shown in figure 6. When we look at the percentages related to greenery in the home locations is in most of the home locations less than 5% of the surface designated for greenery. The mean of this variable is 2.766m2.

Two variables indicate the amount of surface that is designated for crossings in the home and school locations. As derived from the literature are crossings related to the perception to traffic safety by parents of school students. Indirectly might this influence the number of students that would travel to school by an active mode of transportation and the amount of performed physical activity. Although there is no open source geographical data available on the amount of crossings in a specific location does this indicate how much space is designated for crossings.

The literature also points out that the presence of roads, specifically designated for cyclists, is positively related to the perception of traffic safety. This is specifically regarding school locations and can indirectly influence the amount of active transportation. One variable regarding the built environment level indicates the presence of such a cycle path. This variable is found at the bottom of table 6 and is dichotomous of nature.

The table in appendix A presents all means of the surfaces designated for the various spatial features. All variables are grouped per school location to indicate the difference in BE characteristics.

DESCRIPTIVE STATISTICS BUILT ENVIRONMENT VARIABLES						
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
HOME LOCATIONS CHARACTERISTICS						
SSLOC_Buildings x 100m2	654	3,55	206,76	61,1802	25,69555	660,261
SSLOC_Green x 100m2	654	0,00	225,94	27,6637	33,38042	1114,253
SSLOC_Forest x 100m2	654	0,00	151,18	4,6390	14,29125	204,240
SSLOC_Water x 100m2	654	0,00	179,61	5,6174	14,86570	220,989
SSLOC_Pedestrian x 100m2	654	0,00	86,70	44,2280	14,80670	219,238
SSLOC_Crossing x 100m2	654	0,00	19,11	3,7859	2,47088	6,105
SSLOC_Water500 x 100m2	654	0,00	3137,79	360,1976	463,05130	214416,506
SSLOC_Green500 x 100m2	654	66,50	6636,91	1384,3188	868,71070	754658,276
SSLOC_Forest500 x 100m2	654	0,00	4172,77	310,6408	519,23594	269605,960
SCHOOL LOCATION CHARACTERISTICS						
SDLOC_Green x 100m2	654	0,00	545,83	174,1048	119,30846	14234,508
SDLOC_Forest x 100m2	654	0,00	234,60	62,4870	80,84554	6536,001
SDLOC_Pedestrian_100m	654	8,91	261,23	145,0152	78,33699	6136,684
SDLOC_Crossing_100m	654	2,19	42,34	19,7971	11,03060	121,674
SDLOC_BikePath_YesNo	654	0,00	1,00	0,6835	0,46547	0,217

Table 6. Descriptive statistics of built environment variables.

4.2.4. Descriptive statistics dependent physical activity variables

The two dependent variables differ in their characteristics. The travel mode choice is a nominal categorical variable that presents the five values: '1' by car, '2' by public transport, '3' by bike, '4' by foot and '999' by other mode of transportation. The performed amount of physical activity, expressed in minutes of moderate to vigorous physical activity (MVPA) is a continuous variable. Both variables are shown in table 7. The mean of the variable regarding travel mode is not interpretable as this is based on the five categories and one value of 999 is possible. The mean of minutes MVPA is 11,8 minutes of MVPA per day.

DESCRIPTIVE STATISTICS PHYSICAL ACTIVITY						
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Travel Mode To School categorical	654	1,00	999,00	~~57,7722~~	~~227,34576~~	~~51686,097~~
Minutes_MVPA2_outside of school	654	0,00	66,00	11,8044	11,01398	121,308

Table 7. Descriptive statistics of physical activity variables.

Table 9 presents the difference regarding PA at the different schools. The school students of school 'P' and 'R' are more physically active on average. Especially school 'I' shows a low average of performed physical activity. If we take a closer look at the table in appendix A can we see the built environment characteristics that are found in the school locations of these respective schools. The schools P and R show no relatively high amount of surface designated for green and pedestrian area. School location I shows no surface designated for greenery. The school locations I and R have a cycle path that is strictly designated for cyclists and school location P does not. This is just a preliminary view of the relations between BE and PA. The regression analyses will provide more insights on the relation between the BE characteristics and the performed PA.

To provide better insights on the dependent variable that is minutes of performed MVPA are four categories introduced. These four categories show how the amount of PA is distributed. With a slightly higher number are most respondents executing less than 5 minutes of MVPA per day on average. This does however mean that 67,7% of the respondents performs more physical moderate to vigorous physical activity on a daily bases.

FREQUENCIES OF MINUTES OF MVPA				
	Frequency	Percent	Valid Percent	Cumulative Percent
under 5 minutes	211	32,3	32,3	32,3
5 to 15 minutes	130	19,9	19,9	52,1
15 to 25 minutes	188	28,7	28,7	80,9
above 25 minutes	125	19,1	19,1	100,0
Total	654	100,0	100,0	

Table 8. Frequencies of MVPA.

4.2. STATISTICAL ANALYSES

Before any regression analyses can be executed correctly are the assumption tested like is mentioned in chapter 3.2.2. data analysis. All variables that are used in the regression model are either a continuous one with an ratio scale or are transformed into categorical (dummy) variables with values '0' or '1'.

The first assumption is directed at the linearity of the complete model. Which can be checked by a scatterplot of the residuals from the dependent variable. Figure 19 presents this scatterplot. The residuals are not equally distributed under and above the null line which indicates that the model is not linear one (De Vocht, 2017). Also when we look at the normal distributions of residuals, tested by the histogram and the P-P plot of standardized residuals (De Vocht, 2017) are these not distributed normally. As shown in figure 20 are the residuals creating a slight curve around the 0 line in the P-P plot. The linear regression can be executed with these variables. When the model does not meet these assumptions it is possible to transform the dependent variable into a logarithmic or square root variable. The Minutes of MVPA variable is therefore transformed into a square root variable. The choice of square root is based on the fact that logarithmic variables cannot include values of 0, which the Minutes of MVPA variable has (when no MVPA is performed by the student). The new scatterplot, histogram and normal P-P plot are shown in appendix B. The figure show that the Minutes of MVPA sqrt (square root) variable does meet all the assumptions for a multiple linear regression analysis.

Minutes_MVPA per school

School	Mean	N	Std. Deviation
A	8,4859	16	9,93583
B	7,9786	33	7,87338
C	12,0950	94	11,17348
D	9,8889	12	8,13278
E	12,0869	47	11,02421
F	10,4331	51	9,20979
G	16,7675	24	13,43565
H	12,4258	23	13,62222
I	3,0500	4	3,59768
J	9,3007	15	9,20194
K	11,1620	29	11,12831
L	10,9689	17	7,56117
M	9,5658	71	10,97704
N	8,0811	14	6,33550
O	14,7977	43	11,20546
P	19,4750	51	12,24075
Q	10,0251	99	9,53733
R	18,2572	11	16,00048
Total	11,8044	654	11,01398

Table 9. Minutes of MVPA per school.

The second assumption which needs to be tested is regarding the multicollinearity of the variables. This is done by a bivariate correlate analysis in SPSS and the variance inflation factor (VIF) from the regression output. The outcomes of this analysis are found appendix E. A few variables point out to be correlated with each other. There are two variables that have a strong correlations with other variables and might indicate the same thing. These are the 'nationality of dad' variable and the 'SDLOC_Crossing' variable. The nationality of dad is correlated with the nationality of the mother and the variable regarding having siblings. The pearson correlate is 0,590 and 0,834. All around 0,7 or higher indicates a correlation . Also the VIF shows a number higher than 2,5 which indicates a strong correlation with other factors (Allison, 2012). The variable 'nationality dad' will be deleted from the regression analysis. The SDLOC_crossings shows a 0,634 Pearson correlate with SDLOC_Pedestrian and a 2,559 VIF value. The SDLOC_Pedestrian variable is deleted from the regression analysis as the crossing variable is theoretically more important to the model. The VIF outcomes are also found in appendix E.

5. RESEARCH OUTCOMES

5.1. REGRESSION ANALYSES

For the linear regression analysis, that explains the minutes of performed MVPA, are five different models introduced. Each model is filled with extra variables that are derived from the conceptual model. Figure 19 shows the construction of the five different models. In every model is one environment level added to the regression analysis. This will eventually provide insights on the difference in model fit between the models and therefore the different environments. This is not the case for the multinomial logistic regression where one model is introduced with all variables.

Model 1	Model 2	Model 3	Model 4	Model 5
INDIVIDUAL ENV.	INDIVIDUAL ENV.	INDIVIDUAL ENV.	INDIVIDUAL ENV.	INDIVIDUAL ENV.
Gender	Gender	Gender	Gender	Gender
Age	Age	Age	Age	Age
Nationality	Nationality	Nationality	Nationality	Nationality
injury	injury	injury	injury	injury
Att. to PA	Att. to PA	Att. to PA	Att. to PA	Att. to PA
Athl. Comp.	Athl. Comp.	Athl. Comp.	Athl. Comp.	Athl. Comp.
	SOCIAL ENV.	SOCIAL ENV.	SOCIAL ENV.	SOCIAL ENV.
	Nat. mom	Nat. mom	Nat. mom	Nat. mom
	Siblings	Siblings	Siblings	Siblings
	Comp. in hh	Comp. in hh	Comp. in hh	Comp. in hh
	Cars in hh	Cars in hh	Cars in hh	Cars in hh
	FAS score	FAS score	FAS score	FAS score
		BE - HOME LOC.	BE - HOME LOC.	BE - HOME LOC.
		Buildings (100m)	Buildings (100m)	Buildings (100m)
		Greenery (100m)	Greenery (100m)	Greenery (100m)
		Forestry (100m)	Forestry (100m)	Forestry (100m)
		Water (100m)	Water (100m)	Water (100m)
		Walking (100m)	Walking (100m)	Walking (100m)
		Crossings (100m)	Crossings (100m)	Crossings (100m)
		Greenery (500m)	Greenery (500m)	Greenery (500m)
		Forestry (500m)	Forestry (500m)	Forestry (500m)
		Water (500m)	Water (500m)	Water (500m)
			BE - SCHOOL LOC.	BE - SCHOOL LOC.
			Greenery (200m)	Greenery (200m)
			Forestry (200m)	Forestry (200m)
			Crossings (200m)	Crossings (200m)
			Cycle path	Cycle path
				TRAVEL MODE TS
				TRAVEL MODE TS

Figure 19. Models for the linear regression analysis.

5.1.1. Logistic regression analysis to explain the travel mode to school

This paragraph is related to the outcomes of the statistical analysis regarding the dependent variable travel mode choice. In a multinomial logistic regression are all independent variables from the various environment introduced in one model. Table 10 shows the model fitting information for the results. The Chi-Square test indicates that the model is statistically significant on a 0,01 level. Also the goodness of fit, measured by the Pearson and deviance Chi-Square tests, indicate that the new model is showing significant results as the null-hypothesis is proven to be not significant and therefore dismissible.

Model Fitting Information				
	Model Fitting Criteria	Likelihood Ratio Tests		
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	1568,974			
Final	1021,284	547,690	220	0,000
Goodness-of-Fit				
		Chi-Square	df	Sig.
Pearson		2129,761	2376	1,000
Deviance		1016,890	2376	1,000

Table 10. Model fitting information logistical regression.

On the next page are the results presented from the multinomial logistic regression. Tabel 11 shows only the statistically significant regression coefficients from the independent variables. The complete outcome of the analysis can be found in appendix D. The results of the logistic regression are presented according to the values of the dependent variable which is travel mode choice. Table 11 shows the results of values 'by bus' and 'by bike', 'by foot' and 'other'. All results need to be interpreted in comparison to the reference category which is the travel mode 'by car'. This is also the case for every independent variable as they are inserted in the model as dummy-variables. For example does the variable SSLOC Water 5to15% (home locations with 5 to 15 % area designated for water) indicate a significant relation with the dependent variable travel mode choice. This means that school students with a home location that has 5 to 15% of its area designated for water are more likely to travel to school by bus instead of by car in comparison to school students with a home location that has less than 5% of its area designated for water. This is also the case with variable SSLOC Water above15%. Together is this a strong indication that students are overall more likely to travel by bus instead of by car when there is more water present in their direct home environment. The Exp (B) column, presenting the odds ratio, indicates the nature of the relation with the dependent variable. An odds ratio higher than 1 indicates a positive relation and an odds ratio lower than 1 indicates a negative relation. Furthermore regarding the travel mode by bus do the results indicate that amount of water present in a 500 meter radius is negatively related to the choice for going by bus instead of going by car. The presence of forestry and a cycle path is positively related to the choice for taking the bus instead of the car.

Regarding the choice for travelling by bicycle to school do the outcomes indicate the following. School students are less likely to travel by bike to school when they are younger. Both variables age = 10 and age = 12 are significant proven to be related to the travel mode choice. The reference category for age is 14. The variables related to the attitude towards PA and the perceived athletic competence show that students are less likely to travel by bike when they are positive about being physically active and more likely to go by bike when they perceive themselves as bad at physical activity. Also having siblings is positively related to the choice for going by bike to school instead of going by car. From the BE characteristics of the school location are

MULTINOMIAL LOGISTIC REGRESSION - SIGNIFICANT OUTCOMES									
								for Exp(B)	
TravelMode_ToSchool_cat[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	Lower Bound	Upper Bound
PARAMETER ESTIMATES (BY BUS)									
by bus	Intercept	-18,421	39,377	0,219	1	0,640			
	SSLOC Water 5to15%	2,027	1,037	3,817	1	0,051	7,589	0,993	57,966
	SSLOC Water above15%	3,245	1,574	4,248	1	0,039	25,659	1,173	561,495
	SSLOC Forest500 5to15%	1,335	0,737	3,275	1	0,070	3,798	0,895	16,118
	SSLOC Water500 5to15%	-1,961	0,782	6,295	1	0,012	0,141	0,030	0,651
	SSLOC Water500 above15%	-2,013	1,085	3,442	1	0,064	0,134	0,016	1,120
	SDLOC BikePath = Yes	3,121	1,883	2,748	1	0,097	22,679	0,566	908,960
PARAMETER ESTIMATES (BY BIKE)									
by bike	Intercept	11,377	19,647	0,335	1	0,563			
	Age=10 (ref. = 14)	-3,232	1,976	2,675	1	0,102	0,039	0,001	1,898
	Age=12 (ref. = 14)	-3,209	1,940	2,737	1	0,098	0,040	0,001	1,808
	AttitudePA = Pos	-0,961	0,513	3,509	1	0,061	0,383	0,140	1,045
	Ath Comp = BAD	1,927	0,738	6,819	1	0,009	6,867	1,617	29,159
	Siblings = Yes	1,037	0,529	3,845	1	0,050	2,820	1,000	7,947
	SSLOC Forest 5to15%	1,888	0,619	9,310	1	0,002	6,608	1,965	22,228
	SDLOC Perc Green under5%	1,144	0,600	3,641	1	0,056	3,140	0,969	10,171
	SDLOC Forest above3%	-1,684	0,871	3,734	1	0,053	0,186	0,034	1,024
PARAMETER ESTIMATES (BY FOOT)									
by foot	Intercept	0,424	22,360	0,000	1	0,985			
	Nationality = other	-1,247	0,765	2,653	1	0,103	0,287	0,064	1,289
	Injury = Yes	-1,044	0,476	4,800	1	0,028	0,352	0,138	0,896
	Cars in hh = two	0,881	0,422	4,364	1	0,037	2,414	1,056	5,520
	SSLOC Water above15%	3,535	2,156	2,688	1	0,101	34,304	0,501	2348,298
	SSLOC Water500 5to15%	-1,412	0,625	5,104	1	0,024	0,244	0,072	0,829
PARAMETER ESTIMATES (BY OTHER)									
Other	Intercept	-0,124	28,106	0,000	1	0,996			
	Age = 13 (ref. = 14)	-3,960	2,056	3,709	1	0,054	0,019	0,000	1,072
	Nationality = other	-2,357	0,950	6,162	1	0,013	0,095	0,015	0,609
	AttitudePA = Pos	-2,601	1,101	5,576	1	0,018	0,074	0,009	0,643
	Ath Comp = BAD	4,512	2,111	4,567	1	0,033	91,072	1,453	5707,273
	Ath Comp = GOOD	1,583	0,682	5,393	1	0,020	4,870	1,280	18,524
	Siblings = Yes	1,449	0,841	2,965	1	0,085	4,258	0,819	22,146
	SSLOC Water500 above15%	-2,147	1,114	3,717	1	0,054	0,117	0,013	1,036
	SDLOC Crossing above3%	1,466	0,711	4,246	1	0,039	4,331	1,074	17,460
**	Significance level on 0,01								
*	Significance level on 0,05								
~	Significance level on 0,10								
a. The reference category is: by car.									
b. This parameter is set to zero because it is redundant.									
c. Floating point overflow occurred while computing this statistic. Its value is therefore set to system missing.									

Table 11. Logistic regression outcomes.

more forestry and greenery significantly related to less bicycle usage among the students. In the home location will more area for forestry lead to more usage of bikes to travel to school compared to the use of cars. The choice for going by foot is apparently positively related to the amount of water in the direct home location. In contrast to this does a larger amount of water in a radius of 500 meter have a negative effect on going by foot. Having a non-Dutch nationality and having an injury are related to the student's choice to go by car instead of by foot. Surprisingly does having more cars in the household indicate that students are more likely to travel by foot. The choice for travelling with other travel modes compared to traveling by car is significantly proven to be related to a number of variables from the individual environment level. From the built environment level can be said that water on a neighborhood level (negative) and the amount of space for crossings (positive) are related to the choice for other travel modes.

5.1.2. Linear regression analysis to explain the performed minutes of MVPA

On the next page is the model summary presented of the multiple linear regression for explaining the performed amount of minutes MVPA by the Dutch school students. The outcomes are presented per model. The ANOVA table shows that all models are significant and that the null-hypotheses can be dismissed. The model summery table shows the percentage of MVPA that is explained by the relevant model. The table indicates that model 5 explains 17% of the performed amount of MVPA. In the column of R Square Change can we see the difference in explained percentage per model. This shows that the individual environment is the main factor for the performed amount of MVPA with 11,8% (model 1). The model summery also indicates that the built environment variables (models 3 & 4) explain a larger percentage than the social environment variables (model 2). The outcomes of the linear regression are found in table 13. As we use a square root dependent variable are the regression coefficients not easily interpretable. The outcomes do indicate a positive or negative relation between the independent and the dependent variables.

LINEAR REGRESSION MVPA - ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	239,577	7	34,225	12,298	,000[b]
	Residual	1797,752	646	2,783		
	Total	2037,329	653			
2	Regression	271,437	15	18,096	6,538	,000[c]
	Residual	1765,892	638	2,768		
	Total	2037,329	653			
3	Regression	312,526	24	13,022	4,749	,000[d]
	Residual	1724,803	629	2,742		
	Total	2037,329	653			
4	Regression	336,072	28	12,003	4,409	,000[e]
	Residual	1701,257	625	2,722		
	Total	2037,329	653			
5	Regression	345,992	32	10,812	3,970	,000[f]
	Residual	1691,337	621	2,724		
	Total	2037,329	653			

a. Dependent Variable: sqrt_MVPA

LINEAR REGRESSION - MODEL SUMMARY

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	,343[a]	0,118	0,108	1,66820	0,118	12,298	7	646	0,000
2	,365[b]	0,133	0,113	1,66369	0,016	1,439	8	638	0,177
3	,392[c]	0,153	0,121	1,65594	0,020	1,665	9	629	0,094
4	,406[d]	0,165	0,128	1,64985	0,012	2,163	4	625	0,072
5	,412[e]	0,170	0,127	1,65032	0,005	0,911	4	621	0,457

Table 12. ANNOVA and model summary linear regression analysis.

The first interesting remark on the outcomes of the linear regression analysis is that most significant coefficients are found in the individual environment box. In all models are the gender and age of the respondents influencing the performed amount of moderate to vigorous physical activity. The outcomes show that men perform more MVPA than women as the B coefficient is always positive. The age coefficient shows that a person performs less MVPA when he or she gets older. Also is the Athletic competence variable related to the performed amount of MVPA. It indicates that a person who perceives him- or herself to be good at physical activity will indeed perform more MVPA. As this is a dummy-variable is this as opposed to a person that is neutral towards their own athletic competence. Dummy variables are the relations between the independent and dependent variable in contrast with another value. In this case is a good perceived athletic performance '1' and a neutral perception towards their athletic performance '0'. When athletic performance is '1' than the person is more likely to perform MVPA. Regarding the social/cultural environment is the number of computers significantly related to the performed minutes of MVPA by a significance level of 0,05. This coefficient indicates that school students who have none or one computer in their household are more physically active than the school students with more computers. All other social environment variables are not significantly related to the minutes of MVPA.

Built environment characteristics
The model distinguishes the variables related to the BE of student home locations (SSLOC) and school district locations (SDLOC). From an overall view on the BE coefficients can be said that there are not many BE characteristics influencing the amount of MVPA by school students. Nevertheless is in some cases this relation is indeed found to be true. The one variable, regarding the home location of the school students, that is significant is the amount of greenery present within a range of 500 meter. Nevertheless is this relation so small that no regression coefficient is presented. The BE of school districts does influence the performed amount of MVPA. The first significant relation is found in the amount of greenery that is present in the school district. This is regarding a 200 meter radius from the school location. The relation is significant at a 0,05 level. The regression coefficient indicates a negative relation between. This means that students are less-likely to perform MVPA when there is more area for greenery present in the direct surroundings of the school. Also the variable for area of crossings presents a significant relation with the performed amount of MVPA on a level of 0,05. The regression coefficient indicates a negative relation. This means that school students are less-likely to perform physical activity outside of school when there is more space for infrastructural crossings in the direct surroundings of the school.

Travel mode choice
The travel mode choice is not found to be of influence on the performed amount of MVPA by the school students. The travel mode choice variable is inserted in the linear regression model as a dummy-variable. All regression coefficients need to be interpreted in contrast to car use. Nevertheless does all coefficients indicate no significant relation with the dependent variable which is minutes of MVPA.

LINEAR REGRESSION COEFFICIENT OUTCOMES										
	B	Sig.	B	Sig.	B	Sig.	B	Sig.	B	Sig.
(Constant)	4,205	0,000	4,030	0,000	4,895	0,000	4,999	0,000	5,089	0,000
Gender	0,733	0,000	0,727	0,000	0,725	0,000	0,729	0,000	0,735	0,000
Age	-0,197	0,000	-0,197	0,000	-0,202	0,000	-0,169	0,020	-0,169	0,023
Nationality	-0,447	0,063	-0,293	0,261	-0,297	0,256	-0,357	0,173	-0,286	0,282
Injury_YesNo	0,249	0,134	0,230	0,172	0,240	0,153	0,267	0,114	0,256	0,133
Attitude_PA_PosNeg	0,292	0,176	0,348	0,112	0,334	0,132	0,314	0,160	0,348	0,123
Ath_Comp_BAD_dum	-0,110	0,738	-0,080	0,809	-0,150	0,650	-0,174	0,599	-0,168	0,616
Ath_Comp_GOOD_dum	0,592	0,001	0,563	0,001	0,553	0,002	0,551	0,002	0,536	0,002
Nationality mom			-0,062	0,767	-0,050	0,809	-0,037	0,859	-0,047	0,824
Siblings_YesNo			-0,209	0,312	-0,281	0,187	-0,189	0,381	-0,195	0,370
FAS_LOW_dum			-0,522	0,075	-0,409	0,166	-0,420	0,154	-0,422	0,153
FAS_HIGH_dum			0,146	0,354	0,106	0,502	0,065	0,682	0,073	0,647
Cars_hh_none			0,160	0,521	0,121	0,629	0,109	0,661	0,130	0,603
Cars_hh_two			0,081	0,586	0,092	0,538	0,089	0,550	0,096	0,522
Comp_hh_NoneOrOne			0,776	0,013	0,698	0,026	0,670	0,032	0,651	0,038
Comp_hh_three			0,091	0,644	0,149	0,452	0,143	0,473	0,120	0,549
SSLOC_Buildings_100m					-0,003	0,303	-0,003	0,323	-0,004	0,275
SSLOC_Green_100m					0,002	0,396	0,003	0,305	0,003	0,316
SSLOC_Forest_100m					0,000	0,937	0,000	0,973	0,000	0,944
SSLOC_Water_100m					-0,005	0,313	-0,006	0,258	-0,006	0,239
SSLOC_Pedestrian_100m					0,000	0,968	-0,001	0,934	-0,001	0,858
SSLOC_Crossing_100m					-0,049	0,160	-0,048	0,170	-0,046	0,191
SSLOC_Water500_100m					0,000	0,369	0,000	0,267	0,000	0,331
SSLOC_Green500_100m					0,000	0,007	0,000	0,012	0,000	0,008
SSLOC_Forest500_100m					-6,982E-05	0,646	-5,412E-05	0,723	-4,430E-05	0,772
SDLOC_Green_100m							-0,002	0,021	-0,002	0,024
SDLOC_Forest_100m							0,001	0,255	0,001	0,304
SDLOC_Crossing_100m							-0,018	0,021	-0,018	0,021
SDLOC_BikePath_YesNo							0,092	0,632	0,081	0,681
TMTS_by_foot_dum									-0,111	0,665
TMTS_by_bike_dum									0,042	0,857
TMTS_by_PT_dum									-0,238	0,499
TMTS_other_dum									-0,439	0,231
**	Significance level on 0,01									
*	Significance level on 0,05									
~	Significance level on 0,10									

Table 13. Outcomes multiple linear regression analysis.

5.2. CONCLUSION & RECOMMENDATIONS

The structural built environment characteristics have a minimal effect on both the travel mode choice and the performed amount of MVPA. Both regression outcomes show that the individual environment is the primary environment that explains the physical activity of school students between the ages 9 and 14. The regression outcomes do indicate some relation between the BE characteristics and the physical activity. For the travel mode choice do diverse variables relate to choices for specific travel modes. The performed amount of MVPA is mainly explained by BE characteristics from the school location. This is contradictory to the existing literature.

Individual environment

All variables from the individual environment level have some significant relation to either the travel mode choice or the performed amount of MVPA. Especially the variables gender and age are often found significant. The analysis outcomes indicate that school students are more likely to take active modes of transportation when they get older, have a Dutch nationality and have no injuries. In contrast to the literature do the results indicate that students who perceive themselves as having a bad athletic competence will choose for travelling by bike instead of going by car. Nevertheless do the outcomes of the linear regression indicate that school students overall will perform more moderate to vigorous physical activity when they perceive themselves as athletically skilled. In addition to this can be said that boys are more physically active than girls and that school students get less physically active as they get older.

Social/cultural environment

Surprisingly is the social/cultural environment not as important for explaining the performed PA. This is contradictory to what the relevant literature indicates as school students are relatively more dependent on the policies and (economic) situation of their parents. It is interesting to see that school students who have two or more cars in their household are more likely to travel to school by foot. The literature indicates that school students when in possession of more cars are likely to travel by car. This is not the case in this study. Having siblings does influence the choice for active transportation positively. This could be related to the fact that parents are more likely to let their children travel by active means when they travel together with (older) siblings. The amount of computers is the only significant variable that corelates with the performed amount of MVPA. The regression coefficient tells us that having less than two computers is positively related to the amount of MVPA. The analysis outcomes indicate that the other social/cultural variables do not influence the active behavior of the school students between the ages of 9 and 14.

Built environment

Various BE variables are somehow related to the choice for a specific travel mode to school. The school students are more likely to choose an active travel mode instead of the car when there is some forestry or water present in there direct surroundings. On a neighborhood level (radius of 500 meter) do the results indicate the complete opposite. More forestry and greenery on a neighborhood level leads to lower chances for choosing an active mode for transportation. This can be related to the fact the areas with a high percentage of greenery and forestry are most likely to be located further from the city or village where the school is located. Travelling by car or by bus is a more compelling choice as the distance increases (Davison & Lawson, 2006; Dunton et al., 2009; Sallis et al., 2012). The variables related to BE characteristics in de school's surroundings indicate that the chances for students to choose active modes of transportation over the car decreases when there is more greenery or forestry present. The structural built environment characteristics do not explain the performed moderate to vigorous physical activity of school students between the ages of 9 and 14. The outcomes of the linear regression analysis indicate that only greenery in a radius of 500 meter has a significant relation with the dependent variable which is minutes of MVPA. The regression coefficient is too small to be interpreted as positive or negative. All other BE variables do not present a significant linear relation with the performed MVPA. This is contradictory to the existing literature.

Recommendations

The results of this study indicate that built environment characteristics are just slightly influencing active behavior among school students. Due to the unavailability of spatial data are only structural spatial elements of the built environment tested. Therefore are a number of BE variables, derived from the literature review, not analyzed in both regression analyses. It possible that less structural spatial objects show a significant relation between the built environment and the performed physical activity of Dutch school students. Further research could elaborate on this matter. The use of regression analysis is an efficient way to provide insights on the relation between objective BE characteristics and performed amounts of PA. Further research that uses regression analysis could provide new quality insights when more specific spatial features are introduced in the model.

This research is executed from a quantitative, positivist, approach towards gathering knowledge. New insights from a more qualitative, constructivist, theoretical perspective will show additional insights. Research methods such as case studies have a large potential for this.

6. DISCUSSION

This inquiry used the MyMovez project data as its primary data source. The use of data that is gathered in a different project creates a certain liability to that dataset. When the data is not organized in a quality manner will this influence the research. This was also the case in this thesis study. It became an iterative process where various variables in the dataset were found to be insufficient or missing too many variables. The main focus of the MyMovez project is the relation between social influence factors and the behavior of school students. The data regarding physical activity and built environment characteristics is therefore secondary. The research design is adapted to the variables that had no missing values. Some variables are completed by multiple imputation.

Because of the missing values in the MyMovez data are changes made in the dataset. Due to these changes are three schools and circa 25% of the respondents in the total dataset left out in the regression analysis. This has potentially altered the research outcomes. Additional research that has no focus and a random group of respondents could provide ne quality outcomes on the relation between BE and PA of school students.

The spatial open source data was unavailable for this research. During the study were various open source data platforms not functioning correctly. In light of this was it necessary to change the conceptual model accordingly. The focus was put on more structural built environment characteristics instead of more detailed ones. The use of more detailed BE characteristics in the statistical analyses would potentially show other outcomes. Nevertheless do the research outcomes present interesting insights on the relation between structural built environment characteristics and the performed amount of physical activity by school students.

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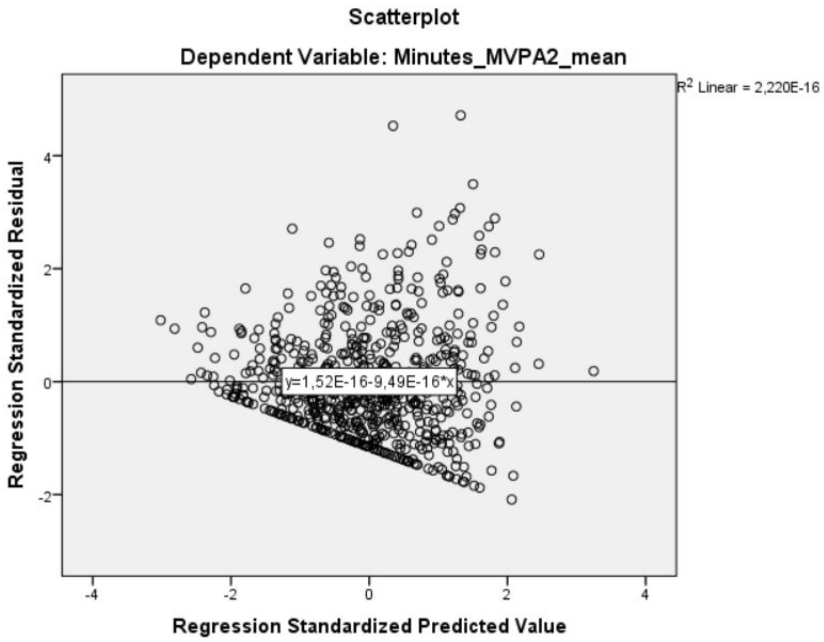
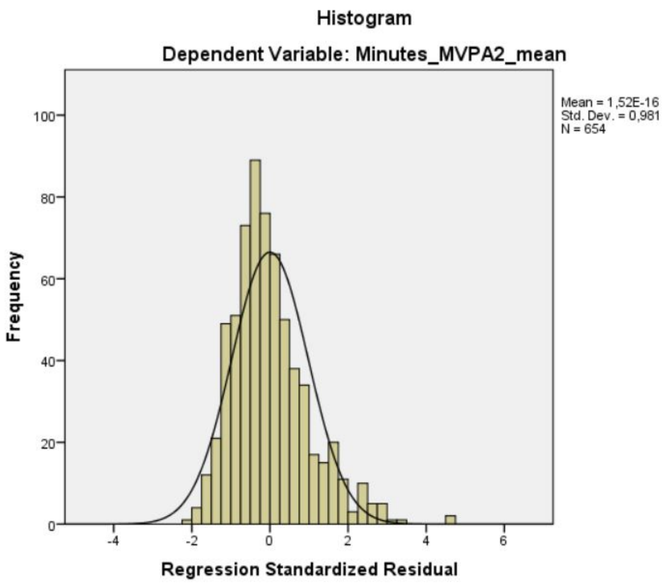
APPENDIX A: MEANS OF BUILT ENVIRONMENT CHARACTERISTICS

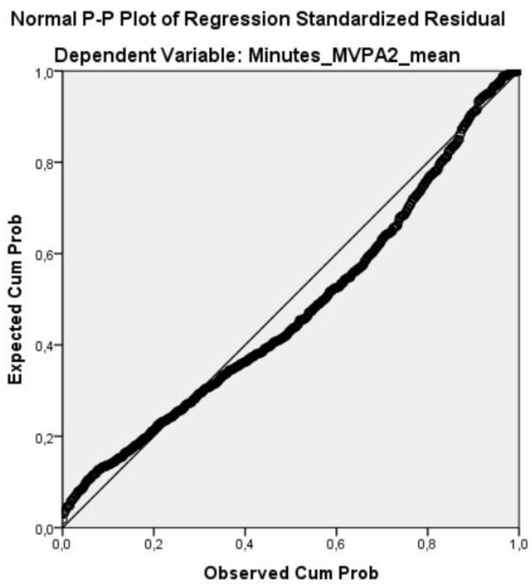
MEANS OF BUILT ENVIRONMENT CHARACTERISTICS										
School		SSLOC_Buildings_100m	SSLOC_Green_100m	SSLOC_Forest_100m	SSLOC_Water_100m	SSLOC_Pedestrian_100m	SSLOC_Crossing_100m	SSLOC_Water500_100m	SSLOC_Green500_100m	SSLOC_Forest500_100m
A	Mean	60,7464	40,8353	9,8075	1,5735	41,5007	4,2544	194,3213	1523,8723	586,4894
	N	16	16	16	16	16	16	16	16	16
	Std. Deviation	25,13598	60,79189	20,41068	5,18162	16,01422	3,34748	346,26446	1142,93170	889,67610
B	Mean	64,2288	17,9450	2,0328	0,0731	47,1698	4,3861	68,0468	1221,6475	342,3761
	N	33	33	33	33	33	33	33	33	33
	Std. Deviation	17,60880	21,31271	4,77480	0,30431	15,69446	2,66727	104,43364	727,36650	276,59903
C	Mean	53,7749	33,5865	8,9215	4,7058	39,3317	3,4572	320,7095	1414,7205	507,0834
	N	94	94	94	94	94	94	94	94	94
	Std. Deviation	24,72255	39,28881	21,87700	13,56933	16,72849	3,12688	514,50594	840,03661	787,15505
D	Mean	75,4576	22,4327	5,0005	0,0410	59,0883	6,5181	102,4816	658,7374	251,9165
	N	12	12	12	12	12	12	12	12	12
	Std. Deviation	48,33868	23,24616	12,14524	0,14197	10,67278	4,00908	66,33209	406,00535	232,20784
E	Mean	60,2748	38,7459	0,6197	12,6619	54,1133	4,7525	648,0423	1498,4400	120,2437
	N	47	47	47	47	47	47	47	47	47
	Std. Deviation	17,67892	20,95957	2,47381	14,34978	11,47528	2,37585	439,78215	662,33236	45,32074
F	Mean	60,2674	23,1184	0,6227	15,2650	34,5846	2,5034	911,7909	1887,3810	37,9492
	N	51	51	51	51	51	51	51	51	51
	Std. Deviation	16,00044	35,96710	2,13651	18,62452	13,64116	1,27260	541,23800	1520,63446	40,55788
G	Mean	52,1868	31,1948	5,7107	9,6594	44,9964	2,9449	277,0152	1413,9473	284,1904
	N	24	24	24	24	24	24	24	24	24
	Std. Deviation	21,83162	28,14845	8,10715	23,22029	11,24997	1,40357	180,94731	558,11850	256,78394
H	Mean	51,8953	43,0139	4,6445	7,4509	45,2411	3,7437	752,1417	1997,8857	536,6670
	N	23	23	23	23	23	23	23	23	23
	Std. Deviation	20,25953	27,03273	7,76515	19,82620	11,21500	1,54555	606,41162	422,36549	592,92822
I	Mean	53,3220	9,9585	7,3693	2,9801	47,1229	4,2593	194,5504	671,8974	373,6444
	N	4	4	4	4	4	4	4	4	4
	Std. Deviation	5,42870	15,96079	9,31742	5,96016	3,97006	2,06570	53,25865	323,00751	314,30836
J	Mean	82,8786	12,8480	0,0000	0,7270	59,5640	6,3271	282,9496	782,7423	170,6417
	N	15	15	15	15	15	15	15	15	15
	Std. Deviation	23,90527	12,55779	0,00000	2,57817	10,74534	2,42500	248,99290	195,52095	67,87503
K	Mean	79,3961	25,3792	0,6232	0,7585	49,0764	3,8162	80,1580	660,9870	145,9151
	N	29	29	29	29	29	29	29	29	29
	Std. Deviation	22,78211	39,63993	2,35526	4,08476	13,46738	1,70615	150,61507	370,30505	186,43049
L	Mean	56,5694	10,6337	4,7970	0,0000	39,8952	3,3826	25,4879	1502,8457	1261,0983
	N	17	17	17	17	17	17	17	17	17
	Std. Deviation	12,66186	20,60966	8,05110	0,00000	11,69779	1,56242	85,03096	1084,54236	1119,78832
M	Mean	55,4736	36,9923	8,9749	6,9349	42,2458	3,6576	408,3975	1767,1035	428,1140
	N	71	71	71	71	71	71	71	71	71
	Std. Deviation	17,71613	39,75277	21,38435	22,71096	12,45535	1,92068	495,07423	841,08579	641,88133
N	Mean	56,2538	40,2032	2,3909	2,9740	26,6226	1,7342	251,2966	2137,7439	236,8898
	N	14	14	14	14	14	14	14	14	14
	Std. Deviation	23,30445	54,30805	4,14667	8,98556	12,55201	1,02718	175,25642	629,27829	178,84322
O	Mean	52,3657	23,2975	3,0516	0,1672	54,7090	5,0275	97,2618	968,2820	170,8569
	N	43	43	43	43	43	43	43	43	43
	Std. Deviation	14,14574	20,10210	9,07150	1,09629	11,25101	2,82858	107,96861	336,50659	98,70755
P	Mean	93,1344	11,3720	0,7681	2,0779	46,5309	3,4493	258,7160	790,0126	98,5347
	N	51	51	51	51	51	51	51	51	51
	Std. Deviation	36,66562	20,81178	3,87871	9,36197	12,98785	2,20611	253,47919	476,98737	104,50627
Q	Mean	53,1370	25,4599	6,0087	7,1657	41,1434	3,5851	387,9314	1466,9209	276,6498
	N	99	99	99	99	99	99	99	99	99
	Std. Deviation	17,71668	29,58399	17,71950	15,33568	12,81350	2,14482	462,31266	685,26030	311,18567
R	Mean	81,6743	21,9284	3,7716	2,2831	46,9397	3,7338	168,5884	1045,4502	167,2567
	N	11	11	11	11	11	11	11	11	11
	Std. Deviation	48,09866	25,59365	9,82216	4,77927	12,47725	2,27724	313,52380	566,89028	198,82405
Total	Mean	61,1802	27,6637	4,6390	5,6174	44,2280	3,7859	360,1976	1384,3188	310,6408
	N	654	654	654	654	654	654	654	654	654
	Std. Deviation	25,69555	33,38042	14,29125	14,86570	14,80670	2,47088	463,05130	868,71070	519,23594

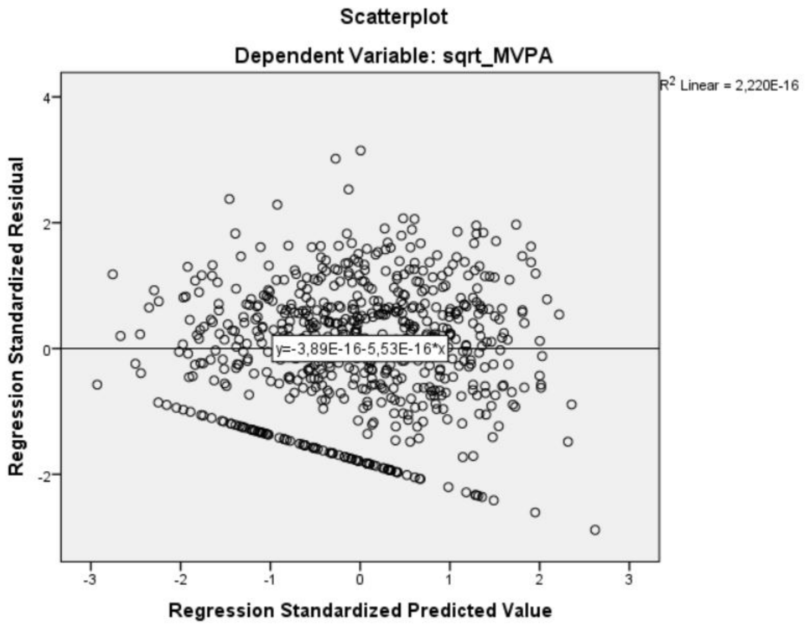
SDLOC - MEANS OF BUILT ENVIRONMENT CHARACTERISTICS						
School		SDLOC_Green_100m	SDLOC_Forest_100m	SDLOC_Pedestrian_100m	SDLOC_Crossing_100m	SDLOC_BikePath_YesNo
A	Mean	115,5117	23,0887	222,1464	19,3875	0,0000
	N	16	16	16	16	16
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
B	Mean	545,8323	89,4847	47,1455	2,1933	1,0000
	N	33	33	33	33	33
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
C	Mean	189,7011	26,1105	166,8662	18,7272	1,0000
	N	94	94	94	94	94
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
D	Mean	76,8466	0,0000	179,1172	22,7657	1,0000
	N	12	12	12	12	12
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
E	Mean	77,2845	17,7906	10,9746	11,4377	1,0000
	N	47	47	47	47	47
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
F	Mean	127,2636	9,1745	8,9050	8,9050	0,0000
	N	51	51	51	51	51
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
G	Mean	202,8692	35,0697	12,5646	13,1978	1,0000
	N	24	24	24	24	24
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
H	Mean	335,5741	16,8369	145,6628	10,6867	1,0000
	N	23	23	23	23	23
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
I	Mean	0,0000	37,4835	117,1431	10,5090	1,0000
	N	4	4	4	4	4
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
J	Mean	57,9912	0,0000	261,2306	32,2431	0,0000
	N	15	15	15	15	15
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
K	Mean	79,6401	18,2160	249,8299	42,3420	1,0000
	N	29	29	29	29	29
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
L	Mean	4,3395	0,0000	175,2105	12,7004	0,0000
	N	17	17	17	17	17
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
M	Mean	256,9537	116,4574	155,6219	38,4779	1,0000
	N	71	71	71	71	71
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
N	Mean	295,8695	0,0000	64,6876	4,1246	0,0000
	N	14	14	14	14	14
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
O	Mean	98,4290	0,0000	233,1174	21,1384	0,0000
	N	43	43	43	43	43
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
P	Mean	20,1303	7,5497	174,3852	9,0546	0,0000
	N	51	51	51	51	51
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
Q	Mean	206,4339	234,5959	197,0527	26,3377	1,0000
	N	99	99	99	99	99
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
R	Mean	109,5284	0,0000	207,4412	21,7769	1,0000
	N	11	11	11	11	11
	Std. Deviation	0,00000	0,00000	0,00000	0,00000	0,00000
Total	Mean	174,1048	62,4870	145,0152	19,7971	0,6835
	N	654	654	654	654	654
	Std. Deviation	119,30846	80,84554	78,33699	11,03060	0,46547

APPENDIX B: LINEARITY AND HOMOSCEDASTICITY OF MINUTES MVPA

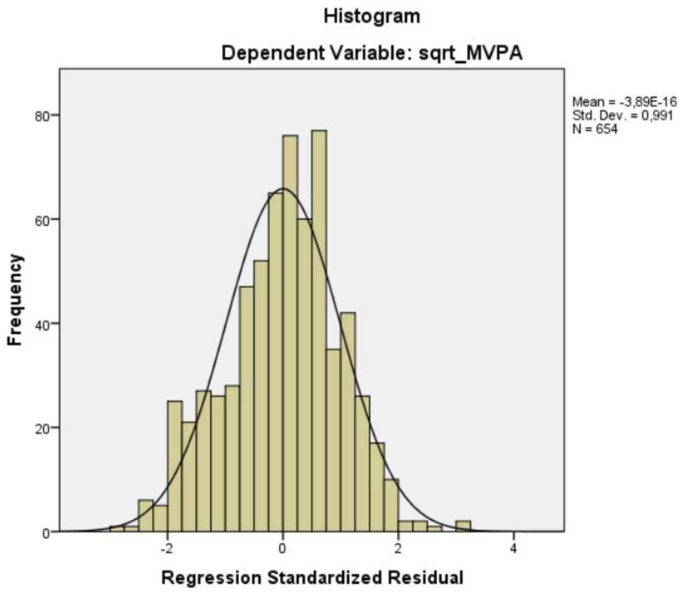




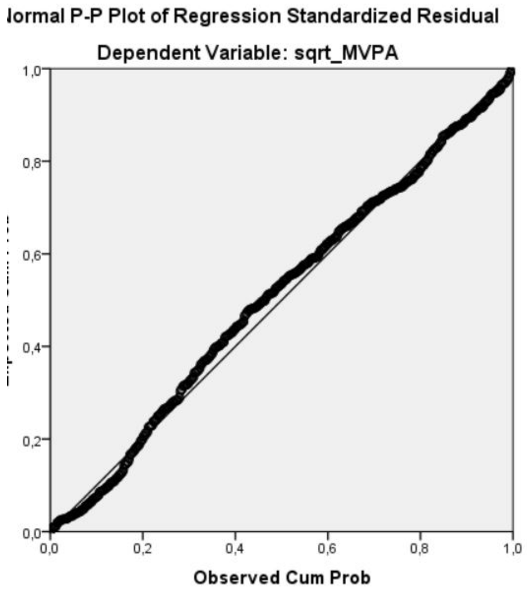




Scatterplot
Dependent Variable: sqrt_MVPA
R2 Linear = 2,220E-16
y=-3,89E-16-5,53E-16*x
Regression Standardized Residual
Regression Standardized Predicted Value



Histogram
Dependent Variable: sqrt_MVPA
Mean = -3,89E-16
Std. Dev. = 0,991
N = 654
Frequency
Regression Standardized Residual



Normal P-P Plot of Regression Standardized Residual
Dependent Variable: sqrt_MVPA
Observed Cum Prob

APPENDIX C: MULTICOLLEANARITY OF INDEPENDENT VARIABLES

		Gender	Age	Nationality	Injury_YesNo	Attitude_PA_PosNeg	Athletic_Competence	Nationality mom	Nationality dad	Siblings_YesNo	Total computers in hh	Total cars in hh	Family affluence score
Gender	Pearson Correlation	1	-0,033	-0,013	-0,069	-0,006	,109**	0,070	0,007	0,021	-0,024	-0,017	-0,002
	Sig. (2-tailed)		0,397	0,741	0,079	0,880	0,005	0,075	0,854	0,593	0,538	0,672	0,950
	N	654	654	654	654	654	654	654	654	654	654	654	654
Age	Pearson Correlation	-0,033	1	0,018	-0,019	-0,030	-,117**	-,084*	-0,046	-0,074	,111**	,106**	0,051
	Sig. (2-tailed)	0,397		0,653	0,626	0,438	0,003	0,032	0,238	0,059	0,005	0,007	0,190
	N	654	654	654	654	654	654	654	654	654	654	654	654
Nationality	Pearson Correlation	-0,013	0,018	1	0,010	-0,057	-0,051	,370**	,359**	,290**	-0,072	-,093*	-0,062
	Sig. (2-tailed)	0,741	0,653		0,798	0,147	0,197	0,000	0,000	0,000	0,066	0,018	0,111
	N	654	654	654	654	654	654	654	654	654	654	654	654
Injury_YesNo	Pearson Correlation	-0,069	-0,019	0,010	1	0,057	-0,019	0,040	0,058	,088*	0,002	,093*	0,076
	Sig. (2-tailed)	0,079	0,626	0,798		0,142	0,627	0,303	0,137	0,024	0,960	0,017	0,051
	N	654	654	654	654	654	654	654	654	654	654	654	654
Attitude_PA_PosNeg	Pearson Correlation	-0,006	-0,030	-0,057	0,057	1	,400**	-,089*	0,016	0,041	,103**	-0,026	0,061
	Sig. (2-tailed)	0,880	0,438	0,147	0,142		0,000	0,023	0,680	0,290	0,009	0,514	0,122
	N	654	654	654	654	654	654	654	654	654	654	654	654
Athletic_Competence	Pearson Correlation	,109**	-,117**	-0,051	-0,019	,400**	1	-0,069	0,041	0,041	0,008	0,032	0,069
	Sig. (2-tailed)	0,005	0,003	0,197	0,627	0,000		0,078	0,297	0,300	0,848	0,413	0,080
	N	654	654	654	654	654	654	654	654	654	654	654	654
Nationality mom	Pearson Correlation	0,070	-,084*	,370**	0,040	-,089*	-0,069	1	,590**	,533**	-,158**	-,209**	-,171**
	Sig. (2-tailed)	0,075	0,032	0,000	0,303	0,023	0,078		0,000	0,000	0,000	0,000	0,000
	N	654	654	654	654	654	654	654	654	654	654	654	654
Nationality dad	Pearson Correlation	0,007	-0,046	,359**	0,058	0,016	0,041	,590**	1	,834**	-,129**	-,186**	-,143**
	Sig. (2-tailed)	0,854	0,238	0,000	0,137	0,680	0,297	0,000		0,000	0,001	0,000	0,000
	N	654	654	654	654	654	654	654	654	654	654	654	654
Siblings_YesNo	Pearson Correlation	0,021	-0,074	,290**	,088*	0,041	0,041	,533**	,834**	1	-,113**	-,148**	-,095*
	Sig. (2-tailed)	0,593	0,059	0,000	0,024	0,290	0,300	0,000	0,000		0,004	0,000	0,015
	N	654	654	654	654	654	654	654	654	654	654	654	654
Total computers in hh	Pearson Correlation	-0,024	,111**	-0,072	0,002	,103**	0,008	-,158**	-,129**	-,113**	1	,178**	,448**
	Sig. (2-tailed)	0,538	0,005	0,066	0,960	0,009	0,848	0,000	0,001	0,004		0,000	0,000
	N	654	654	654	654	654	654	654	654	654	654	654	654
Total cars in hh	Pearson Correlation	-0,017	,106**	-,093*	,093*	-0,026	0,032	-,209**	-,186**	-,148**	,178**	1	,563**
	Sig. (2-tailed)	0,672	0,007	0,018	0,017	0,514	0,413	0,000	0,000	0,000	0,000		0,000
	N	654	654	654	654	654	654	654	654	654	654	654	654
Family affluence score	Pearson Correlation	-0,002	0,051	-0,062	0,076	0,061	0,069	-,171**	-,143**	-,095*	,448**	,563**	1
	Sig. (2-tailed)	0,950	0,190	0,111	0,051	0,122	0,080	0,000	0,000	0,015	0,000	0,000	
	N	654	654	654	654	654	654	654	654	654	654	654	654

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Gender	Pearson Correlation	SSLOC_Buildings_100m	SSLOC_Green_100m	SSLOC_Forest_100m	SSLOC_Water_100m	SSLOC_Pedestrian_100m	SSLOC_Crossing_100m	SSLOC_Water500_100m	SSLOC_Green500_100m	SSLOC_Forest500_100m	SDLOC_Green_100m	SDLOC_Forest_100m	SDLOC_Pedestrian_100m	SDLOC_Crossing_100m	SDLOC_BikePath_YesNo
	Sig. (2-tailed)	0,007	-0,010	0,001	-0,008	-0,044	0,006	0,043	-0,030	0,053	-,095*	-0,063	0,073	0,043	-0,064
	N	0,864	0,805	0,982	0,843	0,258	0,885	0,277	0,442	0,176	0,015	0,107	0,064	0,275	0,103
Age	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	-,232**	0,063	,134**	-0,016	-,132**	0,016	-0,070	,111**	,129**	,430**	,643**	,216**	,261**	,484**
	N	0,000	0,107	0,001	0,675	0,001	0,689	0,072	0,004	0,001	0,000	0,000	0,000	0,000	0,000
Nationality	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	0,036	0,005	-0,015	-0,042	0,022	0,031	-0,035	-0,055	0,045	-0,054	-0,049	0,065	0,004	-0,051
	N	0,358	0,895	0,704	0,279	0,566	0,427	0,368	0,161	0,247	0,171	0,209	0,095	0,928	0,194
Injury_YesNo	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	-0,033	0,072	-0,001	-0,005	0,021	0,061	0,003	0,005	-0,009	-0,010	0,051	0,048	,113**	0,052
	N	0,393	0,067	0,977	0,895	0,591	0,121	0,934	0,907	0,812	0,795	0,192	0,218	0,004	0,188
Attitude_PA_PosNeg	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	-0,009	0,028	0,029	0,067	-0,072	-0,014	-0,026	0,013	-,108**	-,104**	-,084*	-0,005	0,024	-0,049
	N	0,810	0,474	0,461	0,088	0,065	0,729	0,503	0,738	0,006	0,008	0,032	0,889	0,535	0,209
Athletic_Competence	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	0,027	0,037	0,046	-0,019	-0,040	-0,027	-0,008	0,035	-0,024	-0,037	-,124**	-0,028	-0,060	-0,073
	N	0,499	0,344	0,242	0,629	0,301	0,487	0,834	0,366	0,542	0,346	0,002	0,474	0,126	0,063
Nationality mom	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	0,045	-0,056	-0,059	-0,075	,153**	,120**	-0,069	-,123**	0,018	-,139**	-0,069	,205**	,144**	-,142**
	N	0,250	0,151	0,135	0,056	0,000	0,002	0,077	0,002	0,649	0,000	0,076	0,000	0,000	0,000
Nationality dad	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	0,038	-0,058	-0,059	-0,047	,195**	,167**	-,086*	-,163**	-0,029	-,081*	-0,036	,221**	,162**	-,082*
	N	0,330	0,137	0,134	0,234	0,000	0,000	0,028	0,000	0,455	0,039	0,353	0,000	0,000	0,037
Siblings_YesNo	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	0,025	-0,063	-0,067	-0,072	,222**	,172**	-,124**	-,180**	-0,053	-,096*	-,095*	,248**	,172**	-,100*
	N	0,517	0,106	0,085	0,066	0,000	0,000	0,001	0,000	0,179	0,014	0,016	0,000	0,000	0,010
Total computers in hh	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	-0,033	0,043	0,064	,091*	-0,038	0,017	,121**	0,058	0,032	,092*	,133**	-0,060	0,017	,134**
	N	0,399	0,267	0,100	0,020	0,332	0,668	0,002	0,140	0,416	0,019	0,001	0,123	0,664	0,001
Total cars in hh	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	-,108**	0,071	0,069	0,064	-,110**	-,088*	0,055	,101*	0,021	,094*	,095*	-0,021	-0,027	,108**
	N	0,006	0,071	0,077	0,104	0,005	0,025	0,157	0,010	0,590	0,017	0,015	0,593	0,491	0,006
Family affluence score	Pearson Correlation	654	654	654	654	654	654	654	654	654	654	654	654	654	654
	Sig. (2-tailed)	-,092*	,099*	0,069	0,057	-,135**	-,089*	0,007	0,039	0,048	-0,007	0,052	0,032	-0,025	0,035
	N	0,018	0,011	0,079	0,145	0,001	0,023	0,860	0,319	0,220	0,851	0,185	0,421	0,524	0,365
		654	654	654	654	654	654	654	654	654	654	654	654	654	654

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

		Gender	Age	Nationality	Injury_YesNo	Attitude_PA_PosNeg	Athletic_Competence	Nationality mom	Nationality dad	Siblings_YesNo	Total computers in hh	Total cars in hh	Family affluence score
SSLOC_Buildings_100m	Pearson Correlation	0,007	-,232**	0,036	-0,033	-0,009	0,027	0,045	0,038	0,025	-0,033	-,108**	-,092*
	Sig. (2-tailed)	0,864	0,000	0,358	0,393	0,810	0,499	0,250	0,330	0,517	0,399	0,006	0,018
	N	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Green_100m	Pearson Correlation	-0,010	0,063	0,005	0,072	0,028	0,037	-0,056	-0,058	-0,063	0,043	0,071	,099*
	Sig. (2-tailed)	0,805	0,107	0,895	0,067	0,474	0,344	0,151	0,137	0,106	0,267	0,071	0,011
	N	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Forest_100m	Pearson Correlation	0,001	,134**	-0,015	-0,001	0,029	0,046	-0,059	-0,059	-0,067	0,064	0,069	0,069
	Sig. (2-tailed)	0,982	0,001	0,704	0,977	0,461	0,242	0,135	0,134	0,085	0,100	0,077	0,079
	N	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Water_100m	Pearson Correlation	-0,008	-0,016	-0,042	-0,005	0,067	-0,019	-0,075	-0,047	-0,072	,091*	0,064	0,057
	Sig. (2-tailed)	0,843	0,675	0,279	0,895	0,088	0,629	0,056	0,234	0,066	0,020	0,104	0,145
	N	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Pedestrian_100m	Pearson Correlation	-0,044	-,132**	0,022	0,021	-0,072	-0,040	,153**	,195**	,222**	-0,038	-,110**	-,135**
	Sig. (2-tailed)	0,258	0,001	0,566	0,591	0,065	0,301	0,000	0,000	0,000	0,332	0,005	0,001
	N	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Crossing_100m	Pearson Correlation	0,006	0,016	0,031	0,061	-0,014	-0,027	,120**	,167**	,172**	0,017	-,088*	-,089*
	Sig. (2-tailed)	0,885	0,689	0,427	0,121	0,729	0,487	0,002	0,000	0,000	0,668	0,025	0,023
	N	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Water500_100m	Pearson Correlation	0,043	-0,070	-0,035	0,003	-0,026	-0,008	-0,069	-,086*	-,124**	,121**	0,055	0,007
	Sig. (2-tailed)	0,277	0,072	0,368	0,934	0,503	0,834	0,077	0,028	0,001	0,002	0,157	0,860
	N	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Green500_100m	Pearson Correlation	-0,030	,111**	-0,055	0,005	0,013	0,035	-,123**	-,163**	-,180**	0,058	,101*	0,039
	Sig. (2-tailed)	0,442	0,004	0,161	0,907	0,738	0,366	0,002	0,000	0,000	0,140	0,010	0,319
	N	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Forest500_100m	Pearson Correlation	0,053	,129**	0,045	-0,009	-,108**	-0,024	0,018	-0,029	-0,053	0,032	0,021	0,048
	Sig. (2-tailed)	0,176	0,001	0,247	0,812	0,006	0,542	0,649	0,455	0,179	0,416	0,590	0,220
	N	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_Green_100m	Pearson Correlation	-,095*	,430**	-0,054	-0,010	-,104**	-0,037	-,139**	-,081*	-,096*	,092*	,094*	-0,007
	Sig. (2-tailed)	0,015	0,000	0,171	0,795	0,008	0,346	0,000	0,039	0,014	0,019	0,017	0,851
	N	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_Forest_100m	Pearson Correlation	-0,063	,643**	-0,049	0,051	-,084*	-,124**	-0,069	-0,036	-,095*	,133**	,095*	0,052
	Sig. (2-tailed)	0,107	0,000	0,209	0,192	0,032	0,002	0,076	0,353	0,016	0,001	0,015	0,185
	N	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_Pedestrian_100m	Pearson Correlation	0,073	,216**	0,065	0,048	-0,005	-0,028	,205**	,221**	,248**	-0,060	-0,021	0,032
	Sig. (2-tailed)	0,064	0,000	0,095	0,218	0,889	0,474	0,000	0,000	0,000	0,123	0,593	0,421
	N	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_Crossing_100m	Pearson Correlation	0,043	,261**	0,004	,113**	0,024	-0,060	,144**	,162**	,172**	0,017	-0,027	-0,025
	Sig. (2-tailed)	0,275	0,000	0,928	0,004	0,535	0,126	0,000	0,000	0,000	0,664	0,491	0,524
	N	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_BikePath_YesNo	Pearson Correlation	-0,064	,484**	-0,051	0,052	-0,049	-0,073	-,142**	-,082*	-,100*	,134**	,108**	0,035
	Sig. (2-tailed)	0,103	0,000	0,194	0,188	0,209	0,063	0,000	0,037	0,010	0,001	0,006	0,365
	N	654	654	654	654	654	654	654	654	654	654	654	654

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

		SSLOC_Buildings_100m	SSLOC_Green_100m	SSLOC_Forest_100m	SSLOC_Water_100m	SSLOC_Pedestrian_100m	SSLOC_Crossing_100m	SSLOC_Water500_100m	SSLOC_Green500_100m	SSLOC_Forest500_100m	SDLOC_Green_100m	SDLOC_Forest_100m	SDLOC_Pedestrian_100m	SDLOC_Crossing_100m	SDLOC_BikePath_YesNo
SSLOC_Buildings_100m	Pearson Correlation	1	-,524**	-,310**	-,198**	,296**	,187**	-0,065	-,436**	-,228**	-,199**	-,173**	,077*	-0,047	-,176**
	Sig. (2-tailed)		0,000	0,000	0,000	0,000	0,000	0,097	0,000	0,000	0,000	0,000	0,050	0,228	0,000
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Green_100m	Pearson Correlation	-,524**	1	,119**	,114**	-,232**	-0,065	,084*	,517**	0,023	,082*	0,013	-0,055	0,060	,136**
	Sig. (2-tailed)	0,000		0,002	0,003	0,000	0,097	0,032	0,000	0,550	0,037	0,744	0,158	0,127	0,001
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Forest_100m	Pearson Correlation	-,310**	,119**	1	-0,004	-,125**	-0,021	0,021	,103**	,511**	0,069	,086*	0,073	,099*	,112**
	Sig. (2-tailed)	0,000	0,002		0,917	0,001	0,583	0,588	0,009	0,000	0,079	0,028	0,062	0,011	0,004
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Water_100m	Pearson Correlation	-,198**	,114**	-0,004	1	-,148**	-,119**	,461**	,218**	-,081*	-0,007	0,047	-,207**	-0,041	0,043
	Sig. (2-tailed)	0,000	0,003	0,917		0,000	0,002	0,000	0,000	0,038	0,850	0,229	0,000	0,289	0,274
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Pedestrian_100m	Pearson Correlation	,296**	-,232**	-,125**	-,148**	1	,634**	-,082*	-,314**	-,083*	-,120**	-,107**	,095*	0,052	0,013
	Sig. (2-tailed)	0,000	0,000	0,001	0,000		0,000	0,036	0,000	0,033	0,002	0,006	0,015	0,183	0,745
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Crossing_100m	Pearson Correlation	,187**	-0,065	-0,021	-,119**	,634**	1	-0,058	-,207**	-,079*	-0,045	-0,039	,112**	0,066	0,026
	Sig. (2-tailed)	0,000	0,097	0,583	0,002	0,000		0,140	0,000	0,043	0,246	0,314	0,004	0,089	0,515
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Water500_100m	Pearson Correlation	-0,065	,084*	0,021	,461**	-,082*	-0,058	1	,251**	-,109**	-0,013	0,016	-,293**	-,099*	-0,004
	Sig. (2-tailed)	0,097	0,032	0,588	0,000	0,036	0,140		0,000	0,005	0,747	0,683	0,000	0,011	0,910
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Green500_100m	Pearson Correlation	-,436**	,517**	,103**	,218**	-,314**	-,207**	,251**	1	0,023	,186**	,100*	-,220**	-0,044	0,064
	Sig. (2-tailed)	0,000	0,000	0,009	0,000	0,000	0,000	0,000		0,550	0,000	0,010	0,000	0,260	0,105
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SSLOC_Forest500_100m	Pearson Correlation	-,228**	0,023	,511**	-,081*	-,083*	-,079*	-,109**	0,023	1	,084*	0,017	,097*	0,039	,084*
	Sig. (2-tailed)	0,000	0,550	0,000	0,038	0,033	0,043	0,005	0,550		0,031	0,656	0,013	0,322	0,031
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_Green_100m	Pearson Correlation	-,199**	,082*	0,069	-0,007	-,120**	-0,045	-0,013	,186**	,084*	1	,381**	-,239**	-,080*	,479**
	Sig. (2-tailed)	0,000	0,037	0,079	0,850	0,002	0,246	0,747	0,000	0,031		0,000	0,000	0,041	0,000
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_Forest_100m	Pearson Correlation	-,173**	0,013	,086*	0,047	-,107**	-0,039	0,016	,100*	0,017	,381**	1	,209**	,407**	,477**
	Sig. (2-tailed)	0,000	0,744	0,028	0,229	0,006	0,314	0,683	0,010	0,656	0,000		0,000	0,000	0,000
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_Pedestrian_100m	Pearson Correlation	,077*	-0,055	0,073	-,207**	,095*	,112**	-,293**	-,220**	,097*	-,239**	,209**	1	,616**	-0,030
	Sig. (2-tailed)	0,050	0,158	0,062	0,000	0,015	0,004	0,000	0,000	0,013	0,000	0,000		0,000	0,446
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_Crossing_100m	Pearson Correlation	-0,047	0,060	,099*	-0,041	0,052	0,066	-,099*	-0,044	0,039	-,080*	,407**	,616**	1	,360**
	Sig. (2-tailed)	0,228	0,127	0,011	0,289	0,183	0,089	0,011	0,260	0,322	0,041	0,000	0,000		0,000
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654
SDLOC_BikePath_YesNo	Pearson Correlation	-,176**	,136**	,112**	0,043	0,013	0,026	-0,004	0,064	,084*	,479**	,477**	-0,030	,360**	1
	Sig. (2-tailed)	0,000	0,001	0,004	0,274	0,745	0,515	0,910	0,105	0,031	0,000	0,000	0,446	0,000	
	N	654	654	654	654	654	654	654	654	654	654	654	654	654	654

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D: OUTCOMES MULTINOMIAL LOGISTIC REGRESSION

LOGISTIC REGRESSION - PARAMETER ESTIMATES									
								95% Confidence Interval for Exp(B)	
TravelMode_ToSchool_cat[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	Lower Bound	Upper Bound
by bus	Intercept	-18,421	39,377	0,219	1	0,640			
	[Gender=0]	0,041	0,513	0,006	1	0,936	1,042	0,381	2,844
	[Gender=1]	0[b]			0				
	[Age=9]	-7,113	27,627	0,066	1	0,797	0,001	2,485E-27	267171498698392000000,000
	[Age=10]	-1,416	2,480	0,326	1	0,568	0,243	0,002	31,325
	[Age=11]	-0,822	2,424	0,115	1	0,735	0,440	0,004	50,837
	[Age=12]	-1,810	2,320	0,608	1	0,435	0,164	0,002	15,453
	[Age=13]	-0,039	2,271	0,000	1	0,986	0,962	0,011	82,426
	[Age=14]	0[b]			0				
	[Nationality=0]	0,116	1,266	0,008	1	0,927	1,123	0,094	13,436
	[Nationality=1]	0[b]			0				
	[Injury_YesNo=,00]	0,175	0,685	0,066	1	0,798	1,192	0,311	4,565
	[Injury_YesNo=1,00]	0[b]			0				
	[Attitude_PA_PosNeg=,00]	-0,677	0,792	0,731	1	0,393	0,508	0,108	2,400
	[Attitude_PA_PosNeg=1,00]	0[b]			0				
	[Ath_Comp_BAD_dum=,00]	-0,156	1,065	0,022	1	0,883	0,855	0,106	6,890
	[Ath_Comp_BAD_dum=1,00]	0[b]			0				
	[Ath_Comp_GOOD_dum=,00]	-0,331	0,767	0,187	1	0,666	0,718	0,160	3,230
	[Ath_Comp_GOOD_dum=1,00]	0[b]			0				
	[Nationality mom=0]	1,074	19,225	0,003	1	0,955	2,928	1,265E-16	67748329323890500,000
	[Nationality mom=1]	1,186	19,239	0,004	1	0,951	3,275	1,377E-16	77886679768922200,000
	[Nationality mom=2]	0[b]			0				
	[Siblings_YesNo=,00]	1,252	0,897	1,947	1	0,163	3,496	0,603	20,281
	[Siblings_YesNo=1,00]	0[b]			0				
	[FAS_LOW_dum=,00]	1,669	1,204	1,922	1	0,166	5,307	0,501	56,169
	[FAS_LOW_dum=1,00]	0[b]			0				
	[FAS_HIGH_dum=,00]	-0,601	0,582	1,065	1	0,302	0,548	0,175	1,716
	[FAS_HIGH_dum=1,00]	0[b]			0				
	[Cars_hh_none=,00]	-0,944	0,961	0,964	1	0,326	0,389	0,059	2,559
	[Cars_hh_none=1,00]	0[b]			0				
	[Cars_hh_two=,00]	0,381	0,604	0,399	1	0,528	1,464	0,449	4,779
	[Cars_hh_two=1,00]	0[b]			0				
	[Comp_hh_NoneOrOne=,00]	-0,492	1,341	0,135	1	0,714	0,611	0,044	8,470
	[Comp_hh_NoneOrOne=1,00]	0[b]			0				
	[Comp_hh_three=,00]	0,652	0,733	0,789	1	0,374	1,919	0,456	8,078
	[Comp_hh_three=1,00]	0[b]			0				
	[SSLOC_Perc_Build_5to15_dum=,00]	-0,739	1,652	0,200	1	0,655	0,477	0,019	12,171
	[SSLOC_Perc_Build_5to15_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Build_15to25_dum=,00]	0,540	1,752	0,095	1	0,758	1,715	0,055	53,135
	[SSLOC_Perc_Build_15to25_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Build_above25_dum=,00]	0,765	1,977	0,150	1	0,699	2,150	0,045	103,646
	[SSLOC_Perc_Build_above25_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Green_5to15_dum=,00]	0,104	0,663	0,025	1	0,875	1,110	0,303	4,068
	[SSLOC_Perc_Green_5to15_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Green_15to25_dum=,00]	-0,650	0,768	0,718	1	0,397	0,522	0,116	2,349
	[SSLOC_Perc_Green_15to25_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Green_above25_dum=,00]	1,784	1,260	2,005	1	0,157	5,954	0,504	70,333
	[SSLOC_Perc_Green_above25_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Forest_5to15_dum=,00]	0,748	0,911	0,673	1	0,412	2,112	0,354	12,593
	[SSLOC_Perc_Forest_5to15_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Forest_15to25_dum=,00]	3,910	4,553	0,738	1	0,390	49,919	0,007	375041,261
	[SSLOC_Perc_Forest_15to25_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Forest_above25_dum=,00]	1,690	6,660	0,064	1	0,800	5,417	1,161E-05	2527658,927
	[SSLOC_Perc_Forest_above25_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Pedes_5to15_dum=,00]	-0,892	1,302	0,469	1	0,493	0,410	0,032	5,261
	[SSLOC_Perc_Pedes_5to15_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Pedes_15to25_dum=,00]	-0,541	1,463	0,137	1	0,711	0,582	0,033	10,232

_dum=,00]								
[SSLOC_Perc_Pedes_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Pedes_above25_dum=,00]	3,045	6,308	0,233	1	0,629	21,017	8,975E-05	4921206,578
[SSLOC_Perc_Pedes_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_1to5_dum=,00]	0,087	0,877	0,010	1	0,921	1,091	0,196	6,088
[SSLOC_Perc_Water_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_5to15_dum=,00]	2,027	1,037	3,817	1	0,051	7,589	0,993	57,966
[SSLOC_Perc_Water_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_above15_dum=,00]	3,245	1,574	4,248	1	0,039	25,659	1,173	561,495
[SSLOC_Perc_Water_above15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_1to5_dum=,00]	0,468	0,592	0,626	1	0,429	1,597	0,500	5,099
[SSLOC_Perc_Crossing_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_5to15_dum=,00]	0,561	31,984	0,000	1	0,986	1,753	1,046E-27	2939593285607250000000000000,000
[SSLOC_Perc_Crossing_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_above15_dum=,00]	0[b]			0				
[SSLOC_Perc_Green500_5to15_dum=,00]	0,337	1,210	0,078	1	0,781	1,401	0,131	14,999
[SSLOC_Perc_Green500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green500_15to25_dum=,00]	1,542	1,300	1,405	1	0,236	4,672	0,365	59,760
[SSLOC_Perc_Green500_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green500_above25_dum=,00]	1,187	1,437	0,683	1	0,409	3,278	0,196	54,754
[SSLOC_Perc_Green500_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_5to15_dum=,00]	1,335	0,737	3,275	1	0,070	3,798	0,895	16,118
[SSLOC_Perc_Forest500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_15to25_dum=,00]	2,257	3,049	0,548	1	0,459	9,559	0,024	3766,659
[SSLOC_Perc_Forest500_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_above25_dum=,00]	-2,998	3,236	0,858	1	0,354	0,050	8,787E-05	28,343
[SSLOC_Perc_Forest500_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_1to5_dum=,00]	0,120	0,643	0,035	1	0,852	1,128	0,320	3,976
[SSLOC_Perc_Water500_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_5to15_dum=,00]	-1,961	0,782	6,295	1	0,012	0,141	0,030	0,651
[SSLOC_Perc_Water500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_above15_dum=,00]	-2,013	1,085	3,442	1	0,064	0,134	0,016	1,120
[SSLOC_Perc_Water500_above15_dum=1,00]	0[b]			0				
[SDLOC_Perc_Green_under5_dum=,00]	-0,036	1,174	0,001	1	0,975	0,964	0,097	9,632
[SDLOC_Perc_Green_under5_dum=1,00]	0[b]			0				
[SDLOC_Perc_Green_above15_dum=,00]	-1,505	1,433	1,103	1	0,294	0,222	0,013	3,682
[SDLOC_Perc_Green_above15_dum=1,00]	0[b]			0				
[SDLOC_Perc_Forest_under1_dum=,00]	1,993	1,568	1,616	1	0,204	7,339	0,340	158,600
[SDLOC_Perc_Forest_under1_dum=1,00]	0[b]			0				
[SDLOC_Perc_Forest_above3_dum=,00]	-2,004	1,757	1,301	1	0,254	0,135	0,004	4,221
[SDLOC_Perc_Forest_above3_dum=1,00]	0[b]			0				
[SDLOC_Perc_Crossing_under1_dum=,00]	0,769	0,947	0,658	1	0,417	2,157	0,337	13,806
[SDLOC_Perc_Crossing_under1_dum=1,00]	0[b]			0				
[SDLOC_Perc_Crossing_above3_dum=,00]	-0,279	0,659	0,179	1	0,672	0,757	0,208	2,754
[SDLOC_Perc_Crossing_above3_dum=1,00]	0[b]			0				
[SDLOC_BikePath_YesNo=,00]	3,121	1,883	2,748	1	0,097	22,679	0,566	908,960
[SDLOC_BikePath_YesNo=1,00]	0[b]			0				

a. The reference category is: by car.

b. This parameter is set to zero because it is redundant.

c. Floating point overflow occurred while computing this statistic. Its value is therefore set to system missing.

LOGISTIC REGRESSION - PARAMETER ESTIMATES (BY BIKE)

TravelMode_ToSchool_cat[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	Interval for Exp(B)	
								Lower Bound	Upper Bound
by bike	Intercept	11,377	19,647	0,335	1	0,563			
	[Gender=0]	-0,378	0,338	1,254	1	0,263	0,685	0,354	1,328
	[Gender=1]	0[b]			0				
	[Age=9]	-13,307	36,321	0,134	1	0,714	1,663E-06	2,014E-37	###########
	[Age=10]	-3,232	1,976	2,675	1	0,102	0,039	0,001	1,898
	[Age=11]	-2,756	1,980	1,938	1	0,164	0,064	0,001	3,077
	[Age=12]	-3,209	1,940	2,737	1	0,098	0,040	0,001	1,808
	[Age=13]	-2,150	1,933	1,236	1	0,266	0,117	0,003	5,154
	[Age=14]	0[b]			0				
	[Nationality=0]	-0,262	0,739	0,126	1	0,722	0,769	0,181	3,271
	[Nationality=1]	0[b]			0				
	[Injury_YesNo=,00]	-0,367	0,443	0,685	1	0,408	0,693	0,291	1,652
	[Injury_YesNo=1,00]	0[b]			0				
	[Attitude_PA_PosNeg=,00]	-0,961	0,513	3,509	1	0,061	0,383	0,140	1,045
	[Attitude_PA_PosNeg=1,00]	0[b]			0				
	[Ath_Comp_BAD_dum=,00]	1,927	0,738	6,819	1	0,009	6,867	1,617	29,159
	[Ath_Comp_BAD_dum=1,00]	0[b]			0				
	[Ath_Comp_GOOD_dum=,00]	0,691	0,488	2,007	1	0,157	1,996	0,767	5,194
	[Ath_Comp_GOOD_dum=1,00]	0[b]			0				
	[Nationality mom=0]	0,300	11,848	0,001	1	0,980	1,350	1,109E-10	###########
	[Nationality mom=1]	1,012	11,851	0,007	1	0,932	2,752	2,248E-10	###########
	[Nationality mom=2]	0[b]			0				
	[Siblings_YesNo=,00]	1,037	0,529	3,845	1	0,050	2,820	1,000	7,947
	[Siblings_YesNo=1,00]	0[b]			0				
	[FAS_LOW_dum=,00]	0,843	0,735	1,316	1	0,251	2,324	0,550	9,818
	[FAS_LOW_dum=1,00]	0[b]			0				
	[FAS_HIGH_dum=,00]	-0,410	0,393	1,091	1	0,296	0,663	0,307	1,433
	[FAS_HIGH_dum=1,00]	0[b]			0				
	[Cars_hh_none=,00]	-0,100	0,670	0,022	1	0,881	0,905	0,244	3,361
	[Cars_hh_none=1,00]	0[b]			0				
	[Cars_hh_two=,00]	0,440	0,377	1,357	1	0,244	1,552	0,741	3,253
	[Cars_hh_two=1,00]	0[b]			0				
	[Comp_hh_NoneOrOne=,00]	-0,872	0,887	0,966	1	0,326	0,418	0,073	2,380
	[Comp_hh_NoneOrOne=1,00]	0[b]			0				
	[Comp_hh_three=,00]	0,391	0,456	0,734	1	0,392	1,479	0,604	3,617
	[Comp_hh_three=1,00]	0[b]			0				
	[SSLOC_Perc_Build_5to15_dum=,00]	-0,588	1,096	0,287	1	0,592	0,556	0,065	4,763
	[SSLOC_Perc_Build_5to15_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Build_15to25	-0,557	1,136	0,241	1	0,624	0,573	0,062	5,305

_dum=,00]								
[SSLOC_Perc_Build_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Build_above25_dum=,00]	-0,488	1,224	0,159	1	0,690	0,614	0,056	6,767
[SSLOC_Perc_Build_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green_5to15_dum=,00]	-0,037	0,415	0,008	1	0,928	0,963	0,427	2,171
[SSLOC_Perc_Green_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green_15to25_dum=,00]	0,013	0,563	0,001	1	0,982	1,013	0,336	3,055
[SSLOC_Perc_Green_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green_above25_dum=,00]	-0,507	0,777	0,426	1	0,514	0,602	0,131	2,762
[SSLOC_Perc_Green_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest_5to15_dum=,00]	1,888	0,619	9,310	1	0,002	6,608	1,965	22,228
[SSLOC_Perc_Forest_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest_15to25_dum=,00]	1,220	1,321	0,854	1	0,356	3,389	0,254	45,119
[SSLOC_Perc_Forest_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest_above25_dum=,00]	-0,913	4,213	0,047	1	0,828	0,401	0,000	1546,691
[SSLOC_Perc_Forest_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Pedes_5to15_dum=,00]	-0,805	0,893	0,813	1	0,367	0,447	0,078	2,573
[SSLOC_Perc_Pedes_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Pedes_15to25_dum=,00]	-1,215	0,999	1,478	1	0,224	0,297	0,042	2,104
[SSLOC_Perc_Pedes_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Pedes_above25_dum=,00]	0,182	1,664	0,012	1	0,913	1,200	0,046	31,273
[SSLOC_Perc_Pedes_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_1to5_dum=,00]	0,080	0,572	0,020	1	0,889	1,083	0,353	3,322
[SSLOC_Perc_Water_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_5to15_dum=,00]	0,490	0,599	0,670	1	0,413	1,633	0,505	5,281
[SSLOC_Perc_Water_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_above15_dum=,00]	1,064	0,971	1,199	1	0,274	2,897	0,432	19,436
[SSLOC_Perc_Water_above15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_1to5_dum=,00]	0,446	0,398	1,256	1	0,262	1,562	0,716	3,406
[SSLOC_Perc_Crossing_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_5to15_dum=,00]	-6,371	14,167	0,202	1	0,653	0,002	1,493E-15	###########

15_dum=1,00]								
[SSLOC_Perc_Crossing_above15_dum=,00]	0[b]			0				
[SSLOC_Perc_Green500_5to15_dum=,00]	0,148	0,735	0,040	1	0,841	1,159	0,275	4,895
[SSLOC_Perc_Green500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green500_15to25_dum=,00]	0,692	0,785	0,777	1	0,378	1,999	0,429	9,316
[SSLOC_Perc_Green500_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green500_above25_dum=,00]	0,722	0,918	0,618	1	0,432	2,058	0,341	12,433
[SSLOC_Perc_Green500_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_5to15_dum=,00]	0,710	0,492	2,084	1	0,149	2,034	0,776	5,334
[SSLOC_Perc_Forest500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_15to25_dum=,00]	-0,512	1,272	0,162	1	0,687	0,599	0,049	7,252
[SSLOC_Perc_Forest500_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_above25_dum=,00]	-4,531	2,875	2,483	1	0,115	0,011	3,843E-05	3,019
[SSLOC_Perc_Forest500_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_1to5_dum=,00]	0,488	0,411	1,410	1	0,235	1,629	0,728	3,645
[SSLOC_Perc_Water500_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_5to15_dum=,00]	-0,598	0,548	1,190	1	0,275	0,550	0,188	1,610
[SSLOC_Perc_Water500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_above15_dum=,00]	-0,177	0,774	0,052	1	0,819	0,838	0,184	3,819
[SSLOC_Perc_Water500_above15_dum=1,00]	0[b]			0				
[SDLOC_Perc_Green_under5_dum=,00]	1,144	0,600	3,641	1	0,056	3,140	0,969	10,171
[SDLOC_Perc_Green_under5_dum=1,00]	0[b]			0				
[SDLOC_Perc_Green_above15_dum=,00]	0,276	0,697	0,157	1	0,692	1,318	0,336	5,168
[SDLOC_Perc_Green_above15_dum=1,00]	0[b]			0				
[SDLOC_Perc_Forest_under1_dum=,00]	0,261	0,671	0,151	1	0,698	1,298	0,348	4,835
[SDLOC_Perc_Forest_under1_dum=1,00]	0[b]			0				
[SDLOC_Perc_Forest_above3_dum=,00]	-1,684	0,871	3,734	1	0,053	0,186	0,034	1,024
[SDLOC_Perc_Forest_above3_dum=1,00]	0[b]			0				
[SDLOC_Perc_Crossing_under1_dum=,00]	-0,599	0,500	1,433	1	0,231	0,550	0,206	1,465
[SDLOC_Perc_Crossing_under1_dum=1,00]	0[b]			0				
[SDLOC_Perc_Crossing_above3_dum=,00]	-0,276	0,480	0,331	1	0,565	0,759	0,296	1,944
[SDLOC_Perc_Crossing_above3_dum=1,00]	0[b]			0				
[SDLOC_BikePath_YesNo=,00]	-0,217	0,656	0,110	1	0,740	0,805	0,223	2,909
[SDLOC_BikePath_YesNo=1,00]	0[b]			0				

a. The reference category is: by car.

b. This parameter is set to zero because it is redundant.

c. Floating point overflow occurred while computing this statistic. Its value is therefore set to system missing.

LOGISTIC REGRESSION - PARAMETER ESTIMATES (BY FOOT)									
								for Exp(B)	
TravelMode_ToSchool_cat[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	Lower Bound	Upper Bound
by foot	Intercept	0,424	22,360	0,000	1	0,985			
	[Gender=0]	-0,057	0,370	0,023	1	0,878	0,945	0,457	1,952
	[Gender=1]	0[b]			0				
	[Age=9]	-21,708	7437,786	0,000	1	0,998	3,736E-10	0,000	.[c]
	[Age=10]	-1,997	2,129	0,880	1	0,348	0,136	0,002	8,810
	[Age=11]	-1,544	2,134	0,524	1	0,469	0,213	0,003	13,984
	[Age=12]	-3,689	2,115	3,042	1	0,081	0,025	0,000	1,579
	[Age=13]	-2,952	2,101	1,974	1	0,160	0,052	0,001	3,208
	[Age=14]	0[b]			0				
	[Nationality=0]	-1,247	0,765	2,653	1	0,103	0,287	0,064	1,289
	[Nationality=1]	0[b]			0				
	[Injury_YesNo=,00]	-1,044	0,476	4,800	1	0,028	0,352	0,138	0,896
	[Injury_YesNo=1,00]	0[b]			0				
	[Attitude_PA_PosNeg=,00]	-0,888	0,600	2,191	1	0,139	0,412	0,127	1,333
	[Attitude_PA_PosNeg=1,00]	0[b]			0				
	[Ath_Comp_BAD_dum=,00]	1,341	0,895	2,245	1	0,134	3,822	0,662	22,084
	[Ath_Comp_BAD_dum=1,00]	0[b]			0				
	[Ath_Comp_GOOD_dum=,00]	0,384	0,538	0,510	1	0,475	1,468	0,512	4,214
	[Ath_Comp_GOOD_dum=1,00]	0[b]			0				
	[Nationality mom=0]	3,207	14,327	0,050	1	0,823	24,693	1,576E-11	############
	[Nationality mom=1]	3,066	14,330	0,046	1	0,831	21,460	1,361E-11	############
	[Nationality mom=2]	0[b]			0				
	[Siblings_YesNo=,00]	0,267	0,571	0,218	1	0,641	1,305	0,426	3,996
	[Siblings_YesNo=1,00]	0[b]			0				
	[FAS_LOW_dum=,00]	0,473	0,811	0,340	1	0,560	1,605	0,327	7,868
	[FAS_LOW_dum=1,00]	0[b]			0				
	[FAS_HIGH_dum=,00]	-0,402	0,452	0,792	1	0,373	0,669	0,276	1,621
	[FAS_HIGH_dum=1,00]	0[b]			0				
	[Cars_hh_none=,00]	-0,238	0,700	0,115	1	0,734	0,788	0,200	3,107
	[Cars_hh_none=1,00]	0[b]			0				
	[Cars_hh_two=,00]	0,881	0,422	4,364	1	0,037	2,414	1,056	5,520
	[Cars_hh_two=1,00]	0[b]			0				
	[Comp_hh_NoneOrOne=,00]	-0,795	0,929	0,732	1	0,392	0,452	0,073	2,790
	[Comp_hh_NoneOrOne=1,00]	0[b]			0				
	[Comp_hh_three=,00]	0,377	0,495	0,581	1	0,446	1,458	0,553	3,843
	[Comp_hh_three=1,00]	0[b]			0				
	[SSLOC_Perc_Build_5to15_dum=,00]	-1,223	1,619	0,570	1	0,450	0,294	0,012	7,035
	[SSLOC_Perc_Build_5to15_dum=1,00]	0[b]			0				
	[SSLOC_Perc_Build_15to25_dum=,00]	-1,071	1,654	0,419	1	0,517	0,343	0,013	8,768
	[SSLOC_Perc_Build_15to25_du	0[b]			0				

m=1,00]								
[SSLOC_Perc_Build_above25_dum=,00]	-1,585	1,730	0,839	1	0,360	0,205	0,007	6,082
[SSLOC_Perc_Build_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green_5to15_dum=,00]	-0,403	0,464	0,752	1	0,386	0,669	0,269	1,661
[SSLOC_Perc_Green_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green_15to25_dum=,00]	0,177	0,665	0,071	1	0,790	1,194	0,324	4,392
[SSLOC_Perc_Green_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green_above25_dum=,00]	0,364	1,005	0,131	1	0,717	1,439	0,201	10,309
[SSLOC_Perc_Green_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest_5to15_dum=,00]	1,944	0,883	4,848	1	0,028	6,984	1,238	39,406
[SSLOC_Perc_Forest_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest_15to25_dum=,00]	1,313	2,841	0,214	1	0,644	3,716	0,014	973,655
[SSLOC_Perc_Forest_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest_above25_dum=,00]	-0,582	5,499	0,011	1	0,916	0,559	1,166E-05	26781,682
[SSLOC_Perc_Forest_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Pedes_5to15_dum=,00]	-1,024	1,062	0,930	1	0,335	0,359	0,045	2,880
[SSLOC_Perc_Pedes_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Pedes_15to25_dum=,00]	-1,341	1,177	1,299	1	0,254	0,262	0,026	2,626
[SSLOC_Perc_Pedes_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Pedes_above25_dum=,00]	3,576	3,783	0,894	1	0,345	35,735	0,022	59331,151
[SSLOC_Perc_Pedes_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_1to5_dum=,00]	0,265	0,664	0,159	1	0,690	1,303	0,355	4,783
[SSLOC_Perc_Water_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_5to15_dum=,00]	0,949	0,699	1,843	1	0,175	2,584	0,656	10,178
[SSLOC_Perc_Water_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_above15_dum=,00]	3,535	2,156	2,688	1	0,101	34,304	0,501	2348,298
[SSLOC_Perc_Water_above15_	0[b]			0				

[SSLOC_Perc_Water_above15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_1to5_dum=,00]	0,274	0,453	0,365	1	0,546	1,315	0,541	3,194
[SSLOC_Perc_Crossing_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_5to15_dum=,00]	-4,476	14,225	0,099	1	0,753	0,011	8,860E-15	############
[SSLOC_Perc_Crossing_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_above15_dum=,00]	0[b]			0				
[SSLOC_Perc_Green500_5to15_dum=,00]	0,051	0,818	0,004	1	0,950	1,053	0,212	5,233
[SSLOC_Perc_Green500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green500_15to25_dum=,00]	0,765	0,888	0,742	1	0,389	2,149	0,377	12,237
[SSLOC_Perc_Green500_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green500_above25_dum=,00]	0,750	1,043	0,516	1	0,472	2,116	0,274	16,346
[SSLOC_Perc_Green500_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_5to15_dum=,00]	0,129	0,584	0,049	1	0,826	1,137	0,362	3,571
[SSLOC_Perc_Forest500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_15to25_dum=,00]	0,291	1,551	0,035	1	0,851	1,338	0,064	27,997
[SSLOC_Perc_Forest500_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_above25_dum=,00]	-2,627	3,074	0,731	1	0,393	0,072	0,000	29,873
[SSLOC_Perc_Forest500_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_1to5_dum=,00]	-0,357	0,454	0,618	1	0,432	0,700	0,288	1,704

[SSLOC_Perc_Water500_1to5_	0b	0

LOGISTIC REGRESSION - PARAMETER ESTIMATES (BY OTHER)

TravelMode_ToSchool_cat[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B) Lower Bound	Upper Bound
Other	Intercept	-0,124	28,106	0,000	1	0,996			
	[Gender=0]	-0,560	0,548	1,045	1	0,307	0,571	0,195	1,672
	[Gender=1]	0b			0				
	[Age=9]	-21,991	0,000		1		2,815E-10	2,815E-10	2,815E-10
	[Age=10]	-3,748	2,134	3,086	1	0,079	0,024	0,000	1,543
	[Age=11]	-3,524	2,175	2,626	1	0,105	0,029	0,000	2,092
	[Age=12]	-3,739	2,046	3,339	1	0,068	0,024	0,000	1,312
	[Age=13]	-3,960	2,056	3,709	1	0,054	0,019	0,000	1,072
	[Age=14]	0b			0				
	[Nationality=0]	-2,357	0,950	6,162	1	0,013	0,095	0,015	0,609
	[Nationality=1]	0b			0				
	[Injury_YesNo=,00]	-0,122	0,748	0,026	1	0,871	0,886	0,204	3,838
	[Injury_YesNo=1,00]	0b			0				
	[Attitude_PA_PosNeg=,00]	-2,601	1,101	5,576	1	0,018	0,074	0,009	0,643
	[Attitude_PA_PosNeg=1,00]	0b			0				
	[Ath_Comp_BAD_dum=,00]	4,512	2,111	4,567	1	0,033	91,072	1,453	5707,273
	[Ath_Comp_BAD_dum=1,00]	0b			0				
	[Ath_Comp_GOOD_dum=,00]	1,583	0,682	5,393	1	0,020	4,870	1,280	18,524
	[Ath_Comp_GOOD_dum=1,00]	0b			0				
	[Nationality mom=0]	4,658	19,685	0,056	1	0,813	105,413	1,851E-15	6003690243726240000,000
	[Nationality mom=1]	5,248	19,693	0,071	1	0,790	190,269	3,287E-15	11013041615145000000,000
	[Nationality mom=2]	0b			0				
	[Siblings_YesNo=,00]	1,449	0,841	2,965	1	0,085	4,258	0,819	22,146
	[Siblings_YesNo=1,00]	0b			0				
	[FAS_LOW_dum=,00]	0,155	1,174	0,017	1	0,895	1,168	0,117	11,666
	[FAS_LOW_dum=1,00]	0b			0				
	[FAS_HIGH_dum=,00]	-0,305	0,633	0,232	1	0,630	0,737	0,213	2,549
	[FAS_HIGH_dum=1,00]	0b			0				
	[Cars_hh_none=,00]	-0,275	1,020	0,073	1	0,787	0,759	0,103	5,608
	[Cars_hh_none=1,00]	0b			0				
	[Cars_hh_two=,00]	0,159	0,609	0,068	1	0,794	1,172	0,356	3,864
	[Cars_hh_two=1,00]	0b			0				
	[Comp_hh_NoneOrOne=,00]	-0,039	1,463	0,001	1	0,979	0,962	0,055	16,930
	[Comp_hh_NoneOrOne=1,00]	0b			0				
	[Comp_hh_three=,00]	0,802	0,744	1,163	1	0,281	2,230	0,519	9,582
	[Comp_hh_three=1,00]	0b			0				
	[SSLOC_Perc_Build_5to15_dum=,00]	-2,621	3,302	0,630	1	0,427	0,073	0,000	46,997

a

b … s redundant.

c. Floating point overflow occurred while computing this statistic. Its value is therefore set to system missing.

[SSLOC_Perc_Build_5to15_dum=1,00]	0b			0				
[SSLOC_Perc_Build_15to25_dum=,00]	-1,279	3,328	0,148	1	0,701	0,278	0,000	189,389
[SSLOC_Perc_Build_15to25_dum=1,00]	0b			0				
[SSLOC_Perc_Build_above25_dum=,00]	-1,578	3,436	0,211	1	0,646	0,206	0,000	173,449
[SSLOC_Perc_Build_above25_dum=1,00]	0b			0				
[SSLOC_Perc_Green_5to15_dum=,00]	-0,574	0,666	0,744	1	0,388	0,563	0,153	2,076
[SSLOC_Perc_Green_5to15_dum=1,00]	0b			0				
[SSLOC_Perc_Green_15to25_dum=,00]	0,182	0,909	0,040	1	0,842	1,199	0,202	7,117
[SSLOC_Perc_Green_15to25_dum=1,00]	0b			0				
[SSLOC_Perc_Green_above25_dum=,00]	-0,237	1,198	0,039	1	0,843	0,789	0,075	8,262
[SSLOC_Perc_Green_above25_dum=1,00]	0b			0				
[SSLOC_Perc_Forest_5to15_dum=,00]	1,360	0,866	2,463	1	0,117	3,894	0,713	21,276
[SSLOC_Perc_Forest_5to15_dum=1,00]	0b			0				
[SSLOC_Perc_Forest_15to25_dum=,00]	2,081	2,006	1,076	1	0,300	8,016	0,157	408,920
[SSLOC_Perc_Forest_15to25_dum=1,00]	0b			0				
[SSLOC_Perc_Forest_above25_dum=,00]	1,530	6,106	0,063	1	0,802	4,617	2,931E-05	727107,087
[SSLOC_Perc_Forest_above25_dum=1,00]	0b			0				
[SSLOC_Perc_Pedes_5to15_dum=,00]	-2,402	2,579	0,867	1	0,352	0,091	0,001	14,190
[SSLOC_Perc_Pedes_5to15_dum=1,00]	0b			0				
[SSLOC_Perc_Pedes_15to25_dum=,00]	-2,598	2,673	0,945	1	0,331	0,074	0,000	14,017
[SSLOC_Perc_Pedes_15to25_dum=1,00]	0b			0				
[SSLOC_Perc_Pedes_above25	2,162	7,434	0,085	1	0,771	8,684	4,080E-06	18485793,495

[SSLOC_Perc_Pedes_above25_dum=,00]	2,162	7,434	0,085	1	0,771	8,684	4,080E-06	18485793,495
[SSLOC_Perc_Pedes_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_1to5_dum=,00]	0,651	0,999	0,425	1	0,515	1,918	0,270	13,600
[SSLOC_Perc_Water_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_5to15_dum=,00]	0,113	0,883	0,016	1	0,898	1,120	0,198	6,327
[SSLOC_Perc_Water_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water_above15_dum=,00]	1,777	1,592	1,246	1	0,264	5,913	0,261	134,034
[SSLOC_Perc_Water_above15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_1to5_dum=,00]	0,509	0,627	0,660	1	0,417	1,664	0,487	5,685
[SSLOC_Perc_Crossing_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_5to15_dum=,00]	-5,605	14,296	0,154	1	0,695	0,004	2,494E-15	5428845507,689
[SSLOC_Perc_Crossing_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Crossing_above15_dum=,00]	0[b]			0				
[SSLOC_Perc_Green500_5to15_dum=,00]	0,612	1,139	0,289	1	0,591	1,844	0,198	17,177
[SSLOC_Perc_Green500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green500_15to25_dum=,00]	1,348	1,241	1,180	1	0,277	3,850	0,338	43,854
[SSLOC_Perc_Green500_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Green500_above25_dum=,00]	2,200	1,402	2,462	1	0,117	9,024	0,578	140,881
[SSLOC_Perc_Green500_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_5to15_dum=,00]	1,178	0,798	2,179	1	0,140	3,249	0,680	15,536
[SSLOC_Perc_Forest500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_15t	-0,231	1,756	0,017	1	0,895	0,794	0,025	24,810

[SSLOC_Perc_Forest500_15to25_dum=,00]	-0,231	1,756	0,017	1	0,895	0,794	0,025	24,810
[SSLOC_Perc_Forest500_15to25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Forest500_above25_dum=,00]	-4,523	3,055	2,192	1	0,139	0,011	2,724E-05	4,326
[SSLOC_Perc_Forest500_above25_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_1to5_dum=,00]	-0,498	0,683	0,531	1	0,466	0,608	0,159	2,320
[SSLOC_Perc_Water500_1to5_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_5to15_dum=,00]	-0,819	0,917	0,798	1	0,372	0,441	0,073	2,660
[SSLOC_Perc_Water500_5to15_dum=1,00]	0[b]			0				
[SSLOC_Perc_Water500_above15_dum=,00]	-2,147	1,114	3,717	1	0,054	0,117	0,013	1,036
[SSLOC_Perc_Water500_above15_dum=1,00]	0[b]			0				
[SDLOC_Perc_Green_under5_dum=,00]	0,043	1,255	0,001	1	0,973	1,044	0,089	12,225
[SDLOC_Perc_Green_under5_dum=1,00]	0[b]			0				
[SDLOC_Perc_Green_above15_dum=,00]	-2,051	1,284	2,551	1	0,110	0,129	0,010	1,594
[SDLOC_Perc_Green_above15_dum=1,00]	0[b]			0				
[SDLOC_Perc_Forest_under1_dum=,00]	1,895	1,304	2,113	1	0,146	6,656	0,517	85,723
[SDLOC_Perc_Forest_under1_dum=1,00]	0[b]			0				
[SDLOC_Perc_Forest_above3_dum=,00]	-1,005	1,428	0,496	1	0,481	0,366	0,022	6,014
[SDLOC_Perc_Forest_above3_dum=1,00]	0[b]			0				
[SDLOC_Perc_Crossing_under1_dum=,00]	0,390	0,848	0,211	1	0,646	1,477	0,280	7,776
[SDLOC_Perc_Crossing_under1_dum=1,00]	0[b]			0				
[SDLOC_Perc_Crossing_above3_dum=,00]	1,466	0,711	4,246	1	0,039	4,331	1,074	17,460
[SDLOC_Perc_Crossing_above3_dum=1,00]	0[b]			0				
[SDLOC_BikePath_YesNo=,00]	1,046	1,309	0,638	1	0,424	2,845	0,219	37,018
[SDLOC_BikePath_YesNo=1,00]	0[b]			0				

a. The reference category is: by car.

b. This parameter is set to zero because it is redundant.

c. Floating point overflow occurred while computing this statistic. Its value is therefore set to system missing.

APPENDIX E: OUTCOMES MULTIPLE LINEAR REGRESSION ANALYSIS

Coefficients [a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	4,205	0,641		6,562	0,000
	Gender	0,733	0,132	0,207	5,543	0,000
	Age	-0,197	0,051	-0,144	-3,867	0,000
	Nationality	-0,447	0,240	-0,069	-1,864	0,063
	Injury_YesNo	0,249	0,166	0,056	1,501	0,134
	Attitude_PA_PosNeg	0,292	0,216	0,055	1,354	0,176
	Ath_Comp_BAD_dum	-0,110	0,330	-0,014	-0,334	0,738
	Ath_Comp_GOOD_dum	0,592	0,173	0,145	3,419	0,001
2	(Constant)	4,030	0,662		6,085	0,000
	Gender	0,727	0,134	0,205	5,441	0,000
	Age	-0,197	0,052	-0,144	-3,799	0,000
	Nationality	-0,293	0,260	-0,045	-1,126	0,261
	Injury_YesNo	0,230	0,168	0,051	1,368	0,172
	Attitude_PA_PosNeg	0,348	0,219	0,065	1,593	0,112
	Ath_Comp_BAD_dum	-0,080	0,330	-0,010	-0,242	0,809
	Ath_Comp_GOOD_dum	0,563	0,174	0,138	3,233	0,001
	Nationality mom	-0,062	0,208	-0,014	-0,297	0,767
	Siblings_YesNo	-0,209	0,207	-0,045	-1,012	0,312
	FAS_LOW_dum	-0,522	0,293	-0,076	-1,784	0,075
	FAS_HIGH_dum	0,146	0,157	0,038	0,928	0,354
	Cars_hh_none	0,160	0,249	0,027	0,642	0,521
	Cars_hh_two	0,081	0,149	0,023	0,545	0,586
	Comp_hh_NoneOrOne	0,776	0,312	0,111	2,488	0,013
	Comp_hh_three	0,091	0,197	0,021	0,463	0,644
[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]

3	(Constant)	4,895	0,839		5,832	0,000
	Gender	0,725	0,134	0,205	5,414	0,000
	Age	-0,202	0,054	-0,147	-3,708	0,000
	Nationality	-0,297	0,261	-0,046	-1,138	0,256
	Injury_YesNo	0,240	0,168	0,054	1,430	0,153
	Attitude_PA_PosNeg	0,334	0,221	0,063	1,509	0,132
	Ath_Comp_BAD_dum	-0,150	0,330	-0,019	-0,454	0,650
	Ath_Comp_GOOD_dum	0,553	0,174	0,136	3,176	0,002
	Nationality mom	-0,050	0,207	-0,011	-0,242	0,809
	Siblings_YesN	-0,281	0,213	-0,061	-1,322	0,187
	FAS_LOW_du	-0,409	0,295	-0,060	-1,387	0,166
	FAS_HIGH_du	0,106	0,158	0,027	0,671	0,502
	Cars_hh_none	0,121	0,250	0,020	0,484	0,629
	Cars_hh_two	0,092	0,149	0,026	0,617	0,538
	Comp_hh_NoneOrOne	0,698	0,312	0,100	2,234	0,026
	Comp_hh_three	0,149	0,198	0,034	0,753	0,452
	SSLOC_Buildings_100m	-0,003	0,003	-0,051	-1,030	0,303
	SSLOC_Green_100m	0,002	0,003	0,041	0,849	0,396
	SSLOC_Forest_100m	0,000	0,006	-0,004	-0,079	0,937
	SSLOC_Water_100m	-0,005	0,005	-0,043	-1,009	0,313
	SSLOC_Pedestrian_100m	0,000	0,006	-0,002	-0,041	0,968
	SSLOC_Crossing_100m	-0,049	0,035	-0,069	-1,407	0,160
	SSLOC_Water500_100m	0,000	0,000	-0,039	-0,898	0,369
	SSLOC_Green500_100m	0,000	0,000	-0,127	-2,698	0,007
	SSLOC_Forest500_100m	-6,982E-05	0,000	-0,021	-0,460	0,646
4	(Constant)	[illegible]	[illegible]		[illegible]	[illegible]

4	(Constant)	4,999	0,953		5,245	0,000
	Gender	0,729	0,135	0,206	5,419	0,000
	Age	-0,169	0,072	-0,124	-2,337	0,020
	Nationality	-0,357	0,261	-0,055	-1,364	0,173
	Injury_YesNo	0,267	0,169	0,060	1,581	0,114
	Attitude_PA_PosNeg	0,314	0,223	0,059	1,406	0,160
	Ath_Comp_BAD_dum	-0,174	0,330	-0,022	-0,527	0,599
	Ath_Comp_GOOD_dum	0,551	0,174	0,135	3,177	0,002
	Nationality mom	-0,037	0,209	-0,008	-0,178	0,859
	Siblings_YesNo	-0,189	0,215	-0,041	-0,876	0,381
	FAS_LOW_dum	-0,420	0,294	-0,061	-1,427	0,154
	FAS_HIGH_dum	0,065	0,158	0,017	0,410	0,682
	Cars_hh_none	0,109	0,249	0,018	0,438	0,661
	Cars_hh_two	0,089	0,149	0,025	0,599	0,550
	Comp_hh_NoneOrOne	0,670	0,312	0,096	2,151	0,032
	Comp_hh_three	0,143	0,199	0,033	0,718	0,473
	SSLOC_Buildings_100m	-0,003	0,003	-0,049	-0,989	0,323
	SSLOC_Green_100m	0,003	0,003	0,050	1,026	0,305
	SSLOC_Forest_100m	0,000	0,006	0,001	0,033	0,973
	SSLOC_Water_100m	-0,006	0,005	-0,048	-1,132	0,258
	SSLOC_Pedestrian_100m	-0,001	0,006	-0,004	-0,082	0,934
	SSLOC_Crossing_100m	-0,048	0,035	-0,068	-1,375	0,170
	SSLOC_Water500_100m	0,000	0,000	-0,048	-1,112	0,267
	SSLOC_Green500_100m	0,000	0,000	-0,119	-2,511	0,012
	SSLOC_Forest500_100m	-5,412E-05	0,000	-0,016	-0,355	0,723
	SDLOC_Green_100m	-0,002	0,001	-0,112	-2,320	0,021
	SDLOC_Forest_100m	0,001	0,001	0,062	1,138	0,255
	SDLOC_Crossing_100m	-0,018	0,008	-0,109	-2,314	0,021
	SDLOC_BikePath_YesNo	0,092	0,193	0,024	0,479	0,632
5	(Constant)	[illegible]	[illegible]		[illegible]	[illegible]

5	(Constant)	5,089	0,975		5,220	0,000
	Gender	0,735	0,135	0,208	5,446	0,000
	Age	-0,169	0,074	-0,123	-2,286	0,023
	Nationality	-0,286	0,266	-0,044	-1,078	0,282
	Injury_YesNo	0,256	0,170	0,057	1,506	0,133
	Attitude_PA_PosNeg	0,348	0,225	0,065	1,545	0,123
	Ath_Comp_BAD_dum	-0,168	0,335	-0,021	-0,502	0,616
	Ath_Comp_GOOD_dum	0,536	0,175	0,132	3,060	0,002
	Nationality mom	-0,047	0,210	-0,010	-0,222	0,824
	Siblings_YesNo	-0,195	0,218	-0,042	-0,897	0,370
	FAS_LOW_dum	-0,422	0,295	-0,062	-1,431	0,153
	FAS_HIGH_dum	0,073	0,159	0,019	0,458	0,647
	Cars_hh_none	0,130	0,250	0,022	0,520	0,603
	Cars_hh_two	0,096	0,149	0,027	0,640	0,522
	Comp_hh_NoneOrOne	0,651	0,313	0,093	2,083	0,038
	Comp_hh_three	0,120	0,199	0,028	0,600	0,549
	SSLOC_Buildings_100m	-0,004	0,003	-0,054	-1,092	0,275
	SSLOC_Green_100m	0,003	0,003	0,049	1,003	0,316
	SSLOC_Forest_100m	0,000	0,006	-0,003	-0,070	0,944
	SSLOC_Water_100m	-0,006	0,005	-0,051	-1,178	0,239
	SSLOC_Pedestrian_100m	-0,001	0,006	-0,009	-0,179	0,858
	SSLOC_Crossing_100m	-0,046	0,035	-0,065	-1,310	0,191
	SSLOC_Water500_100m	0,000	0,000	-0,042	-0,972	0,331
	SSLOC_Green500_100m	0,000	0,000	-0,127	-2,659	0,008
	SSLOC_Forest500_100m	-4,430E-05	0,000	-0,013	-0,289	0,772
	SDLOC_Green_100m	-0,002	0,001	-0,109	-2,266	0,024
	SDLOC_Forest_100m	0,001	0,001	0,057	1,028	0,304
	SDLOC_Crossing_100m	-0,018	0,008	-0,109	-2,307	0,021
	SDLOC_BikePath_YesNo	0,081	0,198	0,021	0,411	0,681
	TMTS_by_foot_dum	-0,111	0,255	-0,025	-0,434	0,665
	TMTS_by_bike_dum	0,042	0,234	0,012	0,180	0,857
	TMTS_by_PT_dum	-0,238	0,351	-0,032	-0,677	0,499
	TMTS_other_dum	-0,439	0,366	-0,057	-1,200	0,231

a. Dependent Variable: sqrt_MVPA