DETERMINANTS OF ACTIVE TRANSPORTATION AMONG 10 – 12 YEAR OLD SCHOOL CHILDREN IN NAIROBI CITY COUNTY, KENYA

BY

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DECLARATION

This thesis is my original work and has not been presented for award of degree in this or any other University or for any other award.

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DEDICATION

This work is dedicated to my parents, the late William Hayker Masigah and the late Theresa Aor Hayker. Without your wisdom and stern guidance I wouldn't have been able to chart the paths I am on today.

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LIST OF ABBREVIATIONS AND ACRONYMS

AT: Active Transportation

AST: Active School Transportation

CVDs: Cardiovascular Diseases

GPS: Global Positioning Systems

HIC: High Income Countries

HSES: High Socio-Economic Status

IDEFICES: Identification and prevention of Dietary- and lifestyle-induced health EFfects In Children and infants

ISCOLE: The International Study of Childhood Obesity, Lifestyle and the Environment

LIC: Low Income Countries

LMIC: Low and Middle Income Countries

LSES: Low Socio-Economic Status

MIC: Middle Income Countries

MoEST: Ministry of Education Science and Technology

MSES: Middle Socio-Economic Status

MVPA: Moderate to Vigorous Physical Activity

NCDs: Non-Communicable Diseases

NEWS: Neighbourhood Walkability Scale

NMIMTs: Non - Motorised and Intermediate Means of Transport

PA: Physical Activity

PE: Physical Education

SES: Socio-Economic Status

OPERATIONAL DEFINITION OF TERMS

Active transportation: Non motorised human powered mode of travel between destinations by children in Nairobi City County like walking, cycling, running, skating among others.

Built Environment: The part of physical environment built by human activity comprising elements like land use patterns, transport system, distribution across space of activities and the infrastructure housing them, physical infrastructure (roads, bike lanes, walking paths), appearance and arrangement of physical elements and urban design.

Neighbourhood walkability: Is a measure of whether community design of children's home and school in Nairobi City County (including the quality of the environment, safety, comfort and pleasure) encourages or inhibits walking.

Pedometer: A motion sensor that measures the number of steps taken.

Physical Activity: Is any bodily movement produced by skeletal muscles that require energy expenditure.

Transportation: Is the movement of goods and persons from place to place and the various means by which such movement is accomplished.

Walkability: Is a measure of whether community design (including the quality of the environment, safety, comfort and pleasure) encourages or inhibits walking.

ABSTRACT

Active Transportation (AT) contributes significantly to the health and wellbeing among children and youth. This benefit can in turn be carried over to adulthood. AT is an important factor in increasing levels of physical activity (PA) in children. The objectives of this study were to; assess AT to school and other destinations, determine barriers of AT to school and other destinations, examine the effects of socio-economic status on AT, determine difference in pedometer step count data and analyse difference in pedometer Moderate to Vigorous Physical Activity (MVPA) rates data for 10 – 12 year old children in high socio-economic status (HSES), mid socio-economic status (MSES) and low socio-economic status (LSES) regions in Nairobi City County. A cross-sectional descriptive research design was used to determine the participation in AT and resultant PA rates. Stratified random sampling was used to get 1,200 school children (boys and girls) aged 10 – 12 year old. Of the number sampled, 877 returned complete parental conscent forms and duly filled questionnaires, attaining a response rate of 78.2%. Data on PA and MVPA was collected using PiezoRx® pedometer sets while data on AT, demographic characteristics, parents and children's views collected through questionnaires. Chi-square test was used to compare the children's responses on AT as well as rates of PA. Analysis of Variance (ANOVA) Test was used to ascertain difference in PA and MVPA across regions in Nairobi City County. A *p*-value of ≤ 0.05 was considered significant in the testing of hypotheses. Majority of the children 629 (71.7%) walked to and from school while 1 (0.1%) rode a bicycle to and from school. More children in LSES used AT to and from school and other destinations than the children from MSES and HSES. AT to and from school showed strong statistical association significance across the three regions of Nairobi City County. Safety affected AT choice more for children in LSES 214 (24.4%) than MSES 357 (40.7%) and HSES 306 (34.9%). Among the socioeconomic factor indicators, only the level of education of a parent/guardian and family ownership of vehicles determined the children's choice of transport mode. Ownership of motorcycles and/or bicycles had no significant difference on the children's choice of transportation mode. Most children achieved the recommended pedometer step counts on the first day $\bar{x}$=13,502.43 and a weekly $\bar{x}$=12,490.53 of wearing the pedometer. The study recommends that Nairobi City County in liaison with all stakeholders develop interventions for increasing AT among school going children. This should be done by developing safe routes to school, walking and cycling programmes that ensure local environment of schools' catchment regions provide opportunities for children to walk and cycle. The results from this research may inform policy formulation on development of future school transportation systems and physical characteristics of schools.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Active transportation refers to human powered (non-motorized) modes for the purposes of getting to and from a particular destination (work, school, church, shop, market or visit friends). These modes include walking, running, cycling, non-motorized wheel chairing, roller skating, canoeing/kayaking among others (Sallis et al., 2004). Active transportation is increasingly regarded as a strategy to mitigate the negative impacts of motorized travel and lack of physical activity (PA), while reducing pollution (De Nazelle, et al., 2011; Woodcock, et al., 2009). Since most individuals must travel to/from school or work on a daily basis, active transportation has the potential to achieve a significant increase in physical activity levels. Moreover, it is always concomitantly reducing sedentary behaviour because most motorized transportation occurs while individuals are seated. Furthermore, exhaust gases emitted by motorized vehicles are strongly associated with cardiovascular diseases (Brook, et al., 2010). Therefore, active transportation could improve health outcomes by three different, but complementary pathways that is through increased physical activity, decreased sedentary behaviour and through reduced pollution.

Research by a number of scholars reveal a decrease in the prevalence of active school transportation (AST) in high income countries (Buliung et al., 2009; Bringolf-Isler, 2012; McDonald, 2007; Van der Ploeg et al., 2008). In China, the proportion of school children using motorized transportation increased from 3.6% to 14.1% between 1997 and 2006. The strongest correlate of motorized transportation was attending a

school outside of one's community (Cui et al., 2011). Similar trends were observed in Brazil and Vietnam (Trang et al., 2012).

Physically inactive behaviours pose a significant challenge to public health. A study in the transportation field of impacts on the modal choice to walk or cycle to school and other destinations by children may offer guidance on solutions. Change in dietary behaviours, sedentary lifestyles and a decrease in physical activity are seen to contribute to the worldwide obesity epidemic among both adults and children (Ahmed et al., 2013). Obesity among children can lead to higher health care costs, high rate of disability, loss in work productivity, slow economic growth, and possible threats to national security (Humes et al., 2010). In Africa, the World Health Organization (WHO) identified four main risk factors of obesity; hypertension/heart disease, chronic respiratory diseases, most cancers and diabetes (Nikolic et al., 2011). Physical activity among children reduces the risk of type II diabetes, cardiovascular disease, and obesity (Hillman et al., 2009) and mitigates psychological conditions like and not limited to anxiety, stress and depression (Eveland-Seyers et al., 2009).

There is, however, paucity of data on AST in low-income countries (LIC), especially in Africa. One notable exception is the Global School-based Student Health Survey which had data on physical activity and active transportation among 72,845 school children from 34 low and middle income countries (LMIC) from 5 WHO regions (Guthold et al., 2010). The proportion of active travellers varied between countries from 23.2% to 83.4% in boys and from 10.7% to 86.0% in girls. The authors argued that the significant variation in the rates of AST suggested that influential factors are likely to be

at the country level. While informative, this survey had important limitations including (1) the use of self-reported physical activity levels; (2) the questions on active transport and sedentary behaviour were not tested for reliability and validity; (3) children classified as active travellers if they had walked or biked to/from school on at least one day during the past week. The latter limitation suggests that individuals whose primary mode of transportation was passive were included among the active travellers.

A study in Kenya established that both male and female rural children are more active physically than the ones living in urban set up, as measured by pedometer values (Onywera et al., 2012). The research determined that children in rural Kenya recorded a higher number of average steps of 14,700 per day on the pedometer during weekdays compared to their urban Kenya contemporaries who recorded 11,717 daily average steps. The findings corroborated another study stating that most rural communities still living an agrarian lifestyle are primarily active physically (Katzmarzyk & Mason 2009; Ojiambo et al., 2012). Results from another study by Onywera et al. (2012) agreed with Tremblay et al. (2010) who observed that children in less mechanized societies have higher levels of physical activity than modern-living children, despite less participation in organized competitive sports. In light of the above, this study aimed at assessing active transportation modes use among 10 – 12 year old school children in high socio-economic status, middle socio-economic status and low socio-economic status regions in Nairobi City County in Kenya.

This study was part of a large multi-regional study (Assessment of Physical Activity and Active Transportation among School Children in Eastern, Western and Southern regions of Africa: The case of Kenya, Nigeria and Mozambique.) in Africa assessing physical activity and active transportation in school children. The project set out to consolidate existing information on active transportation measurement instruments and published literature on active transportation among African children and youth. The study also sought to refine an instrument or protocol to collect physical activity and active transportation data among African school children. It also collected data on physical activity and active transportation among African school children living in urban, sub-urban and rural areas to help inform report cards from Kenya, Nigeria, and Mozambique. It collected and compared province/county, municipal, and school policies related to active transportation in the African countries where the data collection occurred. The study also developed a physical activity and active transportation surveillance model for expansion to other low and middle income countries (LMIC). Finally, the project intended to provide recommendations for policy and programmes that could be implemented based on findings and suggest future research in the area. Data on distances and various modes of active transportation were used to determine the frequencies and magnitude of active transportation among the school children. Data on different modes used by the children to and from school and their demographic factors were used to address the objectives of this study.

1.2 Statement of the Problem

Children who are more active generally tend to be less predisposed to risks of obesity and diabetes, exhibit higher academic performance and are more on-task and less disruptive in school (De Greef et al., 2018; Maher et al., 2016; Budd & Hayman, 2008). The adoption of active transportation modes by children has the potential to reduce levels of inactivity significantly in children population and promote healthy lifestyles. An analysis of certain characteristics of elementary school children who primarily use active transportation as their mode of movement between home and school versus those who choose passive mode may serve as the basis for interventions designed to increase physical activity levels is critical at this age. This is the age where the children consolidate most of their physical activity skills and attitudes (Smith et al., 2015; Hirvensalo & Lintunen, 2011).

Findings from Kenya's 2014 Report Card posited that only about one-half of Kenyan children and adolescents were engaging in sufficient levels of PA (Wachira et al., 2014). While other researchers have established that only half the children population is sufficiently active, the available information does not show the contribution of active transportation among children to the observed physical activity (PA) levels which is a key variable/contributor to active lifestyle among children (Onywera, et al., 2016; Muthuri et al., 2014; Wachira et al., 2014). Most of the information about PA prevalence in youth comes from High Income Countries (HIC) (Katzmarzyk et al., 2016; Chen et al., 2007). A review of PA prevalence among 2000 participants was largely from HIC in

scope, with more than 80% of the articles published in the United States (Ng et al., 2017; Sallis et al., 2000).

Active transportation to school and other destinations for children has the potential of improving their physical activity rates. Active transportation mode choice by children depends on parents' decision resulting from factors including and not limited to the built environment (structures or places) and socio-economic status (Dessing et al., 2016; Mehdizadeh et al., 2018).

The family that a child lives in determines their transportation mode choice in a variety of ways. They may include objective factors like parental needs, resources, activity patterns, gender and age of siblings, the existence and school trips and subjective parental factors like fears, concerns and attitudes (Scheiner et al., 2019). These factors may interact in more complex and multiple ways. In the past some studies have established that parents recommend walking to school for boys than they would for girls (Mitra & Builing, 2015). Scheiner et al. (2019) notes that some parents may decide to allow their 7 year-old son walk to school by themselves as long as their elder sister takes the same route. Studies have established that children from high socio – economic status households in USA, Iran and China are more likely to use motorized transportation than active transportation mode to their destination (Zhang et al., 2017; Mehdizadeh et al., 2017; Ermagun & Samimi, 2015; Hsu & Saphores, 2014)

The built environment has factors like lack of pavements, existence of wide streets, the need to cross major intersections, difficulty posed by motorised traffic on the trip to

school making parents not to allow their children to cycle or walk independently, speeding vehicles and high traffic density (Stone et al., 2014; Rothman et al., 2015; Ahern et al., 2016; Larsen et al., 2016; Zhang et al., 2017). On the other hand, factors such as the provision of pavements and/or dedicated bicycle paths, measures for traffic calming, the existence of shortcuts and good road connectivity have been seen to positively influence cyling and/or walking (Clark et al., 2016; Kamargianni et al., 2015; Guliani et al., 2015; Stone et al., 2014; Noland et al., 2012).

The Kenyan education policy, the Transport Policy and the Kenyan Vision 2030 do not outline infrastructural provision and monitoring of non-motorised intermediate means of transport (NMIMT), in this case active school transportation for school going children. There is a paucity of data and important information on active transportation among Kenyan children and youth. This study sought to establish active transportation determinants among 10 – 12 year old school children which has potential for improving PA levels among this population cohort. Results from the study may in turn avail reference statistics and literature for Nairobi City County and by extension Kenya.

1.3 Purpose of the Study

The purpose of this study was to assess the barriers, amount of physical activity (PA) through step counts, and patterns of active transportation among 10 - 12 year old school children in high socio-economic status (HSES), mid socio-economic status (MSES) and low socio-economic status (LSES) areas in Nairobi City County in Kenya.

1.4 Objectives of the Study

The study was guided by the following objectives:

1. To assess active transportation modes to school and other destinations among 10 – 12 year old school children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

2. To determine barriers of active transportation to school and other destinations for 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

3. To examine the influence of socio – economic status of 10 – 12 year old school children on active transportation modes use in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

4. To determine difference between pedometer step count data for 10 – 12 year old children and high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

5. To analyse difference between pedometer MVPA rate data for 10 – 12 year old children and high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

1.5 Hypotheses

The study was guided by the following hypotheses;

H_{01} There is no significant statistical difference in active transportation to school and other destinations among 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

H_{02} There is no significant statistical difference in the barriers of active transportation to school and other destinations for 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

H_{03} There is no significant statistical difference on the influence of socio – economic status to 10 – 12 year old children's AT to school and other destinations in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

H_{04} There is no significant statistical difference on pedometer step count data for 10 – 12 year old school children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

H_{05} There is no significant statistical difference on pedometer MVPA rate data for 10 – 12 year old school children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

1.6 Significance of the Study

This study may have provided valuable new information on the status of active transportation to school among 10 –12 year old school children in high socio-economic status, middle socio-economic status and low socio-economic status areas in Nairobi City County in Kenya. This may provide foundational information upon which measures and interventions could be designed and conducted. Further, the study may increase the knowledge on use of pedometers in the Kenyan set up to examine sources of variability in active transportation behaviour among children. The study outcomes may influence policy making leading to the development of new systems and improving existing ones related to active school transportation. For instance, policies in the Ministries of Health and Education particularly, on school programmes, curriculum and teacher training can be reviewed to promote active transportation to school and other destinations for children.

The study has contributed to strengthening and building a body of scientific knowledge for future studies in the area. The study will also inform pedagogical practices and training methods in the field of active transportation and physical activity.

1.7 Delimitations of the study

The study was delimited to the assessment of school children's (ages 10 – 12 year old) barriers of active transportation to school and other destinations, rates of moderate to vigorous physical activity (MVPA) in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County in Kenya. Their modes

of transportation were expected to remain the same throughout the seven-day period they were wearing the pedometer.

1.8 Limitations of the study

Due to a paucity of local data and literature, foreign literature was used to strengthen the conceptual basis of the study. Questionnaires were, however adapted, as much as possible, to suit the local situation. Since the pedometer set used for measuring steps and physical activity rates among the participants is not waterproof, the children were advised not to use it during wet weather situations. Even though swimming is a form of active transport as well as a source of movement in recreational activities that contribute towards improving physical activity (PA) and active lifestyle, it could not be used as a measure in this study.

1.9 Assumptions of the study

The study was carried out based on the following assumptions:

1. That the participating children and parents would answer questions in the research questionnaires honestly and to the best of their knowledge.
2. That the participants would be highly motivated to complete the tasks involved in the study (filling in of research questionnaires and wearing of the pedometer throughout their waking time of the seven days of the study).
3. That the participants' transportation behaviour would not be altered during the seven days' period of the study.

1.10 Conceptual Framework

The socio-ecological theory on physical activity, health and well-being has been recognized and utilised in many national and international policies and strategies. The approach was first advocated for in the Ottawa Charter for Health Promotion (WHO, 1986). The charter recognizes the influence of individual, social, economic and environmental factors in physical activity, health and well-being and different opportunities for interventions on individual and community levels. Consequently, the socio-ecological approach was promoted by WHO in "Health for All" (WHO, 1998) initiative. The approach recognises the myriad effects and inter-relatedness of the relationship that exists between the individual and their environment. The relationship operates at different levels; typically personal (attitudes, skills, knowledge), group/community (family, friends, organisational), environmental (the built and natural physical environment) and policy (national and local laws and strategies) (King et al., 1995; WHO, 2011).

Stokols' socio-ecological model helps to outline opportunities to support participation in physical activity by recognising various factors that affect its promotion or create barriers to individual engagement in physical activity, including walking (Townsend & Foster, 2013; Stockols, 1996; Zurawik, 2014). Boarnet et al. (2005) constracted a conceptual framework that draws out the complexity of the relationship between urban form and a child's trip to school. The framework outlines three main factors; (i) the key decision maker of a child's travel behaviour, (ii) factors to be considered when deciding on children's trip to school, and (iii) how these factors influence the relationship between

urban form and childrens' trip to school (Boarnet et al., 2005). Panter et al. (2010); Romero, (2015) also utilized a multi-level socio-ecological framework to explain young people's active travel behaviour that included environmental perceptions and individual factors for both parents and children.

Based on the different aspects outlined above as foundation, a conceptual framework for this study was adapted and designed. It shows how the four sets of variables; neighbourhood walkability (primary independent variables), socio-economic status and sex of participants (secondary independent variables), children's transport preferences (dependent variables) and parents' decisions (intervening variable) all interact together to cause various effects on children's active transportion behaviours.

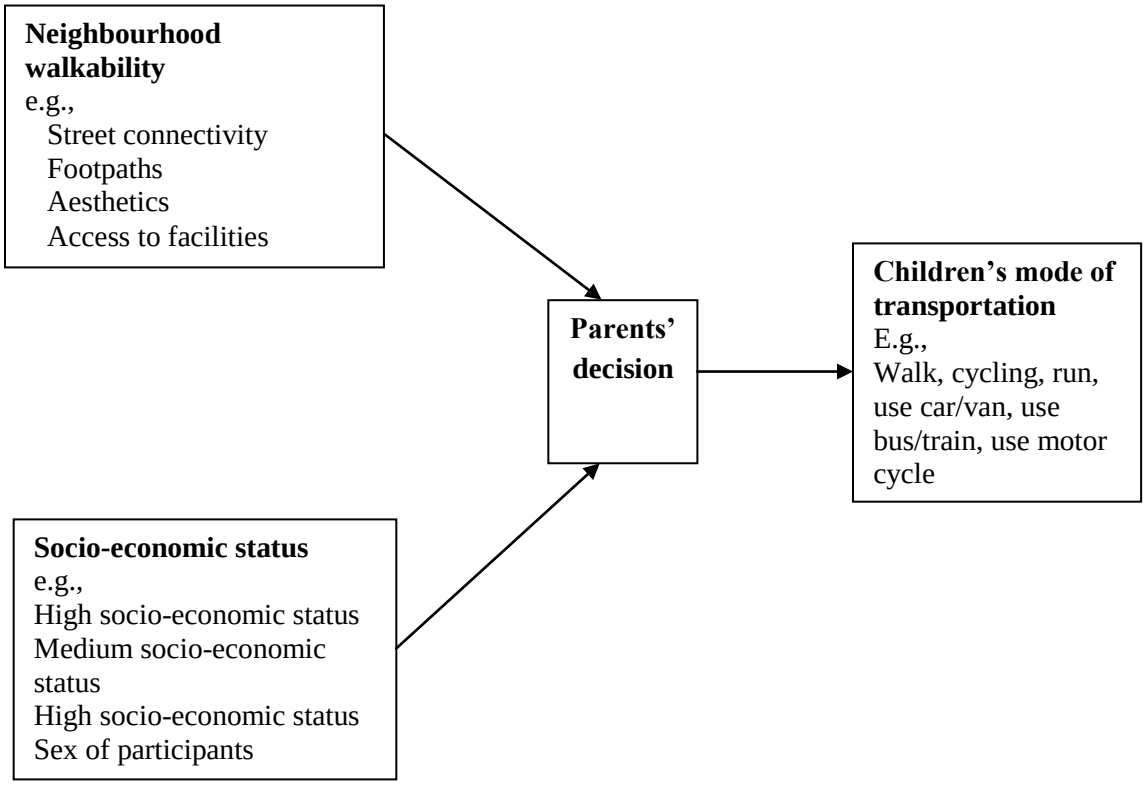


Figure 1. 1. Socio-ecological model on children's active transportation and physical activity behaviour

Source: Adapted and modified from Stokols, (1996) and Grahan, (2005).

1.11 Theoretical Framework

Scholars have used various theories to understand how individuals adopt transportation behavours. Ntoumanis et al. (2018) notes that in exercise psychology, researchers have examined potential use of psychological theories of motivation and behaviour change in determining physical activity (PA) promotion programmes across the lifespan.

Self determinant theory (SDT) has widely been used to investigate motivation to physical activity in survey designs, as well as to construct interviews for promotion of physical activity (Ryan & Deci, 2017). This theory lays emphasis on quantity and quality of motivation in influencing physical activity behaviour.

The Self-determination theory (SDT) stresses, on the one hand, the extent to which a person's behaviour is self-determined and self-motivated (Ryan & Deci, 2000a). On the other hand, there are three fundamental psychological needs which are, the need for autonomy, competence and relatedness – which outline the circustances for either a supportive or an antagonistic social environment through which self-regulation and motivation may be changed. Autonomy is the need to have a volitional feeling, as the originator of one's actions (for example, "I swim due to my own free will"). Competence relates to the need to feel capable of getting the intended outcome at the end of an activity (for example, "I am great at swimming"). Finally relatedness refers to the need to feel to be understood and connected to significant others (for example, "I enjoy and get along well with my swimming partner") (Patrick et al., 2013). On the contrary, when such needs are thwarted, individuals are likely to develop amotivated or controlled reasons for behavioural engagement. A basic principle of SDT is that the social environment is a significant element in thwarting or supporting individual's psychological needs and, therefore, enhancing self-determined motivation for physical activity (Ntoumanis et al., 2018).

Motivation in self-determined theory (SDT) is differentiated as intrinsic and extrinsic motivation. Intrinsic motivation is when an individual perfoms an activity mainly for fun

or enjoyment, while extrinsic motivation refers to an individual taking part in an activity because it will lead to some form of benefit or reward (Deci & Ryan, 2004). In this case motivation is considered a vital element in promoting physical activity.

Next is theory of planned behaviour (TPB) that posits an individual's participation in active transport/physical activities is a function of a person's intentions (Ajzen, 1991). This construct shows how much effort individuals plan to apply towards behaviour performance. Intention is therefore a function of three factors, subjective norms, attitudes and perception of control. Ajzen & Fishbein (1980) notes that attitudes stand for an overall positive or negative examination towards a behaviour. Subjective norms stand for perceived effects that significant others, like peers, parents or teachers may apply on the performance of behaviour; and perceived behavioural control represent general perceptions of control, and is the same as Bandura's (2001) construct of self-efficacy. This theory also implies that when pereptions of control are realistic, perceived behavioural control will forcast active transportation/physical activity behaviour directly together with intentions (Ajzen, 1991).

The two previous theories of active transportation/physical activity, SDT and TPB focus on the role of individual characteristics for behaviour change, in certain instances on individuals' immediate environment. The third theory, Social Ecological Models (SEM) adopt a broader approach since they propose that behaviour is the result of interactions between individual factors, interpersonal/social environment factors, physical environment factors and public policy factors (Ntoumanis et al., 2018; Levin et al., 2009). SEM is anchored in three theories; the Ecological Model of Health Behaviour (McLeroy,

1988), the Social Ecology Model of Health Promotion (Stokols, 1992) and Brofenbrenner's (1978) Ecological Systems Theory. Individual factors comprise but are not limited to age, gender, ability to walk/bicycle ownership, personal history of walking/cycling and current attitude about walking/cycling. Interpersonal/social environment factors comprise travel needs of others in the family or peer social support (having family member, friend or neighbour to walk/cycle with), and social norms. Physical environment factors include weather, attributes of the environment like safety, greenspace, walkin/cycling paths, bicycle parking facility at school, washroom for refreshment among others. Finally public policy factors comprise municipality or school level policy on walking and cycling, urban planning policy and active transport policies. The SEM theory assumes that behaviour needs to be understood in view of societal and environmental enablers and constraints.

Finally, the Norm-Activation Model (NAM) pays particular attention to elements that lead to altruistic behaviour functionalised as giving up on personal interests in order to gain enevironmental advantages for society (Nordlund & Garvill, 2003; Schwartz, 1977). The theory consists of three main components: Awareness of consequences (AC), Ascription of responsibility (AR) and Personal norms (PN). The above components may predict altruistic behaviour/intentions like active transport mode choice instead of choosing private car, in a causal chain or structure (De Groot et al., 2008). Awareness of consequence (AC) means that an individual realises the negative effects of their environmentally unfriendly activity/behaviour, for example choice of a private car for children on school travels. Ascription of responsibility (AR) is another component of

norm-activation model where an individual must view themselves to be responsible personally for the repercussions of their environmental activity/behaviour. The personal norm component means an individual ascribes to themselves personal responsibility to take action that benefits the society (Schwartz, 1977). This theory however has some limitations, since it does not consider variations in situational elements in its components. Variations in situational circumstances conducive for activation of moral obligation also may affect the association between behaviour and personal norm (PN). Secondly, evidence relevant to the sequential nature of the flow in the Norm-Activation Model (NAM) theory is scares making it lack bi-directional relations between its components. For instance, the NAM structure does not take in to account any bi-directional relations from personal norm (PN) to awareness of consequences (AC) or from personal norm (PN) to awareness of responsibility (AR).

Four theories (self determinant theory - SDT, theory of planned behaviour - TPB, social ecological models – SEM and norm-actovation model - NAM) were explored. SEM was used to anchor this study due to its focus on a broader variety of factors (individual, social environmrnt, physical enevironment and policy) that interact to influence choice of active transportation/physical activity behaviour for children.

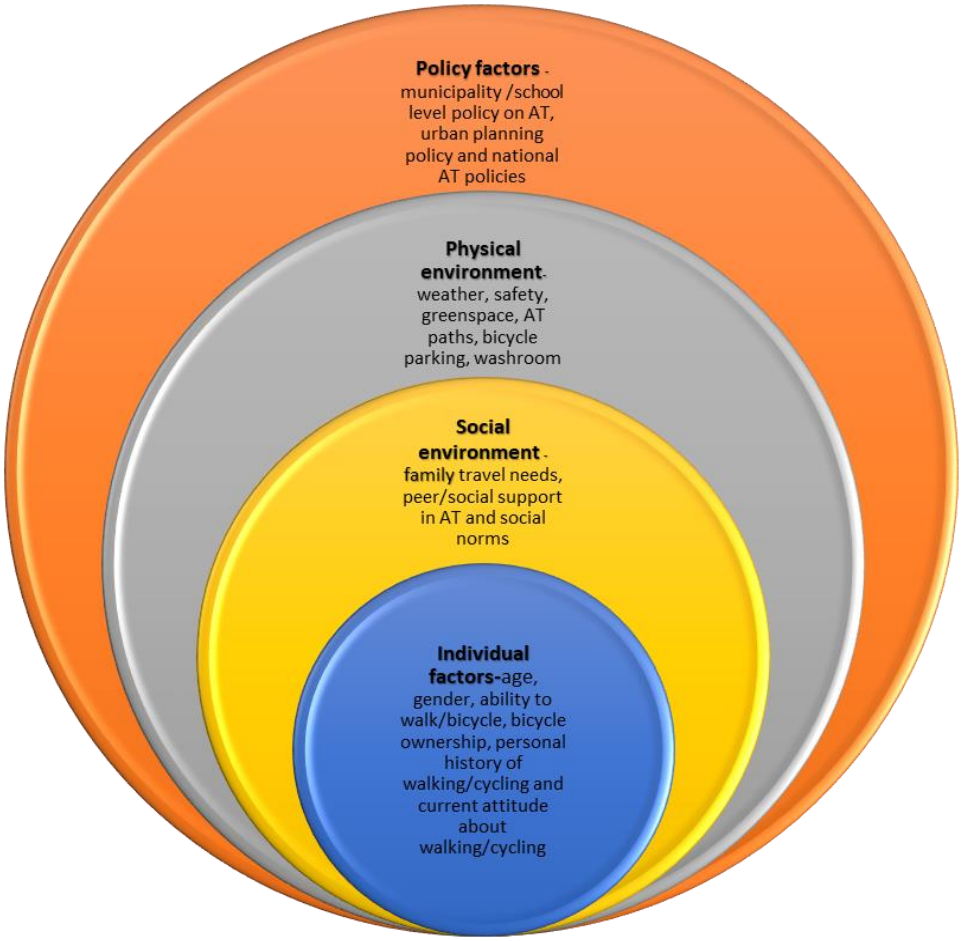


Figure 1. 2. Social Ecological Models (SEM) on children's active transportation and physical activity behaviour

Source: Adapted and modified from Ntoumanis et al., (2018).

CHAPTER TWO: LITERATURE REVIEW

2.1 Active Transportation

Active transportation refers to human powered (i.e., non-motorized) modes for the purposes of getting to and from a particular destination (work, school, the shop or to visit friends) (Villa-Gonzalez et al., 2015; Larouche et al., 2014; Sallis et al., 2004). These modes include walking, running, cycling, non-motorized wheel chairing, roller skating, canoeing/kayaking, etc. Increasing active transportation (AT) is favoured as a strategy to mitigate the negative impacts of motorized travel and lack of physical activity, while reducing pollution (De Nazelle et al., 2011; Larouche, 2013; Woodcock et al., 2009). Because most individuals must travel to/from school or work on a daily basis, active transportation has the potential to achieve a significant increase in physical activity levels. This can potentially reduce sedentary behaviour because most motorized transportation occurs while travellers are seated.

A recent systematic review revealed that, children and youth who engaged in active transportation to/from school had higher daily physical activity levels and greater aerobic fitness than those driven to school (Larouche et al., 2014). The systemic review sought to establish differences in body composition cardiovascular fitness and physical activity (PA) between passive and active travellers. The study consulted 10 key informants and used data from ProQuest, PsycInfo, Embase and PubMed databases. Sixty eight studies met the inclusion threshold with majority of them establishing that active travellers recorded higher physical activity rates with moderate quality of evidence. All studies that had relevant measures established a positive association between cardiovascular fitness

and cycling to/from school; this was also moderate quality evidence. The rewiev suggests that active school transport (AST) be promoted to raise levels of physical activity in adolescents and children since increased cardiovascular fitness is associated with cycling to/from school.

A study conducted in Kenya established that active transportation (AT) was associated with a lower likelihood of being overweight/obese, and a higher probability of meeting the physical activity guidelines (Muthuri et al., 2014). The study sought to determine the prevalence and investigate factors related to overweight/obesity and physical activity (PA) among Kenyan children aged 9 – 11 years old. Physical activity (PA) and body composition measures of participating children were achieved through administration of questionnaires related to lifestyle and diet, the neighbourhood and school environments, anthropometric and accelerometry assessment. The data for the study was collected in Nairobi as part of a bigger International Study of Childhood Obesity, Lifestyle and Environment (ISCOLE). A total of 563 (53.5% girls, 46.5% boys) children took part in the study and based on World Health Organisation (WHO) cut-points 6.4% were obese, 14.4% overweight and 3.7% underweight. From the study, only 12.6% of the children who participated met the recommended $\geq$ 60 minutes of daily moderate to vigorous physical activity (MVPA) rates and 45.7% of the children participants used active transportation (AT) to/from school. The study established evidence for an existing prevalence of childhood obesity/overweight in Nairobi. Most children were spending significant amount of time in sedentary and light intensity physical activity while only

few meeting the ≥ 60 minutes of moderate to vigorous physical activity (MVPA) per day recommendation.

Another research by Wachira et al., (2014) in Kenya established that well over one–half of children and adolescents used active transportation rather than motorised transport. The 2014 report card on body weight status and physical activity (PA) of Kenyan children and youth conducted an analysis and review of available data on core indicators for children and youth aged between 5 to 17 year old. Grading system used in the report card was anchored on a set of existing schemes and specific criteria from similar report cards used in other countries. From the 10 major indicators under consideration, Kenya registered favourable result on active transportation, sedentary behaviours and body composition with a grade B. Grade C was assigned to organised sport participation, active play and overall physical activity (PA) levels. School, family/peers, governmental and non-governmental strategies on physical activity and body composition status registered grade C. The report card established that though majority of Kenyan children and youth do well regarding sedentary time and body composition status, they are performing marginally on the World Health Organisation (WHO) recommendation ≥ 60 minutes of physical activity (PA). Compared to some developed countries, Kenya scored better in most indicators. However, there is need for more representative and robust data for all indicators besides acting to address prevailing trends towards unhealthy lifestyles.

To date, most of the research on active transport among children and youth have focused on the trip to and from school referred to as active school transportation (AST), (De Nazelle et al., 2011; Larouche, 2013; Woodcock et al., 2009). On the other hand, some

studies have examined active transportation for other purposes such as visiting friends and going to sports/recreation venues (Oliver et al., 2016; Veitch et al., 2007; Veitch et al., 2006). Studies have observed that children using AST are more likely to walk or bike to other destinations within their neighbourhood (Dollman & Lewis, 2007; Drake et al., 2012; Goodman et al., 2012). Smith and colleagues in a study to determine associations between modes of transportation to non-school destinations and physical activity (PA) in school children, established that active transportation (AT) to these destinations was associated with greater daily physical activity in British children aged between 9 – 10 years-old (Smith et al., 2012). From the study, 1,859 pupils provided authentic data. Boys who opted for active modes of transportation spent significantly more time in moderate to vigorous physical activity (MVPA) than those who used passive modes in all time segments.

2.2 Active Transportation and the Environment

2.2.1 Neighbourhood Environment Walkability

The walkability of a neighbourhood is a measure of whether community design (including the quality of the environment, safety, comfort and pleasure) encourages or inhibits walking (Gordon-Larsen et al., 2006). Neighbourhood environment walkability considers a number of aspects comprising and not limited to elements of residential density, nearness to shops and facilities. It also considers the ease of reaching these destinations, street connectivity, availability of facilities for cycling and walking, beauty of the surrounding, and safety from traffic and crime (Saelens et al., 2003). Kurka et al. (2015) in a study of children's out-of-school physical activity per day in San Diego

established that children from neighbourhoods seen as less walkable and far from recreation and transit areas engaged in less physical activity rates than children from areas with access to facilities for recreation and parks and better pedestrian facilities. These results correspond to a study by Han et al. (2013) which suggested that safe neighbourhoods with play areas and nearby parks strongly relate to children's rate of physical activity when out of school. Most of the studies (Chaudhury et al. 2016; Frank et al. 2015; Carter et al. 2017; Sallis et al. 2016; Azmi & Ahmad, 2015 and McCormack et al., 2017) relied on adult population for their data. For instance Sallis et al. (2016) in a cross-sectional study with an international sample of adults from fourteen countries established that environmental factors (net residential density, intersection density, public transportation density and number of parks) within the neighbourhood positively and significantly related to active transportation and hence physical activity. Since the studies explored above used adult population, this study therefore may contribute to the body of active transportation literature with reference to 10 – 12 year old school children.

2.2.2 Built Environment

Built environment is the structural factors of an area like the availability of street connectivity, housing densities and footpaths (Gahan, 2011). Davison (2008) and Fulton (2005) state that there is a positive relationship between children's active transportation rates to school and proportion of street distance with sidewalks. They further note that a busy road is associated with low active transportation to school rates, especially among 5 – 6 and 10 – 12 year old children. There is a positive relationship between improved school routes, traffic limits, presence of cycle paths and presence of controlled crossings

and improved use of active transportation by children as a preferred mode of going to school (Eyler & Zwald, 2016). So?

2.2.3 Mixed Land Use

Mixed-land use comprise developments with a variety of shops, restaurants, banks, offices and a number of other activities intertwined amongst one another (Cevero, 1989; Frank & Pivo, 1994; Cevero, 2002). Environments with longer distances to frequently visited destinations like recreation areas and bus stations/stops tend to impede active transportation among children as a preferred mode (Panter et al., 2014). However, neighbourhoods with increase in number of destinations available within accessible short distances will experience a likely upsurge of active transportation to school among children (Larsen et al., 2009).

2.2.4 Street Connectivity

Street connectivity is the number of alternative routes that may affect a particular locality's residents' safety and interest (Oakes et al., 2007).The road environment has a direct effect on children's active transportation depending on the a child's gender and age group. A study by Schlossberg & Brehm (2009) reported that children that took routes to school having dead-end densities but higher densities of intersections were highly likely to cycle or walk to school. Presence of sidewalks on roads or traffic speed are likely to affect children's mode of transportation, this conforms to Conlon (2013) who established that children are less likely to use active transportation if they have to manoeuvre through busy roads to school. Terrain type covered between home and school has a bearing on

transportation mode choice; routes with steep inclines are related with speeding vehicles hence low rates of cycling and walking to school by children (Davison & Lawson, 2006).

2.2.5 Population Density

The number of children using active transportation to school tend to be determined by a neighbourhood's population density (citation?). Population density is the measure of number of residents or entire population within a particular geographic area divided by the size of the designated area (Frank & Pivo, 1994). Children who live in neighbourhoods with high population density seem to embrace active transportation to school since distances between homes and school tend to be relatively shorter (Nelson et al., 2008). Children seem to embrace active transportation modes to school if immediate surroundings of the school are densely populated since the streets are in grid networks resulting in greater connectivity (Braza et al., 2004). Likewise, when a bigger number of the houses within a quarter (¼) mile of the school have their windows facing the route between school and home, more children embraced active modes of transportation to school. This may be due to perceived child visibility in such neighbourhoods (Conlon, 2013).

2.2.6 Distance

Children who live further away from school tend to use less active transportation modes to school (Pont et al., 2009). When distance between home and school increase the number of children cycling or walking to school tend to sharply drop. Children living within a distance of one mile between home and school are more likely to cycle or walk

to school compared to children living within 1.5 miles or further away (Schlossberg & Brehm, 2009; Yelavich et al., 2008; McDonald, 2008a).

2.3 Assessment of Active Transportation

Active transportation can be assessed and measured using several ways such as pedometers, accelerometers and global positioning systems (GPS) sets (Duncan & Mummery, 2007).

2.3.1 Objective Assessment Tools

2.3.1.1 Assessment of Active Transportaion (AT) using Pedometers and Accelerometers

Development of reliable and accurate tools for evaluating children's and adolescents' active transportation behaviours is crucial for research (Panter et al., 2014). Precise evaluation of active transportation is important for the study of duration (minutes engaged in active transportation) and frequency (number of trips in active transportation) of the particular transportation behaviour (Vanwolleghem, 2017). Dollman et al. (2009) notes that the decision to use a particular tool for assessment depends on a variety of factors. These are size of the sample, age of the population, respondent burden, studied behaviour, management of data, cost and measurement error.

An attempt has been made by Vanwolleghem (2017) to outline tools currently in use for assessment of active and passive transportation among children and adolescents. The tools can be classified into objective (pedometers, accelerometers and Global Positioning System (GPS)) and subjective assessment tools (questionnaires, Focus Group Discussions

(FGDs) and diaries). A brief overview of strengths and limitations is presented in Table 1 as well as more detailed description of the same below.

Table 2. 1. Overview of tools for evaluating active and passive transportation

	Assessment tool	**Strengths**	**Limitations**
Objective assessment tools	Pedometers and Accelerometers	• Able to give additional information when combined with GPS or diaries (e.g., number of steps, duration and intensity during active and passive trips)	• Limited ability to capture cycling • Can't assess context-specific active and passive transportation when not combined with GPS or diaries • No information on the purpose of trips
	Global Positioning Systems (GPS)	• Ability to distinguish cycling, walking and passive transportation • Ability to detect number and duration of active and passive trips	• No information on trip objective • Technical challenges (low accuracy due to signal and short battery life) • Processing and analyzing GPS data special skill and expertise
Subjective assessment tools	Questionnaires	• Inexpensive • Practical to use in large samples • Has ability to give information on trip objective • Can reach large group	• The inability to capture frequency and duration of complex transportation behaviours like combined trips • Bias (social desirability and recall)
	Focus Group Discussions (FGD)	• Participants can "feed off each other" as they respond to comments • Participants can agree or disagree with each other, creating more energy hence more data • FGDs can get at perceptions, attitudes and experiences more than quantitative survey	• Shy participants can be intimidated by more assertive ones • Open-ended structured interview format must be used • Groups are more difficult to manage than an individual, interviewer must keep track of what is transpiring in the group • Unexpected conflicts, power struggles, and other group dynamics may inhibit discussion • One participant may dominate to the exclusion of others • Analysis of data may be challenging • Moderators need to be skilled at working with groups • Environment may impact on the responses
	Diaries	• Inexpensive • Large group can be accessed • Has ability to provide information on trip objective • Avails detailed information of self-reported (parent-reported) transport behaviour	• Time consuming • Biased (social desirability and recall)

Source: Developed by author from literature

Pedometers and accelerometers are most of the time objectively utilised to determine statistics on frequency and steps, duration and intensity of physical activities over a period of time in children (Clemes & Biddle, 2013). When combined with other tools for assessment that can positively determine passive and active transportation trips like GPS and diaries, pedometers and accelerometers have the potential of giving additional data of children's active transportation behaviour (Ellis et al., 2014; Panter et al., 2014). Pedometers and accelerometers objectively determine duration and/or intensity and number of steps during particular transportation behaviour.

Pedometers records the number of steps an individual accumulates during the day, some types like the *Omron Walking Style Pro* gives a breakdown of hourly steps (Vanwolleghem, 2017). When assessing step counts (transportation domain) in children, pedometers are valid and reliable tools in the research (Clemes & Biddle, 2013; Hills et al., 2014). Measures using pedometers are relatively easy, achievable, low cost and basic experience is required for data management (Migueles et al., 2017).

Sirard & Pate (2001) notes that pedometers however may not pick a number of physical activity modes like cycling and only accumulate total step counts. But some pedometers have the ability to evaluate aerobic steps in which steps intensity is determined in a particular way, e.g., Omron pedometers can record aerobic steps when participants walk for more than sixty (60) steps a minute continuously for more than 10 minutes (Butte et al., 2012; Vanwolleghem, 2017).

Accelerometers are devices that pick up accelerations of a segment of the body where it is appended. Accelerometers are usually small, light and most of the time attached to the hip hit a belt so that it can sense accelerations emanating from the body whenever the body changes position subject to gravitational force (Cliff et al., 2009). The device is capable of filtering and pre-processing signals to determine activity counts resulting from accelerations occasioned by movement of the body (Migueles et al., 2017). The intensity and sum of daily physical (PA) and sedentary time (SED) may be arrived at by categorizing counts of activity accumulated in a particular interval of time (epoch length) with predetermined cut-points e.g., thresholds of intensity for physical activity (PA) classification (Hänggi et al., 2013; Chandler et al., 2016). The Actigraph accelerometer brand produced by (Manufacturing Technology Inc., Pensacola, Florida, USA) are the most widely used in physical activity studies. This brand is already validated for assessing physical activity among children (Hänggi et al., 2013).

2.3.1.2 Global Positioning Systems (GPS)

GPS sets have increasingly been used in the last few years as a tool in outdoor context for assessing transport behaviour. GPS is a global systems of navigational satellites developed to estimate accurate velocity and positions of data. Using a portable lightweight GPS receiver, actual data of a phenomenon's geographical coordinates (altitude, longitude, latitude), location, duration and number of trips, speed during a specific time period and transportation distances can be established (Schipperijn et al., 2014; Dessing et al., 2014). Eventually, cycling, walking and passive transportation is positively made. It is also possible to accurately establish the period of active

transportation (Krenn et al., 2011; Dessing et al., 2014; Klinker et al., 2014). However, car use and walking in urban settings is usually not possible to distinguish with accuracy as a result of signal challenges. A combination of time-related and geographical information (e.g., school time schedules and school address to exclude transportation to school), GPS-data can be used to accurately determine the mode of transportation in a context-specific transport (e.g., cycling in leisure time or walking to school) (Dessing et al., 2014). GPS devices can easily be worn on a belt on the hip or on the wrist during particular assessment duration. QStarz devices (Qstarz International Co., Ltd, Taipei, Taiwan) are the commonly used GPS-device in transportation related research since it has demonstrated favourable inter-unit reliability (Kerr et al., 2011; Duncan et al., 2013) with a median dynamic positional error of 2.9 meters (Schipperijn et al., 2014).

To change raw GPS data to meaningful behavioural information (time/day of cycling or walking) and to identify and classify trips, systems for managing data must be utilised like self-written scripts, Q-travel (Qstarz), the GeoActivity Processor, Personal Activity and Location Measurement Systems (PALMS) (Coombes et al., 2013). PALMS is currently the application mostly used in physical activity research (Jankowska et al., 2015; Schipperijn et al., 2014). PALMS is a web-based application developed at the University of Carlifonia – San Diego by The Centre for Wireless and Population Health Systems that uses both accelerometer and GPS data, process GPS data by classifying and identifying trips and determining valid data points (Jankowska et al., 2015). Various algorithms to distinguish between trip modes and define trips have been computed. A

study by Carlson et al. (2015) developed valid trip mode detection algorithms and validated the classification accuracy of detecting trips.

This study chose to use the PiezoRx® brand of pedometer to determine the step counts of children. The pedometer computed the step counts into moderate physical activity (MPA), moderate to vigorous physical activity (MVPA) and vigorous physical activity (VPA) rates.

2.3.2 Subjective Assessment Tools

2.3.2.1 Questionnaires

Active transportation for children and adolescents to school and leisure time destinations has mainly been evaluated by self-reported questionnaires (De Vries et al., 2010; Panter, 2014). The questions can either be proxy reported (e.g. parent/guardian) or self-reported (Vanwolleghem, 2017). Since children have lower frequency of recall ability and activity duration, proxy reported active transportation has commonly been utilised when evaluating their transportation behaviour. However, the older the child (ages 10 – 11 years-old) the more appropriate it is to use self-report of active transportation behaviour (Johansson et al., 2006). Vanwolleghem (2017) notes that in northern parts of Belgium (Flanders), the 'Flemish Physical Activity Questionnaire' (FPAQ) is often used to assess parent-reported or self-reported cycling and walking. The FPAQ determines the most frequently used transportation mode to school (e.g., cycling, walking, public transport, car) and the duration (number of minutes) per day of active or passive transportation to school, cycling and walking for transportation during leisure time. FPAQ has been found to be a valid and reliable questionnaire for assessing different aspects of physical activity

in children (duration of transportation during leisure time, transportation to/from school) (Philippaerts et al., 2006). Apart from FPAQ, Bere et al, (2009) came up with a reliable question matrix for assessing indebt information about children's and adolescents' modes of transportation to school. The matrix covers seasonal and topographic variations hence it is divided into seasons to cater for transportation to/from school. Children (together with their parents/guardians) and adolescents fill out per season on a weekly basis how many times they went to school using different modes of transportation e.g., walking, cycling, public transport and car driven. Bere et al. (2009) reported that when using the questionnaire matrix children and adolescents may be classified into one particular mode of transportation if more than 50% of the trips were accomplished by the same mode. Due to the foregoing, it is necessary to investigate validity of the matrix.

This study chose to use a questionnaire to capture data on the modes used by children to get to school and other destinations.

2.3.2.2 Focus Group Discussion

Focus group concept is typically interviews held on a particular subject with a number of unique features or characteristics. The features relate to the components of a particular group (Krueger, 2014) like the participants harbor certain unique characteristics; the group is usually small with an average of five people; participants provide qualitative data; the discussion is focused e.g., ask information about children's physical activity domains like cycling, walking, playing; group moderator help participants understand the topic of interest.

2.3.2.3 Diaries

These are used to derive detailed data on children's and adolescents' self-reported or parent-reported transport (Mackett & Paskins, 2008; Oliver et al., 2014). Children (together with their parents) and adolescents are instructed to fill in their trips daily in a diary for the assessment duration. The children (together with parents) and adolescents are advised to report all trips (any trip lasting at least three minutes) and combined transportation mode (trips comprising public transportation and walking to a bus station/stop). Each trip must have a detailed transportation mode (e.g., walking, cycling and public transportation) and the purpose (leisure time destination, school, sports facility/venue). This study used a similar design of a diary to assess the frequency of each mode the children used to school and other destinations.

2.4 Relationship between Socio – Economic Status (SES) and Active Transportation

The socio-economic status (SES) is a factor that cannot be modified to affect active transportation among children. Lynch & Kaplan (2000) define the socio-economic position as "an aggregate concept that includes both resource-based and prestige based measures, as linked to both childhood and adulthood and adult social class position". A study by Giles-Corti & Donovan (2002) established a difference between two SES regions in the overall prevalence of walking, however the degree of walking varied significantly. When LSES was compared to HSES regions the prevalence of walking for transportation was 33% higher among participants from LSES and those walking for recreation were lower by 21%. In a study among South African children by McVeigh et al. (2004) found a higher percentage of low physical activity on the one hand and higher

duration accumulated in watching television. A study in Kenya by Muthuri et.al., (2014) depicts that higher SES was also associated with decreased time spent in Medium to vigorous physical activity time (MVPA), pointing to a negative SES relationship with physical activity. The current study focused more on transition (transportation to and from school) among 10 – 12 year old school children and the age range.

2.5 Barriers to Active Transportation (AT) among Children

Since parents impose conditions on young children's independent travel to school and other destinations, they are never able to go to school by themselves (Van Kann et al., 2015). In the developed countries the prevalence of private motor vehicles as mode of transportation has been sustained by urban sprawl leading to low-density, monofunctional car-dependent communities, as people sought to move away from the polluted industrial centres (Conlon, 2013). As a result, densely populated areas like Europe have come up with public systems of transportation to benefit high population density cities from reduced vehicle dependency. Conlon (2013) notes that numerous aspects like environmental, social and individual may act independently or put together to affect children's choice/use of active transportation to school. The above aspects may potentially restrict or enhance walking and cycling, but are determined through caregivers'/parents' perceptions and hence unique to every child's social and physical circumstances.

2.6 Active Transportation (AT), Physical Activity (PA) and Health among Children

Underwood et al. (2014) notes that though bicycling and walking most of the times suffer from a negative perception, they are seen to be the two main types of physical activity

easiest to adopt and adhere to. This is due to their low level exertion level, the fact that they can be undertaken both for leisure and utilitarian reasons; and the relatively few obstacles that face participants (for example doesn't include high-intensity exercise and does not significantly consume time) (Frank et al., 2003). Walking compared to cycling is much easier to adopt and adhere to since it doesn't require any equipment hence has zero cost of acquisition (Moran et al., 2016). Timperio et al. (2004) established that walking and cycling have a positive bearing on children's improved self-image, development of independence, decreased dependence on motorised transportation modes, adoption of physical activity behaviour and development of social ties.

Although the benefits of active transportation are well known, majority of adolescents and children, most of the time living within cycling and walking distances from leisure time destinations and school do not cycle or walk to leisure time destinations and school (Van Goeverden & De Boer, 2013). Participating in physical activity on a regular basis is vital for mental and physical health of children, biological maturation, behavioural development and physical growth (Strong et al., 2005). A characteristic physical activity (PA) in childhood has been seen to be related to higher potential of an active adulthood (Craigie et al., 2011). Tracking physical activity through adulthood also show that children's physical activity is indirectly related to a healthy adulthood (Salmon et al., 2005). Relatively higher levels of physical activity have the potential of reducing occurrence of overweight and obesity in children and adolescents (Jansen & LeBlanc, 2010). Physical activity has the potential of mitigating metabolic dysfunctions like cardiovascular disease, hypertension and type – 2 diabetes and improves bone mineral

density (Ekelund et al., 2012; Jansen & LeBlanc, 2010). Furthermore, PA has the potential of positive impact on children's improved self-concept, school performance, reduced depression and anxiety (Jansen & LeBlanc, 2010; Biddle & Asare, 2011; Hallal et al., 2006).

Larouche et al. (2014) notes that the contribution of active transportation to children's and adolescents' daily physical activity rates is anchored on the distance travelled between home and school, implying a feasible dose-response relationship. Sufficient engagement in cycling and walking among children and adolescents to destinations lead to numerous health benefits apart from prompting the development of motor and social skills (Larouche et al., 2014; Saunders et al., 2013). According to socio-ecological model, multiple levels (individual and environmental) affect behaviour related to particular domains of physical activity (PA) especially active transportation (Sallis et al., 2016). Active transportation has the potential of individual, environmental and social benefits (Conlon, 2013). Some studies have consistently established a favourable relationship between bicycle riding for transportation and leisure and health (Oja et al., 2011). Hendriksen (2000) established that even for individuals with initially low fitness levels, with frequent short distance cycling (modest daily distance of six (6) kilometres three times weekly) is sufficient to boost physical performance. Walking and cycling to school has been determined to be connected to higher levels of cardio-vascular fitness and physical fitness compared to passive modes of travel to school (Cooper et al., 2006; Davison et al., 2008; Sirard et al., 2005). Cycling and walking to school among children has the potential of reducing the prevalence of seven (7) conditions (breast and colon

cancers, depression, cerebrovascular disease, diabetes, ischaemic heart disease and Alzheimer's disease) that have been related to minimal or physical inactivity (Woodcock et al., 2009). Garrard (2009) notes that increased active transportation levels potentially reduce motorised transportation use; this portends additional gains comprising community strengthening due to increased social interactions on the streets in the neighbourhood. The spontaneous interactions are more likely to take place and increase the chance of greater social bonds (Lund, 2002).

2.7 Policy governing Active Transportation (AT) to School

Government policies can influence an individual's choice of mode of travel in two ways, either through pull or push policies. Pull factors make walking or cycling more attractive as a mode of transportation by reducing costs, improving infrastructutre and safety. Push factors make competing modes more expensive, for example, increasing car parking costs, speed limitations and taxation on car ownership (Pucher, 2010).

On policy, GoK (2007) highlights the strategy of developing a 50 year, Integrated National Transport Master Plan, which is linked to the National Spatial Plan. The Master Plan will ensure that the investment and location of transportation infrastructure and services are consistent, with other public policies (GoK, 2007). The Vision also provides for the development of the Nairobi Metropolitan Region Rapid Bus Transit System and the development of Light Rail for Nairobi and its suburbs. The Light Rail is projected to serve at least 150,000 passengers daily, which is 5% of the future transportation demand in the Nairobi Metropolitan (GoK, 2007; Asingo & Mitullah, 2007).

In Kenya, active transportation has been referred to as Non - Motorised and Intermediate Means of Transport (NMIMTs) by the Ministry of transport in the report *Moving a Working Nation* (GoK, 2009). The report noted that 85% of the movements in the rural areas usually take place off the roads (using tracks and paths). NMIMTs support rural mobility needs between homes and farms, markets, rivers, meeting grounds, schools, dispensaries, churches, local administrative offices and rural homes. However, the ministry of transport policy report viewed NMIMTs as a medium of economic production but not as an economic gain in itself. It does not concern itself with regulation and promotion of this mode of transportation among children either. Neither the ministry of transport and infrastructure nor the Kenya Vision 2030 has integrated provisions for non-motorised intermediate means of transportation in their plans.

2.8 Summary of Literature Review

From the literature reviewed on physical activity, it was evident that most of the campaigns for promoting physical activity from around the world target adults and youths; and not the age range of school children in this study. Studies on active transportation done on children were mostly subjective based on self-report, and still most of them focused on the trip to and back from school, ignoring other trips to non-school destinations. A review of Kenya education and transport policies do not have any provision for non-motorised intermediate means of transportation (NMIMT) infrastructure that would encourage active transportation to school among elementary/primary school children. Empirical studies also have revealed the marginal performance of African and particularly Kenyan children in physical activity due to poor

nutrition behaviour and urbanisation. The current study, therefore, sought to fill in the existing gaps in literature on active transportation for children and youth and practice by informing policy on integration of NMIMTs in planning for transportation and provision of education in Kenya.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Research Design

The study utilised cross-sectional descriptive survey design. Cross-sectional designs are usually used to determine the prevalence of a condition at a given point in time and any associated factors, then quantifying the presence and magnitude of associations between variables (Mann, 2003). Mann (2003) further postulated that cross-sectional analytical design is appropriate for examining relationships and associations between variables identified by comparing respondents that had particular characteristics to those who did not, at a given point in time. In the same breath, the researcher examined responses from children who participated in active transport against those who did not to establish a relationship.

3.2 Research Variables

The dependent variable was active transportation to school (denoted by walking, running and cycling). The primary independent variables were route terrain, attractiveness and safety while the secondary independent variables were sex of the participants and socio-economic status (SES). Parental decision on what kind of transportation the child used to school and other destinations and back home was the intervening variable.

3.3 Location of Study

The study was conducted in HSES, MSES and LSES areas of Nairobi City County in Kenya. Nairobi was purposively selected since it is an urban metropolitan area and the capital city of Kenya with people from diverse backgrounds and standards of living

(United Nations University, 2011). The sampling frame comprised pupils from HSES, MSES and LSES areas of Nairobi City County. Socioeconomic Status (SES) is a construct that reflects one's access to collectively desired resources, be they material goods, money, power, friendship networks, healthcare, leisure time, or educational opportunities (Oakes & Rossi, 2003). The researcher anticipated capturing children of varying lifestyle, environmental exposure and opportunities for active school transportation; and providing a more heterogeneous sample even in terms of ethnicity, culture and socio-economic status (SES). For this study, data collection was done within the schools as an appropriate avenue for accessing the participants and their parents.

3.3.1 Nairobi City County

Nairobi City County is located at the South-Eastern end of Kenya's agricultural heartland, at approximately $1^0 9' S$, $1^0 28' S$ and $36^0 4' E$, $37^0 10' E$, Figure 3.1. It occupies an area of about 696.1 Km^2 (CBS, 2002) and the altitude varies between 1,798 metres above sea level. Nairobi city county is surrounded by three counties; Machakos county to the East, Kajiado county to the South and Kiambu county to the North-west. From the three counties neighbouring Nairobi City County, Kiambu shares the longest border with Nairobi. Nairobi City County has a population of 3,138,369 million according to the 2009 Kenya Population and Housing Census with a 3.8% inter-censual growth rate (Kenya National Bureau of Statistics, 2010). The western part of Nairobi is on high ground approximately 1,700-1,800 metres with rugged topography, the eastern side is generally low approximately 1,600 metres and flat (Hayker, 2010).

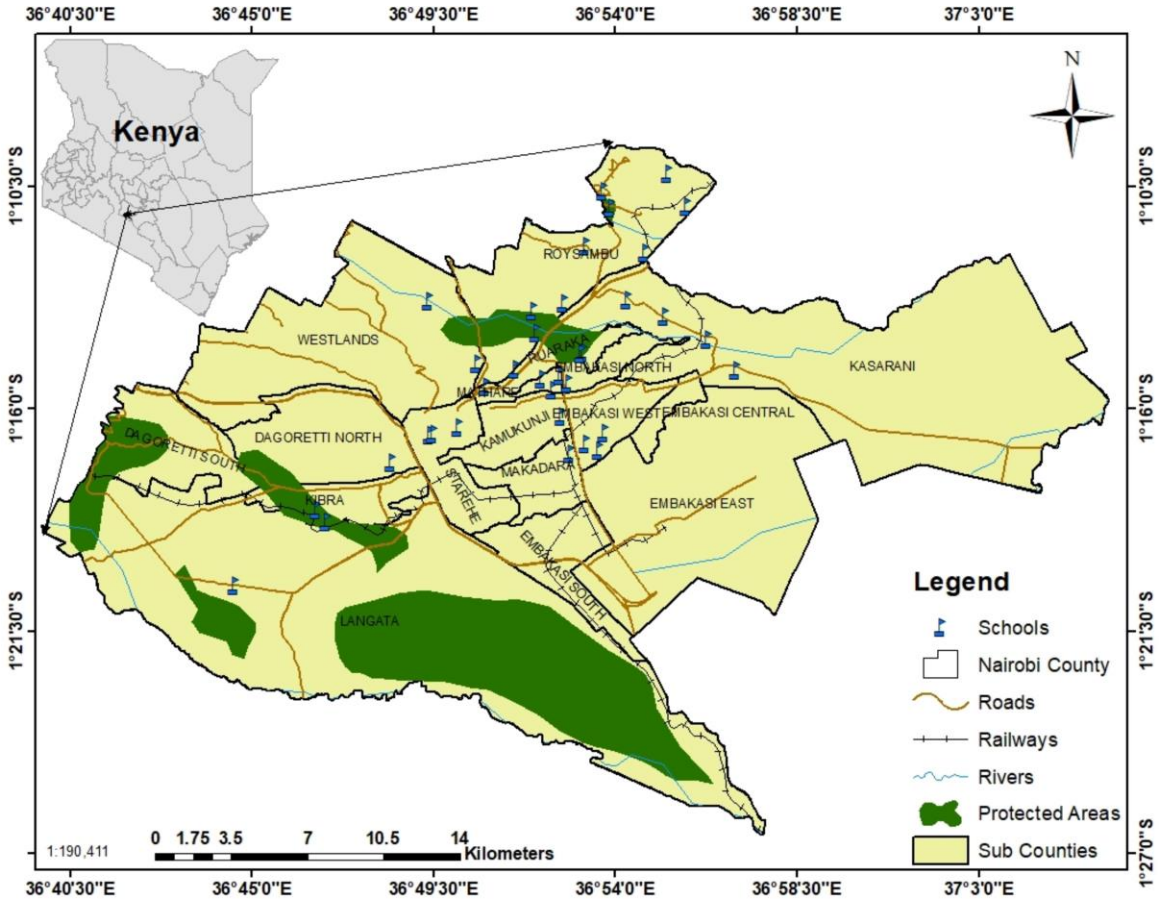


Figure 3. 1. Map of Nairobi City County
Source: Modified by author from Google Maps using ArcGIS 10.3

Socio – economic status is a shorthand reference for aspects that represent the endowment of families, persons, census tracts, households and or other aggregates with regard to capacity to consume or create goods that have societal value (Hauser & Warren 1997). Therefore, socio – economic status may represent occupational standing, educational attainment, income (or poverty), social class, wealth, physical possessions – like houses, cars, home appliances or libraries, award of degrees from prestigious universities and colleges and boats ownership (Vyas & Kumaranayake, 2006) . Hauser &

Warren (1997) further notes that socio – economic status has been tied to but limited to political, cultural and social life participation.

Based on the above residential areas like Karen, Kilimani and Runda were considered to be in high socio – economic status regions. Residential areas like Umoja, Kenyatta University, Ayany and Buruburu were considered to be in middle socio – economic status regions. Residential areas like Kibra, Baba Dogo, Kasarani Kimbo, Kiwanja next to Kenyatta University and Mathare were considered to be low socio - economic status regions.

3.4 Target Population

The target population was estimated to be about 160,879 children in Nairobi City County. According to the nationwide census carried out in 2009, there are 78,788 boys and 82,091 girls in Nairobi County aged between 10 - 12 year old (Kenya National Bureau of Statistics, 2010).

3.4.1 Inclusion Criteria

The study targeted a population of 10 – 12 year old school children from low socio-economic status, middle socio-economic status and high socio-economic status regions of Nairobi City County. The age was determined from their date of birth reported by parent/guardian and as of the date the consent was signed by the parent/guardian. The children were from high socio-economic status (HSES), middle socio-economic status (MSES) and low socio-economic status (LSES) regions of Nairobi City County. Both

male and female school children attending primary schools in Nairobi City County within the predetermined age range were considered for inclusion.

3.4.2 Exclusion Criteria

Participants who were injured or sick at the time of registration were left out, or if they had conditions that could affect active transportation and levels of physical activity. Besides, those already registered but whose data did not contain the essential variables (age, sex, and adequate pedometer data (data for seven days)), were also expunged from the final list.

3.5 Sample Size and Sampling Procedure

3.5.1 Sample Size

A stratified sample population of 1,200 children aged 10 - 12 year old, 400 from high socio-economic status, 400 from middle socio-economic status and 400 from low socio-economic status areas of Nairobi City County were recruited. The research team recruited participants from thirty five (35) schools spread across the three socio-economic status regions to make the sample representative.

The Kenya 2009 census (Kenya National Bureau of Statistics, 2010), reported that there were approximately 160,879 children aged 10 to 12 year old in Nairobi City County. The researcher used the Yamane (Glenn, 2009) formula to estimate the sample size.

A 95% confidence level and p=0.05 (maximum variability) was considered in formulating the following equation:

$$n = \frac{N}{1+N(e)^2} \qquad n = \frac{160879}{1+160879(0.05)^2} = 400$$

Sample size = 400

Where:

N (population size) was 160,879,
'e' is the margin of error (level of precision) set at 0.05,
the confidence level at 0.95,
proportion (response distribution) at 0.05 to get a minimum sample size in each socio-economic status region as 400.

3.5.2 Sampling Procedure

The study used a multi-stage sampling technique that involves working from a large to progressively smaller sampling frames (Sutherland, 2006). The primary sampling unit were schools and the secondary sampling unit were classes within the school that best corresponds to 10 to 12 year old school children. The main sampling frame comprised a list of all mixed day primary schools in Nairobi City County. This sampling frame of schools is typically stratified by indicators of socio-economic status (SES) to maximize variability. First, the schools were categorized as either private or public, which mostly represented various socio-economic classes of schools in terms of schooling costs and incurred expenses. The schools were then classified in three SES groups; low socio-economic status (LSES), middle socio-economic status (MSES) and high socio-economic status (HSES) to capture a range of economic classes.

The secondary sampling frame consisted 10 to 12 year old school children from the sampled schools. The sample frame comprised school children from classes 4 to 6, but in

some cases they came from one class (e.g., all the two/three streams of class five) as determined by activities of the school and school children with the most appropriate age for the study. Due to the nature of data collection procedures which entailed interaction with the pupils during class time, it was imperative to work with a single stream or class (depending on the class size). The study preferred a class-based sample that ensured learning is not disrupted and the children are of a similar education level. In each school, children within the study's age range were randomly selected with help of the respective class teachers using simple random sampling technique. They were then given the consent and assent forms to be completed by the parent and pupils respectively. Since the researcher did not expect 100 percent returns and consent by the parents, the study recruited the first 30 to 40 school children with duly filled forms in each school.

3.6 Research Instruments

The study used step count pedometers, questionnaires and diaries for data collection.

3.6.1: PiezoRx® Pedometer

Pedometers have become increasingly popular as an international approach for supporting PA levels measure in open fields among children (Tudor-Locke et al., 2004a). They estimate vertical oscillations of body movement at the hip line, giving total frequency of accumulated ambulatory movement of steps done (Brusseau et al., 2011; Vincent & Pangrazi, 2002). The PiezoRx® brand of pedometer was used for determining number of step counts to get children's amount of physical activity (PA). The PiezoRx® is an accelerometer based physical activity monitoring device developed for physicians and researchers that use thresholds of step rate to assess intensity related physical activity

(O'Brien et al., 2018). The device has options of factory settings set at moderate =100 steps per minute (SPM) and vigorous =120 steps per minute (SPM), however the thresholds may be adjusted to accommodate individual fitness needs and anthropometrics. The device has the ability record time taken in 'total physical activity' (TPA), this time taken in >60 steps per minute of activity (O'Brien et al., 2018).

The PiezoRx® model used for this study uses the time function to automatically reset the daily data to zero at midnight each day. The last 16 calendar days of data will automatically be stored in the memory and it cannot be switched off either. It has to stay on to retain data memory. The PiezoRx pedometer was worn (Plate 1) by attaching on the waist or hip by both girls and boys for seven (7) days continuous.

Plate 3. 1. A Participant wearing the PiezoRx on the hip

Source: Author field survey

Once the device was collected from the participant after seven (7) days, data was retrieved and recorded into excel data sheet for further data cleaning and scoring. The pedometer data was used to determine active transportation by the 10 – 12 year old school children in HSES, MSES and LSES regions of Nairobi City County in Kenya.

3.6.2 The Active Transportation Assessment Questionnaire

Active transportation was assessed using the Active Transportation Assessment Tool/questionnaire (Appendix A). This was one of the tools used in the Physical Activity and Active Transportation (PAAT) Project that hosted the current study. The questionnaire measured the modes used by the children to get to school, distance from the children's home to school and the barriers (environmental, psychosocial/planning and safety) to active transportation. The PAAT project was a multi-regional study assessing physical activity and active transportation among school children in Eastern, Western and Southern regions of Africa: The case of Kenya, Mozambique and Nigeria. The questionnaires were closed ended with response categories that are prewritten. Dawson (2002) notes that closed ended questionnaires affords a research the following advantages; give the researcher numerical or quantitative data, quick and easy response recording, relatively easy administration, predefined answer from respondents, new issues can't be raised by respondents and it is easy, quick for respondents since they only check 'boxes' therefore likely to complete all questions and ease of analysis. However, questionnaires have disadvantages that must be kept in mind wherever and whenever they are used for collecting data e.g., sometimes answers maybe questionable and inaccurate; when sent by email or post, there may be low return rate; some questions may be unclear and ambiguous leading to unrelated and inaccurate responses; some questions may cause misunderstanding to respondents; respondents' responses may be affected by some questions' wording (Brown, 2001; Zohrabi, 2013).

3.6.3 Child Transportation Diary

The children's transportation behaviour/activities were captured using the child transportation diary (Appendix B). Wolf (2000) notes that travel/transportation diary is a standardised approach used to collect individuals' travel activities conducted at national, state and metropolitan levels. The travel diary is able to pick travel/activity information for a given multi-day or day duration (Wolf, 2000). The study further notes that travel/transportation diaries have developed over the past decades as practitioners and researchers have realised that trip-oriented diaries don't much appropriately with people's thought about daily activities, leading to a large extent trip underreporting.

In the current study, child transportation diary captured travel trip frequencies from home to school and back home, from home to a friend's house/home and back home, from home to a relative's house/home and back home, from home to the park/playground and back home, from home to the shops/supermarket/restaurants and back home, from home to sports venues (e.g., soccer field, swimming pool) and back home and from home to faith places (e.g., church, temple, mosque) by the children while using active transportation modes like walking, running, riding a bicycle. These trip frequencies were recorded on a daily basis for seven (7) days, the duration for data collection at participant level.

3.7 Recruitment and Training of Research Assistants

The principal researcher (PI) for the PAAT project, spearheaded the project in collaboration with his colleagues. The PI's role was to lead in putting together the research team, training and overall management of the research project.

A call for research assistant (RA) position was shared with Kenyatta University students through memos and mounted on all notice boards within the university; this was done in the second half of the month of August 2014. Research assistants were recruited through face – to - face interviews to ensure they possessed basic research knowledge and were available for the study. Those that were recruited had basic knowledge about AT and PA. Twenty (20) research assistants were selected and subjected to a two-day local training facilitated by the PAAT Project PI and Kenyan Site study staff (the PI had previously been trained in Canada on the PAAT study protocol and instrument). The training covered the required procedures on administration of questionnaires and pedometer measurements as well as data management and quality control techniques and professionalism. The trained assistants were examined, certified and assigned duties and responsibilities (desk and field).

3.8 Pre-Testing

A pre-test was conducted to determine that all study procedures, equipment and instruments would enhance the study meeting its set objectives. The purpose of pre-test was to familiarize the research team with the administrative procedures, assess feasibility and logistics, use of research tools, data collection, data management, quality control and data entry. Pre-testing was conducted in three (3) schools in Nairobi City County that were not recruited for the actual data collection. A 4% sample (of the secondary sampling frame) of 20 children, both male and female, was recruited for the pre-test.

3.9 Validity and Reliability

Validity and reliability are ways of measuring research instruments to establish their ability to achieve the research objective and consistency of the results (Flick, 2018). According to Eriksson & Kovalainen (2015), reliability is the extent to which a measure, procedure or instrument have consistency and gives the same result on repeated trials. Blankenship (2010) and Hemphill et al. (2012) define reliability as the repeatability or consistency of the results from an instrument. Validity on the other hand refers to an assessment of whether the data gathered is accurate, about some objective standard or measure (Kimberlin & Winterstein, 2008).

3.9.1 Validity

There are a number of options for establishing the validity of a research instrument. The three main options are criterion validity, construct validity and content validity (Blankenship, 2010).

The research tools (questionnaire and transport diary) were validated through the application of content validity procedures. This is a judgement made better by a team of professionals (Orodho & Kombo, 2002). Content validity comprises examination of format, the number of questions and question types in the research tool (Blankenship, 2010). The researcher had to establish if the print size is appropriate and readable, language used is the right one for the level of respondents and finally clarity of the language to the respondents. For example the questionnaires in this research were interrogated by the student guided by the supervisors to ascertain their appropriateness for each respondent group.

In this connection, the researcher established content validity by piloting these research tools on a similar research population. This gave the researcher an opportunity to review the research tool regarding phrases, words, or confusing sentences. The researcher then sought expert judgement from scholars and practitioners in the field of the research and his supervisors while developing and tuning the research instruments. Any ambiguity and inconsistency were addressed based on the scholars', practitioners' and supervisors' input.

The PiezoRx® device has previously been validated and found suitable. Research has shown that the device has ability to determine precise measure of intensity and steps related to physical activity (Saunders et al., 2014; Colley et al., 2012). However, there is a challenge regarding the interpretation of the findings from above studies since validation research are limited to laboratory environments using particular treadmill speeds hence the need to evaluate the PiezoRx® in a natural setting (O'Brien et al., 2018).

In order to validate the device, a study was conducted by O'Brien and colleagues to determine the accuracy of the PiezoRx® device when measuring steps and intensity related to physical activity compared to ActiGraph® accelerometer among adults in free living conditions (O'Brien et al., 2018). High levels of PA will typically lead to greater physical fitness levels, hence, construct validity was also determined by having step counts per day and MVPA per week of individuals compared to anthropometric, musculoskeletal and aerobic fitness. Finally, PiezoRx® device's usability to underpin regular physical activity behaviour was assessed in a participant subsamples. The study

results established that correlations between PiezoRx® and ActiGraph® functions were statistically significant ($p<0.05$). Sedentary activity per day gave the strongest correlation $r=0.93$ ($p<0.001$). Apart from sedentary activity per day, there were others with strong correlations ($r\geq0.7$); MPA-7, MVPA-7, TPA-7 and Bout (time)-7. There was also moderate correlation between ActiGraph® and PiezoRx® to determine vigorous physical activity (VPA) ($r=0.39$; $p=0.014$). There was also concurrence of means step counts per day between PiezoRx® and ActiGraph® (7601vs7700) (O'Brien et al., 2018). According to the validity study by O'Brien and colleagues, PiezoRx® pedometer had a high correlations to the benchmark measurements for steps ($r=0.88$) and physical activity intensity ($r=0.70$), therefore it can accurately measure intensity and steps related to physical activity among adults in free-living environment (O'Brien et al., 2018).

3.9.2 Reliability

To test reliability in a research, the following methods are widely used; 'test-retest' method, 'equivalent-forms' method, the 'split-halves' method and the 'internal-consistency' method (Flick, 2018).

In the 'test-retest' method, the researcher administers the tool twice with a modest lapse of time between the test and retest (Blankenship, 2010). The researcher then compares the two results to determine their consistency. If the results indicate a consistency then it will be proof of reliability of the research tool. This was not appropriate for this study, since it is time-consuming and some respondents might not agree to filling-in another questionnaire about the same issue with the same questions.

The ‘equivalent-forms’ method calls for the researcher to administer two different research tools to a respondent at the same time; the two tools must evaluate the same variable, for example a leisure participant satisfaction (Blankenship, 2010). The researcher then compares the outcome of the two research tools if they are alike. If the outcomes are similar, it will have proved the reliability of the research tool. This entails the researcher giving the satisfaction survey questionnaire to the participants at the end of their activity giving two sets of data to compare from one contact with the participants. The outcomes from the two research tools are compared for each participant to determine their consistency. This method might not work for this study since getting two research tools measuring the same variable is a challenge (Blankenship, 2010).

The ‘split-halves’ method is more appealing to researchers since it allows use of only one instrument for comparison. The researcher here is required to collect data once only using one research tool. This technique requires the research tool to include at least two questions that enquire about the same thing but in different ways (Blankenship, 2010). However, this method too was not appropriate for this study due to the challenge arriving at a pair of questions enquiring on the same variable.

Finally the ‘internal consistency’ method correlates all items in the whole sample population and the average inter-item correlation is used to test reliability (Flick, 2018).

The study used ‘internal consistency’ method to determine reliability. This was tested using Cronbach’s Alpha which is a measure of internal consistency. It measures how closely related a set of items are as a group. A "high" value of alpha is often used as

evidence that the items measure an underlying (or latent) construct (Warmbrod, 2001). Geoffrey & David (2005) states that to ensure reliability a predetermined threshold of 0.7 is needed. That is, values above 0.7 will indicate presence of reliability while values below 0.7 will signify lack of reliability.

3.10 Data Collection Procedure

Data collection was conducted between May 2015 to November 2015 during the regular school term and school hours at the selected schools. The study targeted to work with 10 to 12 year old school children, and they were recruited from class 4 to 6, depending on the school since the study used a class-based sample. Subjects' age was determined from their date of birth as reported by parent/guardian and as of the date the consent was signed by the parent/guardian. Informed consent forms (Appendix E), and the questionnaires completed by the parent/guardian were given to the sampled children to take home for their parent/guardian to complete. After a week, the research team went back to the schools to collect all the forms from the children. Only those whose consent forms were fully filled were recruited for the study. The recruited school children were then issued with the acsent form (Appendix D) and asked to sign their consent if they wished to participate in the study. Those who assented were then registered as participants in the study.

Once the research team had the number of 10–12 year old school children with duly filled and signed parents' consent forms, data collection commenced. The research team distributed the child questionnaire to the participants while the team leader guided them through the questionnaire. The participants were not supposed to be influenced in any

way by the research team, but to respond to the items in the questionnaire as they understood them.

Once the participants were through with the questionnaire, the team leader explained to them the procedure of filling in the child's transport diary that was to be done by their parents at home. The same explanation (given to the school children) was given to the class teacher who would be guiding them to fill another copy that was retained in school. After this was done, the research team distributed the pedometers to the participants showing them how to wear it while the team leader took them through the process of caring for the instrument. The participants were to wear the pedometers for seven consecutive days of their wake hours after which they were collected for downloading of data and scoring. This phase of data collection was concluded by giving the participants parental questionnaire to take to their parents/guardians to fill and these questionnaires were returned together with pedometers after seven days.

3.11 Data Analysis and Presentation

3.11.1 Data Scoring

Scoring of data, entry, and checking were done by the PAAT Kenya research project team at Kenyatta University. Quality control and consistency for range checks to ascertain the data is complete was conducted by the research team under guidance of the project's Principal Investigator. Once certain that they had complete and quality data, it was then entered and managed using excel spread sheet. The second step involved

extracting data for Nairobi City County then exported to Statistical Package for Social Sciences (SPSS) version 21for purposes of achieving objectives of the current study.

3.11.1.1 Active Transportation to School and other Destinations

Active transportation was scored from the child questionnaire and diary on the number of destinations visited from home. These were school, friend's house, relative's house, shop, sports venue, parks and faith places.

3.11.1.2 Socio-Economic Status (SES) of Participants

The SES data were obtained from the questionnaires completed by the parent or guardian. There were three SES strata in the study, high socio-economic status, middle socio-economic status and low socio-economic status. The SES was assessed as a combination of vehicle ownership, motorcycle ownership, and bicycle ownership; and education level of the parent/guardian.

3.11.1.3 Objectively Monitored Physical Activity using Pedometer

A maximum of 7 days from each pedometer file was screened for possible inclusion in the summary datasets. A rigorous process of data checks and cleaning was conducted by the research team to ensure the final dataset contained valid data (duly completed questionnaires, transportation diaries and pedometers with seven days of data) as per the protocol. The pedometer (PiezoRx® model) sets provided data on daily total number of steps, total time (in hours, minutes and seconds) of physical activity (PA), moderate physical activity (MPA) duration, moderate to vigorous physical activity (MVPA)

duration and vigorous physical activity (VPA) duration. Every pedometer set that had complete logs as stated above were considered valid and entered into the data set.

3.11.1.4 Scoring for Barriers to Active Transportation

There were twenty barriers (hills on the route, unsuitable paths, boring route, unlighted route, too much traffic on route, dangerous crossings, children sweating while using AT, no other children using AT, AT is unfashionable, a lot to carry, easily driven, a lot of prior planning required, crime on route, child gets bullied, no safe bike park, stray dangerous animals, school is far, odours on the route, isolated route and child having a disability) to active transportation. Each of the barriers was recorded from the child's questionnaire.

3.11.2 Data Analysis and Presentation

The data coded in excel spreadsheet was exported into Statistical Package for Social Sciences (SPSS) version 21 for analysis. Descriptive statistics such as frequencies, percentages, means and standard deviations (SD) were used to describe the demographic characteristics of the participants, their schools as well as the variables of the study. For objective one, cross-tabulations were run to determine active transportation modes to school and other destinations. Further, the study also compared children's active transportation to school and other destinations across the three SES regions within Nairobi City County. In objective two, cross-tabulations were run to determine descriptions for the school children's active transportation to other destinations within Nairobi City County. A One-Way ANOVA test was further used to ascertain difference in active transportation across the three SES regions within the study area. Cross-

tabulations and One-Way ANOVA were run to determine the effect of socio-economic factors on active transportation among school children across the three regions (HSES, MSES and LSES) in Nairobi City County. The results were supported by the descriptive statistics from questionnaire. Finally, cross-tabulations, One-Way ANOVA test and Post Hoc test were run to determine moderate to vigorous physical activity (MVPA) rates, means, and their associations across the three socio-economic status regions within Nairobi City County. A p-value of ≤ 0.05 was set to be considered significant in the testing of hypotheses.

3.12 Logistical and Ethical Considerations

Approval of the research proposal (Appendix H), clearance and authorization to conduct the study was sought from the Graduate School, Kenyatta University (Appendix I). Permission to conduct research was sought from the National Commission for Science, Technology and Innovation (NCSTI) (Appendix F). Ethical review Authorisation of the study protocol for the PAAT project had been secured (Appendix G).

As for the school recruitment, school administrators of selected schools were approached and issued with a letter of request to participate, which contained information about the study. A detailed explanation of the study was also presented to parents/guardians to give consent for their children to participate in the study by signing the English language version of the informed consent form (Appendix E). The participating school children also received an explanation about the study and assent to take part by signing the assent forms (Appendix D). Participants were assured of confidentiality and that data collected was to be used for research purposes only.

CHAPTER FOUR: RESULTS

4.0 Introduction

This study aimed at assessing active transportation behaviours, barriers to active transportation (AT) and effects of socio-economic status on active transportation among 10 - 12 year old school children in high socio-economic status (HSES), middle socio-economic status (MSES) and low socio-economic status (LSES) regions in Nairobi County. The study also sought to objectively measure the amounts of physical activity of children attributed to active transportation. Findings from the study are presented in this chapter.

4.1 Characteristics of the Study Participants

A total of 1,200 questionnaires were distributed to the sampled pupils. From this number, 877 were successfully filled in and returned to the research team, representing a response rate of 78.2%. Reasonable rate of returns in academic studies should be about 60% (Baruch, 1999). Any fluctuation from this average, especially downwards, must be explained. The 877 pupils who successfully took part in the study were from 35 primary schools comprising 214 (24.4%) from high socioeconomic status (HSES), 357 (40.7%) from middle socioeconomic status (MSES) and 306 (34.9%) low socioeconomic status (LSES) regions of Nairobi City County in Kenya.

From the study population, it is indicative that there were more participants in the study from the MSES region. Of the 877 participants, majority were girls 482 (55.0%) while boys were 395 (45.0%). Most of the study participants were 12 years old pupils 369

(42.1%), 11 years old pupils were 280 (31.9%) and 10 years old pupils were 228 (26.0%). These details are outlined in (Table 4.1).

Table 4. 1. Characteristics of study participants

Study participants	n (877)	(%)
Region		
HSES	214	24.4
MSES	357	40.7
LSES	306	34.9
Total	877	100.0
Age		
10	288	26.0
11	280	31.9
12	369	42.1
Total	877	100.0
Gender		
Boy	395	45.0
Girl	482	55.0
Total	877	100.0

n represent number of participants; % percentage

4.2 Active Transportation (AT) Modes to School and other Destinations by 10 – 12 year old Children

From the results on (Table 4.2), most of the children across the regions walked to school. Majority 629 (71.7%) walked to school, 135 (15.4%) of the children used car/van to school, 55 (6.3%) used bus/train to school, 54 (6.2%) of the children ran to school, 3 (0.3%) of the children used motorcycle to school while 1 (0.1%) child rode a bicycle to school. The results indicate that more children from the middle socio economic status region of Nairobi City County walked to school. One phenomenon that stood out is that the second most used mode of transportation was car/van indicating there could be a possibility of children being driven to school by their parents and/or presence of school organised transportation services.

Table 4. 2. School children's modes of transportation to school and other destinations in Nairobi City County

		Transportation Mode						Total
		Walk	Bike	Run	Car/Van	Bus/Train	Motorcycle	
Region	HSES	101(11.5%)	0(0.0%)	11(1.3%)	57(6.5%)	23(2.6%)	1(0.1%)	193(22.0%)
	MSES	274(31.2%)	1(0.1%)	14(1.6%)	64(7.3%)	24(2.7%)	1(0.1%)	378(43.1%)
	LSES	254(29.0%)	0(0.0%)	29(3.3%)	14(1.6%)	8(0.9%)	1(0.1%)	306(34.9%)
Total		629(71.7%)	1(0.1%)	54(6.2%)	135(15.4%)	55(6.3%)	3(0.3%)	877(100.0%)

Results in (Table 4.3) denotes more children in HSES and MSES combined 375 (42.7%) walked compared to more than half the number of their conterparts from the LSES 254 (29.0%). More children in LSES 29 (3.3%) ran to school and other destinations compared to only 25 (2.9%) from HSES and MSES when combined. Further, more children from HSES and MSES combined used private transportation (car/van) 121 (13.8%) and public transportation (bus/train) 47 (5.3%) compared to their LSES counterparts used private transportation (car/van) 14 (1.6%) and public transportation (bus/train) 8 (0.9%).

Table 4. 3. School children's Modes of transportation to school and other destinations comparing HSES and MSES against LSES in Nairobi City County

	Transportation Mode						Total
	Walk	Bike	Run	Car/Van	Bus/Train	Motorcycle	
HSES & MSES	375(42.7%)	1(0.1%)	25(2.9%)	121(13.8%)	47(5.3%)	2(0.2%)	571(65.1%)
LSES	254(29.0%)	0(0.0%)	29(3.3%)	14(1.6%)	8(0.9%)	1(0.1%)	306(34.9%)
Total	629(71.7%)	1(0.1%)	54(6.2%)	135(15.4%)	55(6.3%)	3(0.3%)	877(100.0%)

From the means, in (Table 4.4), more (%) children of LSES used active transportation to school and other destinations (school, friend's house, relative's house, park, shop, sports venue and faith places) than those from HSES and MSES. Another significant phenomenon is that across the regions (HSES, MSES and LSES) in Nairobi City County all the children used active transportation (AT) to other destinations (noted from the minimal variation in the values of means, (Table 4.4). Means of active modes of transportation to shop destinations from the study is significantly high while that of faith places destination are lower. This suggests that children frequented shop destinations than faith place destinations (what do you attribute this to? Cite a study that concurs with this attribution).

Table 4. 4. Description of children's active transportation (AT) to school and other destinations

		N	Mean	Std. Deviation
School AT	HSES	193	4.31	2.60
	MSES	378	4.85	2.20
	LSES	306	5.49	1.90
	Total	877	4.95	2.24
Friends AT	HSES	193	4.13	3.40
	MSES	378	4.16	3.063
	LSES	306	5.48	4.544
	Total	877	4.61	3.762
Relatives AT	HSES	193	3.35	3.075
	MSES	378	3.27	3.077
	LSES	306	3.70	3.708
	Total	877	3.44	3.312
Park AT	HSES	193	5.21	4.344
	MSES	378	4.87	4.380
	LSES	306	5.45	5.923
	Total	877	5.15	4.967
Shop AT	HSES	193	6.65	6.035
	MSES	378	6.25	5.642
	LSES	306	8.84	7.232
	Total	877	7.24	6.426
Sport AT	HSES	193	3.52	3.203
	MSES	378	3.27	3.176
	LSES	306	3.58	4.151
	Total	877	3.44	3.551
Faith AT	HSES	193	2.66	3.516
	MSES	378	2.54	2.914
	LSES	306	2.93	3.553
	Total	877	2.70	3.285

A one-way ANOVA test between groups was performed to compare the means of children's active transportation modes to school and other destinations across HSES, MSES and LSES regions in Nairobi city county, (Table 4.5). Active transportation modes to school (F=17.90, p<0.0001), to a friend's house (F=12.82, p<0.0001) and to shop destinations (F=15.29, p<0.0001) recorded highly significant levels. For the other destinations, relative's house (F=1.49, p=0.23), park destinations (F=1.18, p=0.31), sports

destinations (F=0.73, p=0.48) and faith places (F=1.17, p=0.31). The p values for active transportation means to the latter destinations were not significant hence illustrating no relationship across the three regions of Nairobi city county.

Table 4. 5. ANOVA test for children's active transportation (AT) to school and other destinations

		df	Mean Square	F	Sig.
School AT	Between Groups	2	86.73	17.900	.000
	Within Groups	874	4.85		
	Total	876			
Friends AT	Between Groups	2	176.67	12.818	.000
	Within Groups	874	13.78		
	Total	876			
Relatives AT	Between Groups	2	16.33	1.490	.226
	Within Groups	874	10.96		
	Total	876			
Park AT	Between Groups	2	29.04	1.177	.309
	Within Groups	874	24.66		
	Total	876			
Shop AT	Between Groups	2	611.22	15.287	.000
	Within Groups	874	39.98		
	Total	876			
Sport AT	Between Groups	2	9.18	.728	.483
	Within Groups	874	12.62		
	Total	876			
Faith AT	Between Groups	2	12.62	1.171	.311
	Within Groups	874	10.78		
	Total	876			

A Post Hoc Test, (Table 4.6), was performed to establish the exact groups that had a strong association. From the study results, going to school; visiting a friend's house and going to the shop were found to have significant statistical difference across regions (HSES, MSES and LSES) in Nairobi City County. Active transportation to school showed strong associations across all the three regions. HSES compared to MSES

(p=0.015) and LSES (p<0.0001); MSES compared to HSES (p=0.015) and LSES (p<0.0001); and LSES compared to HSES (p<0.0001) and MSES (p<0.0001). This means that children who live in HSES compared to LSES recorded statistical significant difference for active transportation modes to school and to a friend's house. On the other hand children living in HSES compared to MSES recorded no significant statistical difference for active transportation modes to school, friend's house, relatives' house, park destination, shop, sports/recreation grounds and faith places. On the trip from home to a friends' house statistical significant difference was noted between HSES compared to LSES (p<0.0001); MSES compared to LSES (p<0.0001); LSES compared to HSES and MSES, were (p<0.0001) and (p<0.0001) respectively. This means that children who live in HSES used active transportation modes to school and visit a friend's house, but not to other destinations like relatives' house, park destinations, shops, sports/recreation grounds and faith places they used. Looking at the remaining destinations (relative's house, park, sports ground and faith places), it is noted that there was no statistical significant difference (what can this be attributed to? Cite study from literature that supports the attribution).

Table 4. 6. Multiple comparisons of active transportation (AT) modes by children to other destinations

Dependent Variable	(I) Region	(J) Region	Mean Difference (I-J)	Std. Error	Sig.
School AT	HSES	MSES	-.541*	.195	.015
		LSES	-1.184*	.202	.000
	MSES	HSES	.541*	.195	.015
		LSES	-.644*	.169	.000
	LSES	HSES	1.184*	.202	.000
		MSES	.644*	.169	.000
Friend's house AT	HSES	MSES	-.029	.328	.996
		LSES	-1.351*	.341	.000
	MSES	HSES	.029	.328	.996
		LSES	-1.322*	.285	.000
	LSES	HSES	1.351*	.341	.000
		MSES	1.322*	.285	.000
Relative's house AT	HSES	MSES	.077	.293	.962
		LSES	-.349	.304	.486
	MSES	HSES	-.077	.293	.962
		LSES	-.426	.255	.216
	LSES	HSES	.349	.304	.486
		MSES	.426	.255	.216
Park AT	HSES	MSES	.339	.439	.720
		LSES	-.242	.456	.857
	MSES	HSES	-.339	.439	.720
		LSES	-.581	.382	.281
	LSES	HSES	.242	.456	.857
		MSES	.581	.382	.281
Shop AT	HSES	MSES	.402	.559	.753
		LSES	-2.190*	.581	.001
	MSES	HSES	-.402	.559	.753
		LSES	-2.592*	.486	.000
	LSES	HSES	2.190*	.581	.001
		MSES	2.592*	.486	.000
Sports venue AT	HSES	LSES	.251	.314	.704
		HSES	-.062	.327	.981
	MSES	LSES	-.251	.314	.704
		HSES	-.312	.273	.487
	LSES	MSES	.062	.327	.981
		MSES	.312	.273	.487
Faith places AT	HSES	MSES	.118	.291	.913
		LSES	-.265	.302	.655
	MSES	HSES	-.118	.291	.913
		LSES	-.383	.253	.283
	LSES	HSES	.265	.302	.655
		MSES	.383	.253	.283

Multivariate analysis of variance (MANOVA) was conducted to establish differences on children's use of active transportation to destinations across regions (LSES, MSES and HSES) in Nairobi City County. A non-significant Box's *M* test F = 0.499 and $p = 0.917$ indicates presence of homogeneity of covariance matrices of children's active transportation behaviour across the socio-economic regions (Table 4.7). The first null hypothesis (H_{01}**)** that there would be no significant statistical difference in active transportation to school and other destinations among 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County was accepted. What doe this imply/ infer?

Table 4. 7. Box's Test of Equality of Covariance Matrices[a]

Box's M	6.020
F	.499
df1	12
df2	2520693.043
Sig.	.917

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Region

4.3 Barriers affecting Active Transportation (AT) for Children by Region

A number of barriers affected the children's active mode on the route to school. There were a total of twenty route barriers (hills on the route, unsuitable paths, boring route, unlighted route, too much traffic on route, dangerous crossings, children sweating while using AT, no other children using AT, AT is unfashionable, a lot to carry, easily driven, a lot of prior planning required, crime on route, child gets bullied, no safe bike park, stray dangerous animals, school is far, odours on the route, isolated route and child having a

disability). The study reorganised the twenty barriers into three sub groups; environmental barriers (hills on the route, unsuitable paths, boring route, no safe bike park, school is far, odours on the route and child has a disability), psychosocial barriers (sweating, no other children using AT, AT is unfashionable, a lot to carry, easier driven and a lot of prior planning required) and safety barriers (unlighted route, too much traffic on the route, dangerous crossings, crime on route, child gets bullied, dangerous animals and isolated route).

4.3.1 Environmental Factors affecting Children's Active Transportation to School

Findings from the environmental factors affecting AT for children to school in Nairobi city county's three regions established that more of children in the MSES region 256 (41.4%) recorded higher rates of AT while only 14 (32.6%) posted low AT rates (Table 4.8). In LSES and MSES regions more children 87 (40.5%) and 256 (41.4%) respectively reported moderate rates of AT while in HSES 41 (19.1%) registered moderate AT levels.

Table 4. 8. Environmental factors affecting children's AT to school and other destinations in Nairobi City County

Region	Low AT Rate	Moderate AT Rate	High AT Rate	Total	χ^2	P-value
LSES	16(37.2%)	87(40.5%)	203(32.8%)	214(24.4%)		
MSES	14(32.6%)	87(40.5%)	256(41.4%)	357(40.7%)	47.267	0.0000
HSES	13(30.2%)	41(19.1%)	160(25.8%)	306(34.9%)		
Total	43(4.9%)	215(24.5%)	619(70.6%)	877(100.0%)		

Pearson Chi-Square statistics, $\chi^2 = 47.27$ and $p < 0.0001$ shows there was statistical significant difference across regions on the effect of children's AT by environmental factors. What does this imply?

From the study it was established that some roads children use to school don't support use of active transportation modes as seen in (Plate 4.1). The section for pedestrians has heaps of litter, informal trader structures and dirty waste water.

Plate 4. 1. Heaps of litter, informal trader structures and dirty waste water posing challenges to school children using AT

Source: Author field survey

Some of the roads in Nairobi City County do not have designated pedestrian or cycling paths as illustrated in (Plate 4.2).

Plate 4. 2. School children exposed to motor traffic conflict, foot/pedestrian path totally lacking in Kahawa West, Nairobi

Source: Author field survey

New roads are being constructed that are walking and cycling friendly like Ngong' road next to Kenyatta National Hospital. There are traffic calming measures at pedestrian and cyclist crossing points as illustrated in (Plate 4.3). What are the risk associated with this kind of approach? Cite studies from your literature to support

Plate 4. 3. Clearly marked pedestrian together with bicycle crossing on Ngong' Road in Nairobi
Source: Author field survey

4.3.2 Psychosocial/Planning Factors affecting Children's AT to School

The results from psychological/planning factors affecting AT for children to school in Nairobi city county's three regions (Table 4.9) revealed that more children in the MSES region 133 (43.3%) had Moderate rates of active transportation compared to the low rate of 66 (21.5%) among children in the HSES region. Relatively, more children 112 (40.6%) in the MSES region had moderate rate of AT compared to only 75 (27.2%) from the HSES region. Children from LSES had a lower number 73 (24.8%) of high rate of AT

compared to relatively higher numbers 112 (38.1%) among the MSES children and 109 (37.1%) for HSES regions.

Pearson statistics results χ^2 = 19.55 and p = 0.0006 shows significant statistical difference. This proved that there were differences across the socio-economic regions in Nairobi City County how psychosocial/planning factors affected AT among the children.

Table 4. 9. Psychological/Planning factors affecting children's AT to school and other destinations in Nairobi City County

Region	Low AT Rate	Moderate AT Rate	High AT Rate	Total	χ^2	P-value
LSES	89(32.2%)	108(35.2%)	73(24.8%)	214(24.4%)		
MSES	112(40.6%)	133(43.3%)	112(38.1%)	357(40.7%)	19.546	0.0006
HSES	75(27.2%)	66(21.5%)	109(37.1%)	306(34.9%)		
Total	276(31.5%)	307(35.0%)	294(33.5%)	877(100.0%)		

4.3.3 Safety Factors affecting Children's AT to school

When safety factors were analysed (Table 4.10) results showed that school children in the MSES region of Nairobi City County recorded relatively higher rates of active transportation 113 (41.5%) moderate AT and 211 (41.3%) high AT rate. A relatively large number of school children in HSES and MSES regions 33 (35.1%) respectively recorded low AT rates compare to their counterparts in LSES region 28 (29.8%). In the high AT rate category, relatively fewer children from LSES region of Nairobi City County recorded low AT rates 117 (22.9%) compared to HSES 183 (35.8%) and MSES 211 (41.3%).

Table 4. 10. Safety factors affecting children's AT to school and other destinations in Nairobi City County

Region	Low AT Rate	Moderate AT Rate	High AT Rate	Total	χ^2	P-value
LSES	28(29.8%)	69(25.4%)	117(22.9%)	214(24.4%)		
MSES	33(35.1%)	113(41.5%)	211(41.3%)	357(40.7%)	2.889	0.5766
HSES	33(35.1%)	90(33.1%)	183(35.8%)	306(34.9%)		
Total	94(10.7%)	272(31.0%)	511(58.3%)	877(100.0%)		

Some roads next to schools lack provision for crossing as depicted in the image below. A parent/guardian accompanying children leaving school at Moi Avenue Primary School within Nairobi CBD.

Plate 4. 4. Children accompanied by guardian crossing a road without any signage, calming or vertical measures

Source: Author field survey

A Chi square test to determine difference of the effect of safety factors on children's AT transport across socio-economic regions of Nairobi gave $\chi^2 = 2.89$ and $p < 0.577$. The

results denote no statistical significant difference on the effect of safety factors to children's AT across the regions.

Box's test of equality of covariance matrices[a] resulted in F = 0.499 and p = 0.917 denoting absence of significant statistical difference (Table 4.11). This indicates that the barriers (environmental, psychosocial/planning and safety) affected active transportation use by the children across the regions (LSES, MSES and HSES) in Nairobi City County. As a result null hypothesis H_{02} There would be no significant statistical difference in the barriers of active transportation to school for 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County was accepted.

Table 4. 11. Box's Test of Equality of Covariance Matrices[a]

Box's M	6.020
F	.499
df1	12
df2	2520693.043
Sig.	.917

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + Region

School children brace themselves to cross some roads without signage or traffic calming measures as seen in Plate 4.5 below along Ngumba road.

Plate 4. 5. School children crossing Ngumba Road to Githurai Primary School, there is neither signage nor traffic calming measure of any kind

Source: Author field survey

4.4: Relationship Between Socio-Economic Factors and AT among Children in the Regions

The study considered factors like parent's/guardian's level of education, ownership of vehicles, motorcycles and bicycles as depicters of socio – economic status among the households of the study participants. From the descriptive (Table 4.12) below, the means of level of education across the three regions; HSES (μ=4.88), MSES (μ=4.67) and LSES (μ=3.92) were significantly higher than for the other factors like ownership of vehicles, motorcycles and bicycles which were less than 1 (μ<1).

Table 4. 12. Description of children's household socioeconomic status and active transportation in Nairobi City County

		N	Mean	Std. Deviation	Std. Error
Education	HSES	214	4.88	1.94	.13
	MSES	357	4.67	1.89	.10
	LSES	306	3.92	1.71	.10
	Total	877	4.46	1.89	.06
Vehicles	HSES	214	.82	1.00	.07
	MSES	357	.82	.82	.04
	LSES	306	.64	.79	.05
	Total	877	.76	.86	.03
Motorcycles	HSES	214	.61	.82	.06
	MSES	357	.71	.80	.04
	LSES	306	.64	.68	.04
	Total	877	.66	.77	.03
Bicycles	HSES	214	.79	.90	.06
	MSES	357	.96	1.03	.05
	LSES	306	.85	.85	.05
	Total	877	.88	.94	.03

The dispersion from the standard deviation results and the range between maximum and minimum values are almost equal for all the indicators of socio-economic factors. This does not tell much whether there is any difference on effects of socio-economic factors to children's active transportation across the regions (HSES, MSES and LSES).

A one-way ANOVA test between groups was performed to compare the impact of socio-economic factors children's active transportation across HSES, MSES and LSES regions in Nairobi city county, (Table 4.13) below. Ownership of motorcycles and bicycles within the children's households did not affect active transportation across all the three regions in Nairobi city county (F=1.273, p=0.281) and (F=2.289, p=0.101) respectively.

The other socio-economic indicator factors; parental level of education and ownership of vehicles recorded statistical significant differences (F=21.165, $p<0.0001$) and (F=4.510, $p=0.011$) respectively.

Table 4. 13. ANOVA Test for relationship between children's household socioeconomic status and active transportation (AT) across the socioeconomic regions in Nairobi City County

Indicator		Sum of Squares	df	Mean Square	F	Sig.
Education	Between Groups	144.017	2	72.009	21.165	.000
	Within Groups	2973.629	874	3.402		
	Total	3117.647	876			
Vehicles	Between Groups	6.643	2	3.321	4.510	.011
	Within Groups	643.592	874	.736		
	Total	650.235	876			
Motorcycles	Between Groups	1.496	2	.748	1.273	.281
	Within Groups	513.881	874	.588		
	Total	515.377	876			
Bicycles	Between Groups	4.040	2	2.020	2.299	.101
	Within Groups	767.905	874	.879		
	Total	771.945	876			

Post – hoc comparisons of indicators of socio-economic factors' effect on active transportation by children across HSES, MSES and LSES regions using Tukey HSD test found that parents/guardian's level of education and vehicle ownership had an impact on active transportation within groups in the city's regions. For the parents'/guardian's level of education when HSES region was compared to MSES and LSES, the significance levels were $p=0.389$ and $p<0.0001$ respectively; MSES compared to HSES and LSES the significance levels were $p=0.389$ and $p<0.0001$ respectively; when LSES compared to HSES and LSES, the significance levels were $p<0.0001$ and $p<0.0001$ respectively. On the second socio economic factor, ownership of vehicles, when HSES region was compared to MSES and LSES, the significance levels were $p=1.000$ and $p=0.046$

respectively; MSES compared to HSES and LSES the significance levels were p=1.000 and p=0.017 respectively; when LSES compared to HSES and LSES, the significance levels were p=0.046 and p=0.017 respectively.

On the other hand, ownership of motorcycles and bicycles among the children's households as a measure of socio economics status did not affect active transportation within groups in the city's regions. For the third socio economic indicator factor, ownership of motorcycles within households when HSES region was compared to MSES and LSES, there was no statistical significant difference.

This meant that ownership of motorcycles and bicycles as a socio-economic indicator by parents/guardians of children in Nairobi City County did not have any relationship to the use of active transportation by children within HSES, MSES and LSES regions.

Looking at the other indicators of socio-economic factors, parents'/guardians' level of education and ownership of vehicle, statistical significant difference is noted across most of the regions (Table 4.14) except when HSES is compared to MSES and MSES compared to HSES.

Table 4. 14. Multiple comparisons of children's household socioeconomic status effects on active transportation (AT) across the socioeconomic status regions in Nairobi City County

Dependent Variable	(I) Region	(J) Region	Mean Difference (I-J)	Std. Error	Sig.
Education	HSES	MSES	.209	.159	.389
		LSES	.963*	.164	.000
	MSES	HSES	-.209	.159	.389
		LSES	.754*	.144	.000
	LSES	HSES	-.963*	.164	.000
		MSES	-.754*	.144	.000
Vehicles	HSES	MSES	-.001	.074	1.000
		LSES	.182*	.076	.046
	MSES	HSES	.001	.074	1.000
		LSES	.183*	.067	.017
	LSES	HSES	-.182*	.076	.046
		MSES	-.183*	.067	.017
Motorcycles	HSES	MSES	-.098	.066	.299
		LSES	-.030	.068	.901
	MSES	HSES	.098	.066	.299
		LSES	.069	.060	.484
	LSES	HSES	.030	.068	.901
		MSES	-.069	.060	.484
Bicycles	HSES	MSES	-.165	.081	.103
		LSES	-.060	.084	.753
	MSES	HSES	.165	.081	.103
		LSES	.106	.073	.318
	LSES	HSES	.060	.084	.753
		MSES	-.106	.073	.318

Estimates of covariance parameters test gave $p < 0.0001$ denoting significant statistical difference of the effect of socio-economic factors (parental education level, ownership of vehicles, ownership of motorcycles and ownership of bicycles) on children's active transportation behaviour across the regions (LSES, MSES and HSES) in Nairobi City County. This means that the socio-economic factors did not equally affect children's active transport behaviour in high socio-economic status, middle socio-economic status and low socio-economic status regions in Nairobi City County, (Table 4.15) below. The

third null hypothesis **(**H_{03}) which stated that there would be no significant statistical difference on the effects of socio – economic status to 10 – 12 year old children's active transportation in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County was rejected.

Table 4. 15. Estimates of Covariance Parameters[a]

Parameter	Estimate	Std. Error	Wald Z	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Residual	1.601827	.077563	20.652	.000	1.456797	1.761296

a. Dependent Variable: School Mode.

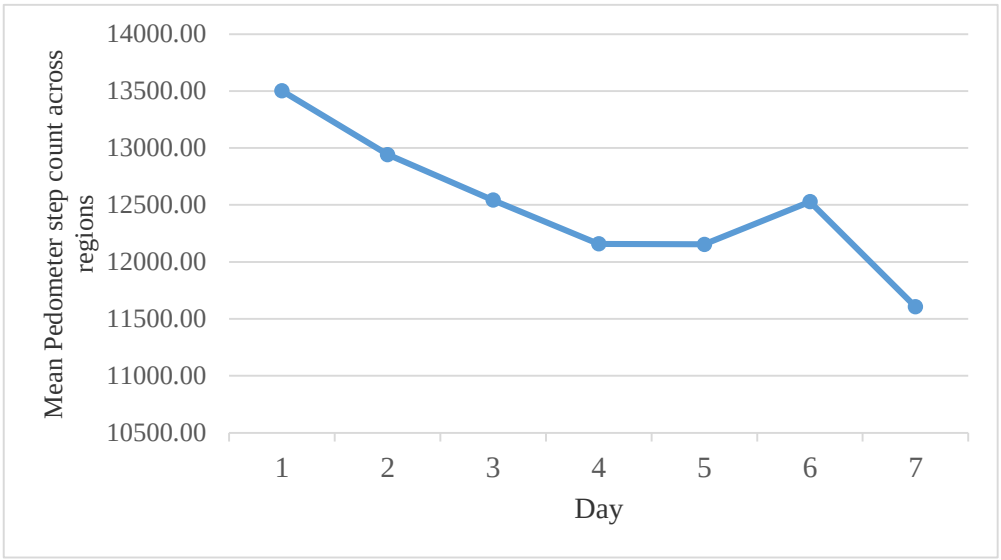
4.5: Pedometer Steps Count for Participants across the Study Regions

Measures of central tendency were computed to summarise the seven days' data for the pedometer steps variable. The pedometer step counts were a composite from the children's usual daily living behaviour/activities and trips to school and other destinations within their neighbourhoods. Measures of dispersion were also calculated to understand the variability of scores for the pedometer steps variable (Table 4.16). It was observed that pedometer step count means were above 12,000 on day one through six (13,502.43, 12,942.41, 12,542.39, 12,158.62, 12,154.03 and 12,528.34) respectively (Figure 4.1). From the means of seven days, it appears that most of the children compared well with a report by Laurson et al. (2008) that set the recommended daily steps per day for 6 to 12 year old children at 12,000 for girls and 15,000 for boys. However, from the large standard deviation, it appears like the total step counts per participant relatively varied.

Table 4. 16. Children's statistics of Pedometer step counts in Nairobi City County

		Day 1 steps	Day 2 steps	Day 3 steps	Day 4 steps	Day 5 steps	Day 6 steps	Day 7 steps
N	Valid	877	877	877	877	877	877	877
	Missing	0	0	0	0	0	0	0
Mean		13502.43	12942.41	12542.39	12158.62	12154.03	12528.34	11605.52
Median		12999.00	12933.00	12300.00	11534.00	11860.00	12238.00	11176.00
Std. Deviation		6172.782	5967.499	5835.468	6017.873	5735.373	6067.037	6096.647
Sum		11841628	11350491	10999675	10663114	10659087	10987352	10178041

Figure 4. 1. Mean Pedometer step count across regions (HSES, MSES and LSES) in Nairobi City County



it

Source: Modified by author from data

There was variation in step count across the seven days in the HSES, MSES and LSES regions of the study. On day one steps count, ANOVA test results F=12.426; p<0.0001 indicate that the there was significant statistical difference in the children's pedometer

step count means across the regions (HSES, MSES and LSES) in Nairobi City County. From day two through day seven there was no significant statistical difference in the children's pedometer step count means in HSES, MSES and LSES regions of the study area as illustrated in (Table 4.17).

Table 4. 17. ANOVA Test for children's Pedometer steps count across the study regions in Nairobi City County

		df	F	Sig.
Day1 steps	Between Groups	2	12.426	.000
	Within Groups	874		
	Total	876		
Day 2 steps	Between Groups	2	.212	.809
	Within Groups	874		
	Total	876		
Day 3 steps	Between Groups	2	.461	.631
	Within Groups	874		
	Total	876		
Day 4 steps	Between Groups	2	.157	.854
	Within Groups	874		
	Total	876		
Day 5 steps	Between Groups	2	1.490	.226
	Within Groups	874		
	Total	876		
Day 6 steps	Between Groups	2	2.532	.080
	Within Groups	874		
	Total	876		
Day 7 steps	Between Groups	2	1.821	.163
	Within Groups	874		
	Total	876		

A multiple comparisons Tukey HSD – Post Hoc Test was run to establish the exact regions that children recorded high means of pedometer step counts presented in Table

4.18. Only on the first day when HSES was compared to MSES $p<0.0001$; HSES compared to LSES $p<0.0001$; MSES compared to HSES $p<0.0001$. While MSES compared to LSES $p=0.974$ and LSES compared to MSES $p=0.974$, all the other days of the study (day two through seven) recorded $p>0.05$. This indicate that the pedometer step count means were less to measure to an average of 12,000 steps for girls and 15,000 steps for boys (Laurson et al., 2008).

Table 4. 18. Multiple Comparisons of Children's Pedometer Steps Count across the Study in Nairobi City County

Dependent Variable	(I) Region	(J) Region	Mean Difference (I-J)	Std. Error	Sig.
Day 1 steps	HSES	MSES	2901.73*	653.79	.000
		LSES	3030.37*	673.90	.000
	MSES	HSES	-2901.73*	653.79	.000
		LSES	128.65	589.14	.974
	LSES	HSES	-3030.37*	673.90	.000
		MSES	-128.65	589.14	.974
Day 2 steps	HSES	MSES	22.75	626.25	.999
		LSES	-319.28	645.52	.874
	MSES	HSES	-22.75	626.25	.999
		LSES	-342.03	564.33	.817
	LSES	HSES	319.28	645.52	.874
		MSES	342.03	564.33	.817
Day 3 steps	HSES	MSES	140.73	759.631	.981
		LSES	-498.21	782.10	.800
	MSES	HSES	-140.73	759.63	.981
		LSES	-638.94	684.52	.619
	LSES	HSES	498.21	783.00	.800
		MSES	638.94	684.52	.619
Day 4 steps	HSES	MSES	219.52	610.29	.931
		LSES	-78.05	629.06	.992
	MSES	HSES	-219.52	610.29	.931
		LSES	-297.57	549.94	.851
	LSES	HSES	78.05	629.06	.992
		MSES	297.57	549.94	.851
Day 5 steps	HSES	MSES	754.31	821.70	.629
		LSES	-512.73	846.97	.817
	MSES	HSES	-754.31	821.70	.629
		LSES	-1267.03	740.45	.202
	LSES	HSES	512.73	846.97	.817
		MSES	1267.03	740.45	.202
Day 6 steps	HSES	MSES	125.26	661.41	.980
		LSES	-1137.16	681.75	.218
	MSES	HSES	-125.26	661.41	.980
		LSES	-1262.42	596.01	.087
	LSES	HSES	1137.16	681.75	.218
		MSES	1262.42	596.01	.087
Day 7 steps	HSES	MSES	920.26	682.20	.368
		LSES	-179.24	703.18	.965
	MSES	HSES	-920.26	682.20	.368
		LSES	-1099.50	614.74	.174
	LSES	HSES	179.24	703.18	.965
		MSES	1099.50	614.74	.174

Multivariate test was conducted p = 0.082 showing absence of significant statistical difference in pedometer step count means for children across regions (HSES, MSES and LSES) in Nairobi City County (Table 4.19). The fourth null hypothesis (H_{04}), There would be no significant statistical difference on pedometer step count data for 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County was accepted.

Table 4. 19. Univariate Tests

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	104158465.502	2	52079232.751	2.513	.082	.006
Error	18114671006.570	874	20726168.200			

The F tests the effect of Region. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

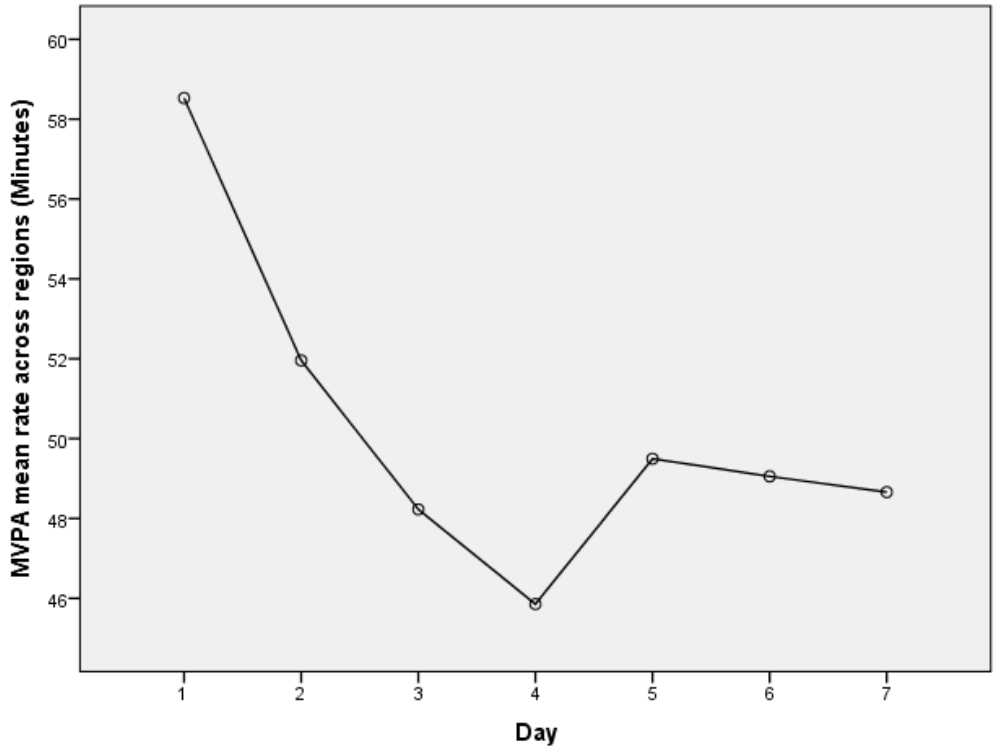
4.6: Moderate to Vigorous Physical Activity (MVPA) levels of the Participants across the Regions

Measures of central tendency for children's daily statistics of pedometer Moderate to Vigorous Physical Activity (MVPA) were calculated to summarise their data (Table 4.20). In addition to measures of central tendency, measures of dispersion were also computed to understand the variability of scores of the MVPA variable. The analysis produced varying results for day one through day seven as displayed in (Figure 4.2). The means here indicate that most of the children met the recommended daily MVPA of ≥60 minutes directly measured seen from the mean daily MVPA rate of 50.32.

Table 4. 20. Children's Statistics of Pedometer Medium to Vigorous Physical Activity (MVPA) Scores across the study regions in Nairobi City County

		Day 1 MVPA	Day 2 MVPA	Day 3 MVPA	Day 4 MVPA	Day 5 MVPA	Day 6 MVPA	Day 7 MVPA	Mean Daily MVPA
N	Valid	877	877	877	877	877	877	877	
	Missing	0	0	0	0	0	0	0	
Mean		56.81	52.61	50.32	48.04	49.07	50.57	47.97	50.77
Median		51.00	50.00	46.00	44.00	44.00	45.00	42.00	
Std. Deviation		51.729	32.521	32.244	31.565	31.523	32.821	33.093	
Sum		49825	46135	44132	42134	43031	44351	42071	

Figure 4. 2. Mean Daily Pedometer MVPA rates across regions (HSES, MSES and LSES) in Nairobi City County



Source: Modified by author from data

Moderate to vigorous physical activity (MVPA) levels as captured by pedometer reading varied across the regions. ANOVA test for day one resulted in (F=2.31; Sig.=0.100) meaning that there was no association amongst the children's pedometer scores of moderate to vigorous physical activity (MVPA) within HSES, MSES and LSES regions of the study area. Day two resulted in (F=3.06; Sig.=0.047) implying that there was strong association on children's pedometer scores of moderate to vigorous physical activity (MVPA) within HSES, MSES and LSES regions of the study area. Day three resulted in (F=7.02; Sig.=0.001) denoting that there was strong association on children's

pedometer scores of moderate to vigorous physical activity (MVPA) within HSES, MSES and LSES regions of the study area. Day four resulted in (F=0.38; Sig.=0.681) meaning that there was no association amongst the children's pedometer scores of moderate to vigorous physical activity (MVPA) within HSES, MSES and LSES regions of the study area. Day five resulted in (F=1.87; Sig.=0.155) implying that there was no significant association amongst the children's pedometer scores of moderate to vigorous physical activity (MVPA) within HSES, MSES and LSES regions of the study area. Day six resulted in (F=0.155; Sig.=0.213) showing that there was no significant association amongst the children's pedometer scores of moderate to vigorous physical activity (MVPA) within HSES, MSES and LSES regions of the study area. Day seven resulted in (F=2.17; Sig.=0.115) indicating that there was no association amongst the children's pedometer scores of moderate to vigorous physical activity (MVPA) within HSES, MSES and LSES regions of the study area as illustrated in (Table 4.21).

Table 4. 21. ANOVA Test for moderate to vigorous physical activity (MVPA) levels of children across the regions in Nairobi City County

		Sum of Squares	df	Mean Square	F	Sig.
Day 1 MVPA	Between Groups	14085.677	2	7042.839	2.31	.100
	Within Groups	2665324.519	874	3049.570		
	Total	2679410.196	876			
Day 2 MVPA	Between Groups	8459.560	2	4229.780	3.06	.047
	Within Groups	1207265.236	874	1381.310		
	Total	1215724.796	876			
Day 3 MVPA	Between Groups	18454.725	2	9227.362	7.02	.001
	Within Groups	1149520.178	874	1315.240		
	Total	1167974.903	876			
Day 4 MVPA	Between Groups	982.062	2	491.031	.38	.681
	Within Groups	1118398.682	874	1279.632		
	Total	1119380.743	876			
Day 5 MVPA	Between Groups	8064.487	2	4032.244	1.87	.155
	Within Groups	1885305.538	874	2157.100		
	Total	1893370.025	876			
Day 6 MVPA	Between Groups	4526.743	2	2263.371	1.55	.213
	Within Groups	1275476.332	874	1459.355		
	Total	1280003.074	876			
Day 7 MVPA	Between Groups	5954.921	2	2977.461	2.17	.115
	Within Groups	1200725.097	874	1373.827		
	Total	1206680.018	876			

A multiple comparisons Tukey HSD – Post Hoc Test was performed to establish the exact regions that recorded *P*-values less than 0.05, this was only noted on days two and three from the seven days of study period (Table 4.22). On day two HSES was compared to MSES p=0.045; HSES compared to LSES p=0.621; MSES compared to HSES p=0.045; MSES compared to LSES p=0.252; LSES compared to MSES p=0.621 and LSES compared to MSES p=0.252. Day three HSES was compared to MSES p=0.006, HSES compared to LSES p=0.001; MSES compared to HSES p=0.006, MSES compared to LSES p=0.775; LSES compared to HSES p=0.001 and LSES compared to MSES

p=0.775. All the other days of the study (day one, then day four through seven) recorded p>0.05, indicating that the children's moderate to vigorous physical activity (MVPA) means were not high enough.

Table 4. 22. Multiple Comparisons of Children's Moderate to Vigorous Physical Activity (MVPA) levels across the study Region in Nairobi City County

Dependent Variable	(I) Region	(J) Region	Mean Difference (I-J)	Std. Error	Sig.
Day 1 MVPA Rate	HSES	MSES	8.041	4.77	.212
		LSES	10.250	4.92	.094
	MSES	HSES	-8.041	4.77	.212
		LSES	2.210	4.30	.865
	LSES	HSES	-10.250	4.92	.094
		MSES	-2.210	4.30	.865
Day 2 MVPA Rate	HSES	MSES	-7.671*	3.21	.045
		LSES	-3.080	3.31	.621
	MSES	HSES	7.671*	3.21	.045
		LSES	4.591	2.90	.252
	LSES	HSES	3.080	3.31	.621
		MSES	-4.591	2.90	.252
Day 3 MVPA Rate	HSES	MSES	-9.615*	3.14	.006
		LSES	-11.538*	3.23	.001
	MSES	HSES	9.615*	3.14	.006
		LSES	-1.923	2.83	.775
	LSES	HSES	11.538*	3.23	.001
		MSES	1.923	2.83	.775
Day 4 MVPA Rate	HSES	MSES	-1.154	3.09	.926
		LSES	-2.730	3.19	.668
	MSES	HSES	1.154	3.09	.926
		LSES	-1.577	2.79	.838
	LSES	HSES	2.730	3.19	.668
		MSES	1.577	2.79	.838
Day 5 MVPA Rate	HSES	MSES	5.070	4.02	.417
		LSES	-1.649	4.14	.916
	MSES	HSES	-5.070	4.02	.417
		LSES	-6.718	3.62	.152
	LSES	HSES	1.649	4.14	.916
		MSES	6.718	3.62	.152
Day 6 MVPA Rate	HSES	MSES	-3.067	3.30	.622
		LSES	-5.968	3.40	.186
	MSES	HSES	3.067	3.30	.622
		LSES	-2.901	2.98	.593
	LSES	HSES	5.968	3.40	.186
		MSES	2.901	2.98	.593
Day 7 MVPA Rate	HSES	MSES	4.874	3.20	.281
		LSES	-.686	3.30	.977
	MSES	HSES	-4.874	3.20	.281
		LSES	-5.560	2.89	.132
	LSES	HSES	.686	3.30	.977
		MSES	5.560	2.89	.132

General linear multivariate test resulted in F = 0,637; p = 0.529 as presented in (Table 4.23). There was no significant statistical difference in daily pedometer MVPA rate means for children across regions (HSES, MSES and LSES) in Nairobi City County. The fifth null hypothesis (H_{05}) stating that there would be no significant statistical difference on pedometer MVPA rate data for 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County was accepted.

Table 4. 23. Univariate Tests

	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Contrast	742.147	2	371.074	.637	.529	.001
Error	508956.926	874	582.331			

The F tests the effect of Region. This test is based on the linearly independent pairwise comparisons among the estimated marginal means.

CHAPTER FIVE: DISCUSSION

5.1 Active Transportation Behaviour of School Children to School and other Destinations

The current study established that of the seven destinations (school, friend's home, relative's home, park destinations, shop destinations, sports grounds and faith destinations), school recorded the strongest association to active transportation modes. A study in Sutherland Shire in Australia worked with 111 school children to establish transportation modes they used to school. The study established that almost two thirds, 67.1% of the trips to school were made by private cars, while only 22.8% of the trips were attributed to walking (Toole, 2011). The results in the research above contrast the current study since 629 (71.7%) of the school children in the current study walked to school while 155 (15.4%) children rode in car/van to school.

Results from Shanghai China's 2016 Report Card on physical activity for children and youth depicted that 32.7% of children and 8.4% of youth rode bicycles and walked to school respectively (Liu, 2016). In a study of 1067 school children and adolescents in urban Portugal showed that 45% used active transportation to and from school (Pizarro et al., 2012). Another study among Portuguese children established walking as the main mode of transportation to school while cycling was minimal (Pizarro et al., 2013) thus agreeing with the current study. Still in Portugal, a survey in countryside regions noted that 30% of children aged 7 to 8 years old used bicycles or walked to school on a regular basis (Mota et al., 2016). Another study agreeing with the current work was done in Scotland on active modes (cycling and walking) of transportation among children to and

from school, the results consistently revealed that approximately 50% of primary children in Scotland usually travel to school using active modes (Reilly et al., 2014). According to the 2014 USA report card on physical activity and body weight of children and youth, majority of children do not go to school using active modes of transportation like cycling and walking. From 1969, the statistics of middle and elementary school children who walk or ride a bicycle to school dropped by 35 percentage points down to 12.7% from 47.7% (Katzmarzyk et al., 2014).

Study results from Spain also agree with the current study, like results of the Identification and prevention of dietary and lifestyle-induced health effects in children and infants study (IDEFICES) show that 54% of children aged between 2 – 5 year old actively commuted to school (Santaliestra-Pasías et al., 2015). Another study focusing on 6 – 9 year old children posit that 73% of them walked to school while 77% of the same cohort walked back home (Roman-Viñas et al., 2016).

In South Africa a General Household Survey scoring 1500 households in Western Cape indicated that 68% of school children and youth went to school by walking, 9% went to school using private cars, while 7% used taxi (Draper et al., 2014). The findings were concurrent with preliminary results of the ISCOLE study which pointed that 62% of children walked to school while those from high socio economic status areas were more reliant on passive means (motorised) of transportation (Katzmarzyk et al., 2013).

Data from Kenya's 2016 report card on physical activity for children and youth denote that Kenya was succeeding inactive transportation section of measurement by over a half

of the children and youth (Onywera et al., 2016). A report by National Plan of Action for Children in Kenyan established that 87% of children living in rural neighbourhoods used active modes of transportation to school (Republic of Kenya, 2015). The report noted that among Kenyan children and youth active transportation is less embraced in urban regions by youth attending higher socio economic status schools (Onywera et al., 2016). Results from this study therefore compares well with a number of studies above.

5.2 Barriers Affecting Active Transportation to School and other Destinations by Participants

In order to synthesise various aspects that may determine active transportation behaviour, environmental, social and policy variables are of importance (Sallis et al., 2004; Spencer & Blades 2006). Sallis et al. (2006) and Stokols (1996) noted that according to environmental, social ecological models; individual and family characteristics affect non-motorised transportation (active commuting).

Hampshire et al., (2011) in South Africa compared youths living in urban and rural areas establishing that considerably fewer youths living in urban areas used AT modes to various destinations like to wash clothes at water points, to fetch water, work in the fields and fetch firewood. Porter et al. (2012) in a study of child porterage in three African countries (Ghana, Malawi and South Africa) to curb the African transport gap notes that some of the barriers children face include but not limited to heavy loads, narrow routes, bushy tracks and fear of a potential attacks. The same situation was characteristic of the current study's findings with significantly higher AT mode rates evident among children from low socio-economic status (LSES) regions of Nairobi City County. Results from the

current study indicate that irrespective of a number of barriers (environmental, psychosocial/planning and safety factors), a significant number of children used AT to school and other destinations within their neighbourhood (biked, walked or ran).

The Nairobi City County Non-Motorised Transport (NMT) Policy (2015) pointed out the lack of infrastructure for Non Motorised Transportation. Both the safety and environmental factors could have possibly occasioned the current position of children in the higher socio economic status (HSES) region of Nairobi City County recording lower rates of AT modes. For instance, those in HES regions of Nairobi live in households with vehicle as well as motorcycle ownership coupled with shorter distances to destinations. Active transportation mode users in Nairobi City County are not protected from fast, aggressive and high motorised transportation (MT) volumes with the possibility of traffic accidents (Mitullah, 2017). Active transportation spaces encroachment is common and children, the aged and women, who most of the time are vulnerable road users, encounter challenges travelling without help. High rate of road accidents among people using AT modes in Nairobi may be a significant indicator of how unsafe it is to use active transportation mode. Road accident statistics for 2014 show that out of 724 fatality cases, pedestrians were 507(70%), followed by public transportation (PT) passengers 101(14%), riders of motorcycles 52(7%), drivers of private vehicles 46(6%) and finally bicycle users 17(2%) (Nairobi City County Non-Motorised Transport Policy, 2015).

The ostensibly calm environment in the outskirts/periphery of Nairobi City County could have been a reason for confidence in the children in the low socio economic status (LSES) region to record higher AT rates. Apart from psychosocial/planning,

environmental and safety factors, a significant number of children posted higher rates of AT while fewer recorded low rates of active transportation. This could be a manifestation that children generally prefer AT modes compared to the motorised modes. Therefore, the need to subscribe to the Transit-oriented Standard (TOD) when developing urban transport infrastructure. Objective of the TOD standard is to achieve the right of all to access the city...."to cycle and walk safely, easily and affordably get to the furthest destination through rapid and frequent transit, and to live a good life devoid of car dependence. The Transit-Oriented Standard aims to achieve access to services, opportunity, education and all the resources available via no-or low-cost mobility options" (Joshi et al., 2017).

5.2.1 Environmental Factors Affecting Active Transportation to School of Participants

In this study environmental factors (hills on the route to school, unsuitable paths, boring route, no safe bike park, school is far, odours on the route and child has a disability) had a bearing on the children's use of active transportation to school in high socio economic status (HSES) areas of Nairobi city county.

Hills, unsuitable paths and odours on the children's route to school and other destinations acted as barriers for the children to use active transportation modes. Lack of safe bicycle parking places in schools may also deter children from riding/biking to school. Longer distances between children's home and school/other destinations is potential deterrence of using active transportation to school. Children with a disability may have found it

challenging to embrace active transportation to school and other destinations within their neighbourhoods.

The likelihood for children to use active transportation has been tested empirically for different type of neighbourhoods (Mokhtarian & Cao, 2008); street network, including connectivity and accessibility (Cervero & Duncan, 2003); pedestrian environment features (Alfonzo et al., 2008) and land use pattern (Cervero & Duncan, 2003; Krizek & Johnson, 2006). Banerjee et al. (2014) in their study in Los Angeles established that school location and their accessibility is one of the significant impediments to use of active transportation. Prior research had consistently found that distance, perceived or actual is likely to determine how children travel to school and back home (Timperio et al., 2006; Ewing et al., 2004). Mc Donald (2007) posits that increase of distance of travel alone may have accounted for half of the decline in use of active transportation to school in the United States of America between 1969 and 2001.

Lu et al. (2014) in their systemic review of empirical, methodological and theoretical evidence suggested need for more research to understand better the value of perceived barriers to AT in other regions like Europe and Asia. A study by Curtis et al. (2015); Mertens et al. (2017) established that children living in close-knit urban environments are significantly associated with higher frequency of active modes of transportation to school and other destinations. This is because close-knit urban environments depict shorter distances to vital destinations. The current study found that most children from LSES areas of Nairobi City County used active transportation to school compared to their HSES resident counterparts. This was similar to the study by Banerjee et al. (2014) who

established that the children who cycled or walked to school and back often did not take the shortest routes between school and home. Possible reasons would have been to avoid unsafe area or heavy traffic, to walk with friends on the way to or from home to school, to experience distortion in their cognitive maps, or simply to view interesting sceneries while walking. These studies however did not stratify for the various urban socio-economic cohorts, as is the case in the current study of Nairobi City County.

Results from a study in Waterford, Ireland established that cycling and walking within neighbourhoods by children is still common. Those that were positive about cycling and walking cited well designated pedestrian crossing, cycle lane, stop signs, designated places for leaving bikes and availability of green areas (Gahan, 2011). This study only focused on neighbourhood trips without regard to active transport to school. Madsen (2013) in Denmark studied transportation cycling behaviour and established that active transportation is determined by a myriad of factors in the built environment like: distance, distance between locations or commuting distance/destinations/activities, residential density since transportation between locations is shortened by a locality's high density, street connectivity/network layout since it impacts distance, the land use mix factor as it increases utility while reducing travel distance, walking and biking infrastructure since more walking and cycling facilities increase their mode share and continuity of walking and biking lanes. The study above was done in Denmark with a totally unique physical, topological and socio-economic set up from the study area of the current research. Factors that encouraged active transportation in the mentioned study do not exist in the

LSES areas of Nairobi City County where most of the children used active transportation to school and back home. So what makes them use actve transportation?

Another study conducted in Israel by Moran et al. (2016) contrary to the Danish research established associations between children's cycling and walking and urban-form measures to be parallel: cycling for leisure and travel was more common in urban sprawl areas while walking to school and neighbourhood destinations was more dominant in compact areas, both scenarios being a departure from the current research.

A study by Hume et al. (2007) established that children and young people used active transportation more frequently in neighbourhoods with a lot of graffiti than those in neighbourhoods without. Results from Gahan (2011) posits that children stated litter affect various wildlife in their neighbourhoods by posing danger and the potential danger of attracting unwanted animals like rats, this concurs with the current study where in HSES areas most children were discouraged to use active transportation due to litter and bad odours on the route to destinations. The litter may determine how frequent the children ventured into the neighbourhood, hence decreasing their active transportation behaviours (Gahan, 2011).

5.2.2 Psychosocial/Planning Factors affecting Active Transportation to School of Participants

There were six different Psychosocial/planning barriers grouped together (sweating as the child uses AT to school, no other children using AT to school, AT is unfashionable, child has a lot to carry to school, easier driven by parent to school and a lot of prior planning

required before going to school). Active transportation modes to school like walking, running and cycling may result into sweating. This may make the children feel uncomfortable during class time especially in instances where they may not have washrooms and running water for freshening up, this may be an impediment to active transportation use. In cases where not many children in a neighbourhood use motorised transportation instead of active transportation, even the child that would have used active transportation may feel left out hence opt out of AT use. Trends and fashion determine behaviour most of the time, in instances where in a neighbourhood children feel that active transportation mode to school is not fashionable then there is likelihood that some children's choices of embracing AT may be negatively affected. Sometimes children have more than just their books to carry to school coupled with planning before leaving home for school hence having a negative impact on the use active transportation modes (Sallis & Glanz, 2006). Some children's mode of going to school most of the time is determined by parents especially in instances where the school is in the same direction to work then it will be easier to drop and pick the child (Kerr et al., 2006).

From the current study, these barriers affected AT mode choice and use for children from HSES areas than their counterparts from the LSES areas within Nairobi City County. Some studies have opined that over time trends have shown children from lower socio-economic status (LSES) areas use active transportation to school more than their counterparts from higher socio-economic status (HSES) (Salmon et al., 2005; Yelavich, 2008). Children's peers may have either a positive or negative influence on their choice of active transportation mode to school. Kirby (2013) established that children who chose

active transportation to school were motivated by social benefits and they used active modes of transportation to school with friends. At the same time walking to school is most of the time a result of being with friends, and was seen to be more fun if with friends (Kirby & Inchley, 2012). When it comes to active travel parents can be significant determinants and role models. Gahan (2011) in a study established that most of the participants commonly used a car, however a notable minority of them used active transportation to school and various other destinations indicating that among some children walking and cycling is still a common means of transportation. Results from the study above to some extent mirrors the current research, the point of difference being stratification of the study area into three socio-economic status hence it is not easy to establish the cohort that used active transportation.

5.2.3 Safety factors affecting active transportation to school by children

The safety factors under consideration were; unlighted route, too much traffic on the route, dangerous crossings/intersections, potential crime on the route, possibility of a child getting bullied, dangerous animals on the route and isolated route.

Unlight routes, too much traffic and crime on the route, isolated routes and dangerous crossings act as deterrent factors for children to chose active transport modes to school. Kerr et al. (2006) suggests that some of the approaches of boosting confidence on active transportation mode to school for children would be protection from traffic, improvement in cycling and walking infrastructure, street lighting, route safety and general aesthetics of routes to school. They further note that children may not be encouraged to use active

transportation to school until they are certain of their safety (bullying and associated danger of stray animals) of their trips (Kerr et al., 2006).

The study established that more children in the LSES areas of the study areas recorded high rates of active transportation to school and other destinations compared to their counterparts in middle socio economic status (MSES) and HSES areas, suggesting that safety factors did not affect their choice for active transportation. This scenario may have been occasioned by lack of alternatives in the low socio – economic status areas. McMillan et al. (2006); Kerr et al. (2006) notes that children in high socio – economic status regions have options open to them for transportation, hence active transportation becomes a choice rather than the only mode.

In a study of strolling trips in Austin, Texas, Cao et al. (2018) found that neighbourhood factors such as perceptions of safety, shade, and traffic did affect the number of leisure walking trips. Safety concerns play a vital role in how people react to the environment, with fear and perception of crime a significant inactivity contributor (National Research Council, 2005). A study by Romero et al. (2001) established that unlike results from other studies, children from lower SES use active transportation even if there are gangs or there is a high rate of crime around their neighbourhood, this concurs with the current study. Use of active transportation modes is typically determined by parental decisions hence perceptions by parents rather than objective decisions may play a more significant role in parents' decision making (Kearns et al., 2003). Parents who fear for their children's safety within the neighbourhood or on the roads may impose stringent

restrictions on their children's activities like cycling, walking or playing out on the streets (Kearns et al., 2003). Dangerous bends in rural were specifically singled out as areas of concern that parents felt cars are driven too fast and a car could emerge at any moment around the bend while children are out cycling or walking (Gahan, 2011). In rural areas parents also were concerned about the busy road crossings/intersections that their children crossed to get to various destinations (Gahan, 2011); this is contrary to the results of the current study, since it did not focus on the parents' perceptions about safety.

There is a relationship between crossings that are controlled, (Davison & Lawson, 2006); improved school routes, bike paths and traffic speed limits (Eyler et al., 2007) and increased active travel to school. Results from the aforementioned studies seem to support the scenario in the current study's MSES and HSES areas that witnessed reduced rates of active transportation by children to school and various destinations. Kingham (2011) posits that it seems accidents to children occur less frequently in the immediate school environs, where there is evident traffic controls, but often areas usually involve major arterial roads. The considerations above concur with study by Toole (2011) that suggests may be responsible for increased potential of cycling or walking to school by children living nearer to schools, but decrease with distance as it increases the possibility of having to navigate arterial roads and intersections.

Toole (2011) notes that children's movement may be influenced more by safety factors like the presence of sidewalks or traffic speed, this concurs with Giles-Corti et al. (2010) position that children are less likely to embrace active transportation if the route involves crossing a busy road. However, Timperio et al. (2006) notes that the shortest route

between school and home, or probably the best connected, may not be chosen due to safety concerns.

5.3 Socio-Economic Factors and Active Transportation (AT) among Children

This study sought to examine the effects of socio – economic status of 10 – 12 year old school children on active transportation in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County. The socio-economic factors in the current study with the potential of influencing children's choice of mode of transportation to school are parents/guardian's level of education, vehicle ownership, motorcycle ownership and bicycle ownership. These were the indicators of SES. Children from high socio – economic status regions may have access to vehicles for transportation hence they will depend less on neighbourhood safety and proper transportation infrastructure; while the other hand children from low socio – economic status regions may not have access to vehicles for transportation therefore these children will walk more for transportation and leisure where in most circumstances most destinations are in close proximity (D'Haese et al., 2014).

From the study results parental level of education and ownership of vehicles did affect the children's choice of active mode of transportation to school and other destinations in Nairobi City County, however the other factors (motorcycle and bicycle ownership) did not. This implies that use of active transportation modes to school and other destinations by the children within the neighbourhood was affected was not uniform across the regions (HSES, MSES and LSES). Children from low socio – economic status regions where in most cases parents' education level is low and no/low ownership of vehicles is

prevalent, children may not have access to vehicles for transportation hence the use of active transport. From the study, this may have been different among children from middle and high socio – economic status regions where education levels are relatively higher with a prevalence of vehicle ownership, children tend to use vehicles for transportation (Kerr et al., 2006).

A study by Conlon (2013) established that almost two thirds (63%) of children at low socio-economic status schools used active transportation compared to only 19% from lower socio-economic status schools who went to school by car. This was a departure from the current study and other studies that have over time found children from lower socio-economic status regions using active school transportation more than children from higher socio-economic status (Salmon, 2005; Yelavich, 2008; Davison et al., 2008). This could be attributed to the greater number or vehicles owned per household making children from higher socio-economic status children to be often driven to school.

Some studies attribute high crime and traffic injuries to be the two factors most often reported reasons parents cite for restricting active school transportation for their children (Christie et al., 2004; Wilkinson & Pickett, 2009). Paradoxically, children from lower socio-economic backgrounds, where there is a higher potential of crime, are likely to use active school transportation more, or possibly parallel is attributed to higher socio-economic status communities having a tendency of car dependency. A number of studies posit that in many developing countries, parents from the higher socio-economic status communities often accompany their children with motorised modes to school. These parents view safety and poor security to be associated with active transportation to

school modes like cycling and walking (Shokoohi et al., 2012; Ermagun & Samimi, 2015; Mehdizadeh et al., 2016; Dave et al., 2013).

A study in Iran by Mehdizadeh et al. (2016) established that parents' sensitivity to the walk from home to school and back by their children increases when the number of cars owned in the family are more than two. Li & Zhao (2015) notes that longer distances of walk between home and school is likely to increase the role of household characteristic on children's walking to school and the household car is a potential option to be used. In a study conducted among children in 34 schools in California established that active transportation rates to school were higher in schools with higher number of African American and Hispanic pupils (low socio-economic status) and lower in schools with higher number of white pupils (higher socio-economic status) (Braza et al., 2004). Results from a North Carolina (USA) study posits a similar pattern, where low socio-economic status African American pupils cycle and walk to school more often than the high socio-economic status white pupils (Evenson et al., 2003).

A study by Sirard et al. (2005) notes that although numerous research point out that children from low socio-economic status communities are more likely to opt for active transportation to school, no relationship found active transportation to school and school – level socio-economic status.

A few studies, support results of the current research, established no relationship between family car ownership which is an indirect measure of socio-economic status, and pupils' mode of transportation to school (McMillan, 2007; DiGuiseppi et al., 1998; Timperio et

al., 2006; Merom et al., 2006). The difference between the aforementioned studies and the current one is that the various factors that measure socio-economic factors have not been highlighted. Li & Zao (2015) noted that socio-economic status factors (car, ownership, income and parental education) had no influence on children's active mode of transportation in the school trip.

On the other hand, Martin et al. (2007) established a negative association between the children's use of active transportation to school and parental level of education. This possibly is attributed to the positive correlation between education and income, or to the notion that highly educated parents harbour a perception of potential risks in cycling and walking by children.

5.4 Mean Daily Pedometer Steps Count for Participants across the Study Regions

The study here sought to determine difference in pedometer step count data for 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County.

The study conducted a seven day survey where the participants wore a pedometer most of their waking time and only removing it when going to bed and when taking a bath/shower. The seven days did not necessarily correspond to the normal days of the week, for instance, some begun their first day on a Tuesday while others commenced on a Friday. From the study's mean daily pedometer data, most of the children managed to accumulate the recommended daily mean steps for children aged between 5 – 15 year old (>12,000 step counts per day) (WHO, 2011). Participants in the study achieved the

threshold of 10,000 steps per day as seen in day 1 – 13,447.76; day 2 – 12,906.57; day 3 – 12,488.51; day 4 – 11,653.36; day 5 – 12,063.18; day 6 – 12,236.87 and day 7 – 11,740.69. Tudor-Locke & Basset (2004a) set 5,000 steps per day as the baseline for their proposed progressive step index, which comprised <5,000 (sedentary), 5,000 – 7,499 (low active), 7,500 – 9,999 (somewhat active), 10,000 – 12,499 (active), and ≥12,500 (highly active). The researchers in the year 2008 termed individuals accumulating <5,000 steps per day as leading a 'sedentary lifestyle' (Tudor-Locke et al., 2008b). Tudor-Locke *et al*. (2009) proposed ≤5,000 steps a day terming it (basal activity) into 2,500 – 4,999 steps a day terming them (limited activity). The departure is that these recommendations by Tudor-Locke and colleagues are for adults in free living life.

A number of recent descriptive studies have looked at pedometer-determined patterns of physical activity (PA) among children on weekdays (Vincent & Pangrazi, 2002; Tudor-Locke, et al., 2004; Tudor-Locke et al., 2006), establishing various recommendations for steps/day. The recommendations suggest that boys should accumulate 12,000 - 15,000 while girls 11,000 - 12,000 steps/day.

A volume of 10,000 steps per day has gained prominence in practice and with the media and can be traced to a business slogan more than 30 years ago and Japanese walking clubs (Tudor - Locke & Basset, 2004a). A threshold of 10,000 steps per day sounds a reasonable estimate for daily physical activity for reasonably healthy individuals and research is emerging with documented health benefits of accumulating similar levels. In contrast, initial results suggest the 10,000 steps per day target may unsustainable for some population cohort (individuals living with chronic diseases and older adults). One

particular challenge is relating to the universal target of 10,000 steps per day is that it may be too low for children, the most significant population cohort in the fight against obesity (Tudor – Locke et al., 2004).

A study in south-western USA by Brusseau et al. (2011) among elementary schools established that the children were significantly active (p=0.01) on physical education (PE) days. Even though the above findings by Brusseau et al. (2011) compared positively to the current study results, difference is, in the current research there was no discrimination for particular days of the week but a composite of seven days. The current study returned significant statistical differences in mean step counts across regions (LSES, MSES and LSES) contrasting the Brusseau et al. (2011) findings that also had significant differences but across days of the week.

Abbott et al. (2009) in a research of school day and weekend day activities among school children aged 5 – 16 year old in Queensland Australia established lower weekend day step counts than school week days. This study results too compares positively with the currents research, however the difference being the consideration of activities for school week days and weekend days.

A hypothesis that there would be no significant statistical difference on pedometer step count data for 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County was accepted.

5.5 Mean Daily Moderate to Vigorous Physical Activity (MVPA) Rates in relation to AT of the Participants across the Regions in Nairobi City County

An objective of this study was to determine difference in pedometer step count data for 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County. Increased use of active transportation modes among children is known to increase the overall PA levels and eventually contributing significantly to the recommended rate of 60 min of MVPA per day (CDC, 2008; Larouche et al., 2014).

The study ran a seven day survey with the participating children while maintaining their normal daily routines while wearing the pedometer most of their waking hours. Results from the study established that as much as most of the children were found to engage in a lot of active transportation during the seven days they met the recommended daily rate (60 min of MVPA per day). Draper et al. (2014) in the South African physical activity report card established that among participants ages 7, 11 and 15 years old, only 27% (7), 6.1% (2) and 0% (0) respectively attained the recommended daily physical activity of MVPA of at least 60 minutes. In an ISCOLE study in Kenya Muthuri et al. (2016) found that among the 563 children who participated in the study 12.6% (71) children clocked the recommended daily medium to vigorous physical activity (MVPA) rate of ≥60 minutes, however this study used accelerometers in data collection.

In Nigeria on the other hand results from self-report by 1006 secondary school adolescents for the 2016 physical activity report card revealed that 37% (372) appeared to meet the global guidelines of ≥60 minutes of moderate to vigorous physical activity

(MVPA) per day (Adeniyi et al., 2016). The MVPA rates attained by children in the current study emanate from a seven days' objectively measured pedometer data thereby making the results stand out. The participants accumulated the daily minutes from a normal weekly routine including trips to school and all other destinations and back home. All these studies indicate that many children are still not achieving the recommended rates and perhaps an increase in active transportation in their daily living will help increase their PA levels.

The current study established that daily average MVPA was 50.32 showing that few of the children in the three socio-economic status regions of Nairobi City County (HSES, MSES and LSES) achieved the globally recommended ≥60 minutes of MVPA per day. Stockie (2009) in a study established that parents of children from higher socio-economic status most of the time have the ability to support their children to take part in active games and sports activities but since it is not a daily occurrence like walking or cycling to school most of the time these children fall short of the daily physical activity rate recommendations. Parents who are homemakers and full-time employees have the potential than those unemployed or employed on a part-time basis, or are on leave from their occupation to engage in active sports or games with their children very often or at the very least often (Cameron et al., 2007). Therefore parents of participants in the current study may have had an opportunity to determine their children's daily MVPA rates. For this study parental responses were not considered for their children's daily pedometer MVPA rates.

A hypothesis that there would be no significant statistical difference on pedometer MVPA rate data for 10 – 12 year old children in high socio-economic status, mid socio-economic status and low socio-economic status areas in Nairobi City County was accepted.

CHAPPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary of Findings

The study established that environmental factors did not negatively affect use of active transportation in MSES and LSES regions hence more children in the MSES and LSES regions used active transportation mode to school and other destinations than in the HSES regions of Nairobi City County.

The psychosocial/planning barriers have negatively affected active transportation mode choice among children in LSES regions; hence fewer children recorded high rates of active transportation mode use. Fewer children from MSES and HSES were negatively affected by psychosocial/planning barriers; therefore more children recorded higher frequencies of moderate and high AT rates.

Safety barriers least affected children from MSES in their use of active transportation modes to school and other destinations. However, more children from LSES seem to have been affected negatively by the safety barriers than their colleagues from HSES in the choice of AT modes to school and other destinations in Nairobi City County.

The study also established that children prefer using active transportation modes to other destinations apart from school within their neighbourhoods. It was noted that MSES children used active transportation more than the children from the other regions (HSES and LSES) in Nairobi City County.

The study used factors like, parental education, vehicle ownership, motorcycle ownership and bicycle ownership as measures of socio-economic status of the participants' household. Among the socio-economic variables, parental/guardian's level of education and vehicle ownership had effect on the children's choice of active transportation mode to school and other destinations and back home across the three regions of Nairobi City County. The other socio-economic status indicators; motorcycle and bicycle ownership did not affect the choice of active transportation mode choice by children across the three regions in the study area.

Day one, two and three the children recorded higher pedometer step count means (13,447.76, 12,906.57 and 12,488.51) respectively. From the means of seven days, most of the children achieved the daily recommended step counts. However, the large standard deviation shows that the total step counts per participant was relatively varied.

The objectively measured daily moderate to vigorous physical activity (MVPA) for the seven days of the study gave means of 57.78 minutes on day one day two 52.57, day three 49.12, day four 45.98, day five 49.15, day six 49.37 and day seven 48.31. This is an indicator that most of the children across the regions of the study area for the seven days did not meet the globally recommended daily moderate to vigorous physical activity (MVPA) rate of ≥60 minutes in spite of the noted active transportation use to various destinations.

6.2 Conclusion of the Study

The study established that most children given an opportunity would prefer independent movement by opting for active transportation modes to school and around their neighbourhoods; this is a departure from most literature. A number of factors influence active transport mode choice; environmental, psychosocial/planning and safety factors for example the presence of appropriate sidewalks/footpaths and pedestrian crossings will encourage children's likelihood of children to get destinations by active transportation. However parental perception of safety can be linked to their children's own perceptions, this in turn may influence their choice for active transportation mode. If a parent feels that a destination is too far to cycle or walk, the footpaths are not appropriate or the route has a lot of speeding vehicles then they may fear for safety and dissuade their child/children from using active transportation mode.

The study concludes that children's active transportation mode choice is a factor of variety of variables in play. Parental perceptions, the built environment design/planning, social factors and policy measures all work together to either sustain or suppress the growth of active transportation mode choice by children.

Findings from this study demonstrate existence of a significant relationship of active transportation among children and neighbourhood and built environments. Both perceived and actual characteristics of both environments may have an effect on this behaviour in children. Increasing mobility and access to destinations within the built environment may benefit active transportation mode choice among children and by large the larger neighbourhood environment.

6.3 Implication of Findings

Active transportation is a complex interaction of social factors, environmental factors and individual factors; the relative significance of which can vary according to parental perceptions, gender and age. This is evident from the fact that a number of factors have common importance across levels of socio-economic status like value for money and cost, access to neighbourhood destinations and use of green space. The implication of this is interventions should target population level considering the factors that have the strongest influence within the particular group. Hence there is need to have all sectors within Nairobi city county working together to make active transportation to be accessible for mobility and physical activity gains.

The study established that factors influencing active transport may be context specific. Children reported specific facilitators and barriers to using active transportation e.g., cycling or walking. Walking and cycling was more popular among the low socio-economic status (LSES) children and reasons for choice could differ within the three (LSES, MSES and HSES) regions of Nairobi City County. The implication is that promotion strategies should consider active transportation mode and the context in which it takes place. As a result of the above, each line department within Nairobi City County should deem fit how they participate in active transportation promotion. This could be done by redesigning streets so that communities regain public spaces to enhance active living; promotion of active transportation to school for children by organising cycling/walking events and provide for safe bicycle storage; providing incentives to

parents and children for active transportation to induce physical activity in various settings.

Social effects are vital across ages and gender, although the relative influence of peers and parents changes with age. Having friends is a vital motivation for embracing physical activity particularly in relation to cycling/walking and active transportation to school. This implies that interventions that promote social side that embrace walking for leisure and active transportation hence inducing physical activity is of utmost benefit. This can be achieved by (i) parents organising walking for leisure and physical activities as social events and encourage children to invite their friends; (ii) promoting physical activities that bring together parents and children; (iii) incorporate parents in promotion strategies especially where safety is concerned; (iv) developing and providing friendly support groups in the community or at school.

Some of the children had concern of lack of bicycle storage or parking facility in school. The children also showed willingness to cycle to school however some of them were concerned with the safety of their bicycles. The schools need to provide safe bicycle parking or storage facility and encourage the children to use it.

6.4 General Recommendations for Practice

1. Nairobi city county in liaison with ministries concerned with education; Public Health and Transport and Infrastructure need to develop interventions for increasing active transportation to school among school – going children by developing designated and safe routes to school, walking and cycling programmes to school, introduction of walking

school bus (WSB) and initiate programmes that will ensure local environment of schools' catchment regions provide opportunities for children to walk or cycle.

2. Encourage mixed use development since denser neighbourhoods affect active transportation positively among children, fewer dispersed urban development should be built (Braza et al., 2004). Having households close together does not only motivate children to cycle or walk to school, but has the same bearing on adults too. Frank et al. (2007); Nelson et al. (2008); Saelens & Handy (2008) notes that mixed use development have proved to offer people residing in them health benefits. This may have the potential to improve street connectivity hence children's accessibility to active mobility and variety of activities within the neighbourhood. Under such circumstances, children would rely less on their family members, parents, or friends for rides hence giving them an opportunity of exercising mobility independence.

6.5 Recommendations for Policy

i. Ministry of Education Science and Technology (MoEST) in Kenya in consultation with parents, school children's representatives and other stake holders in academia and research fields need to draft policies and implement focusing on children with main goal of promoting active transportation hence healthy active living. This may be attained by (i) developing strong networks, create strategies to sustain physical activity levels like specific walk to school days within the school term; (ii) developing links between schools and local leisure centres/sports clubs to help children have a path from school to physical activities within the community

ii. Behavioural factors like active transportation and patterns of physical activity have a bearing on mortality and morbidity. A collaborative approach focusing on social, economic and political interventions aimed at initiating and sustain change of behaviour in individuals are vital. As a result, the Nairobi city county need to formulate and implement policy interventions related to health to highlight all the multiple influence overlays of involving communities, schools, households and individuals through ministry of public health.

iii. The current study established that the participants who used active transportation to school were likely to achieve moderate to vigorous physical activity (MVPA) rates as recommended. This may result in instilling early in the children's development the value of active transportation and the accrued benefit on exercise and physical health, hence adopt as lifetime habits. To foster this, the Nairobi city county's urban planning department need develop policy for modification of existing built neighbourhoods to accommodate walking and cycling on the one hand and new developments to incorporate infrastructure for active mobility on the other.

6.6 Recommendations for Further Studies and Intervention

This study investigated school children aged 10 – 12 year old going to primary school in low socio-economic status (LSES), middle socio-economic status (MSES) and high socio-economic status (HSES) regions of Nairobi City County.

i. Future studies should be structured to focus on a broader range of ages and environments to enhance interventions tailored for specific groups. Given the

context specific nature of the current study, further investigation of the highlighted relationships in different counties in Kenya would be beneficial.

ii. Combining child questionnaire, pedometer and the transport diary demonstrated to be effective technique for data collection on active transportation behaviour and physical activity rates among school children. Future studies would benefit from combination of qualitative methods like focus group discussions, apart from involving children's parents too in such study. This may allow for a deeper understanding of active transportation behaviours and perceptions among school children and parents respectively.

iii. Literature seems to support the role of active transportation to school to enhance increase of moderate to vigorous physical activity (MVPA) among children. While the data analysed in this study sets stage for characterising active transportation behaviour of school children in Nairobi City County, numerous opportunities for further research abound. These opportunities entail working with much younger or older age cohorts hence develop interventions for increasing active transportation mode use to school among them.

iv. To be able to support the value of active transportation to school relating to increased moderate to vigorous physical activity (MVPA) rates among children in Nairobi city county, objective studies measuring active transportation to school and physical activity should be replicated with this (10 – 12 year old) population subset in other counties. Similar studies using pedometers, accelerometers, Global

Positioning Systems (GPS), cycle computers to report moderate to vigorous physical activity (MVPA) levels that can be tied to self reported active transportation behaviour. This will lead to concrete evidence for the influence of active transportation in the Kenyan population.

v. The study recommends that future research be conducted to investigate the social factors affecting transportation modes for the school transportation like community connection, cohesion, engagement and trust. A qualitative and focused investigation into this theme by use of focus group discussions may help in qualitative data collection and help the research team in coming up with plans (like community activities or events) solve low connection within the community. Such approaches offer a complementary means or potentially affordable alternative to implementing physical infrastructure, by focusing and solving the role played by complex social processes in determining community and transportation behaviours

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Appendix A: Parental Questionnaire

Country: _____School: _____Urban/peri-urban/rural:_____

Study ID #:_____

Parental contact (Mobile number):_____

(The study team will only contact you concerning the research)

1. What is your relationship to the child? (are you the Mother/Father/Guardian?)_____

2. What is highest level of education achieved by any of the mother/father/guardian in this home?

- ☐ Less than primary school
- ☐ Primary school
- ☐ Less than high school
- ☐ Some high school
- ☐ High school
- ☐ Diploma/Higher Diploma
- ☐ Bachelor's degree
- ☐ Graduate(Masters/PhD)/professional degree

3. How many functioning vehicles (cars or trucks) are available for use at your house?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4 or more

4. How many functioning motorcycles (piki-piki) [or tricycles] are available for use at your house?

- ☐ 0
- ☐ 1
- ☐ 2

☐ 3
☐ 4 or more

5. How many functioning bicycles are available for use at your house?

☐ 0
☐ 1
☐ 2
☐ 3
☐ 4 or more

6. How does your child usually go **to school** in a typical week (from Monday to Friday)? Please tick only one box.

☐ He/she walks ☐ He/she bikes ☐ He/she runs
☐ By car or van ☐ By bus or train ☐ By motorcycle
☐ By another way. Please write it down: _____

7. How does your child usually go **back home** in a typical week (from Monday to Friday)? Please tick only one box.

☐ He/she walks ☐ He/she bikes ☐ He/she runs
☐ By car or van ☐ By bus or train ☐ By motorcycle
☐ By another way. Please write it down: _____

8. How far away is your child's school from your home? _____ Kilometres

9. Please indicate your level of agreement with the statements written in the table below. *Please TICK (√) ONE number only*.

It is <u>difficult for my child</u> to walk/run or bike to school because…	**1 Yes**	**2 No**
There are too many hills along the way		
There are no suitable walking/running or biking paths		
The route is boring (nothing interesting to see)		
The route does not have good lighting		
There is too much traffic along the route		
There are dangerous crossings		
My child gets too hot and sweaty		
No other children walk/run or bike to school		
It's not considered fashionable to walk/run or bike		
My child has too many things to carry		
It is easier for me to drive my child		
It involves too much planning ahead		
It is unsafe because of crime (strangers, gangs, drugs)		
My child gets bullied, teased, harassed		
There is nowhere to leave a bike safely		
There are stray dogs or other dangerous animals		
It is too far		
The route is difficult to walk/run or bike because of garbage, water or bad smells		
The route is isolated		
My child has a disability		
Other*:		
Other:		

*If there are other barriers, please indicate what they are in the two last rows.

Transportation diary

10. When your child wore the pedometer, how many times did he/she go **from home to the following destinations** using active modes of travel (for example, walking, running, biking)? Please respond for each day of the week.

Destinations	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
School							
Friend's houses/home							
Relative's houses/home							
Parks or playgrounds							
Shops or markets, or restaurants							
Sport venues (e.g soccer field, swimming pool)							
Faith places (e.g church, mosque)							
Other							

** If you have written "other", please specify which destination it is: _____

11. When your child wore the pedometer, how many times did he/she go **to home from the following destinations** using active modes of travel (for example, walking, running, biking)? Please respond for each day of the week.

Destinations	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
School							
Friend's houses/home							
Relative's houses/home							
Parks or playgrounds							
Shops or markets, or restaurants							
Sport venues (e.g soccer field, swimming pool)							
Faith places (e.g church, mosque)							
Other							

** If you have written "other", please specify which destination it is: _____

Appendix B: The Active Transportation Assessment Tool

Instructions: The child questionnaire is to be completed in the classroom under the supervision of research assistants. The transportation diary is to be completed in the classroom for each school day during the week when they wear the pedometer.

CHILD QUESTIONNAIRE

Country: _____ School: _____ Urban/Peri-urban/rural: _____

Date: _____

Study ID #:_____

Age:_____

Gender (boy/girl): _____

1. How do you usually go **to school** in a typical week (from Monday to Friday)? Please tick only one box.

☐ I walk ☐ I bike ☐ I run

☐ By car or van ☐ By bus or train ☐ By motorcycle

☐ By another way. Please write it down: _____

2. How do you usually go **back home** in a typical week (from Monday to Friday)? Please tick only one box.

☐ I walk ☐ I bike ☐ I run

☐ By car or van ☐ By bus or train ☐ By motorcycle

☐ By another way. Please write it down: _____

3. How far away is your school from your home? _____ Kilometers

4. Are any of the following a challenge/barrier for you to walk or run or bike to school?

Item	**1** **Yes**	**2** **No**
There are too many hills along the way		
There are no suitable walking/running or biking paths		
The route is boring (nothing interesting to see)		
The route does not have good lighting		
There is too much traffic along the route		
There are dangerous crossings		
I get too hot and sweaty		
No other children walk/run or bike to school		
It's not considered fashionable to walk/run or bike		
I have too many things to carry		
It is easier for my parents to drive me		
It involves too much planning ahead		
It is unsafe because of crime (strangers, gangs, drugs)		
I get bullied, teased, harassed		
There is nowhere to leave a bike safely		
There are stray dogs or other dangerous animals		
It is too far		
The route is difficult to walk/run because of garbage, water or bad smells		
The route is isolated		
I have a disability		
Please indicate any other challenges/barriers:		

Appendix C: Child Transportation Dairy

Country: _____ School: _____ Urban/Semi-urban/rural: _____

Date:_____1. Study ID #:_____

2. Gender (boy/girl): _____

3. When you wore the pedometer, how many times did you go to and from **home to the following destinations** using active modes of travel such as walking, running, biking)? Please respond for each day of the week.

Destinations	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
	To	From	To	From	To	From	To	From	To	From	To	From	To	From
School														
Friend's houses/home														
Relative's houses/home														
Parks or playgrounds														
Shops or markets, or restaurants														
Sport venues (e.g soccer field, swimming pool)														
Faith places (e.g church, mosque)														
Other**														

** If you have written "other", please specify which destination it is: _____

4. For each day of the week, please write "yes" if you have worn the activity monitor for most of the day or "no" if you did not.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Did you wear the pedometer for most of the day?							

Appendix D: Child Assent to be in the Study

1. Sylvester Hayker, Ph.D. Student,
Dept. of Recreation and Sports Management,
Kenyatta University,
P O Box 43844 00100 Nairobi, Kenya.
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Cell phone: +254-722 787 289 (available 24hrs a day)

2. Vincent Onywera, Ph.D.
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3. Caleb Mireri, Ph.D.
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4. Joy Wachira, Ph.D.
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Cell phone: +254-722 842 543

Why are they doing this study?

The researchers want to find out how school children living in urban, sub-urban, and rural areas in Nairobi county travel to school and other places of interest; and whether they walk, run, bike, or use vehicles.

What will happen to me?

If I want to be in the study, three things will happen:

1. I will fill out some papers assisted by the researchers
2. I will wear a monitor at my waist to measure my steps and activity.
3. I will record the activities that I do each day that I am wearing the monitor.

Will the study hurt?

Being in the study should not hurt me.

What if I have any questions?

I can ask questions any time. I can ask now. I can ask later. I can talk to the researchers or I can talk to someone else.

Do I have to be in the study?

I don't have to be in this study. No one will be mad at me if I don't want to do this. If I **don't want** to be in the study, I just have to tell the researchers. If I **want to** be in the study, I just have to tell the researchers. I can say yes now and change my mind later. It's up to me.

_____	_____	_____
Name of Volunteer	Age	Date

_____	_____
Signature of Person Administering Informed Consent	Date

Appendix E: Parental/Guardian Consent for a Minor to Participate in The Study

What you should know about the research study

- We give you this consent form so that you may read about the purpose, risks and benefits of this research study.
- The main goal of research studies is to gain knowledge that may help current and future populations.
- You have the right to refuse to take part, or agree to take part now and change your mind later on.
- Please review this consent form carefully and ask any questions before you make a decision.
- Your participation and that of your child is voluntary.
- By signing this consent form, you agree and allow your child to participate in the study as it is described.

1- Who is doing the study?

Key Investigator: Mr. **Sylvester Hayker,** is a student at the Department of Recreation, Management and Exercise Science**, Kenyatta University, Kenya.**

Mr. Hayker will direct this study in Nairobi County and expect about 1000 children from urban, sub-urban, and rural locations in the county. The study will take place over the 2014-2015 school years.

2 – Where is the study being conducted?

Data collection will be conducted in your child's school with some questionnaires completed by you (the parent or guardian) in your home. The expected time for the assessment of your child in this study will be 1 hour or less at their school and one week of wearing a waist monitor that measures steps taken.

3- What is the purpose of this study?

The purpose of this study is to find out the activity of school children 10 to 12 years of age living in urban, sub-urban and rural areas in Nairobi City County, and how they travel from place to place (whether they walk, run, bike, or use vehicles). This will inform policy interventions to increase physical activity levels among children. This is alluded to the fact that physical activity and active transport is key in reducing non-communicable disease like obesity and cardiovascular diseases.

4- Who is eligible to participate in the study? Who is ineligible?

Your child is eligible for the study if:

- Your child is enrolled in a school that participates in the study.
- Your child is 10 – 12 years old at the time of study enrolment.
- You (the parent or legal guardian) and your child agree (by signing this form) to participate in the study.
- The child signs the separate assent form indicating that he/she wishes to volunteer for the study.

Your child will not be eligible for the study if:

- You (the parent or legal guardian) do not sign this consent form, or your child does not sign the assent form indicating that they wish to volunteer for the study.
- Your child is unable to wear a waist monitor to detect steps and activity.

5- What will happen to you if you take part in the study?

You (the parent or guardian) will be asked to complete a questionnaire on the home environment, including your perception of your child's transportation mode to/from school and other destinations. The questionnaires will be sent home with your child. The parent or guardian will complete the questionnaires at home. It will take about 15 minutes to complete the questionnaire. You should give your child the questionnaires so as to return them to school where the researchers will pick them up.

All children enrolled in the study will have the same assessment. All information collected will be confidential and will not be shown to anyone other than researchers involved in the study.

The children's assessments will be coordinated with school administrators so as to not conflict with important school activities or tests. Your child's assessment will be obtained by trained personnel.

The assessments will include:

1. Questionnaires about activity and transport.
2. Wearing an activity monitor (step counter) for one week.

The physical activity monitor worn by your child for one week should only be removed for bathing, swimming, or when the child is going to bed. The monitor will be worn around their waist.

6- What are the possible risks and discomforts?

This is a minimal risk study. There are no aspects of the study that are anticipated to increase the risk of injury to your child. If the pedometer is disassembled or broken there could be small pieces dislodged which causes a choking hazard to children under the age of three. For this reason children under the age of 3 years old should be kept out of reach of the device.

7- What are the possible benefits?

There may be no direct benefit to your child for participating in this study; however, the research findings will help to shape future activity interventions that will potentially help children to become healthier.

8- If you do not want to take part in the study, are there other choices?

You can either choose to participate in the study by signing this form and returning it to the study staff in the envelope provided, or you can choose not to participate in the study by not signing the form. You have the choice at any time not to participate in this research study. Therefore, if you and your child decide to participate in the study at this time, and later decide to not participate, you are allowed to withdraw from the study.

9- If you have any questions or problems, whom can you call?

If you have any questions about your rights as a research volunteer, you should call Mr. Hayker on 0722 787 289.

10- What information will be kept private?

All data will be collected in a confidential manner. Every effort will be made to maintain the confidentiality of your study records and those of your child's. Your child will be assigned a unique identity number on questionnaires or data collection forms (besides the activity monitoring form which will have their initials). A separate secure list held at the international office will be used only to identify participants for re-contacting purposes. Results of the study may be published; however, we will keep your name and other identifying information private. Other than as set forth above, your identity will remain confidential unless disclosure is required by law.

11- Can your taking part in the study end early?

Mr. Hayker can withdraw you and your child from the study for any reason that might jeopardise the study. You and your child may withdraw from the study at any time without penalty. Possible reasons for withdrawal include failure to wear the activity monitor or disruptive behaviour related to the conduct of the study. The sponsor of the study may end the study early.

12- What if information becomes available that might affect your decision to stay in the study?

During the course of this study there may be new findings from this or other research which may affect your willingness to continue participation. Information concerning any such new findings will be provided to you.

13- What charges will you have to pay?
None

14- What payment will you receive?
No payment will be received for participating in this study. Your child's school may receive gifts, such as balls, etc. These gifts will be determined by coordination between school administration and the research team.

15- Will you be compensated for a study-related injury or medical illness?
No form of compensation for medical treatment or for other damages is available from the research team.

16- Confidentiality
Records that you give us permission to keep will be kept confidential as required by law. Except when required by law, you will not be identified by name, identity card number, address, telephone number, or any other direct personal identifier in records disclosed outside of the research. For records disclosed outside of the research, you will be assigned a unique code number.

17- Signatures
The study has been discussed with me and all my questions have been answered. If there is anything I don't understand, I can ask the investigators or anyone from the study team.

The study volunteer is a child and I certify that I am his/her legal guardian.

_____	_____	_____
Printed Name of Parent/ Guardian	Relationship to Child	Date
_____	_____	_____
Parent/ Guardian Signature	Date	Age of Child
_____		_____
Site Staff Member Receiving the Signed Informed Consent		Date

Researcher:
Mr. Sylvester William Onyango Hayker, Ph.D, Student,
Department of Recreation Management and Exercise Science
Kenyatta University
P.O BOX 43844-00100 Nairobi-KENYA
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Appendix F: Utathmini wa Mazoezi ya Viumngo na Usafiri Mwafaka kati ya Wanafunzi Barani Afrika

Maagizo: Hojaji ya mwanafunzi itajazwa darasani chini ya uongozi wa watafiti wasaidizi nyanjani. Shajara ya usafiri inafaa kujazwa darasani kila siku za shule mwanafunzi akiwa amevaa kifaa maalumu cha kuratibu hatua na kiwango cha mazoezi kiunoni (Pedomita). Hojaji ya mzazi /mlezi itajazwa na mzazi au mlezi wa mtoto. Wazazi/ walezi wataombwa kujaza shajara ya usafiri na vipengele vingine vya usafiri kwa nia ya majaribio. Hojaji ya sera itajazwa na wajuzi wanaohusika na waratibu wa mipango au wajuzi wa mabo ya uchukuzi.Weledi hawa watakodishwa katika kila mazingira.

HOJAJI YA MALEZI

Taifa: _____Shule: _____ Mjini/Mashambani /Kitongojini:_____Nambari/Jina la udadisi

#:_____

1. Una uhusiano gani na mtoto? (Wewe ni mama / baba / mlezi?)_____

2. Kiwango gani cha juu zaidi cha elimu ya Mama/baba/Mlezi ni kipi?

- ☐ Chini ya shule ya msingi
- ☐ Shule ya msingi
- ☐ Chini ya shule ya upili
- ☐ Shule yoyote ya upili
- ☐ Shule ya upili
- ☐ Shtahada(Diploma)/Shtahada(Diploma ya juu)
- ☐ Shahada ya awali/kwanza
- ☐ Shahada ya taaluma (PhD)/Mhitimu (Stashahada / Uzamili)

3. Ni magari mangapi(makubwa na madogo) yanayohudumu katika nyumba yenu?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3

☐ 4 au zaidi

4.Ni piki piki au tuk tuk ngapi zinazohudumu katika nyumba yenu?

☐ 0
☐ 1
☐ 2
☐ 3
☐ 4 au zaidi

5. Mna baiskeli ngapi zinazohudumu katika nyumba yenu?

☐ 0
☐ 1
☐ 2
☐ 3
☐ 4 au zaidi

6. Kwa kawaida, mtoto wako husafiri vipi **<u>kuelekea</u>**/**<u>Kwenda</u>** shuleni vipi kuanzia Jumatatu hadi Ijumaa? Tafadhali onyesha kwenye kisanduku kimoja tu

☐ Hutembea ☐ Hutumia baiskeli ☐ Hukimbia

☐ Gari dogo / daladala ☐ Kwa basi au gari la moshi ☐ Kwa piki piki

☐ Kwa namna nyingine.Tafadhali iandike: _____

7. Kwa kawaida, mtoto wako husafiri vipi **<u>akirudi nyumbani</u>** kuanzia Jumatatu hadi Ijumaa? Tafadhali onyesha kwenye kisanduku kimoja tu

☐ Hutembea ☐ Hutumia baiskeli ☐ Hukimbia

☐ Gari dogo / daladala ☐ Kwa basi au gari la moshi ☐ Kwa piki piki

☐ Kwa namna nyingine.Tafadhali iandike: _____

8. Shule anayosomea motto wako iko umbali gani na nyumbani kwako?
Kilomita_____

9. Tafadhali onyesha kiwango chako cha kukubaliana na misimamo au dhana zilizo katika jedwali hili.Tafadhali weka alama ya*(√) katika nambari moja tu*.

Ni vigumu kwa motto wangu kutembea, kukimbia au kutumia baiskeli akienda shuleni kwa sababu.....	**1 Ndiyo**	**2 Laa**
Kuna milima mingi sana njiani		
Hakuna vichorochoro mwafaka kwa kutembea, kukimbia au kuendesha baiskeli		
Barabara inachusha (Hakuna cha kuvutia macho)		
Njia /Barabara haina mwangaza /taa za kutosha		
Kuna magari mengi njiani		
Kuna vivuko hatari barabarani		
Mtoto wangu huwa na joto jingi na hutokwa na jasho jingi sana		
Hakuna watoto wengine ambao hutembea, hukimbia au hutumia baiskeli		
Kutembea /Kukimbia au kuendesha baiskeli kumepitwa na wakati/si ustaarabu		
Mtoto wangu hubeba mzigo mzito		
Ni rahisi kwangu kumwendesha motto wangu		
Inahitaji matayarisho kabambe		
Ni hatari kwa sababu ya uhalifu (ugaidi, ujambazi na mihadarati)		
motto wangu huteswa , kukejeliwa na kuharakishwa		
Hakuna mahali pa kuegesha baiskeli		
Kuna mbwa koko na wanyama hatari wengine hatari		
Ni mbali sana		
Ni vigumu kutembea /kuendesha baiskeli/ pikipiki takataka, maji au harufu mbaya		
Njia ni pweke		
Mtoto wangu ana ulemavu / upungufu		
Nyingine*:		
Nyingine:		

*Kama kuna vizuizi vingine, tafadhali viandike katika sehemu hizo mbili

SHAJARA YA USAFIRI

10. Ni mara ngapi mtoto wako alivaa Pedometer akisafiri kwa kutembea, akikimbia, akiendesha baiskeli **akitoka nyumbani akielekea sehemu zifuatazo**:

Tafadhali toa jibu kwa kila siku ya wiki

Mahali	Jumatatu	Jumanne	Jumatano	Alhamisi	Ijumaa	Jumamosi	Jumapili
Shuleni							
Kwao rafiki yake							
Kwa jamaa							
Bustanini /sehemu za michezo							
Madukani, sokoni au mikahawani							
Sehemu za michezo(Uwanja wa kandanda,vidimbwi vya kuogelea)							
Sehemu za ibada (k.v kanisani, msikitini)							
Nyingine							

** Kama umeandika ”nyingine” tafadhali eleza ni mahali kupi: _____

11. Ni mara ngapi mtoto wako alivaa Pedometer akisafiri kwa kutembea, akikimbia, akiendesha baiskeli **akirudi nyumbani akitoka sehemu zifuatazo**

Mahali	Jumatatu	Jumanne	Jumatano	Alhamisi	Ijumaa	Jumamosi	Jumapili
Shuleni							
Kwao rafiki yake							
Kwa jamaa							
Bustanini /sehemu za michezo							
Madukani, sokoni au mikahawani							
Sehemu za michezo(Uwanja wa kandanda,vidimbwi vya kuogelea)							
Sehemu za ibada (k.v kanisani, msikitini)							
Nyingine							

**Kama umeandika ”nyingine” tafadhali eleza ni mahali kupi:: _____

Hojaji ya Mtoto

Taifa: _____ Shule: _____
Mjini/Vitongojini/Mashambani:_____

Jina . Nambari ya udadisi #:_____

Umri: Miaka_____

Jinsia (Mvulana/Msichana): _____

1. Kwa kawaida, wewe husafiri vipi **kuenda shuleni** kuanzia Jumatatu hadi Ijumaa kati ya mwezi wa **Januari na Aprili**?

☐ Hutembea ☐ Hutumia baiskeli ☐ Hukimbia

☐ Gari dogo / daladala ☐ Kwa basi au gari la moshi ☐ Kwa piki piki

☐ Kwa namna nyingine.Tafadhali iandike:
_____

2. Kwa kawaida, wewe husafiri vipi **kuenda shuleni** kuanzia Jumatatu hadi Ijumaa kati ya mwezi wa **Mei na Agosti**?

☐ Hutembea ☐ Hutumia baiskeli ☐ Hukimbia

☐ Gari dogo / daladala ☐ Kwa basi au gari la moshi ☐ Kwa piki piki

☐ Kwa namna nyingine.Tafadhali iandike:
_____

3. Kwa kawaida, wewe husafiri vipi **kuenda shuleni** kuanzia Jumatatu hadi Ijumaa kati ya mwezi wa **Septemba na Desemba**?

☐ Hutembea ☐ Hutumia baiskeli ☐ Hukimbia

☐ Gari dogo / daladala ☐ Kwa basi au gari la moshi ☐ Kwa piki piki

☐ Kwa namna nyingine.Tafadhali iandike:
_____

4. Kwa kawaida, wewe husafiri vipi **ukirudi nyumbani** kuanzia Jumatatu hadi Ijumaa kati ya mwezi wa **Januari na Aprili**?

☐ Hutembea ☐ Hutumia baiskeli ☐ Hukimbia

☐ Gari dogo / daladala ☐ Kwa basi au gari la moshi ☐ Kwa piki piki

☐ Kwa namna nyingine.Tafadhali iandike:

_____

5. Kwa kawaida, wewe husafiri vipi **ukirudi nyumbani** kuanzia Jumatatu hadi Ijumaa kati ya mwezi wa **Mei na Agosti**?

☐ Hutembea ☐ Hutumia baiskeli ☐ Hukimbia

☐ Gari dogo / daladala ☐ Kwa basi au gari la moshi ☐ Kwa piki piki

☐ Kwa namna nyingine.Tafadhali iandike:

_____

6. Kwa kawaida, wewe husafiri vipi **ukirudi nyumbani** kuanzia Jumatatu hadi Ijumaa kati ya mwezi wa **Septemba na Desemba**?

☐ Hutembea ☐ Hutumia baiskeli ☐ Hukimbia

☐ Gari dogo / daladala ☐ Kwa basi au gari la moshi ☐ Kwa piki piki

☐ Kwa namna nyingine.Tafadhali iandike:

_____

7. Wewe huenda nyumbani wakati wa kishuka wakati wa masomo?

☐ Naam ☐ La

8. Mara ngapi kwa wiki/Juma?

☐ 0 Sufuri ☐ Mara 1 ☐ Mara 2

☐ Mara 3 ☐ Mara 4 ☐ Mara 5

9. Wewe husafiri vipi **kwenda nyumbani** wakati wa kishuka siku za masomo? Tafadhali onyesha kwenye kisanduku kimoja tu

☐ Hutembea ☐ Hutumia baiskeli ☐ Hukimbia

☐ Gari dogo / daladala ☐ Kwa basi au gari la moshi ☐ Kwa piki piki

☐ Kwa namna nyingine.Tafadhali iandike: _____

☐ Huwa sirudi nyumbani

10. Shule yako iko umbali gani na shule yako? Kilomita _____

11. Tafadhali onyesha kiwango chako cha kukubaliana na misimamo au dhana zilizo katika jedwali hili.Tafadhali weka alama ya*(√) katika nambari moja tu*.

Ni vigumu kwa mtoto wangu kutembea, kukimbia au kutumia baiskeli akienda shuleni kwa sababu.....	**1 Sikubaliani kamwe**	**2 Kwa kiwango sikubali**	**3 Kwa kiasi nakubali**	**4 Nakubali kabisa**
Kuna milima mingi sana njiani				
Hakuna vichorochoro mwafaka kwa kutembea, kukimbia au kuendesha baiskeli				
Barabara inachusha (Hakuna cha kuvutia macho)				
Njia /Barabara haina mwangaza /taa za kutosha				
Kuna magari mengi njiani				
Kuna vivuko hatari barabarani				
Mtoto wangu huwa na joto jingi na hutokwa na jasho jingi sana				
Hakuna watoto wengine ambao hutembea, hukimbia au hutumia baiskeli				
Kutembea /Kukimbia au kuendesha baiskeli kumepitwa na wakati/si ustaarabu				
Mtoto wangu hubeba mzigo mzito				
Ni rahisi kwangu kumwendesha motto wangu				
Inahitaji matayarisho kabambe				
Ni hatari kwa sababu ya uhalifu (ugaidi, ujambazi na mihadarati)				
motto wangu huteswa , kukejeliwa na kuharakishwa				
Hakuna mahali pa kuegesha baiskeli				
Kuna mbwa koko na wanyama hatari wengine hatari				
Ni mbali sana				
Ni vigumu kutembea /kuendesha baiskeli/ pikipiki takataka, maji au harufu mbaya				
Njia ni pweke				
Mtoto wangu ana ulemavu / upungufu				
Nyingine*:				
Nyingine:				

*Kama kuna vizuizi vingine, tafadhali viandike katika sehemu hizo mbili

Shajara ya Usafiri wa Mtoto

Taifa: _____Shule: _____

Mjini/Vitongojini/Mashambani:_____

1.Jina . Nambari ya udadisi

#:_____

2. Jinsia (Mvulana/Msichana): _____.

3. Ni mara ngapi ulivaa Pedometer ukisafiri kwa kutembea, ukikimbia, ukiendesha baiskeli **ukitoka nyumbani akielekea sehemu zifuatazo**:

4. Tafadhali toa jibu kwa kila siku ya wiki

Mahali	Jumatatu	Jumanne	Jumatano	Alhamisi	Ijumaa	Jumamosi	Jumapili
Shuleni							
Kwao rafiki yako							
Kwa jamaa							
Bustanini /sehemu za michezo							
Madukani, sokoni au mikahawani							
Sehemu za michezo(Uwanja wa kandanda,vidimbwi vya kuogelea)							
Sehemu za ibada (k.v kanisani, msikitini)							
Nyingine							

** Kama umeandika ”nyingine” tafadhali eleza ni mahali kupi: _____

4. Ni mara ngapi mtoto wako alivaa Pedometer akisafiri kwa kutembea, akikimbia, akiendesha baiskeli **akirudi nyumbani akitoka sehemu zifuatazo**

Mahali	Jumatatu	Jumanne	Jumatano	Alhamisi	Ijumaa	Jumamosi	Jumapili
Shuleni							
Kwao rafiki yake							
Kwa jamaa							
Bustanini /sehemu za michezo							
Madukani, sokoni au mikahawani							
Sehemu za michezo (Uwanja wa kandanda,vidimbwi vya kuogelea)							
Sehemu za ibada (k.v kanisani, msikitini)							
Nyingine							

**Kama umeandika ”nyingine” tafadhali eleza ni mahali kupi: _____

5. Kwa kila siku ya wiki, tafadhali andika “Naam/Ndio” kama umewahi kuvaa pedometer kwa muda mrefu wa siku na “La” ikwa hukuvaa.

	Jumatatu	Jumanne	Jumatano	Alhamisi	Ijumaa	Jumamosi	Jumapili
Je? Ulivaa pedometer kwa wakati mwingi ?							

Taifa: ____________________________ Shule: __________________________
Mjini/Vitongojini/Mashambani:____

Makadirio ya mwalimu kuhusu umbali kati ya kwao mwanafunzi na shule yao.

Kwa kila mwanafunzi anayeshiriki katika utafiti huu, tungependa ukadirie umbali wa kwao mwanafunzi hadi shuleni. Tutauthamini usaidizi wako katika sehemu hii. Tafadhali andika “Sijui” ikiwa hujui mahali mtoto anakoishi.

Jina la mtoto	Umbali (Kilomita)

HOJAJI YA SERA: Kuhusu usafiri

(Ijazwe na wajuzi wa mabo ya usafiri / waratibu wa mipango ya miji)

1. Habari zinatoka wapi:

Shirika la kimataifa

□ Shirika la afya duniani (WHO)

□ Shirika la umoja wa mataifa ya elimu, sayansi na utamaduni (UNESCO)

□ Hazina ya dharura ya watoto ya umoja wa mataifa (UNICEF)

□ Nyingine (Fafanua):_____

Kiwango cha Serikali

□ Kitaifa (National)

□ Chini ya Kitaifa (Fafanua):_____

Sjrika lisilo la serikali(NGO)

□ (Fafanua):_____

Habari zimetoka kwingine

□ (Fafanua):_____

Mhojiwa Mkuu (Jina/Cheo): _____

Habari zilikusanywa kwa kupitia barua pepe/moja kwa moja /kwa njia nyingine (Fafanua):_____

1. Je? kuna msimamo / mipango / sheria zilizoratibiwa au zinazoendelea kutayarishwa kuhusu usafiri wa watoto kwa njia ya kutembea, kukimbia, kuendesha baiskeli au pikipiki mbali na utumiaji wa magari.

2. Je? Kuna habari / nakala zilizo na misimamo / mienendo zilizo na habari hizi? Je, tunaweza kuzipata nakala hizi?(Kama ni ndio, Je nakala hizo zilitolewa?) Ndio /Lani

3. Je, unamfahamu mtu yeyote anayeweza kutupatia habari /nakala zilizo na habari hizi?

UTATHMINI WA MAZOEZI YA MWILI NA USAFIRI BAINA YA WANAFUNZI BARANI AFRIKA

IDHINI YA MWANAFUNZI KUSHIRIKI KATIKA UTAFITI

Mtafiti mkuu nchini Kenya: Dk. Vincent Onywera, Mzamili, Chuo Kikuu cha Kenyatta.

Nambari za simu: +254-0788291696 au +254-0723842543

Ni kwa nini wanafanya udadisi huu?

Mdadisi anahitaji kujua jinsi watoto wanaoishimjini, vitongojini na mashambani husafiri kutoka sehemu moja hadi nyingine na ikiwa wao hutembea, hukimbia, hutumia baiskeli/pikipiki au hutumia magari kweda na kutoka shuleni.

Ni nini kitakachonitendekea?

Nikitaka kujumishwa katika udadisi, mambo matatu yatatendeka:

4. Utajaza karatasi nikisaidiwa na mtafiti
5. Nitavaa kifaa spesheli kiunoni cha kupima na kuratibu kiwango change cha mazoezi.
6. Nitaorodhesha aina ya mazoezi yangu na matokeo yote ya kila siku ambayo nitakuwa nimekivaa kifaa hicho.

Je udadisi unaweza kudhuru?

Kuwa katika udadisi hakufai kunidhuru.

Na nikiwa na maswali fulani?

Naweza kuuliza maswali wakati wowote, wakati huu, baadaye, ninaweza kuongea na wadadisi au kuongea na mtu mwengine.

Ni sharti niwshirikishwe katika udadisi huu?

Sio lazima nishirikishwe katika udadisi huu. Hakuna atakayeudhika nawe kwa kukataa. Nitamweleza mtafiti ikiwa sitaki kushiriki katika bila tashwishi. Ikiwa nataka

kushirikishwa, nitanmweleza mtafiti. Naweza kukubali sasa hivi na nibadili msimamo au kauli yangu baadaye. Ni uamuzi wangu.

_____	_____	_____
Jina la anayejitolea kushiriki	Umri	Tarehe

_____ Sahihi ya anayetoa idhini ya kushiriki

Tarehe

KUTATTHMINI KWA MAZOEZI YA VIUNGO NA USAFIRI MWAFAKA KATI YA WATOTO WA SHULE ZA AFRIKA

IDHINI YA MTOTO KUSHIRIKI KATIKA UTAFITI

Unafaa kujua yafuatayo kuhusu udadisi na uchunguzi huu

- Tunakupatia fomu hii ili ya idhini ili uisome na uelewe madhumini, madhara na umuhimu wa udadisi huu.
- Madhumuni ya udadisi huu ni kupata elimu ambayo inaweza kuvisaidia vizazi vya sasa na vya vijavyo.
- Una haki na uhuru wa kukubali, kukataa kushiriki katika udadisi au utafiti huu. Unaweza kukubali kushiriki sasa hivi na ubadili msimamo au mawazo yako baadaye
- Tafadhali hakiki/pitia kwa makini fomu hii ya idhini na uulize maswali kabla ya kuufanya uamuzi.
- Ni hiari yako nay a motto wako kushiriki katika udadisi / utafiti huu.
- Kwa kuweka sahihi, unakubali na kumpatia motto wako idhini ya kushiriki katika udadisi huu.

1- Nani anafanya utafiti huu?

Mpelelezi Mkuu :Dk. **Vincent Onywera,** ambaye ni Mhadhiri Mwandamizi katika idara ya burudani, usimamizi na sayansi ya kupasha misuli moto, Chuo kikuu cha Kenyatta nchini Kenya. Daktari ananuia kuwafikia wanafunzi takriban 1000 nchini Kenya wanaoishi mijini, vitongojini na mashambani wakati wa masomo kati ya miaka 2014 - 2015

2 – Udadisi / utafiti utafanywa wapi?

Utafiti na upatikanaji wa matokeo/data utafanywa kwenye shule ya motto wako na hojaji nyingine ikamilishwe na (mzazi/ mlezi) nyumbani kwako. Muda ambao unatarajiwa kwa kutathmini idadisi / utafiti wa motto wako ni saa moja au chini katika shule yake na wiki moja ya kuvaa tepu ya kiuno ambayo hupima hatua zilizochukuliwa

3- Ni nini umuhimu wa utafiti huu?

Udaddisi / utafiti huu unanuiwa kutathmini na kuchunguza shughuli za wanafunzi kati ya miaka (10 – 12_ ambao huishi mjini, vitongojini na vijijini nchini Kenya na vile wanavyosafiri kutoka sehemu moja hadi nyingine (Wakitembea, wakikimbia, kwa baiskeli/pikipiki au magari)

4- Ni nani anaruhusiwa kushiriki katika udadisi /utafiti huu?Nani haruhusiwi?

Mtoto wako atashiriki kwenye udadisi/utafiti huu ikiwa:

- Amesajiliwa katika shule inayoshiriki katika udadisi /utafiti huu .
- Ikiwa mtoto wako ana umri wa miaka kati ya 10 – 12 wakati amesajiliwa kwenye utafiti huu
- Wewe (Mzazi / mlezi halali) na motto mmekubaliana (kwa kutia sahihi katika fomu hii) kushiriki katika udadisi /utafiti huu.
- Mtoto ameweka sahihi kwenye fomu ya tathmini tofauti inayoonyesha kuwa amejitolea kushiriki katika utafiti / udadisi huu.

Mtoto wako hatashiriki katika utafiti huu ikiwa:

- Wewe (Mzazi au mlezi halali) hutaweka sahihi ya kutoa idhini au mtoto na ikiwa mtoto wako hatakuwa ameweka sahihi kwenye fomu ya idhini kuonyesha kuwa amejitolea kushiriki katika uchunguzi
- Mtoto wako hawezi kuvaa tepu fuatiliaji kiunoni kuratibu hatua na shughuli.

5- Ni gani yatakayokufanyikia ikiwa utashiriki katika udadisi huu?

Wewe (Mzazi au mlezi) utatakikana ujaze hojaji ya mazingira ya nyumbani, hisia zako kuhusiana na usafiri wa motto wako kwenda na kutoka shuleni na kwingineko. Hojaji hizi zitatumiwa na motto wako. Mzazi au mlezi atajaza hojaji hizi nyumbani. Itakuchukua takriban dakika kumi na tano (15) kujaza hojaji. Utampatia mtoto wako hojaji hizi arudishe shuleni pale watafiti / wadadisi watazichukua na kuzishughulikia.

Watoto wote waliosajiliwa kwenye kwenye udadisi watatathminiwa sawa. Habari zote zitakazopatikana zitakuwa siri na hazitajadiliwa wala kuonyeshwa mtu yeyote isipokuwa watafiti au wadadisi wenyewe.

Tathmini za watoto zitaratibiwa na wasimamizi wa shule ili shughuli zozote za mitihani zisiathirike kwa njia yoyote. Utatthmini wa mtoto wako utafanywa na mhudumu aliyehitimu.

Tathmini zitakuwa za:

5. Hojaji za shughuli na usafiri
6. Kuvaa shughuli – fuatiliaji kwa wiki moja.

Kifaa kitakachovaliwa kiunoni na motto wako kitatolewa tu wakati mototo anapoenda kuoga/kuogelea au kulala.

6- Kuna madhara au maumivu yoyote yanayoweza kuibuka?

Huu ni utafiti ambao unaweza kuwa na madhara machache kama shughuli nyingine yoyote. Hakuna hali yoyote ya utafiti ambayo itazidisha madhara ya kuumia kwa mtoto wako. Hata hivyo, kifaa cha kupimia umbali kikisambaratika kinaweza kuwa na vipande vidogo vodogo ambavyo vinaweza kumezwa na kuwasakama watoto wadogo wadogo walio chini ya umri wa miaka mitatu (3). Kutokana na sababu hii ndio maana udadisi / uchunguzi huu haujumuishi watoto walio chini ya umri wa miaka mitatu

7- Je kuna faida zozote?

Utafiti huu hautamfadhili mtoto wako moja kwa moja. Hata hivyo, matokeo haya yatatumiwa na washikadau kuratibu mienendo na uwekezaji utakaowasaidia watoto wa siku za usoni wawe na afya/siha nzuri.

8- Usipotaka kushiriki kwenye utafiti, je kuna viteuzi vingine?

Unaweza kuchagua kushiriki kwenye utafiti ukiweka sahihi kwenye fomu hii na kuirudisha kwa watafiti ikiwa ndani ya bahasha. Unaweza vilevile kuchagua kushiriki katika uchunguzi/ utafiti huu bila kuweka sahihi kwenye fomu.

Unaweza kuchagua wakati wowote kutoshiriki katika udadisi/ utafiti huu. Kwa hivyo, ikiwa wewe na motto wako mmechagua kushiriki katika udadisi/ utafiti huu, na baadaye muamue kutoshiriki, mmekubaliwa na mna hiari kujiondoa kwenye utafiti huu.

9- Je? Utampigia nani simu ukiwa na maswali au matatizo yoyote?

Ukiwa na maswali yoyote kama aliyejitolea kushiriki, usisite kumpigia Dk.Vincent Onywera kupitia kwa nambari 0788291696.

10- Ni habari gani zitatunzwa kwa usiri?

Data zote zitachukusanywa kwa usiri.Juhudi na mikakati kabambe itawekwa kuhifadhi siri na kumbukumbu za uatfiti wako na wa motto wako. Mtoto wako atapewa nambari ya kipekee kwenye hojaji au data ya kunakili (Na tena fomu ya uratibu wa shughuli ambayo itakuwa na nambari). Stakabadhi tofauti katika ofisi ya kimataifaitatumiwa tu kuwahjua washiriki kwa minajili ya kuwapata baadaye ikiwa watahitajika.

Matokeo ya utafiti yanaweza kuchapishwa, hata hivyo, uchapishaji huo utalificha jina lako pamoja na habari zako zote za siri. Isipokuwa vile imekubaliwa hapa juu, hutajulikana ila tu kwa mujibu wa sheria.

11- Je kushiriki kwangu kwenye udadisi huu unaweza kukamilika ya muda ulioratibiwa?

Dk. Vincent Onywera anaweza kuwaondoa wewe na motto wako katika utafiti/udadisi huu akiwa na sababu au bila sababu. Vilevile, wewe na motto wako mnaweza kujiondoa bila kuadhibiwa.

Hata hivyo, baadhi ya sababu zinazoweza kumfanya mtu aondolewe katika utafiti huu ni kutovaa kifaa maalum cha kuratibu hatua na kiwango cha mazoezi ya viungo kuhusiana na utafiti. Ni vizuri kuelewa kuwa, mfadhili wa uchunguzi anaweza kusitisha kushiriki kwako katika udadisi huu mapema.

12- Na je, ikiwa habari zitpatikane ambazo zinaweza kukushawishi kutoendelea na kushiriki katika udadisi huu?

Wakati wa utafiti huu, kuna uwezekano wa kupatikana kwa habari / matokeo mapya hapa au pale ambayo yanaweze kuziathiri hisia zako za kuendelea kushiriki katika utafiti huu. Habari kuhusu jambo au chimbuko lolote jipya utapewa.

13- Utalipishwa shilingi ngapi?

Hukuna malipo yoyote

14- Utapata malipo kiasi gani?

Hakuna malipo yoyote utakayoyapata kutokana na kushiriki katika utafiti huu.Hata hivyo, shule anakosomea mtoto wako inaweza kupata zawadi ndogo ndogo kama vile mipira na vinginevyo. Zawadi hizi zitategemea uratibu kati ya usmamizi wa shule na wale ambao wanafanya utafiti

15- je utafidiwa kutokana na madhara yatakayotokana na utafiti au magonjwa?

Hakuna fidia yoyote ya matibabu au uharibifu utatolewa na watafiti.

16- Usiri

Habari au kumbukumbu ambazo utatupa idhini za kuzitunza tuzihifadhi kwa usiri kwa mujibu wa sheria

Isipokuwa kwa mujibu wa sheria, hutajulikana kwa jina, nambari ya kitambulisho, S.L.P, Nambari ya simu, au nyingine kwa mujibu wa rekodi itakayofanywa nje ya utafiti.

Kwa mujibu wa utafiti wetu, utapewa nambari ya kipekee ya utafiti

17- Sahihi

Udadisi /utafiti umejadiliwa name na maswali yangu yote yamejibiwa. Kama kuna jambo ambalo silielewi,naweza kumwuliza mtafiti / mdadisi au mshikadau yeyote anyehusika kikundi cha watafiti.

Anayejitolea ni motto na nahakiki kuwa mimi ndiye mzazi /mlezi halali

_____	_____	_____
Jina la mzazi/Mlezi ambalo limechapishwa	Uhusiano na mtoto	Tarehe

_____	_____	_____
Sahihi ya mzazi /Mlezi	Tarehe	Umri wa mtoto

_____	_____
Mtafiti anayekabidhi makubaliano yaliyowekwa sahihi	Tarehe

Mchunguzi mkuu nchini Kenya:

Dr. Vincent O. Onywera, Ph.D,ISAK 2
Mhadhiri Mwandamizi
Idara ya burudani, usimamizi na sayansi ya kupasha misuli moto,
Chuo Kikuu cha Kenyatta
S.L.P 43844-00100 Nairobi-KENYA
Barua pepe: vonywera@gmail.com
Barua pepe saidizi: onywera.vincent@ku.ac.ke
Nambari ya simu: 0788291696.

Appendix G: Pedometer Instructions (PiezoRx®)

"We would like to measure your normal physical activity rate today and over the next 7 days. We can measure this by having you wear this monitor on your waistband. You wear it on your right side; just over your hip (demonstrate). We would like you to wear it during your waking hours. However, since the pedometer is NOT water proof, you will need to remove it while showering or taking a bath. On the last day wear it as normal to school where we will collect it from you. We will call you to see if you have any questions about the pedometer. You can also call us if you have any questions (show them the number at the bottom). It is very important that you don't do anything different just because you are wearing the pedometer. Just do your normal routine today and over the next 7 days."

Wearing the Waist Pedometer

1. Using the strap and clip provided, clip the pedometer on your belt (for boys) or on the waist line of your tunic (for girls) under your right armpit. Position the pedometer to slip into your right side pocket for its safety. Refer to the picture below for proper placement

2. Keep the pedometer on for all the 7 days, excluding when you sleep.

3. The pedometer MUST be removed when bathing (either bath or shower) or when going swimming. DO NOT GET THE PEDOMETER WET!

4. If you have any problems with attaching the pedometers, or think they may not be working, please call the number listed below and we will call you back.

Pedometer use instruction

Keep the monitor on for all your waking day. During this time, please live your life as you normally do.

If you have any questions please call: 0722 787 289

Appendix H: Permission for PAAT Kenya study site to conduct research from National Commission for Science, Technology and Innovation (NACOSTI)

REPUBLIC OF KENYA

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349, 254-020-2673550
Mobile: 0713 788 787 , 0735 404 245
Fax: 254-020-2213215
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: **NCST/RCD/14/013/1430**

Date: **20th August, 2013**

Vincent Ochieng Onywera
Kenyatta University
P.O.Box 43844-00100
Nairobi.

RE: RESEARCH AUTHORIZATION

Following your application dated ***1st August, 2013*** for authority to carry out research on ***"Assessment of physical activity and active transport among school children in Eastern, Western and Southern Regions of Africa: The case of Kenya, Nigeria and Mozambique,"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi and Kisumu Counties** for a period ending **31st August, 2016.**

You are advised to report to **the County Commissioners and the County Directors of Education, Nairobi and Kisumu Counties** before embarking on the research project.

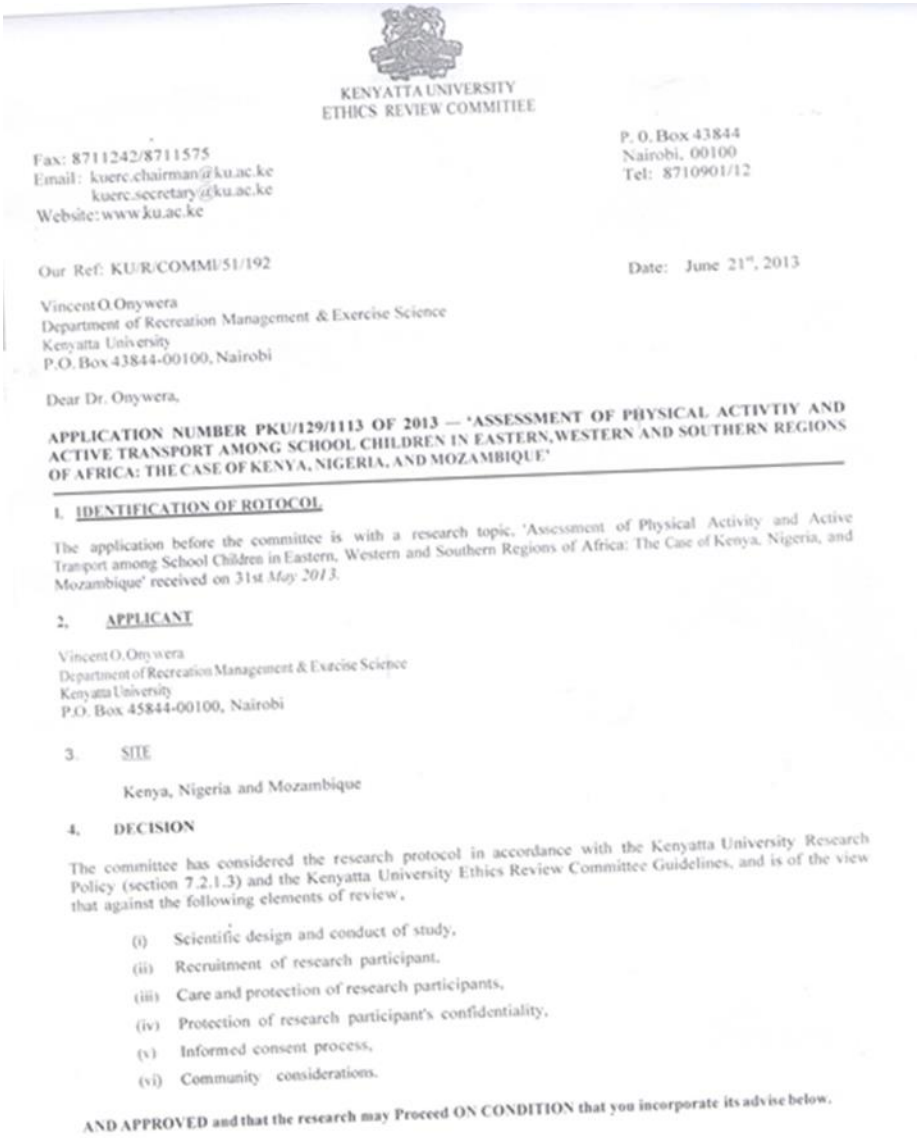
On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. M. K. RUCHTT, PhD, HSC.
DEPUTY COUNCIL SECRETARY

Copy to:

The County Commissioners
The County Directors of Education
Nairobi County
Kisumu County.

Appendix I: Ethics Review Approval Letter for PAAT Kenya study site by Kenyatta University Ethics Review Committee



KENYATTA UNIVERSITY
ETHICS REVIEW COMMITTEE

Fax: 8711242/8711575
Email: kuerc.chairman@ku.ac.ke
kuerc.secretary@ku.ac.ke
Website: www.ku.ac.ke

P. O. Box 43844
Nairobi, 00100
Tel: 8710901/12

Our Ref: KU/R/COMM/51/192

Date: June 21st, 2013

Vincent O. Onywera
Department of Recreation Management & Exercise Science
Kenyatta University
P.O. Box 43844-00100, Nairobi

Dear Dr. Onywera,

APPLICATION NUMBER PKU/129/1113 OF 2013 — 'ASSESSMENT OF PHYSICAL ACTIVTIY AND ACTIVE TRANSPORT AMONG SCHOOL CHILDREN IN EASTERN, WESTERN AND SOUTHERN REGIONS OF AFRICA: THE CASE OF KENYA, NIGERIA, AND MOZAMBIQUE'

1. **IDENTIFICATION OF ROTOCOL**

The application before the committee is with a research topic, 'Assessment of Physical Activity and Active Transport among School Children in Eastern, Western and Southern Regions of Africa: The Case of Kenya, Nigeria, and Mozambique' received on 31st *May 2013*.

2. **APPLICANT**

Vincent O. Onywera
Department of Recreation Management & Exercise Science
Kenyatta University
P.O. Box 45844-00100, Nairobi

3. SITE

Kenya, Nigeria and Mozambique

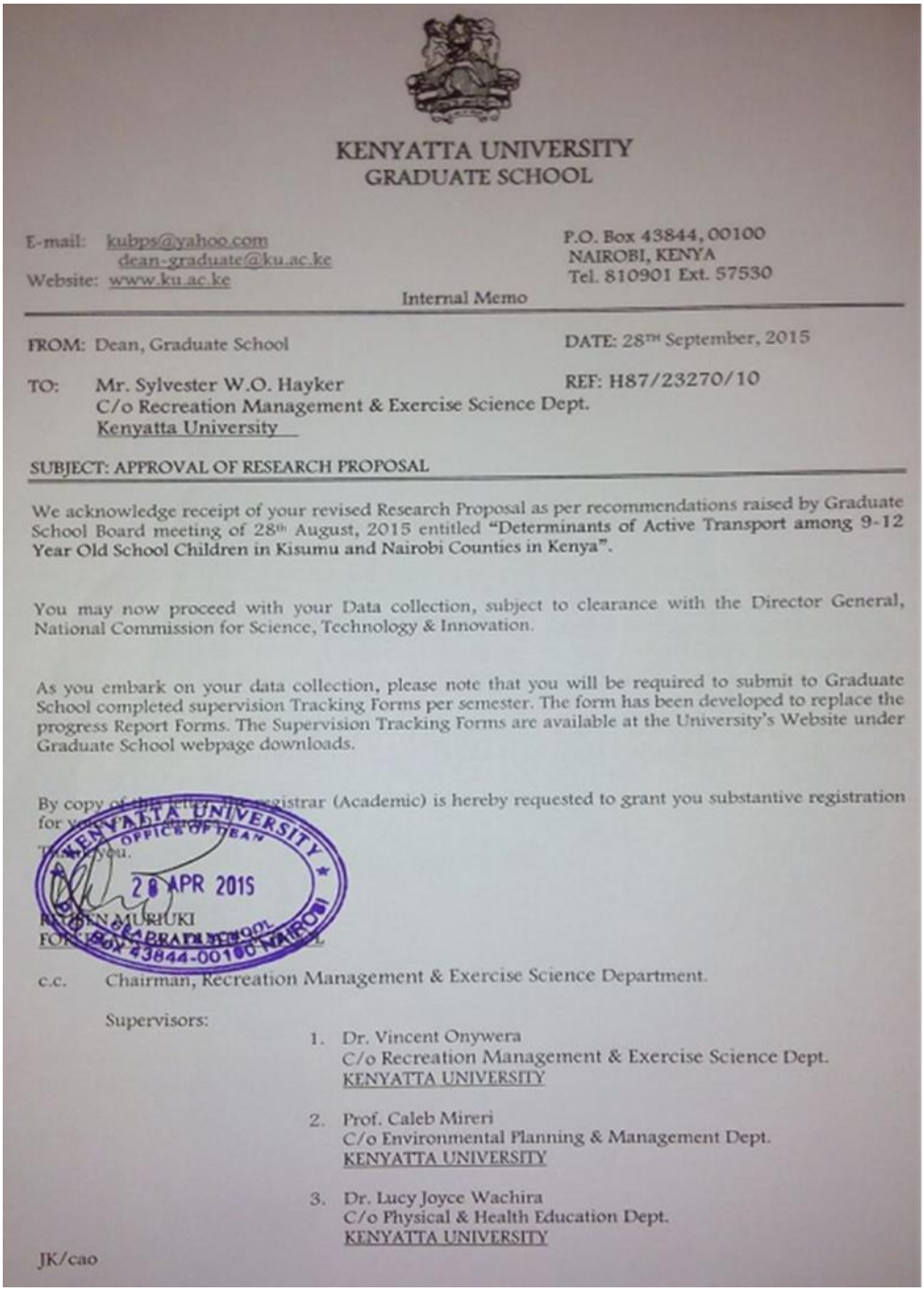
4. **DECISION**

The committee has considered the research protocol in accordance with the Kenyatta University Research Policy (section 7.2.1.3) and the Kenyatta University Ethics Review Committee Guidelines, and is of the view that against the following elements of review,

(i) Scientific design and conduct of study,
(ii) Recruitment of research participant,
(iii) Care and protection of research participants,
(iv) Protection of research participant's confidentiality,
(v) Informed consent process,
(vi) Community considerations.

AND APPROVED and that the research may Proceed ON CONDITION that you incorporate its advise below.

Appendix J: Approval of Research Proposal



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: kubps@yahoo.com
dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 57530

Internal Memo

FROM: Dean, Graduate School

DATE: 28TH September, 2015

TO: Mr. Sylvester W.O. Hayker
C/o Recreation Management & Exercise Science Dept.
Kenyatta University

REF: H87/23270/10

SUBJECT: APPROVAL OF RESEARCH PROPOSAL

We acknowledge receipt of your revised Research Proposal as per recommendations raised by Graduate School Board meeting of 28th August, 2015 entitled **"Determinants of Active Transport among 9-12 Year Old School Children in Kisumu and Nairobi Counties in Kenya".**

You may now proceed with your Data collection, subject to clearance with the Director General, National Commission for Science, Technology & Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed supervision Tracking Forms per semester. The form has been developed to replace the progress Report Forms. The Supervision Tracking Forms are available at the University's Website under Graduate School webpage downloads.

By copy of this letter, the Registrar (Academic) is hereby requested to grant you substantive registration for your [illegible].

Thank you.

KENYATTA UNIVERSITY
OFFICE OF DEAN
28 APR 2015
P.O. BOX 43844-00100 NAIROBI

PROF. KIMANI MURIUKI
FOR: DEAN, GRADUATE SCHOOL

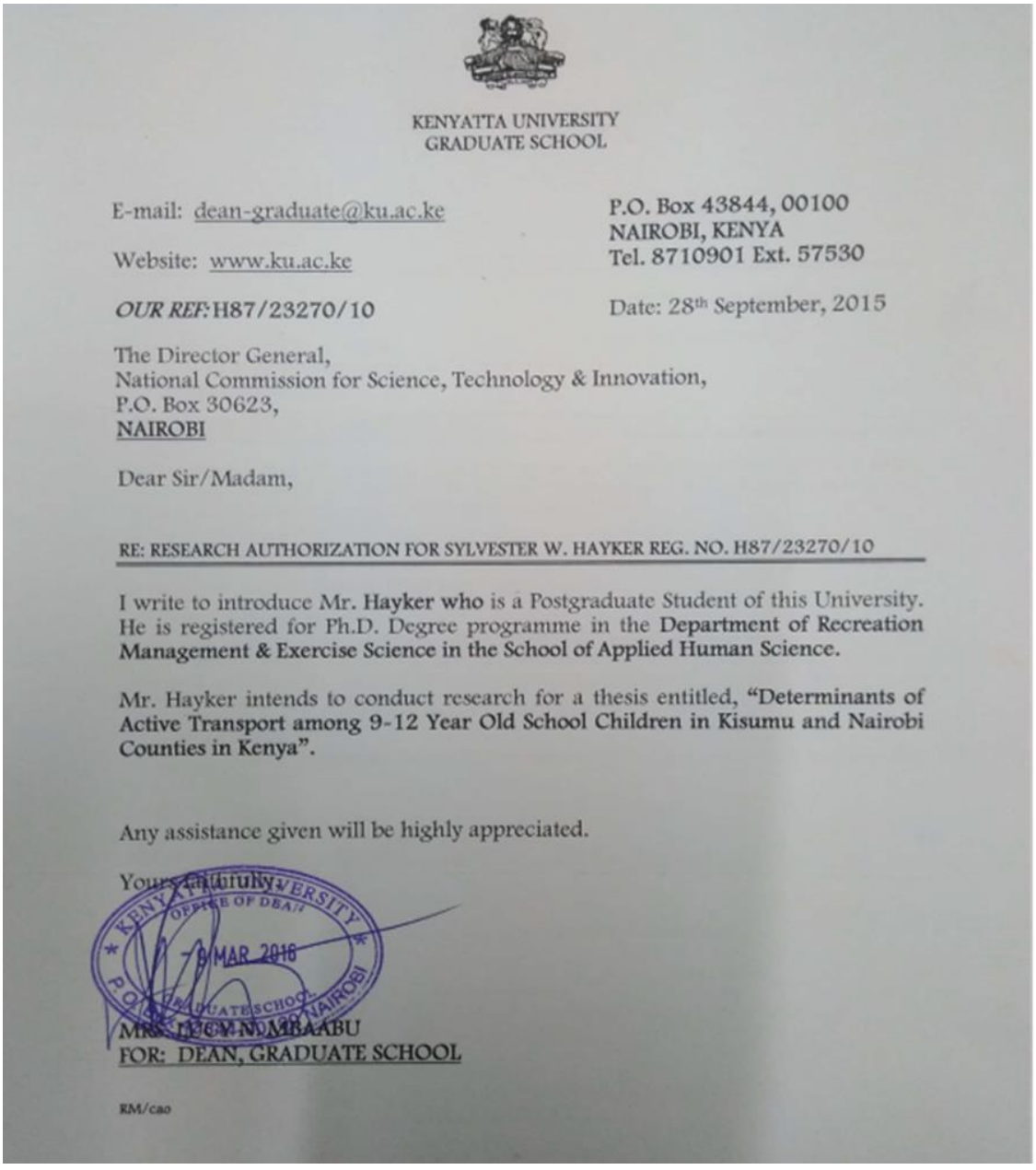
c.c. Chairman, Recreation Management & Exercise Science Department.

Supervisors:

1. Dr. Vincent Onywera
   C/o Recreation Management & Exercise Science Dept.
   KENYATTA UNIVERSITY
2. Prof. Caleb Mireri
   C/o Environmental Planning & Management Dept.
   KENYATTA UNIVERSITY
3. Dr. Lucy Joyce Wachira
   C/o Physical & Health Education Dept.
   KENYATTA UNIVERSITY

JK/cao

Appendix K: Research Authorisation by Kenyatta University Graduate School



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P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

OUR REF: H87/23270/10

Date: 28th September, 2015

The Director General,
National Commission for Science, Technology & Innovation,
P.O. Box 30623,
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR SYLVESTER W. HAYKER REG. NO. H87/23270/10

I write to introduce Mr. **Hayker who** is a Postgraduate Student of this University. He is registered for Ph.D. Degree programme in the **Department of Recreation Management & Exercise Science in the School of Applied Human Science.**

Mr. Hayker intends to conduct research for a thesis entitled, **"Determinants of Active Transport among 9-12 Year Old School Children in Kisumu and Nairobi Counties in Kenya".**

Any assistance given will be highly appreciated.

Yours faithfully,

KENYATTA UNIVERSITY OFFICE OF DEAN 9 MAR 2016 P.O. BOX GRADUATE SCHOOL NAIROBI

MRS. [illegible] MBAABU
FOR: DEAN, GRADUATE SCHOOL

RM/cao