A MULTI-LEVEL INTERVENTION ON THE PHYSICAL ACTIVITY BEHAVIOURS OF IN-SCHOOL ADOLESCENTS IN OYO STATE, NIGERIA

BY

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DEDICATION

This work is dedicated to God for his provision and divine intervention which ensured the successful completion of this project. Also to the loving memory of my father, Lieutenant Colonel James Oladipupo Toba. May God grant him eternal rest, Amen.

ABSTRACT

Physical inactivity is on the increase among Nigerian adolescents and it remains a key risk factor for noncommunicable diseases. Although multi-level, school-based intervention may offer opportunities for promoting Physical Activity (PA), its effects have not been well investigated. This study was conducted to evaluate the effects of a 12-week multi-level intervention on the PA behaviours of adolescents in secondary schools, Oyo State.

A cluster randomised experimental design was adopted with measurements at baseline and post-intervention. Ibadan North-west and Ogbomosho North Local Government Areas (LGAs) were randomly selected and allocated to the Experimental Group (EG) and Control Group (CG) respectively. Twenty-two of the 72 schools in both LGAs were randomly selected. A total of 1,318 respondents (EG= 666; CG= 652) participated in the baseline assessments and 995 (EG =493; CG=502) did so at post-evaluation. A pre-tested, self-administered questionnaire, comprising a10-point knowledge, 90-point attitude, 50-point self-efficacy and 5-point Self-reported PA (SPA) scales was used for data collection. Knowledge Score (KS), Self-Efficacy Score (SES) and Attitude Score (AS) were dichotomised into "poor" and "good", using 50th percentile as the cut-off. The SPA score was categorised as low (<1 to ≤1.9), moderate (>1.9 to ≤3.9) and vigorous (>3.9). Seven key informant interviews and six focus group discussions were held with principals and teachers, respectively. Baseline findings guided the design and implementation of the intervention which comprised the following: dialogue meetings with officials of the Ministry of Education and school authorities; health education and medical screening for teachers; teacher-led sessions on PA, and provision of educational and sporting materials for students in EG. Quantitative data were analysed using descriptive statistics, Student's t-test, Chi-square and mixed-effects linear regression. Level of significance was $\alpha_{0.05}$. Qualitative data were analysed using thematic approach.

Ages in EG and CG were 13.4±2.1 and 14.3±1.9 years, respectively. Baseline KS increased significantly from 8.4±1.3 to 8.7±1.2 in the EG but decreased slightly in the CG (8.6±1.1 to 8.5±1.3). Attitude score increased significantly from 65.3±13.4 to 69.3±11.3 in EG but decreased among the CG (66.7±11.2 to 64.3±12.4), while SES increased from 39.6±7.2 to 40.5±6.7 in EG but decreased in CG (39.6±6.4 to 39.4±6.1). At baseline, the

moderate and vigorous SPA levels of the EG were 72.2% and 1.7% respectively; among the CG, the proportions were 72.9% and 0.8%, respectively. This increased significantly post-intervention to 89.2% and 3.7% in EG and 88.8% and 1.0% in CG. Exposure to intervention (β=0.10, CI=0.01-0.18), having a positive attitude (β=0.11;CI=0.06-0.15) and high self-efficacy (β=0.16, CI=0.11-0.21) were positively associated with increased SPA score at post-evaluation, while being a female (β= -0.22; CI= -0.27- -0.17) and being in the 15-19 years age range (β = -0.13; CI=-0.19-0.08) were negatively associated. Qualitative data revealed inconsistent PA policy implementation due to inadequate human, sporting resources and facilities and increasing time-demand for academic activities.

School-based multi-level intervention could improve adolescents' attitude, self-efficacy and physical activity behaviours. It is therefore recommended for adoption and scale-up in schools in the study location.

Keywords: Physical activity, In-school adolescents, Multi-level intervention
Word count: 485

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CERTIFICATION

This is to certify that this study was carried out by Mojisola Morenike OLUWASANU in the Department of Health Promotion and Education, Faculty of Public Health, College of Medicine, University of Ibadan, Nigeria under my supervision.

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OPERATIONAL DEFINITION OF TERMS

Adolescent:	An individual aged 10 to 19 years
Multi-level intervention:	An intervention that focuses on at least two levels of the multilayer, socio-ecological system with the aim of influencing behaviours and improving health outcomes (Taplin, 2012)
Physical activity:	"Any bodily movement produced by the skeletal muscles which result in a substantial increase in energy expenditure over resting levels" (Bouchard, Blair and Haskell, 2007). These include *Home based activities* such as scrubbing and washing, *Leisure activities and exercises* such as jogging and football and *Active transportation* such as cycling and walking to places.
Physical inactivity:	This term describes the failure to attain one hour of moderate-to-vigorous physical activity which is the daily recommended level for adolescents (World Health Organisation, 2009).

ABBREVIATIONS

CONSORT:	Consolidated Standards of Reporting Trials
ICC:	Intraclass Correlation Coefficient
LGA:	Local Government Areas
MLMC:	Multi-Level, Multi-Component
MVPA:	Moderate- to Vigorous-intensity physical activity
NCDs:	Noncommunicable Diseases
PA:	Physical Activity
PAQ-A:	Physical Activity Questionnaire for Adolescents
PBC:	Perceived Behavioural Control
RCT:	Randomised Controlled Trial
S-PAPA:	School Physical Activity Policy Assessment tool
SPEEDY:	Sport, Physical activity and Eating behaviour: Environmental Determinants in Young people
TRA:	Theory of Reasoned Action (TRA)
WHO:	World Health Organisation

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

Physical inactivity is a modifiable, behavioural risk factor which contributes significantly to the global burden of Noncommunicable Diseases (NCDs). It is the fourth leading cause of death globally, accounting for over 3 million deaths per year (WHO, 2009) and linked with over 60% of deaths from chronic diseases in developing countries (WHO, 2004; Abegunde, Mathers, Adam, Ortegon and Strong, 2007). In Nigeria, physical inactivity related NCDs already account for 27% of all mortalities (WHO, 2010a).

Although the ill effects of NCDs manifest largely in adulthood, it is increasingly known that its development typically begins in childhood or adolescence. Therefore, physical inactivity and sedentary behaviour in the early years could potentially increase the risk for NCDs; and the transitional stage of adolescence has been identified as a crucial period in the development of adult NCDs (Pate, Davis, Robinson, Stone, and Young, 2006).

In spite of the increasing correlation between physical inactivity and the rising burden of NCDs, it is alarming to note that physical activity levels are low among young people in many countries around the world (Knuth and Hallal, 2009; Institute of Medicine, 2013). Findings of the Global School-based Student Health Survey in 34 countries revealed that only 23.8% of male and 15.4% of female in-school adolescents achieved the WHO recommendations for physical activity. In-school adolescents in India had the highest prevalence (37.5%) while Zambia and the Philippines had the lowest (both at 8.8%). Furthermore, only approximately 8 to 35 percent of African adolescents engaged in sufficient physical activity (Guthold, Cowan, Autenrieth, Kann and Riley, 2010). This highlight the burden of this problem among adolescents worldwide.

The World Health Organisation (2004) Global Strategy on Diet, Physical Activity and Health recommends that individuals aged 5–17 years should attain 60 minutes of moderate- to vigorous-intensity physical activity daily and a significant proportion of this should be aerobic and focused on strengthening the muscles and bones (WHO, 2004).

These targets have largely been unachieved in most countries due to factors such as motorisation, rapid urbanisation, automation of day-to-day activities and sedentary lifestyles (Knuth et. al., 2009; Institute of Medicine, 2013). The inability of adolescents to achieve this target has culminated in calls for interventions aimed at increasing the physical activity levels using a lifespan approach.

Physical activity has immense benefits for adolescents and it is linked to improved cardiovascular health, muscular strength and bone mineral density. Furthermore, it is linked with lower adiposity, improved glucose metabolism, blood lipids and blood pressure (Schmalz, Deane, Birchand Davison, 2007; World Health Organisation, 2010 and Fedewa and Ahn, 2011). Physical activity in youth can also improve mental health by preventing conditions such as anxiety and depression and enhancing self-esteem and physical self-concept (Institute of Medicine, 2013; Lubans, Morgan, Cliff, Barnett and Okely, 2010: Sibley and Etnier, 2003). Thus, the earlier this important health behaviour is ingrained, the greater its impact on lifelong health.

These potential benefits underscore the need to identify innovative, cost effective strategies to promote and increase the physical activity levels of young people. This remains a strategic option for reducing the burden of NCDs and turning around the tide of the global epidemic (WHO, 2010).

1.2. Statement of the problem

Low physical activity levels have been shown to be a risk factor for noncommunicable diseases (Guthold, Cowan, Autenrieth, Kann and Riley, 2010). Furthermore, insufficient physical activity in childhood and adolescence has been linked to an increased risk of cardiovascular diseases, cancers, diabetes mellitus, anxiety and depression (Daniels, Arnett, Eckel, Giddling, Hayman, Kumanyika and Williams, 2005; Raitakari, Juonala, and Viikari, 2005; Herva, Laitinen and Miettunen, 2006; Institute of Medicine, 2013).

Adolescence has been identified as a period characterised by a rapid decrease in physical activity which is largely due to the automation of daily activities, less emphasis on the importance of physical health education and reduction in co-curricular school-based

activities. Furthermore, the decrease in physical activity could be attributed to the pre-adolescence stage of life which marks the onset of a critical transitional stage characterised by a tendency for young people to become sedentary (Carnethon, 2005). Contributing to these are unfavourable environmental and policy level actions which limit opportunities for physical activity among young people.

Though there are no national estimates of the proportion of adolescents meeting the recommended levels for sufficient physical activity levels in Nigeria (Akinroye, Oyeyemi, Odukoya, Adeniyi, Adedoyin and Ojo, 2014) however, findings from the 2016 Nigerian Report card on Physical Activity suggest a decline in overall PA among adolescents with a rating of "C" in 2013 but "D" in 2016 (Adeniyi, Odukoya, Oyeyemi, Adedoyin, Ojo, Metseagharun and Akinroye, 2016). Available studies of smaller samples of in-school adolescents in Nigeria found that between 25% to 50% engaged in low levels of physical activity (Odunaiya, Ayodele and Oguntibeju 2010; Senbanjo and Oshikoya, 2010; Adeniyi, Okafor and Adeniyi, 2011; Oyeyemi, Ishaku,Oyekola, Wakawa, Lawan,Yakubu and Oyeyemi, 2016).

Furthermore, knowledge of the benefits of physical activity and its role in reducing the risk of occurrence of some diseases condition is low and several misconceptions exist among adolescents. A study by Oyerinde, Oyerinde and Oshiname (2013) in Ikenne LGA, Ogun State revealed that slightly over half of the respondents (50.4%) and (56.4%) were unaware that physical inactivity is a risk factor for cardiovascular diseases and obesity respectively. Over half of the adolescents opined that participation in physical exercise is unnecessary after graduation from secondary school and it is unsafe for girls especially during their monthly menstrual period. They also stated that physical activity affects the anatomy of females and the mental abilities of students. For instance, the respondents opined that physical exercise makes the breasts of young girls sag and students who participate are usually academically dull (Oyerinde, Oyerinde and Oshiname, 2013).

Most in-school adolescents reside at home and parents can influence their physical activity behaviours by providing support, encouragement and opportunities for physical activity. However, most parents in Nigeria are unlikely to foster positive physical activity behaviours at home or ensure adolescents explore opportunities for PA. For instance, a

study conducted in Ibadan North Local Government Area (LGA) in Oyo State showed that although over half (52.7%) of the students lived within 1 to 3 km from their school, however, only a fifth were active commuters and parental restraints was identified as a barrier to walking or cycling to school (Adeniyi, Ogwumike, Ayanleke, and Maruf, 2014). Another study in Ogun state reported that 58% of parents were not in support of active commuting due to potential violence and insecurity (Okueso, Okundare and Olawunmi, 2015). Furthermore, a study in Maiduguri found that the minutes of physical activity within the home was (24.3%) which is less than half of the figure documented for the school setting (57.1%) and the least was during active commuting to and from school (7.9%) (Oyeyemi *et al.*, 2016).

Schools have a potential of promoting the physical activity levels of young people through curricula-based approach, however, the implementation of the school curriculum for physical health education can only ensure 10-20 minutes of vigorous- or moderate-intensity physical activity per session which is inadequate to meet the WHO threshold. Hence, physical health education, although important, cannot be the sole source of the 60 minutes per day session of vigorous- or moderate-intensity physical activity recommended to enhance the health of children and adolescents. Other ways to promote physical activity in youth must therefore be systematically explored.

In addition, challenges exist to the equitable and effective delivery of physical health education sessions in schools. Financial and budgetary constraints over the years have resulted in the low employment of teachers including Physical Health Education Teachers and lack of equipment thus inhibiting the provision of quality physical health education in many schools in Nigeria. Furthermore, the increasing demand for better examination results coupled with the poor attitude of School Principals to physical activity/exercise have resulted in increasing classroom academic time to the detriment of other co-curricular activities; physical exercise inclusive (Institute of Medicine, 2013; Personal Communication with Mr. Akinosun, Deputy Director Sports Unit, Oyo State Ministry of Education).

Oyo state currently has no policy indicating the minimum duration of physical activity for students. However, there is a curriculum that guides the delivery of physical health education classes (Personal Communication with Mr. Akinosun, Deputy Director Sports

Unit, Oyo State Ministry of Education; Edim, Ogabor and Odok, 2014). The Nigerian National Policy and Strategic Plan of Action on NCDs (2013) proposed the **i**mplementation of school-based programmes in line with WHO health-promoting school initiative as an intervention to promote physical activity among young people (FMOH, 2013). The extent of adoption of this initiative in Nigeria is currently low.

A number of research studies on physical activity among young people in Nigeria have been conducted, however; most of these have focused solely on individual behaviours (Oyerinde *et al.*, 2013; Odunaiya *et al.*, 2010, Adeniyi *et al.*, 2011, Odunaiya, Grimmer and Louw, 2015, Oyeyemi *et al.*, 2016) without analyzing critically, the influence of environmental and policy interventions on their PA patterns resulting in an unbalanced attention to individualized behaviour change strategies instead of a true public health intervention which requires a systems approach premised on the socio-ecological model (Institute of Medicine, 2013).

A systematic review of studies conducted in high income countries found strong evidence that multi component interventions and policies were effective in promoting physical activity among students (Pate, Trilk, Byin and Wang, 2011). However; this intervention has not been tested in Nigeria and remains a research gap to be addressed.

1.3 Justification

Globally, there is a call to address the underlying cause of physical inactivity by implementing population- levelinterventionsin health promoting settings such as workplaces and schools. This requires insightful and decisive policy and leadership support (Institute of Medicine, 2013) considering that in-school adolescents spend up to 8 hours at school and several attend after-school programmes. It is therefore essential to examine the roles and potential impact of schools in promoting physical activity among in-school adolescents.

To reduce the burden and health impact of the major risk factors for NCDs, the World Health Assembly adopted the Global Strategy on Diet, Physical Activity and Health (DPAS) and the DPAS School Policy Framework on Diet and Physical Activity (WHO, 2010b).Paragraph 49 of DPAS states that*: "School policies and programmes should*

support the adoption of healthy diets and physical activity. Schools are encouraged to provide students with daily physical education and should be equipped with appropriate facilities and equipment. Governments are encouraged to adopt policies that support healthy diets at school and limit the availability of products high in salt, sugar and fats".

In line with the reccomendations of the DPAS, the World Health Organisation developed theSchool Policy Framework on Diet and Physical Activity to guide policy-makers at national and sub-national levels in low- and middle-income countries on the development and implementation of policies and programme that promote healthy eating and physical activity in the school setting through changes in environment, behaviour and education (WHO, 2008). Conducting this present study has contributed to understanding the extent to which the WHO reccoemndations for improving physical activity in school settings have been implemented in Nigeria.

This research study has further revealed the individual, school and policy level factors which influence the PA behaviours of in-school adolescents and the findings will contribute to the policy debate in Oyo state and motivate stakeholders at the institutional and policy level to prioritise programmes and funding to improve the physical activity behaviours of adolescents. The results of this research will be useful in engaging policy makers in relevant sectors specifically the Ministries of Health, Education, Youth and Sports to review policies and prioritise physical activity not only as a form of recreation but establish the current paradigm which stresses its linkages with overall physical and mental wellbeing. It will also empower and motivate them to make informed decisions about strategies to adopt that will lead to increased physical activity among adolescents. Finally, the findings of this study have added to the growing body of knowledge on the epidemiology of physical inactivity among in-school adolescents in Nigeria and factors influencing PA behaviours. This aided the conceptualisation of a multi-level intervention which has a potential to be scaled up and replicated in other Nigerian schools with the aim of preventing NCDs across the life course.

1.4 Research questions

1. What is the self-reported and objectively measured physical activity levels of in- school adolescents?

2. What are the individual factors *(attitude, perceived behavioural control, self-efficacy, subjective norms)* which influence the physical activity behaviours of in-school adolescents?
3. What are the factors (school built and policy environments) which influence the physical activity level of students in schools?
4. What are the barriers to the implementation of physical activity policies and programmes in secondary schools?
5. What is the effect of a multi-level intervention on the levels of physical activity of participants in this study?

1.5 Broad objective

The broad objective of this study is to evaluate the effect of a multi-level intervention on the levels of physical activity of secondary school students in a Nigerian state.

1.6 Specific objectives

The specific objectives are to:

- Assess the physical activity levels of in-school adolescents
- Identify individual factors (*attitude,* perceived *behavioural control, self-efficacy, subjective norms, body mass index for age, fitness level*) influencing the level of physical activity of in-school adolescents
- Identify factors (*school built environment and policy environment*) influencing the level of physical activity of in-school adolescents
- Use the results obtained from objectives 1 to 3 to design and implement a multi-level intervention to address individual and school-level factors influencing physical activity among in-school adolescents.
- Assess the immediate outcome of the multi-level intervention on the levels of physical activity among in-school adolescents in the study

CHAPTER TWO

LITERATURE REVIEW

2.1 Prevalence of physical activity

Physical activity in childhood and adolescence is crucial for promoting lifelong health and preventing diverse diseases conditions (Janssen and Leblanc, 2010; US Department of Health and Human Services, 2008). According to a study which analysed data from 105 countries around the world, only 20% of children aged 13 to 15-years reported attaining the WHO threshold for physical activity (Hallal, Andersen, Bull, Guthold, Haskell and Ekelund, 2012). Similar findings were reported in another study which reviewed the physical activity behaviours of Children and Youth in 38 Countries across six continents. The result showed that on the average, grades for physical activity for children across the countries remained low with Slovenia reporting the highest (A-). Twenty out of the 38 countries had a "D" for overall PA while 7 had "F" (Tremblay, Barnes, González, Katzmarzyk, Onywera, Reilly, and Global Matrix 2.0 Research Team, 2016).

Another study which analysed data for over 25 million adolescents aged 9 to 17 years from 28 countries further showed that there is a global decline in the performance of aerobic exercise at a rate of 4% per decade since 1975 (Tomkinson and Olds, 2007; Ekelund, 2011).These reports underscore and reinforce the global concern about the physical activity levels of adolescents which remains a challenge.

2.2 Burden of physical inactivity in adolescents

Physical inactivity is strongly attributed to poor health outcomes across the life span and its prevalence has been described as a pandemic (Institute of Medicine, 2013). According to global statistics and data published in the Lancet Physical Activity Series reports, over 80% of adolescents aged 13–15 year olds do not attain the current physical activity recommended levels of 60 minutes of moderate to vigorous physical activity per day (Hallal, Andersen, Bull, Guthold, Haskell and Ekelund, 2012). In developing countries,

the reducing physical activity levels among adolescents is becoming prominent with its prevalence ranging between 65% and 92% in most African countries (Guthold, Cowan, Autenrieth, Kann and Riley, 2010). Although African adolescents usually engage in significant amount of light and incidental moderate-intensity physical activity during domestic activities and active transportation, several studies (Gibson, Ojiambo, Konstabel , Lieberman , Reilly and Speakman, 2013; Muthuri , Wachira , Leblanc, Francis , Sampson and Onywera, 2014; Craig, Bland and Reilley, 2013) have consistently reported that a significant proportion of adolescents in Africa are insufficiently active to meet the WHO MVPA recommendations (Guthold *et al.*, 2010, Craig, Bland and Reilley, 2013, McVeigh and Meiring, 2014).

The decreasing levels of physical activity is more prominent in girls than boys (Santos, Page and Cooper *et al.*, 2009; Butcher, Sallis and Mayer *et al.*, 2008) and in older adolescents (15–18 years) compared to younger ones (12–14 years) (Kimm, Glynn and Kriska *et al.*, 2002; Troiano, Berrigan and Dodd *et al.*, 2008). Furthermore, ethnicity is a key determinant with black girls being less active compared to white girls (Kimm *et al.*, 2002; Guthold, Cowan and Autenrieth *et al.*, 2010).

In Ibadan, Nigeria, more than half of school-going adolescents reported low levels of physical activity (Adeniyi *et al.*, 2011), with an attendant rise in the prevalence of overweight (13.8%) and obesity (9.4%) in this age group (Oduwole, Ladapo and Fajolu *et al.*, 2012). Another study conducted in Ibadan found that over a third of the in-school adolescents (38%) were not involved in sufficient physical activity,58.8% and 3.2% engaged in low, moderate and high intensity physical activity behaviours respectively (Odunaiya *et al.*, 2010). Furthermore; 8.8% and 1.2% were overweight and obese respectively and body mass index was inversely associated with physical activity. Adeniyi *et al.* (2011) found a significant burden of low physical activity among in-school adolescents attending private schools in Ibadan North Local Government Area which was linked to both individual and school factors. Over half (53.8%) of the students engaged in the low-intensity physical activity and were classified as inactive. Furthermore, 38.8% and 7.4% engaged in moderate and high PA behaviours respectively (Adeniyi, Okafor and Adeniyi, 2011). Oyeyemi *et al.*, (2016) found that only 37% of in-school adolescents in Maiduguri attained 60 min of MVPA daily.

It is important to understand the factors influencing the physical activity behaviours of adolescents. An in-depth contextual understanding of the cause and factors associated with physical inactivity among adolescents will help guide the development of effective interventions for the promotion of adolescents' physical activity behaviours (Sallis, Owen and Fotheringham, 2000).

2.3. **Conceptual clarification: the socio-ecological model**

The social-ecological model is a broad framework which emphasizes the unique complexities and factors which influence behaviours. Components include the intrapersonal, interpersonal, community, institutional and policy factors (See Figure 1) (McLeroy, Bibeau and Steckler *et al.*, 1988).The model emphasizes that each of the five components are not mutually exclusive, but each level influences each other both positively and negatively. Central to this theory is the understanding that health promotion should focus not only on intrapersonal behavioural factors but also on the external multiple-level factors that influence behaviours (Stokols, 1996) and the most successful public health programmes have been premised on this principle (Glanz, Rimer and Lewis, 2002).

The conceptual framework has been adapted for different health behaviours (Giles-Corti and Donovan, 2002). A key philosophy of the socio-ecological model is the need to tailor it to specific behaviours; thus, it has been recognized as an appropriate theoretical model for the conceptualisation and implementation of PA research and interventions studies (King, 2002; Pate Davis and Robinson *et al.*, 2006; Pate, Saunders, Dishman, Addy, Dowda and Ward, 2007; Giles-Corti, Timperio, and Bull *et al.*, 2005).

Specifically for physical activity, it has unique advantages with regards to its ability to identify opportunities to promote PA by recognizing the individual (*e.g. age sex, beliefs, and attitudes*), behavioural (*sedentary and active time*), social (*family, teachers, peers*) physical (e.*g. vegetation, structural layout of urban environment availability of PA equipment and facilities*) and policy factors that may influence an individual's ability to be sufficiently physically active (Bauman, Reis, Sallis, Wells, Loos and Martin, 2012). This is very important considering that physical activity is affected by diverse factors (Drewnowski and Darmon, 2005) and should be conducted in different settings (Humpel,

Owen and Leslie, 2002).In addition, the conceptual model gives researchers a leverage to identify enablers and foster the adoption and maintenance of health-enhancing physical activity behaviour, rather than the traditional isolated focus on intrapersonal factors (Fleury and Lee, 2006). Another key justification for applying this model is the research gap with regards to the study of environmental and policy variables which influences PA (Bauman, Reis and Sallis *et al.*, 2012) despite the fact that early studies have shown the associations of PA with a wide range of environmental variables (Humpel, Owen and Leslie, 2002).

Consequently, this conceptual model was applied to this study to facilitate an in-depth knowledge of the various types of PA influences and guide the design and implementation of a multi-level intervention. Based on this, the review of the literature was underpinned by some of the core constructs of the socio-logical model.

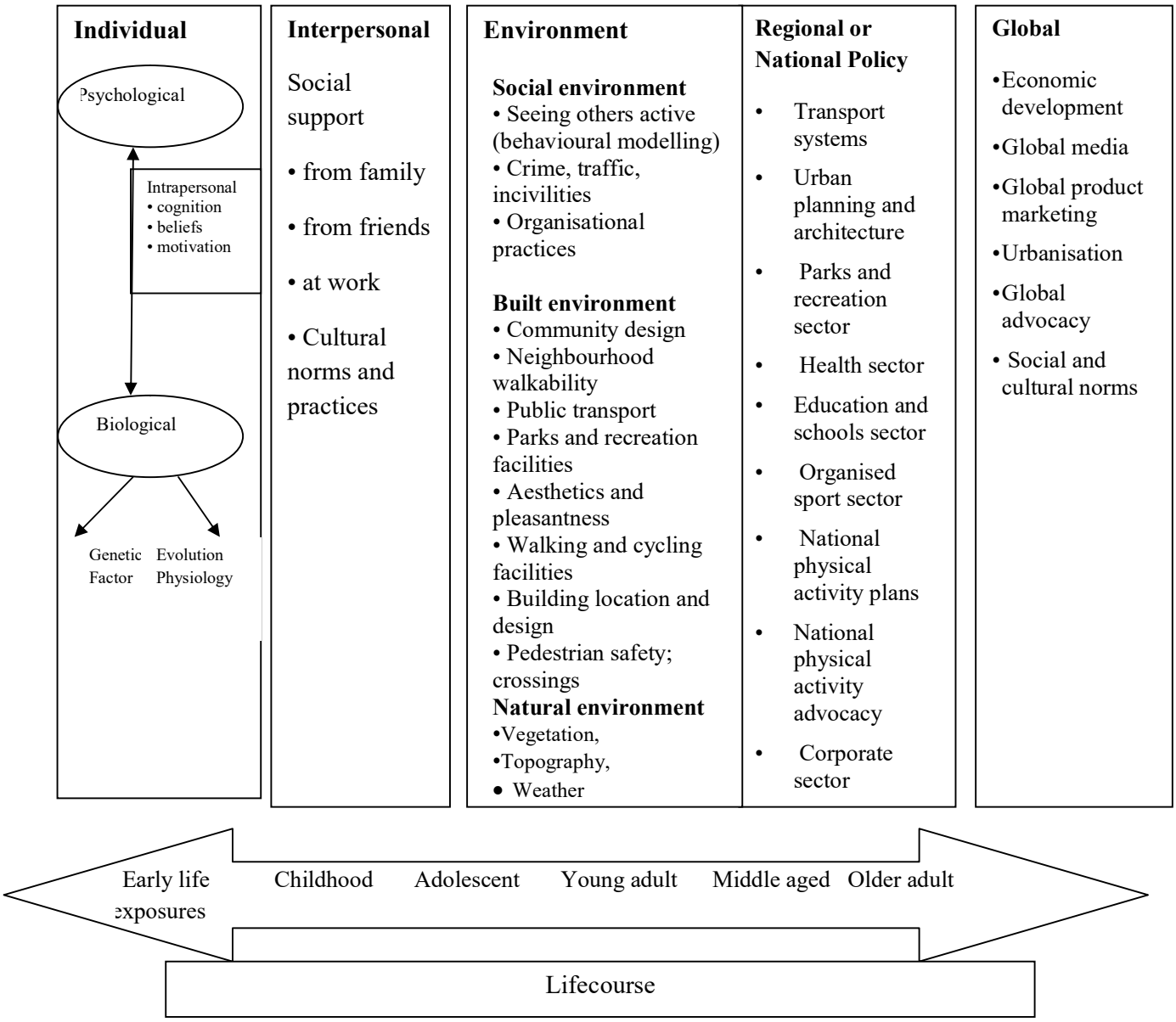

Figure 1: An adapted ecological model of the determinants of physical activity

Source: Bauman, Reis and Sallis, 2012

2.4. Application of the socio-ecological model to analyse factors influencing the physical activity behaviours of adolescents

2.4.1. Individual level factors

The individual level factors are the first level of the social-ecological model. This includes personal factors – *biological and psychological* which influence an individual's ability to be physically active. Some of the individual factors include age, gender, knowledge, attitude, self-efficacy, perceived behavioural control, perceived barriers and socio-economic status (Victorian Curriculum and Assessment Authority, 2011). The key individual factors which influence the physical activity behaviours of adolescents will be discussed further in the subsequent sections.

2.4.1.1. Age

Studies in Nigeria and globally have found a significant association between the age of an individual and the level of physical activity with a decrease in moderate to vigorous physical activity throughout childhood and in adolescence (Adeniyi *et al.*, 2011, Odunaiya *et al.*, 2015; Troiano, Berrigan, Dodd, Masse, Tiler and McDowell, 2008; Nader, Bradley, Hout, McRitchie and O'Brien, 2008; Riddoch, Andersen, Wedderkopp, Harro, Klasson-Heggebø, Sardinha, Cooper and Ekelund, 2004; Dumith, Gigante, Domingues, and Kohl, 2011, Cooper, Goodman, Page, Sherar, Esliger, van Sluijs, Andersen, Anderssen, Cardon, Davey and Froberg, 2015). Physical inactivity has been shown to persist into adulthood in longitudinal studies (Barnekow-Bergkvist, Hedberg, Janlert and Jansson, 1998; Kjønniksen, Fjørtoft and Wold, 2009) with its associated negative health sequelae (Anderson, Harro, Sardinha, Froberg, Kekland, Brage and Anderssen, 2006).

A study which assessed the physical activity levels of school children in four European countries – Estonia, Denmark, Norway and Portugal found that at the age of nine years, 97.4% and 97.6% of males and females respectively achieved the recommended levels of physical activity compared to 81.9% and 62.0% of those aged 15 years (Riddoch, Andersen and Wedderkopp *et al.*, 2004).Results from the International Children's Accelerometery Database with data from studies in Europe, North America, Australia and Brazil revealed a decrease of 4.2% in total physical activity with each additional year of

age (Cooper, Goodman and Page *et al.*, 2015). Furthermore, the levels of PA decreased with increasing chronological age in both genders though the boys had a higher level. A systematic review of physical activity studies by Dumith, Gigante and Domingues *et al.* (2011) showed that per year, the average percentage decrease in physical activity was -7.0 (CI: -8.8 to -5.2).

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Adeniyi *et al.*, (2011) found that mean scores for physical activity was higher among younger in-school adolescents in Ibadan (3.1 ± 0.8) than older adolescents (2.2 ± 0.5). Similar findings were reported by Oyeyemi, Ishaku and Oyekola *et al.*, 2016. The authors found that moderate-intensity and total physical activity was lower in older in-school adolescents in Maiduguri than in the younger group (Oyeyemi, Ishaku and Oyekola *et al.*, 2016). Those aged 12 to 14 years achieved more moderate-intensity physical activity levels ($F = 5.129$, $P = 0.024$) and total physical activity ($F = 2.893$, $P = 0.049$) compared to those aged 15 to 18 years.

The age-related decreases in moderate and vigorous-intensity physical activity appear greater for certain population subgroups, including girls, non-whites, adolescents who are overweight/obese as well as those whose mothers have a low educational level (Corder, Sharp and Atkins *et al.*, 2016, Oyeyemi, Ishaku and Oyekola *et al.*, 2016).

2.4.1.2. *Sex and gender roles*

According to findings from several published studies in Africa and globally, sex– a biological characteristics is a significant predictor of physical activity behaviours. Most studies have revealed that males are more active than females (Adeniyi, Okafor and Adeniyi *et al.*, 2011; Odunaiya, Grimmer and Louw *et al.*, 2015; Oyeyemi, Ishaku and Oyekola *et al.*, 2016; Beets, Vogel and Forlaw *et al.* 2006, Ziaee , Kelishadi and Ardalan *et al.*, 2006, Muthuri, Wachira, Onywera and Tremblay, 2014; McVeigh and Meiring, 2014; Muthuri, Wachira, Leblanc, Francis, Sampson and Onywera, 2014) though limited studies have reported otherwise (Benefic, Garnier and Ndiaye, 2001; dos Santos, Gomes, Damasceno, Prista, Eisenmann and Maia, 2013; Wushe, Moss and Monyeki, 2014) .

Al-Hazzaa, Abahussain and Al-Sobayel *et al.*, 2011 in their study conducted among adolescents in Saudi Arabia found that female adolescents were about 2.5 times more likely to have inadequate physical activity per day compared to male adolescents. The authors attributed the huge disparity to gender differences which may be a reflection of the limited opportunities females have for social activities largely linked to socio-cultural and religious barriers as well as restrictions from parents and other significant others. Their study also revealed an interesting dimension by establishing that although males were more active than females, at the same time they spent more time on sedentary behaviours including viewing the television, video and computer game playing than females (Al-Hazzaa, Abahussain and Al-Sobayel *et al.*, 2011).

Oyeyemi, Ishaku and Oyekola *et al.* 2016 in their study in northern Nigeria also revealed that girls on the average spent approximately 23 min/day lower time in MVPA compared to boys (60.6 min/day versus 83.4 min/day). Furthermore, the gender and traditional cultural roles were key influences for the PA behaviours of adolescents. For instance, the authors found that Nigerian adolescent girls spend more time than boys in domestic and light-intensity physical activities while boys spend more time in leisure-time and vigorous-intensity activities than girls.

Studies have indicated that young girls enjoy PA and that it enhances their self-esteem, health, and satisfaction while serving as a creative outlet for self-actualisation and fulfilment (Ojiambo, Easton, Casajus, Konstabel, Reilly, Pitsiladis, 2012; Ojiambo, Gibson, Konstabel, Lieberman, Reilly, Speakman, 2013 ; Craig , Bland and Reilley *et al.*, 2013; Wushe, Moss and Monyeki *et al.*, 2014; Benefice, Garnier and Ndiaye *et al.*, 2001).However, complexities arise in the consideration of the concept of feminity where girls feel pressured to appear feminine and act accordingly thus limiting their ability to behave outside the normal confines of heterosexual femininity (Craig, Bland and Reilley, 2013; Cockburn and Clarke, 2002;Witmer, Bocarro and Henderson, 2011).

Unfortunately, girls who challenge these norms risk being perceived as overly masculine, resulting in what Cockburn and Clarke (2002) call a “femininity deficit”. Hence, gender stereotyping is prevalent and remains a key influence on girls’ PA. A study describing how youth spent their time indicated that boys spent time being active, while girls spent

time socializing, while another indicated boys engaged more in energetic sporting activities such as football, while girls took part in dance and gymnastics (Klomsten, Marsh and Skaalvik, 2005; Ferrar, Olds and Walters, 2012). Others indicated that girls recognized male dominance in sport and perceived it to be less *"cool"* for girls (Ojiambo, Easton, Casajus *et al.*, 2012; Wetton , Radley, Jones, Angela and Pearce, 2013) they also described some activities as "too girlie", and identified "boy sports" (Azzarito, Solmon and Harrison, 2006; Ojiambo, Easton, Casajus, Konstabel, Reilly, Pitsiladis, 2012).

The gender roles and its associated complexities indicate the need to challenge sociocultural norms and existing double standards for gender participation in sports and PA (Azzarito, Solmon and Harrison, 2006; Cockburn and Clarke, 2002; Spencer, Rehman and Kirk, 2015). This distinct behavioural pattern of physical activity between girls and boys underpinned by gender differentials underscores the need for gender specific interventions for physical activity promotion among Nigerian adolescents (Oyeyemi *et al.*, 2016).

2.4.1.3. Attitude towards physical activity

Attitude is a psychological attribute which has been defined as an individual's set of beliefs, feelings and behaviours which are organized around an object or situation that may be favourable or unfavourable (Azjen, 1985). Eagly & Chaiken, (1993) defined it as a psychological tendency to evaluate an object in a favourable or unfavourable manner.

According to several studies investigating different adolescent populations, attitudes have been shown to predict physical activity (Deforche, De Bourdeaudhuij and Tanghe , 2006; Dan, Sirard, and Neumark-Sztainer, 2011; Mulhall, Reis and Begum, 2011; Lindelof, Nielsen and Pedersen 2013) though this is inconsistent (Bauman, Reis and Sallis *et al.*, 2012).

According to Dan, Sirard, and Neumark-Sztainer, 2011, attitudes toward sports, exercise, and fitness together predicted MVPA at 5 and 10 years. Adolescents who had a more-favourable attitude toward sports, exercise and fitness engaged in approximately 30-40%

more moderate and vigorous physical activity compared to those with less-favourable attitudes. Furthermore, Mulhall, *et al.*, 2011 in their study revealed that positive attitudes were more strongly associated than were negative attitudes with exercise.

These results suggest that interventions which target attitude and behaviour together may have a more profound effect on PA behaviour change than that targeting behaviour alone. Thus, enhancing the attitudes of adolescents on PA participation could benefit PA promotion efforts (Christodoulos, Douda, Polykratis and Tokmakidis, 2006; Digelidis, Papaioannou, Laparidis and Christodoulidis, 2003; Dan, Sirard, and Neumark-Sztainer, 2011).

2.4.1.4. Self-efficacy

Self-efficacy, a psychological construct has been defined as an individual's confidence in the ability to be physically active in a specific situation (Bauman, Rei and Sallis *et al.*, 2012). According to a Lancet review on physical activity among adolescent and children, self-efficacy was identified as a consistent positive correlate and determinant of physical activity among these age groups (Bauman, Rei and Sallis *et al.*, 2012).Other studies have also shown that self-efficacy is one of the psychological variables which is consistently and positively associated with MVPA among adolescents (Craggs, Corder van Sluijs and Griffin, 2011; Lytle, 2009; Hearst, Patnode, Sirard , Farbakhsh, and Lytle, 2012; de Souza, Rech, Sarabia, Añez and Reis 2013). Research studies have found that in adolescents, the higher the self-efficacy, the higher the likelihood of being active (Park and Kim, 2008; Lytle, 2009; Peterson , Lawman, Fairchild, Wilson and Van Horn, 2013;Mohamadian and Arani, 2014; Craggs, *et al.*, 2011; Hearst *et al.*, 2012; de Souza *et al.*, 2013).

For instance, one-unit increase in self-efficacy was positively associated with changes ranging from 0.06 to 1 metabolic equivalent task (Dishman, Saunders, Felton, Ward, Dowda and Pate, 2006; Dowda, Dishman, Pfeiffer and Pate, 2007; Dzewaltowski, Karteroliotis, Welk, Johnston, Nyaronga and Estabrooks, 2007). However, a study which assessed physical activity among a sample of adolescents in Tabriz, Iran found no association between self-efficacy and physical activity (Shokrvash, Majlessi, Montazeri,

Nedjat, Rahimi, Djazayeri and Shojaeezadeh, 2013) similar to a longitudinal study among white and black adolescents (Motl, Dishman, Ward, Saunders, Dowda and Felton, 2005).

Despite this finding, self-efficacy has been found to mediate changes in PA in several intervention studies among youth (Lubans, Foster and Biddle, 2008). Furthermore, a systematic review of published studies found that self-efficacy was associated with a change in physical activity in older children and adolescents; specifically, higher levels of self-efficacy were associated with smaller declines in PA over time compared to lower levels of self-efficacy (Craggs, Corder, van Sluijs and Griffin, 2011).

Hearst, Patnode and Sirard, 2012 hypothesized that when children become engaged in physical activity at a younger age, they are more likely to experience success and become more involved in physical exercise, and they are more confident thus leading to maintenance of activity over time. This is expected considering that participation in PA requires some motivation, persistence and skills and if unlearned and practiced during early adolescent (behavioural repertoire), the possibility of being active in later adolescence without an external intervention may be more challenging thus serving as a barrier to being active (Lubans, Foster and Biddle, 2008).

2.4.1.5. Perceived behavioural control

Perceived behavioural control according to Azjen, (2011) refers to *an individual's perception of the ease and difficulty of performing the behaviour of interest*'. *PBC* which is the general perceptions of an individual's ability to be physically active is a determinant of PA in adolescents (Bauman, Rei and Sallis *et al.*, 2012). Findings from a study which was conducted across a 1-year period among black and white adolescent girls, found that higher perceived behavioural control had an independent, longitudinal relationship with increase in vigorous physical activity (Motl, Dishman and Ward, 2005).

A study among Chinese adolescents found that PBC predicted moderate to vigorous physical activity further establishing an association between both variables (Wang and Zhang, 2016). Another study which was conducted to assess the utility of the Theory of Planned Behaviour (TPB) for explaining physical activity (PA) intention and behaviour among a large population sample of overweight and obese adolescents in Alberta,

Canada, using a web-based survey found that PBC was the strongest predictor of PA behaviour (Plotnikoff, Lubans, Costigan and McCargar, 2013). A systematic review of published evidence on the determinants of change in physical activity in children and adolescents found that higher PBC was associated with higher physical activity levels (Craggs *et al.*, 2011). This further supports the importance of PBC in influencing physical activity behaviours thus highlighting the need to design interventions to modify PBC to bring about a change in physical activity behaviours.

2.4.1.6. Subjective norms

Ajzen, (1991) defined subjective norms as "*the perceived social pressure to perform or not to perform a behaviour in question*". Ajzen (1985) describes subjective norms as a function of normative beliefs and a motivation to comply. In this case, normative beliefs are viewed as the importance of a referent individual or group to approve or disapprove the performance of the behaviour (Ajzen, 1985). For instance, an individual may feel compelled to perform a behaviour if they think their referents (i.e. parents, siblings, and friends) want them to do it. On the other hand, they may feel pressured not to engage, if they perceive that their personal referents do not want them to do it (Ajzen, 1985, 1991).

Though subjective norms have consistently been studied with regards to its effect on physical activity, however, there are mixed reports on its association. Trost, Saunders and Ward, (2002) from their study among students in the US noted that subjective norms are significantly related to intention and accounted for 13% of the variance in MVPA. Mummery, Spence, & Hudec (2000) showed that the effect of subjective norms on physical activity was stronger among younger adolescents while Everson, Daley, & Ussher (2007) also found that subjective norms predicted intentions which directly predicted physical activity among smoker adolescents. In addition, a study by Alselaimi (2010) among Saudi Adolescents found that subjective norms predicted the physical activity behaviours of the respondents.

However, a number of studies have found that it has a weak or no association and it is regarded as the weakest of the theory of planned behaviour constructs (Blue, 1995; Hagger, Chatzisarantis and Biddle, 2002; Lazuras, Ourda, Barkoukis and Tsorbatzoudis, 2011). Furthermore, an article which systematically reviewed published studies of

correlates of youth physical activity found that the effect of subjective norms was indeterminate (Sallis, Prochaska, and Taylor, 2000). Thus, this construct may not be a strong predictor of physical activity among in-school adolescents.

2.4.2. Interpersonal level

The interpersonal levels are social factors which have been known to influence PA behaviours. These comprise constructs such as social support from family, friend and other significant others. This will be discussed further in the subsequent section.

2.4.2.1. Social support from significant others

Social support is a construct which reflects in several behavioural theories and models such as the Social Cognitive and Planned Behaviours Theory and Health Belief Model which are used to explain physical activity behaviours (Glanz, Rimer and Viswanath, 2008).It can be described as an action that helps a person adopt and/or maintain a particular practice through diverse ways, such as instrumental/direct (i.e. acquisition of sports equipment and participating in physical activities together), psychological/emotional (i.e. providing incentives and words of motivation to encourage and reinforce behaviours) and instructional/informative support (characterised by counselling on the importance of engaging in physical activities) (Duncan, Duncan and Strycker, 2005; Barr-Anderson , Robinson-O'Brien and Haines, *et al.*, 2010; (Beets, Cardinal and Alderman, 2012).

Parents, family members (brothers, uncles and grandparents), friends and teachers have been largely investigated as the sources of social support to adolescents (Duncan *et al.*, 2005, Beets, Vogel and Forlaw *et al.*, 2006; Barr-Anderson, Robinson-O'Brien and Haines *et al.*, 2010; Edwardson and Gorely, 2010; Trost and Loprinzi, 2011). Zhang *et al.*, 2012 observed that social support from friends, parents, and PE teachers in descending order of importance were significant predictors of PA (Zhang, Solmon, Gao and Kosma, 2012).

Significant other can influence others indirectly through behaviour modelling (Beets, Vogel and Forlaw 2006; Wu and Pender, 2002) and directly through social support and these have been found to influence the physical activity behaviours of adolescents. Hence,

the physical activity behaviours of parents and friends could serve as a model for the practice of PA by adolescents (Raudsepp, 2006; Salvy, Haye, Bowker and Hermans, 2012). Indeed, evidence supports the views that more physically active parents and friends offer more social support (Edwardson and Gorely, 2010) and there is a strong relationship between social support and the physical activity behaviours of adolescents (Pugliese and Tinsley, 2007). Systematic reviews have also found a consistently positive association between social support and physical activity behaviours of adolescents (Pugliese and Tinsley, 2007; Beets, Cardinal and Alderman, 2012). Social support can also exert an indirect influence, increasing the perception of self-efficacy (Edwardson and Gorely, 2010; Trost and Loprinzi, 2011).

2.4.2.2. Social support from parents

Family support for physical activity could be either direct or indirect (Dishman, Saunders, Motl, Dowda and Pate, 2009; Bauer, Nelson, Boutelle and Neumark-Sztainer, 2008; Lubans and Sylva, 2009; Bradley, McRitchie, Houts, Nader and O'Brien, 2011). Parents also influence their children's physical activity through the provision of emotional support (Bauer, Nelson and Boutelle *et al.*, 2008; Duncan, Duncan and Strycker, 2005; Dishman, Saunders and Motl, *et al.*, 2009) and role modelling (Bauer, Neumark-Sztainer, Fulkerson, Hannan and Story, 2011; Dishman, Saunders and Motl, *et al.*, 2009; Bauer Nelson and Boutelle *et al.*, 2008). Parental encouragement and family support has shown a strong association with increased PA among adolescents in some studies (Bauer, Nelson and Boutelle *et al.*, 2008; Dowda, Dishman, Pfeiffer and Pate, 2007) but not in others (Bradley, McRitchie, Houts, Nader and O'Brien, 2011; Trost and Loprinz, 2011). Reviews of published studies showed that, physically active parents had a higher likelihood of having physically active children (Edwardson and Gorely, 2010; Seabra, Mendonca, Thomis, Anjos and Maia, 2008). Adolescents who receive family social support had a higher likelihood of being physically active compared to others (Bauer *et al.*, 2011; Dishman, *et al.*, 2009; Hohepa, Scragg and Schofield *et al.*, 2007).

A cross sectional study conducted in Iran revealed that family support was a predictor of physical activity among adolescents. Specifically, low perceived informational support and low practical and emotional support where strong predictors of low physical activity levels in males and females respectively (Shokrvash, Majlessi and Montazeri *et al.*,

2013). Furthermore, social support had strong effects on adherence to physical activity regardless whether adolescents had low orhigh self-efficacy (Bauer *et al.*, 2011, Dishman *et al.*, 2009, Bauer *et al.*, 2008). A study in Kogi State, Nigeria also found that, 97% of in-school adolescents who reported that their parents support their participation in sports were encouraged to be engaged in sporting activities (Alegbejo, 1994).

Cheng, Mendonc and Júnior, (2014) found that adolescents who perceived that their parents participated in physical activities were more likely to have higher levels of physical activity. Furthermore, the PA levels of the father were positively associated with that of the son while that of daughters to that of the mothers. This could be linked to the fact that male adolescents usually identify more with their fathers and see them as role models while females tend to identify with their mothers. The age of the adolescents also influences the extent to which parent's behaviours and social support will influence their PA behaviours. Kirby, Levin and Inchley, 2011 found that the physical activity behaviours of parents had less influence on the PA levels of older adolescent*s*. Furthermore, younger adolescents appeared to be more influenced by their same-sex parent. Numerous studies have shown similar result (Craggs *et al.*, 2011; Kelishadi, Ghatrehsamani, Hosseini, Mirmoghtadaee, Mansouri and Poursafa 2010; Willson and Dollman, 2009; Pearson, Timperio, Salmon, Crawford and Biddle, 2009; Wright, Wilson, Griffin and Evans, 2010) thus corroborating that emotional support coupled with practical advice were the most vital type of family support associated with the physical activity behaviours of adolescents.

2.4.2.3 Social support from friends

Studies have found that adolescents who have friends who are physically active had higher levels of physical activity (Sabiston and Crocker, 2008; Deforche, Van Dyck, Verloigne and De Bourdeaudhuij, 2010; Fermino, Rech, Hino, Rodriguez Añez, and Reis, 2010; Martin, McCaughtry, Flory, Murphy and Wisdom, 2011; Kirby, Levin, and Inchley, 2011; Cheng Mendonc and Júnior, 2014) though a few have found no association (Leslie, Kremer, Toumbouroua and Williams, 2010; Patnode, Lytle, Erickson *et al.*, 2010; Taymoori, Rhodes and Berry, 2010). Interestingly, adolescents tend to be more influenced by their peers as age increases since they are usually the closest people with who they share their preferences, values and standards which consequently influence

behaviours including physical activity (Salvy, Haye, Bowker and Hermans, 2012). This observation can be linked to the inherent need of adolescents to be socially accepted by their peers (Duncan, Duncan and Strycker, 2005).

Studies have found that the physical activity behaviours of friends have a direct relationship with the level of physical activity among adolescents. Hence, it can be deduced that friends with higher physical activity levels had a higher tendency to provide social support (Wu and Pender, 2002; Trost, Sallis, Pate, Freedson, Taylor and Dowda, 2003; Cheng *et al.*, 2014).

This view is in tandem with a study conducted in Kogi State where 82% of in-school adolescents stated that their friends' interest in sports influenced their active participation while 51% reported that they were introduced to sports by their friends (Alegbejo, 1994). Furthermore, studies have found that adolescents who had more social support from friends felt more empowered to overcome barriers and obstacles to PA (Dishman, Saunders, Motl, Dowda and Pate, 2009; Peterson, Lawman, Wilson, Fairchild, and Van Horn, 2013).

2.4.2.4. Social support from teachers

Social support from teachers has the potential to increase the PA levels of adolescents. Furthermore, it has the tendency to enhance students' motivation for physical activity and their perceived athletic abilities. This interaction is more enhanced when they provide positive feedback to students in a stimulating and supportive classroom environment (Koka and Hein, 2003; DeCorby, 2005).

Cox and Ullrich-French, 2010 found that positive relationships with both teachers and students have been associated with optimal physical exercise experiences. Zhang, Solomon, Gao and Kosma, 2012 also documented that social support from PE teachers was a significant predictor of self-reported engagement in PA; specifically, high level of support from teachers during PE classes was associated with higher levels of MVPA.

An intervention programme "Fit-4-Fun" which was implemented to enhance social support for physical activity provided by the classroom teachers found that it increased PA levels among primary school students. Study findings suggest that teachers have a

crucial role in the promotion of physical activity in schools. For instance, Teachers in the intervention schools did not allocate additional time for physical activity during the school period but encouraged adolescents by providing regular support for participation in physical activity through verbal encouragement during physical education lessons and other activities, and also through school-wide approaches using strategies such as newsletters, assemblies, and posters hung around the school (Eather, Morgan and Lubans, 2013). The intervention had a significant effect on physical activity behaviours of the students thus supporting the pivotal roles of teachers, however, a systematic review by Mendon, Cheng, Melo and de Farias Ju´nior, 2014 showed that there is no association between social support from teachers and physical activity in adolescents.

2.4.3. Institutional level

Schools are an ideal setting for influencing the physical activity behaviours of young people; however, several factors determine its role. Schools provide important social, physical and normative environments where students are inculcated with knowledge and skills which enhance their abilities to observe, model and practice healthy behaviours. Thus, they have a great potential to influence the physical activity behaviours of students (U S Department of Health and Human Services, 2010). In-school adolescents spend the greater part of their waking hours in schools with various opportunities for PA such as break times, after the school day and physical education lessons (Wechsler, Devereaux and Davis *et al.*., 2000, Verstraete, Cardon and De Clercq *et al.*., 2006; Jago and Baranowski, 2004).Thus, it is imperative to explore the roles of schools in increasing physical activity among youth and providing opportunities to meet the public health guidelines for PA.

According to the study by Oyeyemi *et al.*, 2016, Nigerian in- school adolescents achieve most of their total minutes of PA in school, this further underscores the need to assess the extent to which schools settings serve and provide opportunities for PA and its influence on the PA behaviours of adolescents. There is an assumption that the physical health education provided in schools offer adequate opportunities for children and adolescents to attain their daily recommended PA levels however this has been challenged on diverse fronts.

Firstly, the recommended 60 minutes per day of moderate to vigorous physical activity is almost impossible to attain through physical health education, even with the best curriculum. This is due to the fact that schools offer the physical health education subject, two to three times per week on the time table and the maximum allotted time is 40 minutes which is devoted largely to class room academic activities (Ojo, 2015). Secondly, quality physical education must include time for class room teaching activities which may not be physically active with limited duration to improve motor skills and fitness (Simons-Morton, Taylor and Snider *et al.*, 1993; Burgeson, Wechsler, Brener *et al.* 2001).

Thirdly, the increasing demand for classroom academic time and pressures on education systems to improve students' performance has had an unintended negative effect on the physical health education curricula thus reducing opportunities for physical activity in Nigeria and other regions of the world (Ojo, 2015; Institute of Medicine, 2013). Lastly, most secondary schools in Nigeria offer physical education as an optional subject for pupils in the senior secondary level and few schools have PHE teachers to deliver the course thus, students can be exempted or excused (Odunaiya *et al.*, 2015; Edim, Ogabor, and Odok, 2014).

2.4.3.1Built environment in schools

The importance of the physical environment on the physical activity behaviours of adolescents is a rapidly emerging and topical area of research study (Jones, van Sluijs, Panter, Harrison and Griffin, 2010; Bauman *et al.*, 2012). Studies assessing the associations between school built environments and student physical activity levels suggests that though it is associated with physical activity, the associations are weak to modest in strength and not consistent for all groups of students(Nichol, Picket and Janssen, 2009; Fein, Plotnikoff, Wild and Spence, 2004; Haug, Torsheim and Samdal, 2010).This view is supported by findings of a review which also found that findings were generally inconsistent across studies (Bauman *et al.*, 2012).

In spite of the disparities of study findings on the influence of the built environment on PA, studies have revealed that different components of the school environment influence the physical activity behaviours of adolescents (van Sluijs, Skidmore, Mwanza, Jones,

Callaghan, Ekelund, Harrison, Harvey, Panter, Wareham, Cassidy and Griffin, 2008). Studies have shown that the availability of fixed play equipment uncoloured playground markings encourages physical activity (Sallis, Conway, Prochaska, McKenzie, Marshall, and Brown, 2001; Ridgers, Stratton, Fairclough and Twisk, 2007; Farley, Meriwether, Baker, Rice, and Webber, 2008). Haug, Torsheim and Samdal, 2010 documented in his study that schools with spacious playing fields have more active pupils than those without. In addition, the layout and aesthetics of school grounds and environments have been associated with higher levels of physical activity (McCormack, Giles-Corti, Lange, Smith, Martin and Pikora, 2004). A study among Brazilian students found that the availability of sporting courts and swimming pool in a school were associated with involvement in physical health education classes (de Rezende, Azeredo, Silva, Claro, França-Junior, Peres, do Carmo Luiz, Levy and Eluf-Neto, 2015). Button and Janssen, 2014 also found from their study that the school built environment score was positively associated with student MVPA ($p<.001$). However, this association was moderated by the PA programs and policies.

A study which assessed the influence of neighbourhood environmental variables on the physical activity behaviours of in-school Nigerian adolescents found that only a few environmental variables - *availability of infrastructures, access to destinations and residential density* predicted the physical activity behaviours of males with regards to leisure-time MVPA and active transportation to school while there was no association for females (Oyeyemi, Ishaku, Deforche, Oyeyemi, De Bourdeaudhuij and Van Dyck, 2014). A study conducted in secondary schools in Ado Ekiti also found that the unavailability of equipment was a barrier to teaching physical health education (Ojo, 2015).

It can be deduced that the inconsistency of the associations between the school built environment and student physical activity levels in different studies and across different groups of students can be linked to other variables (i.*e. behavioural variables*)which may be moderating these associations (Oyeyemi *et al.*, 2014).

2.4.3.2. Policy level

Within the context of this study, policies "*refer to the policy-making initiative, legislative or regulatory actions which have a potential to influence physical activity"*. They are also described as organisational statements or rules that are meant to influence behaviour which maybe explicit or implicit with intended and unintended outcomes or effects (Sallis, Bauman and Pratt, 1998).

In several ecological models, the policy is now described because interventions at this level affect whole populations for extended periods (Brownson, Baker and Houseman *et al.*, 2001; Bellew, Bauman, Martin, Bull and Matsudo, 2011). For instance, policies and legislations can affect physical activity at local (school or workplace), regional government, or national levels (Bellew *et al.*, 2011). A key feature at this stage is that they usually require multi-sectoral partnerships and actions outside the health sector to improve conditions, support services and environments that enable physical activity.

Policies can focus on resources and investments (for example construction of cycling paths, recreational parks and inter-collegiate sports programmes) or development of relevant public health laws (for example proposing standards for the constructions of walking pavement and stair design) (Sallis, Cervero, Ascher, Henderson, Kraft and Kerr, 2006). Cross-sectional studies have shown that policy is a correlate of physical activity (Pucher and Buehler, 2008; McCormack and Shiell, 2011; Kelder, Springer and Barroso *et al.*, 2009; Belansky, Cutforth and Delong, 2009).However, some studies suggest these associations are weak to modest in strength and not consistent for all groups of students (Haug, Torsheim and Samdal, 2010; Sallis, McKenzie, Conway, Elder, Prochaska, Brown, Zive, Marshall, and Alcaraz, 2003).

Nigeria has some policies which are expected to influence PA in schools. These include the *Sports Policy (2009), the School Health Policy (2006) and the National Policy and Strategic Plan on NCDs (2013 and 2015).* These policies have outlined interventions to increase the physical activity levels of the populace, adolescents inclusive (National Sports Commission, 2009, Federal Ministry of Education, 2006; Federal Ministry of Health, 2013 and Federal Ministry of Health, 2015).Specific strategies with potentials to

improve physical activity levels as outlined in the 2009 Sports policy are: "*to support development of physical health education and sporting activities in schools; ensure sports is offered as an obligatory subject at the primary and secondary school level; ensure all Nigerian primary and secondary schools have grounds for play and sporting activities which will be a condition precedent for approval for schools' establishment; ensure schools have structured sporting programme for all students irrespective of age and gender except those with medical conditions which may hinder their participation have students at tertiary institutions must offer a minimum of a 4-credit unit course in Sports and physical exercise".*

The National School Health Policy developed by the Federal Ministry of Education (FME, 2006) also has some policy contents for physical activity and explicitly states that, the Federal Ministry of Education in collaboration with the Ministry of Sports and Social Development shall "*create awareness on prevailing health issues, utilise sports as a strategy to address delinquent problems of school children, support students to surmount educational stress through sports, build the capability of staff to monitor sporting activities in schools and ensure the development and implementation of appropriate leisure activities for the health benefits of the school community"*

Specific activities proposed to address insufficient physical activity in the 2013 National Policy and 2015 Strategic Plan of Action on NCDs included: "*development and implementations of national guidelines on physical activity for health, implement school-based programmes in line with WHO health-promoting school initiative, ensure that the physical environment support safe active commuting, and create space for recreational activity by ensuring that the environment for physical activity is accessible to and safe for all; introducing transport policies that promote active and safe methods of travelling; provision and improvement of sports, recreational and leisure facilities in educational institutions, workplaces and communities and increasing the number of safe spaces available for active play"*. Despite these policies, there remains a significant gap with regards to policy intents and policy actions and the comprehensive implementation of these policies remains fraught with challenges (Oladepo, Oluwasanu and Abiona, 2017).

2.5.0 Multi-level, multi-component Interventions and effects on the physical activity behaviours of adolescents

Multi-level, multi-component interventions align with the principles and philosophy of the socio- ecological approach to behaviour change, which states that since behaviour is influenced at multiple tiers specifically the *intrapersonal, interpersonal, community, institutional and policy levels* ,interventions should target the several layers of the multi-level system for enhanced effectiveness. A review of studies found that school-based multi-level, multi-component interventions were the most promising and consistent strategy for increasing PA in children (Kriemler, Meyer, Martin, van Sluijs, Andersen and Martin, 2011). Hence, there is a recommendation highlighting the need for school-based efforts specifically those which developed students' knowledge and skills, provided social support and created favourable environmental conditions and opportunities (Okely, Cotton, Lubans, Morgan, Puglisi, Miller, Wright, Batterham, Peralta and Perry, 2011, De Bourdeaudhuij, Maes, De Henauw, De Vriendt, Moreno, Kersting, Sarri, Manios, Widhalm, Sjöstrom and Ruiz, 2010).

These recommendations align with the principles and framework of the Health Promoting Schools initiative (Stewart-Brown, 2006), which supports intervening through multiple levels of influence in the students' lives in a logical and comprehensive manner. Health promoting schools prioritises the health of students and staff and supports the participation of the whole school community in addressing health. The involvement and participation of different members of the school community is an empowerment process which improves the value and effectiveness of interventions targeted at increasing students' participation in PA (Dzewaltowski, Estabrooks, Welk, Hill, Milliken, Karteroliotis and Johnston, 2009; Okely, Cotton and Lubans *et al.*, 2011).

Multi-component, school-based interventions are usually developed through two intervention channels: *curricular and non-curricular*. The curricular approach can be implemented through changes in the curricula content and teaching approach of specific subjects such as physical health education, biology etc while the non-curricular channel refers to modification of specific aspects of the school life which are not inherently part of the formal curriculum such asengaging parents to bring about a positive change in behaviours (Murillo, García, Generelo, Bush, Zaragoza, Julián and García, 2013). Some

selected multi-level PA interventions are outlined in Table 1 while selected studies which adopted the multi-level, multi-component school-based interventions are outlined in Table 2.

Table 1: A list of multi-level Interventions identified based on a review of the literature

Level	**Possible Activities**
Individual Level	• IEC materials for students • Special Dance events in schools • Debates and other co-curricula activities • Experience sharing by role models • M health –SMS • Peer Education
Socio Cultural level	• Dialogue and dissemination meetings with Teachers, Principals • Engaging parents though the Parent Teachers Associations, training and provision of educational materials
Built Environment	• Provision/Refurbishment of PA facilities
Policy/Institutional Level	• Development of curriculum &Training of Teachers • Review of PE Curriculum • Creating and training a school-based action team or small groups or committees. • Dissemination Meetings, • Production of evidence based dissemination materials – policy briefs, fact sheets etc. • One – on -one Advocacy visits • Celebration of special days and events

Source: Kriemler, Meyer and Martin *et al.*, 2011; Dobbins, Husson, DeCorby and LaRocca, 2013)

Table 2: Multi-component, school-based experimental research studies to improve the physical activity behaviours of adolescents

Authors	Country	Study design	Intervention	The outcome of the intervention
Peralta 2009	Australia	Design: randomized controlled trial Theoretical framework: Social Cognitive Theory Follow-up: immediately post-intervention. Setting: school, unstated if urban or rural Provider: research	The 16-week intervention program was principally based on Social Cognitive Theory. Activities included a weekly 60-min curriculum session and two 20-min lunchtime physical activity sessions. Each 60-min curriculum session focused on increasing physical activity through enhancing self-efficacy and self-esteem, and decreasing time spent on watching television and other mobile devices on weekends, decreasing sugar-sweetened beverage consumption, and increasing fruit and vegetable consumption. Other activities included the enhancement of self-regulatory behaviours such as time management and goal setting. The co-curricula component included games and fun activities. Other stakeholders who were targeted and involved in programme implementation were staff and parents. A Program Champion (PE teacher) liaised with the school	At follow-up, subjects in the intervention group had reduced waist circumference (-1.65 cm [-4.67, 1.36]; d=0.15); percentage body fat (-1.69% [-4.98, 1.60]; d=0.22) and less time spent on screen recreation (-1.13 h [-5.06, 2.80]; d=0.19). They also had greater increase in cardiorespiratory fitness (2.13 laps [6.22, 10.48]; d=0.16); and total participation in physical activity (140.74 counts/min [-159.44, 440.92]; d=0.36).

		worker, lay person, physical education (PE) teacher Duration: 16 weeks	authorities and other staff to promote the program within the school and facilitate logistical support. Eleventh grade students were involved in peer facilitating the lunchtime sessions and also served as positive role models. Parents were sent 6 newsletters via emails to inform them of the program content and propose strategies to engage the family in healthy behaviours. For the control group, the students participated in a 16 x 60-min physical activity curriculum which ran concurrently at the same time as the intervention group.	
Toftager *et al.*, 2014	Denmark	This was a cluster randomized controlled trial implemented in 7 intervention and 7 control schools. A total of 1,348 students aged	The intervention comprised 11 components which involved changing the institutional and physical environment of the schools. The multi-component study the was developed based on the social- ecological models and constructed in line with existing knowledge-based research and field experiences from school settings in Denmark. All participating schools had a comprehensive written outline for the intervention activities and comprised seven organisational and four physical	There was no significant difference for overall PA in both groups but there was a positive significant intervention effect of PA during break time.

		between 11 to 13 years were recruited for the study.	environment changes. The 11 components were: 1) upgrading outdoor school areas for PA, including unfixed equipment, 2) building playgrounds for adolescents: play spots, 3) improving safety practices for active transport and commuting to schools 4) establishing after-school fitness program, 5) developing and implementing school PA policy, 6) identify teachers as "kick-starters" to facilitate and motivate students to participate in PA during break time, 7) establishing school play patrol: and encouraging older students to initiate play and games for younger students during school break time, 8) ensuring students participate in mandatory outdoor break time and/or free access to gym/sports hall, 9) school traffic patrol who are older students assisted younger students in crossing the streets near the school, 10) students were also trained in safe cycling, and 11) there was a yearly school project/theme week on PA.	

Neumark-Sztainer 2010	US	Design: cluster randomized controlled trial Theoretical frameworks: Transtheoretical Model and Social Cognitive Theory Follow-up was done immediately post-intervention Setting: school and physical education (PE) teachers were trained coaches	The 16-week intervention study consisted of an all-girls PE and nutrition classes during the first semester of the school year. The students also received the New Moves curriculum which guided activities which were implemented throughout the school year. Activities included: 1) the New Moves PE and nutrition classes, social support and self-empowerment sessions 2) individual counselling sessions which utilised motivation interviewing techniques 3) lunchtime get-togethers where students were served healthy food and engaged in informal discussions on New Moves topics; and 4) parent outreach activities through postcards which were sent to reinforce messages as well as and a parent-daughter retreat day focusing on key themes of the intervention. PE teachers attended a full-day training prior the intervention and half-day training in the course of project implementation. For the control group, the teachers were not trained and they conducted their PE classes as per usual practice.	There was improvement in sedentary activity, at 9-month follow-up, intervention girls decreased their sedentary behaviours by approximately one 30-minute block a day ($p=0.050$) and they reported more support by friends, teachers, and families for physical activity.

Haerens 2009	Belgium	Design: cluster randomized controlled trial Theoretical framework: Transtheoretical Model Follow-up assessment was done 3 months post-intervention	Intervention: computer tailored physical activity (PA) program consisting of 3 parts: (a) an introduction page, (b) a diagnostic tool, and (c) advice. The questionnaire used in the diagnostic tool could be filled out on the computer screen and consisted of a demographic questionnaire, a PA questionnaire, and a questionnaire on psychosocial determinants. After questionnaires were completed, feedback was selected out of a database with messages for each possible combination of answers (e.g. normative feedback that related students' PA levels to the PA guidelines). Control: 1.5pg advice including information on the benefits of PA, public health recommendations, differences between moderate and vigorous intensity activities, and tips on how to become more active. The information was a selection of the essential information in the tailored advice, but not tailored to each individual	After 3 months, the intervention was more effective for increasing 'walking in leisure time' among students not complying with recommendations. For all other physical activity scores, no differences between groups were found (all F< or =2.3).

Verstraete 2006	Belgium	Design: cluster randomized controlled trial Theoretical framework was unstated Follow-up assessment was done immediately post-intervention Setting: school, urban Provider: research staff Duration: 3 months	For this 16-week intervention, classes received sporting equipment and 'activity cards' which outlined games and activities which can be performed. Children were allowed to play outdoors with the equipment during break and lunch periods. Teachers participated in the intervention study by stimulating the children to use the. The teachers were advised to divide the game equipment into different sets and to exchange those sets regularly to prevent children losing interest in the equipment. The activities for the control group were not specified.	There was a significant increase in the MVPA in the intervention group (moderate: from 38 to 50%, vigorous: from 10 to 11%), while it decreased in the control group

Singhal 2010	India	Design: cluster randomized controlled trial Theoretical framework: unstated Follow-up evaluation was done immediately post-intervention Setting: school, urban Provider: trained nutritionist, teachers, student volunteers Duration: 42 weeks	This was a 42-week multi-component intervention study comprising nutrition, physical activity and other lifestyle messages comprising the dissemination of health-related information through lectures and focused group discussions. Specifically, the intervention comprised promotion of physical activity, healthy lifestyles, discussion of healthy alternatives and quizzes. In addition, there were individual counselling, policy-level changes in schools, the the involvement of teachers and parents (telephone follow-up counselling and health camp for parents). The control group had no intervention	Higher proportion of children in intervention school (2.4%; *P*=NS) engaged in physical activity at least 4 days a week for at least 30–60 min (9.8%; *P*=NS), whereas there was a decrease in the CG

Angelopoulos 2009	Greece	Design: cluster randomized controlled trial Theoretical framework: Theory of Planned Behaviour Setting: school, urban and rural Provider: classroom teachers Duration: 12 months Follow-up was immediately post-intervention.	This is a 12-month intervention which was mainstreamed into the existing school curriculum in combination with physical health education, science and environmental classes. Program material included a student's workbook and teacher's manual, which provided activities for class based activities. The manual had topics on nutrition, physical activity and fitness, environmental issues, self-esteem and body image. Trained school teachers facilitated the conduct of the intervention coupled with a home component to promote parental involvement and reinforcement.	MVPA (min d^{-1}) increased from 41.1 to 43.4 in EG but decreased from 47.7 to 31.3 in the CG. In addition, there was an increase in leisure time MVPA

Araujo-Soares 2009	Portugal	Design: cluster randomized controlled trial Theoretical framework: Social Cognitive Theory Setting: school Provider: Researchers, physical health education teachers and psychologist Follow-up evaluation was 9 months post-intervention	This is a 12-week intervention comprising 2 classroom-based physical activity sessions of 90 min each coupled with homework. These sessions were delivered by a trained psychologist and a sports education teacher. Prior the intervention, the adolescents were asked to track their physical activity levels using a self-monitoring diary. After the intervention, they were encouraged to maintain the diary for 2 more weeks. At the end of each session, each student was given pamphlets reinforcing the sessions while the activities for the control were not specified.	At post evaluation, test, subjects in the IG reported 18 minutes per week more Physical activity (PA), than those in the CG. This increased to 57 minutes at nine-month post intervention follow-up.

Bayne-Smith 2004	USA	Design: randomized controlled trial Theoretical framework: indicated Follow-up was done immediately post-intervention	The 12-week intervention was implemented using the PATH curriculum which was a wellness course that integrated components such as behaviour modification, health and nutrition education and vigorous exercise. The students were provided information on the anatomy and physiology of the heart, cardiovascular risk factors, physical activity, nutrition, stress management, the danger of tobacco use and cessation techniques and strategies for modifying high-risk health behaviours. Teachers were trained and given manuals which contained for teaching the program and assessing outcomes. The PATH program consisted of daily 30-min classes which were held for 12 weeks. The classes comprised of 5- to 10-min lecture and discussion session on health and fitness and positive behavioural change coupled with assignments and 20 to 25 min of vigorous physical activity such as step aerobics, stair stepping, fast walking, jogging, stationary bicycling, rope jumping, and aerobic dance. The control group had the traditional PE classes.	There was a significant difference in PA in the EG compared to the CG

Colin-Ramirez 2010	Mexico	Design: cluster randomized controlled trial Theoretical framework: not indicated Follow-up was done immediately post-intervention	This intervention had a physical activity and nutritional components. The physical activity component addressed 3 levels: individual, school, and family. At the 'individual level', 30- minutes classes were held on physical activity which was delivered by a team comprising a physician, a dentist, a psychologist, a nurse and a social worker. In addition, a procedure manual was developed for classroom teachers to lead exercises. The school-level intervention focused on increasing the length of time that children participated in moderate to vigorous exercise and PE teachers were given a manual with suggested moderate to vigorous PA. 'Family level' involved the engagement of the family members to reinforce the classroom lessons. Students were given an assignment which had physical exercises which should be implemented in collaboration with the parents. The control group had no nutrition or physical activity intervention.	Post intervention, there was a significant increase in the performance of moderate physical activity in EG (40%, P = 0.04) but not in the control group (8%, P = not significant). The intervention also had a significant reduction in the proportion of children who spent > 3 hours a day on video games from 23% to 13% but no change in the CG.

Dishman, 2004	US	Design: cluster randomized controlled trial Theoretical framework: Social Cognitive Theory Follow up: immediately post-intervention	The Lifestyle Education for Activity Program (LEAP) is a one year school-based intervention that emphasized changes in PHE delivery and the school environment. It focused on increasing physical activity among female students by creating a school environment that took into cognisance, the unique physical activity needs and interests of adolescent girls. The intervention aimed to increase the female students' self-efficacy and interest in physical activity through health education, physical education (PE), school environment, school health services, faculty or staff health promotion, and parent and community involvement. The CG had the standard school- based PE curriculum.	Subjects in the EG were significantly more likely to report engaging in regular vigorous physical activity than the CG.
Donnelly 2009	US	Design: cluster randomized controlled trial Follow-up was done immediately post-intervention	The three-year intervention titled "*Physical Activity Across the Curriculum (PAAC)"* focused on classroom teachers' delivery of PHE classes. The teachers were provided 6-hour in-service training session to deliver existing academic lessons while the control group had regular classroom instruction without PA lessons	There was a three-year change in BMI – in the EG it was 2.0 ± 1.9 and CG 1.9 ± 1.9. Schools in the EG had significantly greater changes in daily PA and academic achievement scores.

Dorgo, 2009	US	Design: cluster randomized controlled trial The theoretical framework was not stated Follow-up was done immediately post-intervention	The 18-week intervention comprised physical education (PE) program that used manual resistance training (MRT) in every session. There were 80-min class sessions 3 times per week, and this was supervised by trained research assistants. The control group had a regular PE program that followed the usual school curriculum.	The EG improved significantly in all 6 fitness measures and showed more improvements than the control group in most fitness measures both at 9 and 18 weeks.

Source: Dobbins, Husson and DeCorby *et al.*, 2013.

Theoretical frameworks

Two theoretical frameworks guided the conduct of this study- the Theory of Planned Behaviour and the Socio-ecological Model. The socio-ecological model explores the intricate relationships between the individual and their environment. It explores in detail, the effect of external factors on behaviours. On the other hand, the theory of planned behaviour critically explores individual variables which could potentially influence intention and the adoption of behaviours. For this study, only three key constructs of the Theory of Planned Behaviour specifically *attitude, subjective norms and perceived behavioural control* were integrated into the individual level of the socio-ecological framework to guide the selection of possible variables which could influence physical activity.

Theory of Planned Behaviour

The Theory of Planned Behaviour (Ajzen, 1988, 1991) is a conceptual model which explains factors which determine human action. This model predicts intentional behaviours. It has three key constructs – *Attitude, Subjective norms and Perceived behavioural control* which jointly predict the intention to perform a behaviour (See Figure 2).

2.1 Behaviour

Behavioural interventions are conceptualised to change behaviour. For this study, the behaviour change desired is to increase the moderate and vigorous physical activity levels of in-school adolescents after a 3-month multi-level intervention.

Intention

Although a perfect linear relationship does not exist between behavioural intention and actual behaviour; it can serve as a proxy measure of behaviour. For this study, this variable will not be used since the outcome of interest is the self-reported and objectively measured physical activity levels.

Attitude

Attitude reflects an individual's summative evaluation of a specific behaviour. It has two components which are: beliefs about the outcomes of the behaviour (behavioural beliefs; e.g. 'being physically active will improve fitness and health) and the consequent negative or positive judgment about the characteristics of the behaviour (e.g. 'improving health and fitness is desirable/undesirable).Attitudes towards the behaviour can be defined as positive or negative feelings with regards to physical activity, in other words, the perceived benefits and/or consequences associated with being physically active.

Subjective norms *(about the behaviour)*

Subjective norm is an individual's personal assessment of the societal pressure to carry out behaviour or not. Subjective norms have two components which include beliefs about how other significant persons people would want them to act (normative beliefs), e.g. 'I feel pressured by my parents to be physically active') and the positive or negative judgment about the normative belief (also known as outcome evaluations *for example, "doing what my parents want with regards to physical activity is important/ unimportant*").Perceived pressures from parents, teachers and the media reflect subjective norms towards physical activity.

Perceived behavioural control *(of the behaviour)*

Perceived behavioural control reflects the degree to which a person feels capable of carrying out behaviour. It has two aspects: an individual's control over the behaviour (e.g. ability to engage in 60 minutes of moderate to vigorous physical activity daily); and confidence in their ability to perform the behaviour (e.g. having sufficient skills in performing physical exercises). Thus, perceived behavioural control is represented by an individual's perceived ability to accomplish a task despite internal and external barriers (Ajzen, 1991).

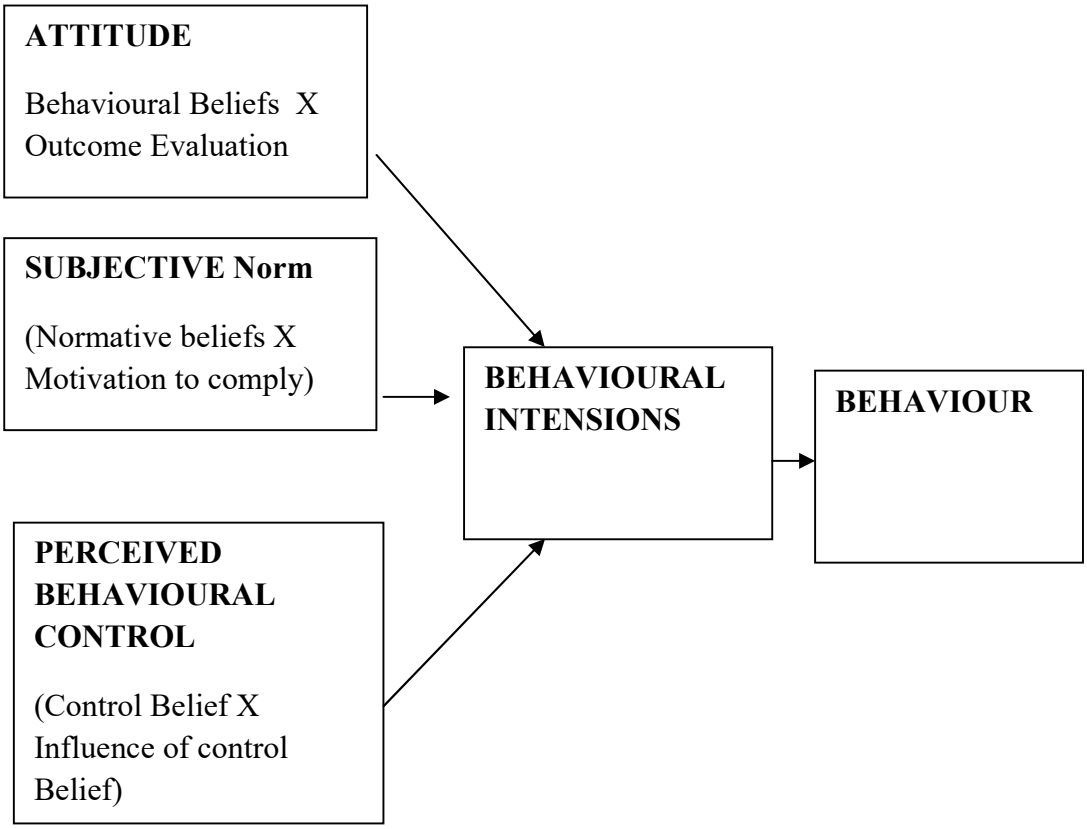

Figure 2: The Theory of Planned Behaviour (Ajzen, 1991)

Socio-ecological model

The socio-ecological model is a framework which acknowledges the intricate relationship which exists between an individual and their social, physical and policy environment (See Figure 3 and 4). Individuals are responsible for implementing lifestyle behavioural changes critical for reducing health risk and improving health, but their ability to implement the proposed behaviour is determined largely by the external environment, e.g. community norms and values, regulations, and policies. Thus, a key assumption is that the most effective approach to promoting positive health behaviours is a combination of efforts at the individual, interpersonal, community, institution and public policy levels.

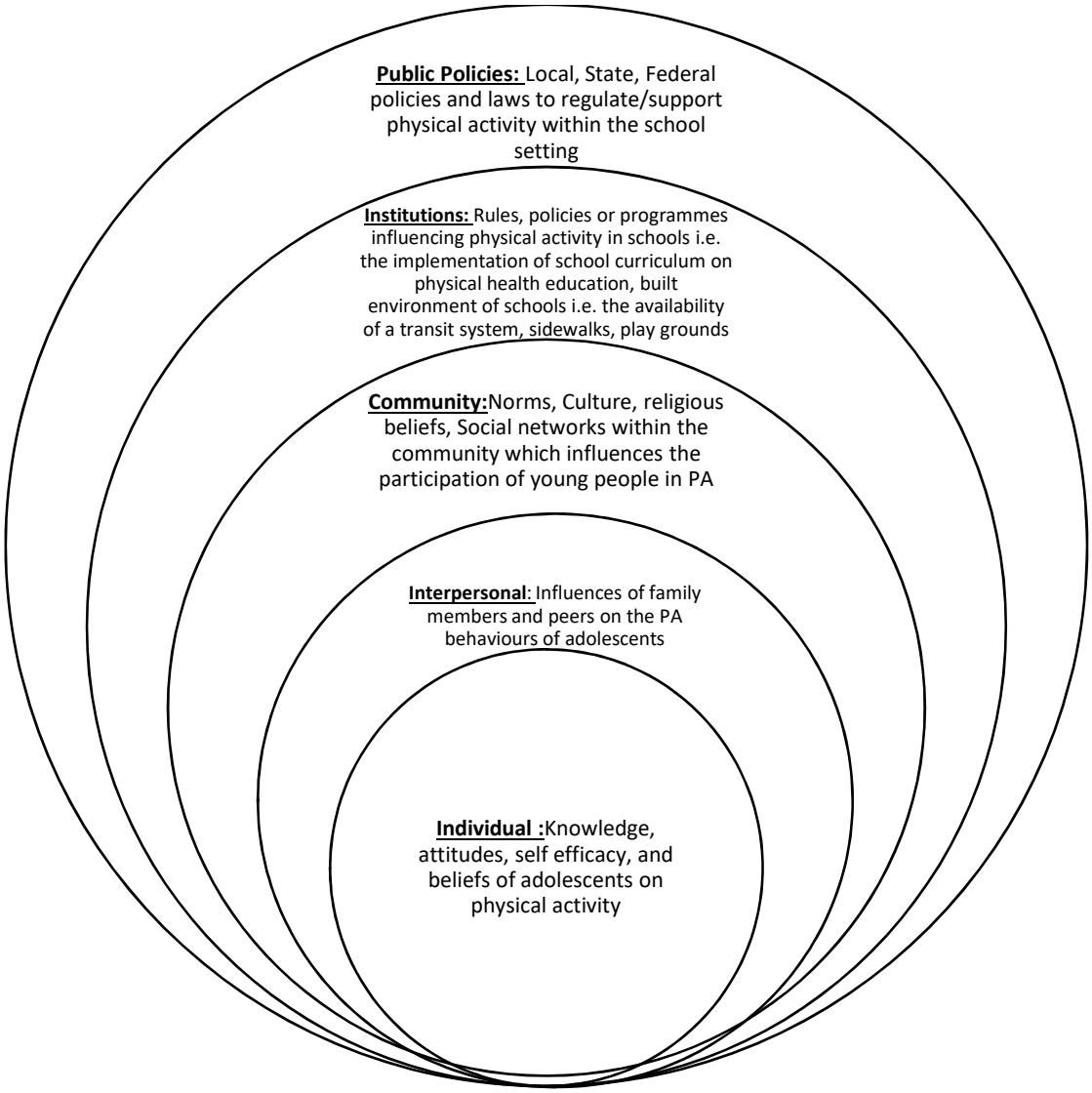

Figure 3: The ecological model adapted to reflect factors influencing the physical activity behaviours of in-school adolescents within the school setting

Individuals

Addressing physical inactivity and obesity related Noncommunicable diseases begin with changing lifestyle behaviours. Individual factors such as knowledge, attitudes, and beliefs influence the adoption of these behaviours.

Interpersonal groups

Interpersonal factors which indicate the extent of relationships with others or networks and they are important channels of encouraging more healthy behaviours. Interpersonal groups can provide the knowledge, influence attitudes and provide support to make good physical activity choices. Peers perception and attitude is likely to influence the adoption of physical activity behaviours.

Communities

This includes community's awareness and attitude to participation in physical activity which will be influenced by norms, culture, religion, social support and approval. Other factors include the built environment of the community as well as the availability of recreation facilities.

Institutions

Institutions include schools, workplaces, faith based institutions — to name just a few. Institutions can encourage physical activity through the provision of health information, enactment of favourable organisational policies and creation of supportive environments. With regards to physical activity behaviours, institutional interventions include special events such as mass walk day, riding to school events or inter house sports competitions.

Policies

These include legislation, state-wide school policies and programmes including partnerships with business and industry to develop a comprehensive strategy to address physical inactivity.

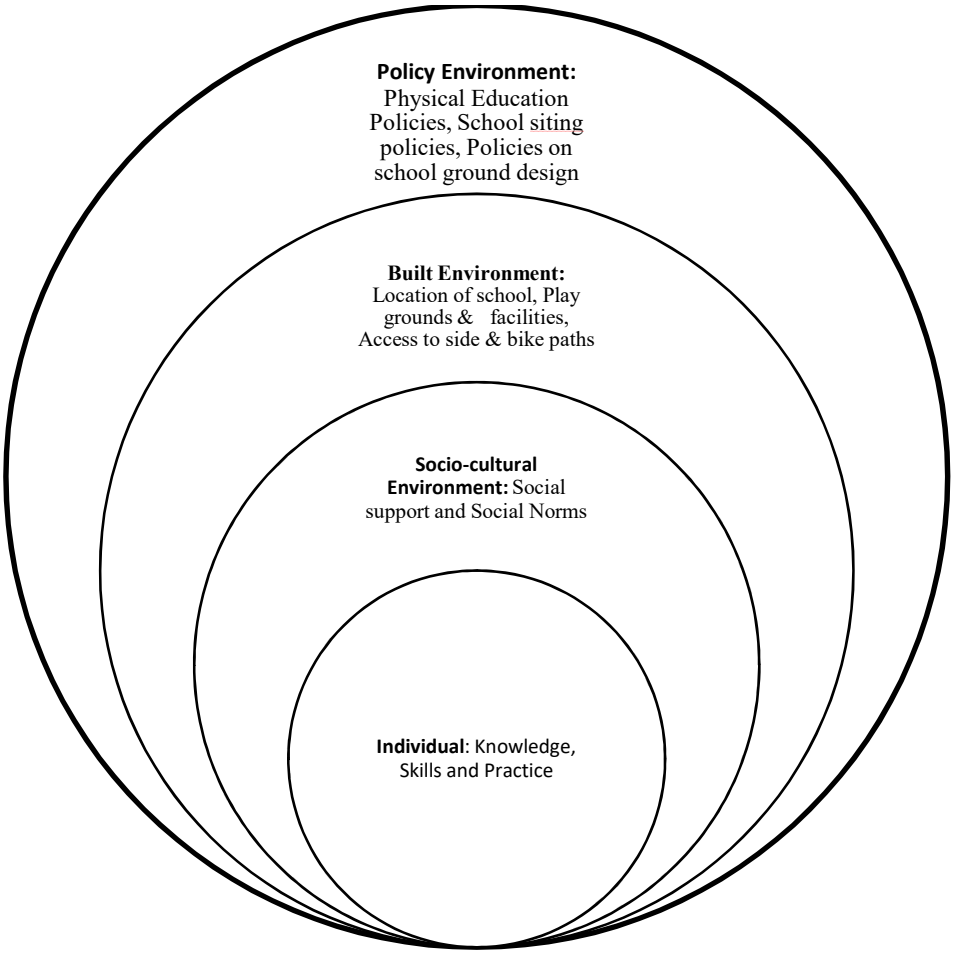

Figure 4: A conceptual framework outlining the ecological model of 4 domains of physical activity

Adapted from Sallis *et al.*, 2012

CHAPTER THREE

METHODOLOGY

This chapter describes the methodology adopted for the conduct of this study and provides information on the study design, study population, sample size, sampling technique, development and administration of research instruments, intervention and evaluation strategies.

3.1 Study design

The study adopted a Cluster Randomised Trial (CRTs) design with the random allocation of 11 secondary schools each in Ibadan North West and Ogbomosho North Local Government Areas (LGAs) into the experimental and control groups respectively. Cluster randomised trials are suited and commonly used to evaluate public health interventions especially when decision to implement an intervention is taken on behalf of a group. They are also appropriate for studies which carry a significant risk of contamination such as public health promotion interventions within settings such as schools, workplaces or communities (Moberg and Kramer, 2015).

The study evaluated the effect of a 12-week multi-level intervention on the physical activity and fitness levels of in-school adolescents aged 10-19 years in Oyo state, south western Nigeria. The cluster randomized trial design consisted of two assessments (baseline and end line) of two groups (experimental group and control group) and the intervention was tailored to in-school adolescents, teachers, school authorities and officials of the Ministry of Education in line with the socio-ecological model while the control only had standard physical health educations classes in tandem with the Nigerian educational curriculum for junior and senior secondary school students, (See Table3).

Table 3: Study design

Group	Baseline	Intervention (12 weeks multi-level intervention)	End line
Experimental Group 11 Secondary Schools	$O_1^{\#}$	X*	O_3^{+}
Control Group 11 Secondary Schools	$O_2^{\#}$		O_4^{+}

[#]Data collection at pre-intervention

* Exposure to the intervention

[+] Data collection at post-intervention

3.2 Study population

The study population for this study were adolescent secondary school students, school teachers, principals and officials of the Ministry of Education. Secondary schools were the unit of randomisation and these were assigned to the multi-level intervention or control arm (no intervention) with longitudinal data collection for index or cohort children who were randomly selected from the student population.

3.2.1 Inclusion criteria

- In-school adolescents in public and private co-educational schools in Junior Secondary School 1 to Senior Secondary School 2
- Secondary school students aged 10 to 19 years who had parental consent to participate in the study
- Students who gave assent to participate in the study

3.2.2 Exclusion criteria

- Out of school youths
- In-school adolescents in schools for the disabled
- In-school adolescents in single sex schools
- Students who were ill or those who declined

3.3 Description of study area

Ibadan North-west Local Government Area

The study areas were Ibadan North-west and Ogbomosho North Local Government Areas (LGAs). Ibadan North West LGA was created in 1991 by the former Military Head of State, General Ibrahim Babangida (rtd). The Local Government covers a large area of land with a population of about 152,834 according to (2006) National Population Census. It is divided into eleven wards and has its administrative headquarters at Onireke.

Ibadan North West Local Government is bounded in the North by Ido LGA, in the West by Ibadan South West LGA, in the East by Ibadan North East and in the South by Ibadan South East LGA. The inhabitants include Yoruba, Hausa, Ibo and other tribes who engage in trading, farming, artisanship and civil service. A predominantly urban area, Ibadan North West LGA has within his jurisdiction areas such as Onireke, Ayeye, Dugbe, Inalende, Ologuneru to mention just a few.

The LGA has 13 public and 18 private secondary schools (see appendix I). The selected schools for this study have a student population ranging from 157 to 1417 with more students in the public secondary schools. All schools have a minimum of two building structures on at least 2,023.45 m^2 land size with public secondary schools occupying larger areas. Furthermore, all the selected schools have a play area of over 648sqm field. The public secondary schools only have play/football fields and basic sporting facilities such as footballs while one of the private schools has a swimming pool, basketball and tennis court. Details are outlined in Table 4.

Table 4: Selected study schools in Ibadan North West Local Government Area

S No.	Public Schools	Type	Year of Establishment	Student population	Availability of sporting facilities
1.	Ansar- deen High School, Almost Opposite Gbaremu Market, Sango Eleyele Road.	Public	2005	1417	Open field and basic equipment i.e. footballs
2.	Eleyele Secondary School, beside Fan milk, Eleyele Ibadan.	Public	1980	638	Open field and basic equipment i.e. footballs
3.	Oba Abass Alesinloye Grammar School, Eleyele, Benjamin Junction, Eleyele, Ibadan	Public	1981	1080	Open field and basic equipment i.e. footballs and table tennis
4.	Urban Day Secondary School, Jericho, Ibadan.	Public	1980	354	Open field and basic equipment i.e. football
5.	Army Day High School, Leutmack Barracks	Public	2007	677	Open field and basic equipment i.e. football
6.	Sacred Heart Secondary School, Ode Oole	Public	2007	947	Open field and basic equipment i.e. football
7.	Community Grammar School, Olopomewa	Public	2013	428	Open field and basic equipment i.e. football
8.	St. Isabel Comprehensive Model College, along Benjamin,	Private	1983	272	Open field and basic equipment i.e. football

Table 4: Selected study schools in Ibadan North West Local Government Area (contd.)

9.	Lead City High School, Jericho, Ibadan	Private	1999	179	Well equipped with a field/pitch for football, basketball track events and swimming pool
10.	Tobi International High School, Jericho, Ibadan	Private	2002	157	Open field and basic equipment i.e. footballs, table tennis
11.	Sunshine Diamond College, Ologuneru/Eruwa Road.	Private	2012	182	Well equipped with a field/pitch for football and basket ball

Ogbomosho North Local Government Area

The present Ogbomosho North LGA with its Administrative Headquarters at Kinnira was carved out of the Old Ogbomosho Local Council on the 27th September 1991.The Local Government being an urban area is strategically located and serves as a link to Northern part of the country. It covers a total land mass of 207,978 square kilometres and using the growth rate of 3.2% from 2006 census, the 2010 estimated population of the LGA is put at 225,408. The Local Government Area is bounded by Ogbomosho South, Orire and Surulere LGAs to the West and East respectively. The predominant religions are Christianity and Islam. The indigenes of the Local Government Area are well known for subsistent farming; Ogbomosho North Local Government comprises multi-ethnic tribes in great numbers with the Yoruba's, constituting the largest percentage.

In all, the LGA has 15 public and 26 private secondary schools (see appendix II). Similar to the experimental group, the selected schools for this study have a student population ranging from 155 to 1217 with more students in the public secondary schools. All schools have a minimum of two building structures on at least 2,023.45 m^2 land size with public secondary schools occupying larger areas. Furthermore, all the selected schools have a play area of over 648sqm field. The

public secondary schools only have play/football fields and basic sporting facilities. One of the private schools has more sporting facilities such as swimming pool, basketball and tennis court, see details in Table 5.

Table 5: Selected study schools in Ogbomosho North Local Government Area

S. No.	Public Schools	Type	Year of Establishment	Student population	Availability of sporting facilities
1.	Ori Oke High School, Attenda, Ogbomosho	Public	1980	649	Open field and basic equipment i.e. footballs
2.	Owode Community Grammar School, Owode, Ogbomosho	Public	2003	1217	Open field and basic equipment i.e. footballs
3.	Ogbomosho Grammar School, Owode	Public	1952	968	Open field and basic equipment i.e. footballs and table tennis
4.	Ansar udeen High School Hamama Area	Public	2006	319	Open field and basic equipment i.e. football
5.	Anglican Grammar School, Attenda, Ogbomosho	Public	1976	951	Open field and basic equipment i.e. football
6.	Are Ago High School, Are Ago Area, Along Old Nitel, Ogbomosho	Public	1982	498	Open field and basic equipment i.e. football
7.	Soun High School, Ikuye Ogbomosho	Public	1978	603	Open field and basic equipment i.e. football
8.	Kings International College, Hamama Area, Ogbomosho	Private	2010	185	Open field and basic equipment i.e. football
9.	Lautech International College, Ogbomosho	Private	2003	292	Well equipped with a field/pitch for football, basketball track events and swimming pool

Table 5: Selected study schools in Ogbomosho North Local Government Area (contd.)

S. No.	Public Schools	Type	Year of Establishment	Student population	Availability of sporting facilities
10	Great City, Oke Owode, Ogbomosho	Private	2003	155	Well equipped with a field/pitch for football and basket ball
11	Canaan Land Comprehensive College, Ogbomosho	Private	2010	178	Open field and basic equipment i.e. footballs, table tennis

3.4 Sample size determination

The minimum sample size for this study was calculated using the formula for calculating sample size for two proportions with the aim of detecting a difference in outcomes between the groups (Thabane, 2004) and the effect size of a similar study (10%) which was conducted in Denmark (Toftager, Christiansen and Kristensen *et al.*, 2011) as well as the prevalence of high intensity physical activity (3.2%) reported by Odunaiya, Ayodele and, Oguntibeju, 2010. A Cochrane systematic review has documented that there is no published study on multi-level intervention to promote physical activity among in-school adolescent in Nigeria (Dobbins, Husson and DeCorby *et al.*, 2013) and the effect size for the multi-level intervention within Nigeria is unknown and justifies the use of the effect size reported by the study conducted in Denmark.

Intracluster correlation coefficient (ICC) is a measurement that captures between-cluster and within-cluster variability in outcome and is required for sample size calculation in clustered studies that comprise exposed or unexposed clusters (Donner and Klar, 2000; Localio, Berline, Ten Have and Kimmel, 2001; Murray, Varnell and Blitstein, 2004).To account for this, the intracluster class correlation reported by Oyeyemi *et al.*, (2014) which assessed participants' self-reported active

transportation to school and leisure-time moderate-to-vigorous physical activity (MVPA) among in-school adolescents was used to estimate the within and between school variation in physical activity in order to control for clustering within the schools (ICC = 0.38). The between school variation was controlled by matching school variables specifically the population of students and availability of sporting facilities.

$$n= \frac{(Z_{\alpha/2} + Z_{\beta})^2 [P_1 (1- P_1) + P_2 (1- P_2)]}{(P_1 - P_2)^2} \times [1+ (m_o-1) \times ICC$$

where $Z_{\alpha/2}$ is the critical value of the normal distribution at α/2 (e.g. for a confidence level of 95%, α is 0.05 and the critical value is 1.96), Z_{β} is the critical value of the normal distribution at β (e.g. for a power of 80%, β is 0.2 and the critical value is 0.84) and P_1 and P_2 are the expected sample proportions of the two groups

$Z_{\alpha/2}$ = 1.96 at 5% level of error

Z_{β} = 0.84

P_1= 3.2% i.e. the proportion of the participants in the unexposed (control) group who are physically active based on the study by Odunaiya, *et al.*, 2010.

P_2= 13.2% i.e. the proportion of the participants in the exposed (experimental) group who are expected to become physically active 12 months after the intervention. This translates to the effect size i.e. 10% increase in the outcome measure of Physical activity at follow up (Toftager, Christiansen and Kristensen *et al.*, 2011).

The design effect or variance inflator factor = [1+ (k-1) X ρ]

k = approximately the average number of individuals to be sampled per cluster which is 12 per school based on a sample size of 115 each for the intervention and the control group

ρ = 0.38 (Oyeyemi *et al.*, 2014)

$$n=\frac{(Z_{\alpha/2} + Z_{\beta})^2 [P_1 (1- P_1) + P_2 (1- P_2)]}{(P_1 - P_2)^2} \times [1+ (m_o-1) \times ICC$$

$$n =\frac{(1.96 + 0.84)^2 [0.62 (1-0.62) + 0.72 (1-0.72)]}{(0.62-0.72)^2} \times [1+ (50-1) \times 0.38$$

$$n = \frac{(1.96 + 0.84)^2 [0.62 (1-0.62) + 0.72 (1-0.72)]}{(0.62-0.72)^2} x [1+ (50-1) x 0.38$$

$$n = \frac{(7.84)[0.2356 + 0.2016]}{(-0.2)} x [1+ (50-1) x 0.38$$

n=336

Three hundred and thirty six participants was the minimum sample size needed for each group to detect whether the stated difference exists between the two proportions however, this was increased to 666 and 652 in the experimental and control groups respectively. Thus, 1318 in-school adolescents were selected for the study to increase the precision for the point estimate for physical activity behaviours and address loss to attrition.

3.5 Sampling technique

A five stage sampling technique was used for the study. Nigeria is divided into six regions with approximately six states each. Oyo state in the south west region was purposively selected for this study.

First stage: The local government areas in Oyo State are stratified into urban, semi-urban and rural. For this study, urban LGAs were purposively selected. Two urban local government areas (LGAs) were randomly selected using simple ballot. One of the LGAs was the experimental group (Ibadan) while the other served as the control (Ogbomosho). The LGA in Ibadan was selected as the experimental site due to the high level of physical inactivity which has been documented in published studies (Odunaiya *et al.*, 2010; Adeniyi *et al.*, 2011).

Second stage: The list of schools was obtained for the two selected LGAs and stratified by ownership i.e. public and private and population size. Twenty-two schools were selected by simple balloting and allocated to either the experimental (11 schools- *7 public and 4 private schools*) or control (11 schools- *7 public and 4 private schools*) group. For cluster, randomized trials, the higher the number of clusters, the greater the power of the study and it is recommended that clusters per arm should not be less than five since it may be difficult to get accurate data from

parametric tests with smaller numbers (Medical Research Council, 2002). To ensure this concern is addressed, 11 clusters per arm were selected for this study taking into cognizance resources and logistical issues. There was a representation of public and private schools in the list of schools selected since high levels of physical inactivity have been documented in both public and private schools (Odunaiya, 2010; Adeniyi, 2011). Furthermore, public and private schools in Nigeria implement a similar curriculum and this justifies the need to ensure the representation of both types of schools. Conducting the study in only one of the types of school would not give an accurate view of the general burden of physical inactivity among adolescents in Oyo state (Adeniyi *et al.*, 2011).

Third stage: The male and female student ratio for the selected schools was obtained and used for the determination of students to be selected for each school disaggregated by sex. All selected in-school adolescents served as the index children although all the students in the intervention schools were exposed to some components of the intervention.

Fourth stage: The number of arms for JSS1 to SS 2 classes in the schools was documented and two arms of classes at each level in the school were selected by balloting for the study (*totalling 10 arms per school from JSS1 to SS2*). Two arms per class were selected to ensure uniformity across the study schools taking into cognisance private schools which have fewer arms per class compared to public schools (average of two to three arms per class). A key assumption of the cluster randomised design is that subjects within a cluster are often more likely to respond in a similar manner and achieve comparable outcomes due to the clustering effect. Thus, they can no longer be assumed to act independently (Campbell, Mollison, Steen, Grimshaw and Eccles, 2000). For instance, two students sampled from the same class are more likely to be similar (in terms of outcomes) than two students sampled from different class and it is encouraged to increase the number of clusters rather than increase the number of subjects within a cluster to achieve the sample size (Medical Research Council, 2002). This was the key justification for selecting

the participants from across 10 arms rather than select all students in a class for the study.

Fifth stage: Study participants in each class were selected using systematic random sampling technique. The selected respondents were enrolled in the intervention and control schools and followed up after the 12 week intervention.

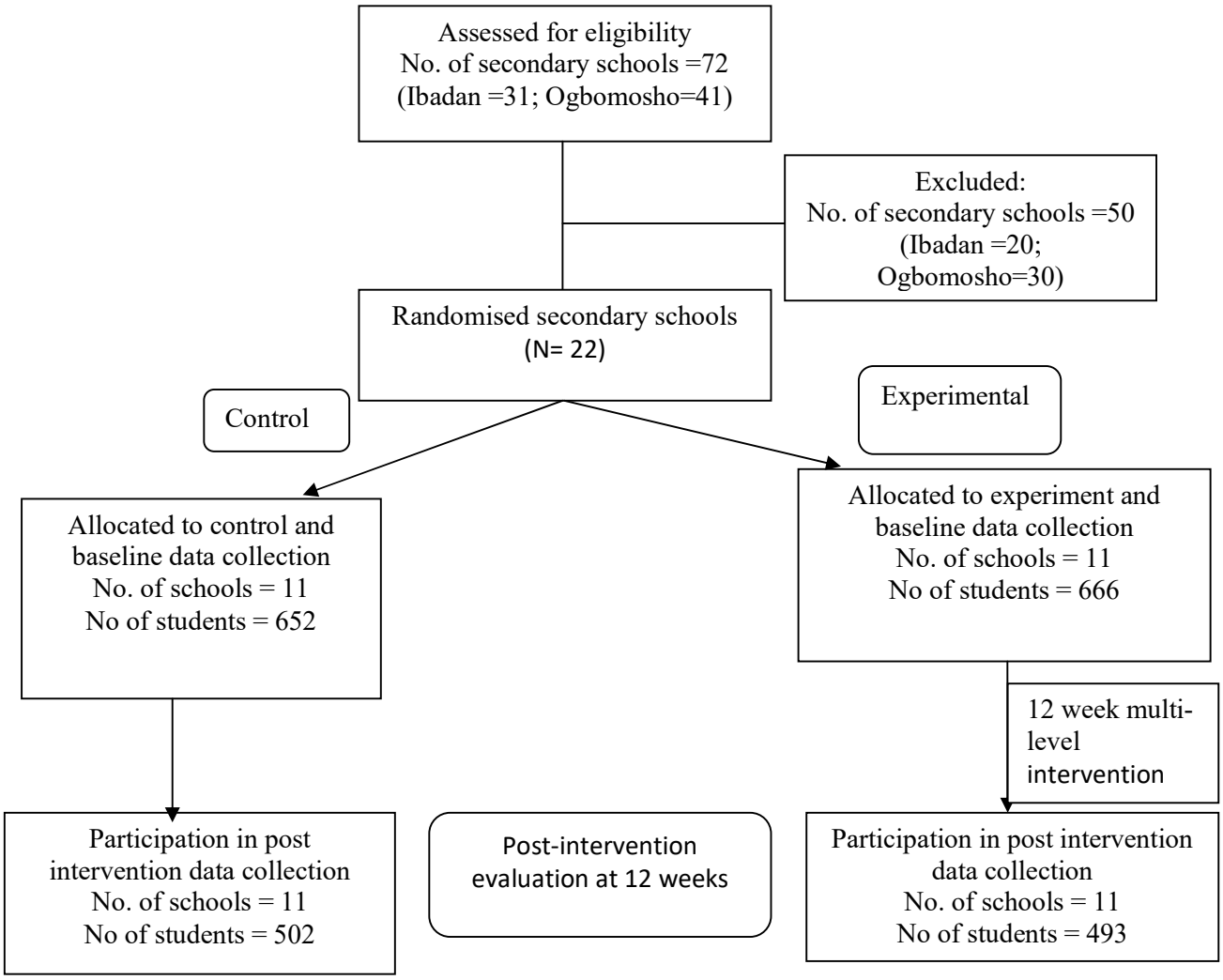

Figure 5: Consolidated Standards of Reporting Trials flowchart describing the progress of participants through the study.

3.6 Study variables and hypotheses

3.6.1. Study variables

The individual-level variables measured in this study included the socio-demographic characteristics of the participants such as age, sex, religion, ethnicity and level of class. Other individual-level measures were the primary outcomes i.e. self-reported physical activity (SPA) levels and step counts recorded using a pedometer (See Table 6) and secondary measures i.e. knowledge of the health benefits of physical activity, attitude, self-efficacy, perceived behavioural control, blood pressure measurement, cardio respiratory fitness levels, anthropometric measurement specifically weight, height, waist and hip circumferences.

Interpersonal-level variables assessed were social support for physical activity from friends, teachers and family. The Institutional-level variables were the built environment specifically *Walking Provision, Cycling Provision, Aesthetics, Sport and facility provision, Other facilities and Design of the school grounds* and the policy environment, in particular, the physical activity policy related to the delivery of physical health education and break time.

Details are outlined in Table 6.

Table 6: Study variables, instruments and methods, timepoints (T0, T1) and target groups

Objectives		**Study variables**	**Study instruments /Methods**	***Target Group***	***Schedule***	
					T_0 *	**T_1 !**
Assess the pattern of physical activity among in-school adolescents	Individual	• PA Behaviours • Cardio respiratory Fitness	PAQ-Questionnaire Pedometers 20-m SRT	Students	X	X
Identify factors (individual, social-cultural, built environment and policy) influencing physical activity behaviours of in-school adolescents	Individual	Knowledge of PA, attitude, subjective norms (normative beliefs and motivation to comply) perceived behavioural control (control beliefs and influence of control beliefs), behavioural intentions and other demographic variables • Weight, Height, Waist-Hip circumference, BMI for Age	Questionnaire Anthropometric measurements	*Students*	X	X
	Socio -cultural environment	Social Norms Social support	Key Informant Interview guide Semi-structured Questionnaire FGD guide	(I)Principals (ii) PHE Teacher (iii) Teachers	X	
	School's built Environment	School grounds and safety, physical activity and recreation facilities aesthetics	Observation using the SPEEDY Checklist	School Environment	X	

Objectives	**Study variables**	**Study instruments /Methods**	***Target Group***	***Schedule***	
				T_0^*	$T_1^!$
Policy	• PA Policies/programme	• Key Informant Interviews • Semi structured Questionnaire	(i) Principals (ii)PHE Teachers	X	
Assess the effect of a multi-level intervention on the physical activity levels of secondary school students	• Knowledge of PA, attitude, subjective norms (normative beliefs and motivation to comply) perceived behavioural control (control beliefs and influence of control beliefs), behavioural intentions and other demographic variables • Weight, Height, Hip and Waist circumference • Fitness level	• Questionnaires • Pedometers • Anthropometric measurements • Multi stage fitness test (20-m shuttle run test)	Students	X	X

T_0^*:Baseline measurement

$T_1^!$: Post intervention measurement

3.6.2 Test of significance and null hypotheses

The following null hypotheses were formulated and tested to determine whether the intervention had impacted on the participants.

Ho_1: There is no significant difference between intervention and control groups with respect to the following:

a. Attitude to physical activity
b. Subjective norms
c. Perceived behavioural control of physical activity behaviours
d. Self-efficacy
e. Social support from Teachers

Ho_2: There is no significant difference in the self-reported physical activity levels of students in the experimental group and control group before and after the intervention

Ho_3: There is no significant difference in the objectively measured physical activity levels of students in the experimental group and control group before and after the intervention

3.7 Instruments for data collection

Five instruments were developed for this study, the first was a 55-item questionnaire which had ten sections focusing *on socio-demographic characteristics, knowledge of the benefits of physical activity, physical activity level, attitude toward PA, subjective norms, perceived behavioural control, self-efficacy, social support for physical activity, anthropometric and blood pressure measurement, fitness test and the assessment of the intervention* (this was included inthe post intervention evaluation for the experimental group only). The instrument was adapted from three tools – firstly, the *Physical Activity Questionnaire for Adolescents (PAQ-A)* which assessed the Self-Reported Physical Activity (SPA) level of respondents,(Kowalski, Crocker and Kowalski, 2004). Secondly, a tool which assesses the constructs of the Theory of Planned Behaviour and how it influences physical activity behaviours (Motl, Dishman, Trost, Saunders, Dowda, Felton, Ward and Pate, 2000). This tool has questions assessing attitude, subjective norms, perceived behavioural control and

self-efficacy about physical activity and thirdly a tool by Sallis *et al.*, 2000 which determines social support for PA. The PAQ-A is a self-administered, 7-day recall instrument designed to assess the physical activity levels of in-school adolescents. It assesses frequency of participation in physical activities during spare time, physical health education classes, lunch period, after school closing hours and at home in the evenings and weekends. In a study to establish the convergent validity of the PAQ-A, the instrument was found to be significantly correlated to all self-report measures (Kowalski, Crocker, and Kowalski, 1997). (See Appendix III).

The second instrument is a 40-item checklist used to assess the built environment and facilities for physical activity in the schools. This instrument was adapted from the Sport, Physical Activity and Eating Behaviour: Environmental Determinants in Young people (SPEEDY) tool. Presently, the SPEEDY is the only tool that analyses the built environment of schools (Jones, van Sluijs and Panter *et al.*, 2010; Tarun, Arora, Rawal and Benjamin Neelon, 2017) and variables are scored to determine the level of environmental support for PA (Van Sluijs, Skidmore., Mwanza, Jones, Callaghan., Ekelund, Harrison, Harvey, Panter, Wareham, Cassidy and Griffin, 2008). (See Appendix IV).

The third instrument for data collection was a 56-item instrument which was adapted from the School Physical Activity Policy Assessment tool (S-PAPA) – a semi-structured tool which measures school-level physical activity policies with regards to the delivery of physical health education sessions, break time, and other opportunities for physical activity (Lounsbery, McKenzie, Morrow, Holt and Budnar, 2013). For this study, only two components were assessed - PA policies for break time and physical health education. (See Appendix V).

The fourth instrument was a key informant guide for School Principals which assessed their perspectives about the level of physical activity among secondary school students in their schools, frequency of engagement in structured and unstructured physical activity and factors (individual, social-cultural, built environment and policy) which influence the physical activity behaviours of in-

school adolescents, the extent to which school guidelines and policies provide opportunities for PA, barriers to the implementation of school physical activity policies and programmes in schools, level of funding and recommended activities to ensure in-school adolescents attain the daily target of 60 minutes of moderate and vigorous daily activity. (See Appendix VI).

The fifth instrument was a focus group discussion guide for class room teachers which was used to assess their opinion about the frequency and opportunities for engagement in structured physical activity (i.*e. sports, class based activities, regular school physical activity programmes*) as well as unstructured activities (*i.e. break time, after school programmes etc.*), social support for physical activity, barriers for the implementation of physical activity policies and programmes in schools and feasible interventions. (See Appendix VII).

3.7.1 Measures

Measures for this study were theoretically derived from the Socio-ecological Model and the Theory of Planned Behaviours. These models guided the selection of the primary outcome measures which are the self-reported physical activity levels among the participants and step count recorded using a pedometer for selected respondents. Secondary behavioural antecedent measures which were documented for all respondents are knowledge of the health benefits of physical activity, attitude, self-efficacy and perceived behavioural control. These variables were incorporated into the multi-level intervention and the design of the instruments for the measurement of the outcome as set in the objective of the study.

<u>Outcome variables</u>

Self-reported Physical Activity (SPA) levels and step counts constituted the outcome variable for this study. The assessment of the SPA levels was operationalised by asking 8 questions in section three of the questionnaire (Appendix III) specifically, the frequency of participation in specific sporting activities and number of time they participated in physical activity during physical health education periods, lunchtime,

immediately after school, in the evenings and on weekends in the last seven days. A composite physical activity score was computed from the average of 8 questions with the lowest and highest scores of 1 and 5 respectively. The step count was recorded for selected students using a Yamax SW200 Step Digi-Walker. The devices were worn on the right hand of the participants for seven consecutive days and only removed before sleeping, or prior water based activities such as swimming or bathing.

Other variables

The knowledge of the health benefits of physical activity was measured using 10 statements with a 2-response option of "Yes" or "No". This was aggregated to create a 10- point knowledge scale. Attitude towards physical activity, subjective norms and perceived behavioural control were measured on a 5-response-option Likert type scale with response categories of *"Strongly Agree", "Agree", "Not sure, "Disagree" and "Strongly Disagree.* The 18 items of attitudinal disposition, the eight items of subjective norms and four items of perceived behavioural control were aggregated to create a 90-point scale, 40-point and 20-point scales respectively (See Table 8). Self-efficacy was assessed using 10-item statements with response categories of "*Extremely confident", "Confident", "Not sure", "Not Confident" and "Extremely Not Confident".* This was computed to create a 50-point scale. (See Table 7).

Social supports in the last three months were assessed using 10-items statements for friends and family and 9-item statements for teachers with response categories of "*Yes", "No" or "Cannot remember"*. These were aggregated to form a 12-point scale for friends and family and 9-point scale for teachers.

Blood pressure was measured and the mean of three measurements was recorded. This measurement was done using a mercury sphygmomanometer developed by ACCOSON, UK and calibrated in mm of mercury (Hg). According to the research proposal, children who had hypertension or hypotension were excluded from the

multi-stage fitness test with the school authorities notified about children with blood pressure above the 95th percentile for age.

Anthropometric measurements were done twice and averaged. Weight was measured using an OMRON Digital Scale produced by OMRON Healthcare Europe and recorded to the nearest gram. Height was measured using a stadiometer produced by the Faculty of Technology, University of Ibadan and calibrated in centimetres. For the measurement, the students were asked to remove their shoes and stand on the stadiometer with a ruler pressed flat on the head and height recorded to the nearest centimetres.

Waist and hip circumferences were measured with an inextensible measuring tape to the nearest 0.1 cm. The adolescents stood erect and relaxed; arms were at the sides and feet positioned close together. Waist was measured at the narrowest part between the end of the rib cage and iliac crest. Hip circumference was measured at the widest circumference below the iliac crest and the level of the greater trochanter (World Health Organisation, 2008). Waist-hip- ratio was obtained as waist circumference/hip circumference.

The cardio-respiratory fitness level of the adolescents was measured using the multi-stage fitness test which is also known as the20-m shuttle run test (20-mSRT). A guide developed by Topend Sports was adopted in conducting the fitness test, (See Appendix VIII) (Topend Sports n.d.). This test is the most commonly used field-based test to assess aerobic fitness in adolescents and young people (Sandercock, Voss, Cohen, Taylor, and Stasinopoulos, 2012). A systematic review of published studies found that the multi-stage fitness test is the most consistent field-based technique for assessing cardio-respiratory fitness in young people (Castro-Piñero, Artero, España-Romero, Ortega, Sjöström, Suni,Ruiz,2010. Performance in the multi-stage fitness test is usually expressed as levels completed. The participants run to and fro between a start point and end point which is 20 metres apart and their pace is guided by a pre-recorded beep/sounds from an audio recording. The running speed is gradually increased by 0.5 km/h each minute or period. The test ends when the

child stops due to exhaustion or when he/she fails to reach the end point in tandem with the beep on two consecutive occasions (De Miguel-Etayo, Gracia-Marc, Ortega, Intemann, Foraita, Lissner, Oja, Barba, Michels, Tornaritis, Molnár, Pitsiladis, Ahrens and Moreno, 2014). In such instance, the last completed level indicates the final result of the test.

The Institutional-level variables for the built environment were assessed using a 5-point, 13-point and 25-point scales for walking provision, cycling provision and aesthetics. Sport and facility provision, other facilities and the design of the school grounds were assessed using a 12, 10 and 9-point scales respectively. (See Table 7).

*P*olicy environment was assessed focusing on Formal Physical Health Education Policies (22-point scale), Physical Health Education Content, Curriculum and Delivery (57-point scale), Formal policies on break time (22-point scale) and Break time utilisation (15-point scale). The constructs for the school built environment and policy were split into two equal parts. The summary for each variable is presented in Table 7.

Table 7: Categorisation of scores for the knowledge, behavioural, environmental and policy constructs

Variable	Categorisation of scores
Knowledge and behavioural constructs	
Knowledge	10
Attitude	90
Perceived Behavioural Control	20
Self-efficacy	50
Subjective Norms	40
Family support	12
Friend support	12
Teacher Support	9
The school built environment constructs	
Walking Provision	5
Cycling Provision	13
Aesthetics	25
Sport and facility provision	12
Other facility	10
Design of the school grounds	9
Policy Constructs	
Formal Physical Health Education Policies	22
Physical Health Education Content, Curriculum and Delivery	57
Formal policies on break time	20
Break time utilisation	15

3.8.0 Validity and Reliability

3.8.1 Validity

To ensure the reliability and validity of the tools, several steps were taken. The validity of the content of the questionnaire and research tools was enhanced by adapting standardised tools which were identified through a review of the literature. In addition, other pertinent variables identified from the review of literature were incorporated.

The tools were adapted taking into cognizance the Nigerian context. For instance, some sporting activities which had unfamiliar terms were replaced with Nigerian equivalent. Specifically, Hopscotch was replaced with a familiar and similar Nigerian term “Suwe”/ "LakanLakan ”. In addition, sporting activities such as golf

which is uncommon in Nigerian secondary schools was deleted while common ones such as "*Ten ten", "Boju boju", "Hide and seek", "Fire on the mountain", "Chinco"* were incorporated into the tool. The tools were also modified using simpler English Language terms. The tools were also reviewed for content and face validity by three Professors in the Departments of Health Promotion and Education, Health Education and Human Kinetics and Physiotherapy. Other professionals consulted were a medical statistician in the United States of America, two epidemiologists in Nigeria and South Africa and health promotion and education specialists.

To ensure the suitability of the tools to the Nigerian context and to provide an opportunity for the Research Assistants (RAs) to demonstrate their competencies in a real-world setting, the tools and entire data collection process were pre-tested in one Public and one Private secondary schools in Ibadan North west Local government areas. The schools were IMG Grammar School, Sharp corner and Sunshine Schools, Joyce B Ibadan, Oyo State. These schools were similar to the study schools with regards to the socio-demographic characteristics of the students and their literacy level. The pretesting of tools commenced on Thursday 14th to 20thJanuary 2016 while the use of the pedometers by students was from the 25th to 31st of January, 2016.Specific feedbacks from the pretest are outlined below:

i. There was a suggestion to incorporate a section on *Knowledge on Physical Activity and its benefits to Health*

ii. Golf was deleted from the list because it is not a common physical activity

iii. The response options for a question were changed from 7 to 3 options for clarity. i.e.

Old Question	*New modified Question*
Do you feel you get too much exercise, too little or about the right amount? 1. Much, too much 2. Somewhat too much 3. Slightly too much 4. About the right amount 5. Slightly too little 6. Somewhat too little 7. Much too little.	*Do you feel you get too much exercise, too little or about the right amount?* 1. Too much 2. About the right amount 3. Too little

iv. The response option for this question was changed from 5 options to 4 options for clarity. i.e.

Old Question	*New modified Question*
How important is physical exercise to you? 1. Extremely important 2. Very important 3. Moderately important 4. Slightly important 5. Not important at all	How important is physical exercise to you? 1. Very important 2. Moderately important 3. Slightly important 4. Not important at all

v. A question in the self-efficacy table was changed as follows:

Old question: I can be physically active during my free time on most days **even if I could watch the TV or play video games instead**

New question: I can be physically active during my free time on most days **even if I have to forgo watching the TV or playing video games instead**

vi. Though the meaning of Physical activity was explained prior the collection of data, there was a tendency for respondents to equate physical activity to physical exercise. This has implication on the accuracy of data collected and to help correct this notion, the term physical activity was clearly stated on the tools and explained repeatedly during the actual data collection.

vii. Other operational issues identified during the pre-test exercise and how they were addressed during actual data collection

- The consent form for the fitness test and use of pedometers were taken to schools a week before the conduct of the study. All students selected for the study were given the consent form (which has the parental consent) and they were instructed to submit back to schools before the day selected for data collection in the schools. The consent forms were required for participation in the fitness test and use of pedometers, however; this was not a requirement for the administration of questionnaires.
- On arrival at the school; a central hall or class room was identified within the school premises and selected students were directed there.
- The physical measurements (weight, height, BP etc.) commenced immediately the students arrived the central hall while they await other students. This strategy was adopted to reduce the time duration for the collection of data in

schools and ensure the students do not miss out on other academic activities. The measurements were recorded in the questionnaires and handed to them.

- Students were grouped according to their classes and one support RA was assigned to each class group. In all subsequent schools, the assigned support RA handled the same class i.e. the same support Reassigned to assist JSS1 students always handled this cadre of students in all the schools visited.
- A lead RA read out the questions to the group of students in English and Yoruba languages while the support RAs and the Doctoral student go around monitoring and ensuring the questionnaires were properly completed. In addition, the support RAs for each class responded to all questions from the students.
- The doctoral student was responsible for monitoring group activities and providing support as required.
- After the tools have been completed, the fitness test was conducted and recorded in the tools.

viii. Harvard fitness test (to be replaced with the Multistage fitness test also known as the 20mRT)

Initially, the doctoral student proposed to use the Harvard fitness test but during the pre-test, it was discovered to be time demanding and cumbersome in the school settings. In addition, it was strenuous for the students and less than half of the respondents, majorly males participated in the test. The doctoral student consulted with Dr Graham Baker and Dr Samantha Fawkner - both Lecturers and researchers at the Department of Physical Activity and Health of the University of Edinburgh, United Kingdom and an alternative test – the multi stage fitness tests also known as the 20-metre shuttle run test (20mRT) which is widely used for adolescents was recommended.

ix. Use of pedometers

During the pre-test exercise, a key challenge was the loss of one of the pedometer by a participant. In addition, one of the students pressed the reset button on the device and the data was lost despite the fact that it was sealed with a paper tape. Based on this experience; the doctoral student discussed with the school authorities

and the following recommended procedures were outlined which guided the assessment of physical activity using the pedometers.

- Four to six students (*depending on the number of participants enrolled in the study in the school)* were randomly selected from the list of enrolled participants. Junior Secondary School 1 students were excluded due to their young age and inability to safeguard the pedometer.
- The designated support teacher reviewed the list to determine those who were capable of keeping the pedometers. Those who may not be able to keep the pedometers based on the teacher's assessment were promptly replaced by the doctoral student from the list. Consideration was given to their sex i.e. an equal number of males and females to use the pedometers.
- The four to six pedometers were handed over to a school designated support teacher who monitored the use of the pedometers daily.
- Parental consent was sought before the use of the pedometers and conduct of the fitness test.
- Parents were sent text messages or called to also help monitor the use of the pedometers.

3.8.2 Reliability

To ascertain the reliability of the instrument, analysis of pre-test data was conducted using Cronbach's Alpha correlation coefficient of the IBM Statistical Package for Social Sciences (SPSS) version 22. A correlation coefficient greater than 0.05 implies the tool is reliable. Pre-test questionnaires completed by the students were subjected to test of internal consistency using SPSS version 22.0 Cronbach's Alpha (α) test, and the internal consistency result for the key constructs are as follows: Self-reported physical activity levels (0.76), attitude (0.74), self-efficacy (0.95), perceived behavioural control (0.79), Subjective Norm (0.97) and Social support for physical activity (0.91).

3.9 Training of research assistants

The training session for research assistants was held on the12th and 13th of January, 2016. The training programme was designed to enhance the competencies of the research assistants in the ethical conduct of research study, administration of research instruments and the skills needed to relate courteously with the respondents in order to get their full cooperation. In addition, the training programme focused on enhancing their skills in physical and anthropometric measurements.

Eight Research Assistants were trained -*3 males and 5 females* with an academic background in Nursing (2), Community Health (1), Medical Physiology (1), Public Health (2) and Social Works (1).Four of the RAs have a Master's degree while others had a first degree. The two Nurses worked at the University College Hospital, Ibadan. The training session included an overview of the project, objectives of the study, the importance of accurate data, a detailed review of all tools and hands-on practical sessions on physical measurements i.e. the measurement of blood pressure, weights, heights, waist and hip circumference and the Harvard fitness test. In addition, the Research Assistants were trained on how to conduct interviews and focus group discussions and ethical issues guiding research studies.

At the end of the training session, the Research Assistants had hands –on demonstration of physical measurement procedures and the doctoral student assessed the intra-observer errors. For the weight, height, waist and hip circumference measurements, the Research assistants got similar readings except for one blood pressure measurement which had very slight variations (i.*e. out of three assessments, only one blood pressure reading had a difference not more than 10 between the diastolic readings though the systolic readings were the same).*There was a review session with the help of one of the trained Nurses to ensure the repeat measurement had similar and consistent readings.

In addition, the Research assistants role-played the administration of the focus group and in-depth interview guides to demonstrate an apt understanding of the intricacies

involved in the use of the tools. This process was assessed by the Research assistants, the Doctoral student, selected Lecturers/Colleagues in the Department of Health Promotion and Education and immediate feedbacks were provided to the RAs on their areas of deficiencies. Several repeat role plays were conducted to ensure the RAs mastered the art of administering the research instruments as well as interacting with respondents to get quality data and the conduct of the physical measurements. In addition, the trained RAs were involved in the pre-test exercise to prepare them for the actual data collection process.

3.10 Ethical issues

The study followed ethical guidelines for studies involving human subject research. This study received ethical approval from Oyo State Research Ethical Review Committee (AD13/479/890) and permission from the Oyo State Ministry of Education (see appendix IX and X). The Local Inspectors of Education of the local government areas and School Principals also provided permission for the conduct of the study (see the letter in the appendix). Parents provide written consent and the adolescents gave oral assent for participation in the study. Teachers and Principals interviewed provided oral consent for participation. The trial was registered on the Pan African Clinical Trial Registry Trial registration number: PACTR201706002224335 on the 26th of June 2017 (see appendix XI).

The following steps were taken to address the ethical issues involved in this study.

3.10.1. Voluntariness

Adequate information was given to all participants to facilitate voluntary participation in the study. Meetings were held with the school authorities and Local Inspectors of Education and the study objectives and procedures were explained. Informed and voluntary consent was received from each research participant to guarantee anonymity, freedom to decline to answer any question or discontinuing participation or withdrawing at any time. Parents provided written consent for the participation of their wards/children. Respondents were informed about plans for

maintaining confidentiality and potential benefits as part of the informed consent process.

3.10.2. Confidentiality of data

All information provided by research participants were kept confidential. To facilitate confidentiality, the research assistants were carefully selected and trained on ethical issues and there was limited access to digital responses of the participants.

3.10.3. Translation of protocol to the local language

The protocol and the research tools were administered majorly in English Language considering the target population who are largely young in-school adolescents. Though during data collection, the RAs explained the questions in both English and Yoruba languages

3.10.4. Beneficence to the participants

The respondents were informed of the study objectives and provided with stipend/incentives (pen, biscuits and pure water) for their participation in the study. Dissemination meeting was held with stakeholders in the education sector to present the baseline findings and suggest recommendations.

3.10.5. Non-maleficence to participants

Minimal risks were involved in participating in this study. As part of the procedure for data collection, sick respondents were prevented from participating in the multi stage fitness test (also known as 20-meter shuttle run test). The respondents were informed of their rights to decline to respond to the questions they were uncomfortable with. Potential respondents who refuse to participate in the study were not victimized or subject to any form of harassment.

3.11 Data collection

Data collection was carried out using the research instruments designed for the study. This was done at two time points during the study; at baseline and immediate post

intervention at the end of the 12-week intervention to measure changes that may have occurred on the physical activity behaviours and behavioural antecedent factors.

3.11.1. Baseline data collection

For this study, the baseline data served as a guide to identify feasible intervention for increasing the PA levels of the participants and benchmark for assessing the outcome of the intervention. Activities included Focus group discussions for class room teachers, key informant interviews with school principals/vice principals, questionnaire administration for in-school adolescents, use of pedometers by selected students, assessment of the school policy environment using the S-PAPA tool and observation of the built environment using the SPEEDY tool. A detailed description is outlined below.

3.11.1.1 Qualitative data collection

Focus group discussion with Classroom Teachers

At baseline, six focus group discussions (FGD) were held with teachers in selected public and private project schools (3 each in the experimental and control group). The participants were provided detailed information on the objectives of the study and assured of their confidentiality and other ethical issues. Request for permission to use digital voice recorded was made and verbal consent was obtained from all the discussant. Participants' names were not obtained but number was assigned to them for easy identification. The discussions were very interactive without any discussant undermining others opinion.

The focus group discussions were held within the school premises at comfortable venues free of distraction and noise. Each FGD session had a group of discussants ranging from six to ten and lasted for a mean duration of 45 minutes. The doctoral student moderated all the FGD sessions supported by a note taker who documented key issues and non-verbal cues.

Key Informant Interviews (KIIs) with school principals

At baseline, six key informant interviews were held with Principals/Vice principals in selected public and private project schools (3 schools each in the experimental and control group). The key informant interviews were held within the school premises at comfortable venues free of distraction and noise. After providing the participants with detailed information on the objectives of the study and assurance of full confidentiality of disclosed information, request for permission to use digital voice recorded was made. Verbal consent was obtained from all the discussant and the mean duration for the KII session was 30 minutes. The doctoral student moderated all the key informant interviews and a note taker documented the key points from the discussion verbatim.

3.11.1.2. Quantitative data collection

Questionnaires administration for students

The administration of the questionnaires was carried out over a period of 2 weeks each at the experimental and control group. At baseline, data collection was done in May 2016. First, a letter of introduction to the Principals was obtained from the Ministry of Education and the Local Inspector of Education Officer in each LGA. This enabled the doctoral student to obtain the co-operation of the principals and fix dates for questionnaire administration. In the school, after the sampling procedure, students were given a consent form to take home. The parents were required to sign the consent form and students were expected to return it to school within a week. Over one thousand four hundred copies were distributed to students and all the students returned them within a week. Extra copies were given to the designated support teachers to give to students who misplaced the consent forms.

On the assigned dates, the selected students were assembled into a hall and unique identifiers/codes were assigned. The unique identifiers/codes were recorded in a logbook and also written on their questionnaires. The trained Research Assistants who had a background in nursing or medical physiology took their blood pressure readings and weight as per the protocol for the study. Other RAs assessed their height, abdominal and hip circumference and these were recorded in the

questionnaires. After this process, the students sat in groups according to their classes with sufficient spaces to ensure privacy and a research assistant was assigned to each group to support questionnaire administration. The questionnaires were guided and self-administered. This was done to ensure the respondent's confidentiality and also to help them provide authentic answers to the questions asked. Specifically, a lead RA reads out the question in English and explained in Yoruba while the RA assigned to the group assisted in addressing any challenges or cases whereby the students had difficulty comprehending any question. During questionnaire administration, the doctoral student continuously assured the respondents of their anonymity and confidentiality. In total, one thousand, three hundred and eighteen (1318) questionnaires were administered- 666 in the EG and 652 in the control group.

After the questionnaire administration, eligible students were taken to the field for the multi stage fitness test. On average, the data collection procedure lasted an average of one hour and 40 minutes in each school and 6 RAs supported data collection process in each school.

Pedometers

A subsample of respondents (100) who participated in the data collection were jointly selected by the doctoral student and school authority to use a pedometer for seven days except during sleep and water based activities. The criteria for selecting the students have been described earlier; this enabled the measurement of the steps counts which is an objectively verifiable physical activity level. Step counts data were retrieved for 96 and 93 subjects at baseline and end line data collection respectively.

Questionnaire administration for Physical and Health Education Teachers/School designee

The Physical Health Education Teacher or a staff designated by the school completed a self-administered tool to assess PA implementation in school. The tool, specifically

the S-PAPA tool covered key issues such as schools, level of funding, the extent of implementation of physical activity policies and programmes in schools and the frequency of engagement in structured and unstructured physical activity. The doctoral student was always around to clarify issues and points documented in the S-PAPA tool.

Observation

The School built environment was assessed using the SPEEDY tool. This tool was used to assess the school physical environment (aesthetics, walking paths, play area etc.) and availability of sporting facilities. Two research assistants completed the tool with the help of a designated teacher. These ensured that intra-observer errors were reduced to the minimum. The two trained RAs completed the tool in all the 22 project schools.

3.11.2. Endline data collection

Immediate post intervention evaluation was conducted in April 2017 at the 22 project schools. This activity was held at the end of the 12-week intervention. Specifically, students enrolled in the study were identified using the unique codes/identifiers recorded in the logbooks. Only students enrolled in the study participated in this phase. The only exception was that students were not required to submit a consent form. For this phase, the only research tools used was the physical activity questionnaire (PAQ) for students and the process adopted at baseline data collection was replicated during the end line data collection. However; there was an additional component which had questions to assess other sources of PA information in the last three months for both the EG and CG. In addition, students in the EG had questions which assessed the extent to which they enjoyed the intervention programme as well as the perceived effect of the educational materials on their motivation to be physically active. Participants selected at baseline also used the pedometers at the end line data collection. At end line data collection, nine hundred ninety-five (EG=493; CG= 502) participants completed the physical activity questionnaire (PAQ) while data for step counts were retrieved for 93 participants.

3.12Intervention protocol

The intervention involved three phases- the pre-intervention which consisted of a participatory process to conceptualise and develop the intervention; implementation of the intervention and follow-up activities.

3.12.1. Pre-intervention phase

The findings of the baseline data guided the development of the multi-level intervention targeting the policy makers specifically the officials of the Ministries of Education School Heads and Physical and Health Education Teachers and the students. The design of the intervention was guided by the principles of the multi-level intervention.

A multiple response question was included in the baseline questionnaire for students to identify three preferred activities for increasing PA levels. Suggested activities in the questionnaire were identified based on literature (Sallis, Mckenzie and Conway *et al.*, 2003; Toftager *et al.*, 2011; Pardo, García , Lanaspa, Bush, Zaragoza Casterad., Clemente and González, 2013). .According to the result from the participants, the two highest preferred activities were the provision of educational materials for students (17.7%)and training programme for students on how to be physically active (16.8%) (See Table 8). In a bid to involve the school authorities and relevant officials of the ministry of education, a meeting was held to disseminate key findings of the baseline study and design the intervention.

Table 8: Respondent's preferred intervention activities to improve physical activity in schools

Variables	Count (Yes)	Percentage of responses
Provision of educational materials (i.e. posters and handbills) for students	354	17.7%
Film show on different types of physical activity	271	13.6%
Special dance events in schools	326	16.3%
Experience sharing by role models i.e. athletes	278	13.9%
M health _ sending text messages (SMS messages) as reminders	84	4.2%
Training programme for students on how to be physically active	336	16.8%
Empowering students to develop fun activities aimed at promoting PA	317	15.9%
Others	32	1.6%
	1998	100%

3.12.2 The intervention phase

3.12.2.1. Dissemination meeting with school authorities and officials of the Ministry of Education

Stakeholder engagement is a critical, initial activity in a multi-level intervention targeted at individuals who have a critical policy or leadership roles with a potential to influence the achievement of the intended objectives. Several approaches can be utilised including one-on- one or group meetings, presentation of data and policy actions using PowerPoint, policy briefs and fact sheets (Paskett, Thompson, Ammerman, Ortega, Marsteller and Richardson, 2016; Hamilton, Brunner, Cain, Chuang, Luger, Canelo, and Yano, 2017).

In line with this, a dissemination and dialogue meeting was held on the 12th of January, 2017 at the training room of the African Regional Health Education Centre, Department of Health Promotion and Education, University of Ibadan to share the baseline findings of the study and solicit the support of the school authorities and officials of the State Ministry of Education for the conduct of the study. In attendance were 29 attendees comprising officials of Ministry of Education, School Vice Principals/Principals, Teachers and selected students from the experimental group. The meeting was organized to present the baseline findings, raise awareness of the burden of physical inactivity among relevant stakeholders and solicit the support of the Officials of the Ministry of Education and School Authorities to design and implement the multi-level intervention. The participants had opportunities to clarify issues emanating from the baseline data. Subsequently, the school authorities and Officials of the Ministry of Education pledge their support publicly for the design and implementation of the intervention.

3.12.2.2. Meeting for the design of the multi-level intervention

A meeting was held on the 31st of January, 2017 at the training room of the African Regional Health Education Center, Dept. of Health Promotion and Education, University of Ibadan. The meeting was held with 20 representatives of the 11 intervention schools in Ibadan and selected students to jointly deliberate and develop the strategies and activities for the multi-level intervention using participatory approaches. At the meeting, the team decided on some activities based on a critical analysis of the baseline findings taking into cognisance the contextual issues in the public and private schools as well as the preferred activities indicated by the students. After an extensive deliberation, the following activities outlined below were selected:

- Design and distribute educational materials to students
- School-wide sensitisation of students on physical activity using PA banners hung at strategic places as well as other opportunities such as the co-curricular period.
- Conduct of Teacher-led PA sessions for students on physical activity using the Physical Activity Guide and other educational materials

- Conduct of a debate titled " *Gender and participation in Sports"*
- Health talk and medical screening for Teachers to provide education on the prevention of NCDs. This event was proposed as an opportunity to create a supportive social environment for PA and solicit the support of teachers for the implementation of the activities considering their critical roles in the school settings. The participants at this meeting informed that medical screening was a strategic way of ensuring teachers attended the health talk and this justified its inclusion.

At the school level, a coordination committee was set up to facilitate the implementation of the activities. The intervention phase spanned three months and a post intervention evaluation was conducted immediately post intervention to assess the outcome of this intervention. Some components of the intervention were implemented school-wide however; the baseline and post interventions measurement was only taken for the selected respondents enrolled as the cohort or index children at the commencement of the study.

3.12.2.3. ***Development of physical activity Information Education and Communication (IEC) material for students***

Effective IEC programmes are based within the overall context of the programme goals and require a systematic assessment of the target audience and their participation (WHO, 2000). For effective IEC materials development, data and input from the target groups are used to determine the messages and the medium and channels needed to convey them. This information is used to guide message development and the selection of the channel of communication. In addition, the data generated is used to develop a prototype message in collaboration with the target audience and this is pretested among them or their representative who share similar characteristics. Subsequently, the materials are revised based on the feedback from the pretesting exercise and further pretested before the final production of the materials (WHO, 2000).

The steps suggested by the World Health Organisation for IEC materials Development guided the process of message development for this study (WHO, 2000). Specific materials design steps adopted in this study included:

(i) ***Analysis of the baseline data to identify the gaps in the behavioural antecedent factors***

There was a preliminary analysis of all the statements for the behavioural antecedent factors to identify gaps in the cognitive (*i.e. knowledge*) and affective (*i.e. attitude, self-efficacy etc.*) domains. The analysis was a frequency distribution of all the statements for each of the variables (knowledge, attitude, self-efficacy etc.).

Any statement with less than 65% of the respondents selecting a favourable response which supported PA was identified as gaps. For instance, with regards to attitude, only 30.2% and 24% "disagreed" and "strongly disagreed" respectively that *"Physical activity is not good for females, it makes them muscular and look like males";* hence almost 45% of the response was either in support or were unsure. With regards to self-efficacy, 21.9%, 11.0% and 4.5% were "Not sure", "Not Confident" and Extremely Not confident" respectively to "*set aside time for a physical activity programme for at least 60 minutes, every day of the week"*

This approach was adopted in identifying gaps which a behavioural change intervention could address.

(ii) ***Participatory design of the prototype messages in collaboration with the beneficiaries and relevant stakeholders (students and school authorities)***.

During the meeting held on the 31st of January, 2017 with 20 representatives comprising selected students, teachers and a graphic artist to develop the educational materials. The findings from the preliminary analysis of all the statements for the behavioural antecedent factors were presented to this group and they corroborated the result. Participants at this meeting in collaboration with the doctoral student jointly developed messages to address these gaps and the graphic artist provided graphical illustrations supporting the messages. One of the students from the private

school had basic skills in sketching images and he supported the graphic artist in illustrating the messages. At this meeting, the participants suggested modifications to the messages and graphics as needed and the doctoral student worked further with the graphic artist to design two educational materials – a cartoon titled *"60 minutes a of Exercise and Play Every day"* and a guide titled *"Physical Activity for Health Promotion: A guide for Students".*

The cartoon storyline which was developed in collaboration with the students depicted five characters/students. According to the storyline, there were 5 students - 2 males (Kola and Mustapha) and 3 females (Titi, Chioma and Halima) who were walking to schooland they had a discussion on physical activity which prompted and motivated them to be active(See appendix XII).

The *"Physical Activity for Health Promotion: A guide for Students"* on the other hand, outlined key issues such as *the definition of physical activity, places where physical activity can occur, levels of physical activity, the concept of "couch potato", benefits of being physical active, physical activity which require and well as those which do not require exercise, basic facts on physical activity to correct myths and misconceptions, examples of celebrity role models who are physically active a and a game puzzle to identify diseases and health conditions associated with physical inactivity"* (Sample in the appendix XIII).

(iii) ***Pretesting of the developed message with the beneficiaries and relevant stakeholders (students and school authorities)***

Consequent upon the development of the two educational materials, it was pretested in one public and one private intervention schools (*Sacred Heart School, Oode Olo and Tobi International School, Jericho*). Twelve students (6 per school – *3 males and 3 females in JSS and SSS classes*) and 3 Teachers who were at the educational materials development meeting were given the materials to read and critique. The selected students comprised a mix of those who did not attend, and those who participated at the educational materials development meeting. The students and the

teachers read both materials and provided their views on areas which were appropriate and those to be modified.

(iv) ***Revision based on the feedback of the pre-test exercise***

Based on the feedback from the pretesting exercise, the doctoral student worked with the graphic artist to effect the suggested corrections and produced a new draft of the educational materials.

*(v)****A repeat of the pretesting exercise***

These materials were subsequently pre-tested again in some of the project schools. Six students (*comprising four who participated in the initial pre-test)* reviewed the materials again before final production and distribution. In addition, four Lecturers at the Department of Health Promotion and Education including the Supervisor of the doctoral student reviewed the educational materials for content validity, acceptability and relevance to the target audience.

(vi) ***Revision and production of the educational materials***

A final revision was effected based on all input and Seven hundred and fifty copies each of the cartoon titled*60 minutes of Exercise and Play Every day"* and "the guide *"Physical Activity for Health Promotion: A guide for Students"* were produced and student enrolled in the study were given a copy each of both materials. Extra copies were given to the Teachers.

3.12.2.4 Teacher-led session on physical activity

Teachers who participated in the dissemination workshop and educational materials development workshop conducted the teacher-led sessions on physical activity using the developed guide - *"Physical Activity for Health Promotion: A guide for Students"*. The students had six contacts/classes over 12 weeks (average of 30 minutes) using the physical activity guide coupled with the cartoon which they could read at their convenience. All the students were given a copy of the Physical activity guide and instructed to bring it whenever they had the training sessions/classes with the teachers. Classes were held during the designated extra-curricula period for each

school usually on Wednesdays or Thursdays. During each class, the following modules/sessions were discussed using the Physical Activity Guide and a reference material developed for Teachers (See appendix XII).

- **Session 1**: Introduction, the definition of physical activity, places where physical activity can occur,
- **Session2**: Levels of physical activity and benefits of being physically active
- **Session 3**: The concept of "couch potato" and a puzzle game to identify diseases and health conditions associated with physical inactivity"
- **Session4**: Different types of physical activity which require as well as those which do not require equipment
- **Session 5**: Basic facts on physical activity and discussions to correct myths and misconceptions,
- **Session 6:**Examples of celebrity role models who are physically active

The teachers read the physical activity guide during the class sessions and explained further using the content of the reference material. Students, on the other hand, read along from their copies. They were also expected to complete a take home assignment on a game puzzle to identify the different types of diseases associated with physical inactivity. In addition, the students had opportunities to demonstrate simple exercise which they could engage in which does not require equipment. On the average, 5 minutes out of the 30 minutes devoted to each session was used for simple physical exercises like dancing, stretching, jogging on the spot etc.

The sessions were participatory and several training methodologies such as brainstorming, discussion, demonstration and return demonstration and role plays were used for the delivery of the sessions. The participants had opportunities to ask questions and clarify issues of concerns. This process was monitored by the doctoral student and the research assistants through visits and the teachers regularly sent pictures of the training held via WhatsApp social media application.

3.12.2.5. Provision of sporting materials to students

Thirty-three footballs (3 per school) and 55 skipping ropes (5 per school) were purchased from the open market (Ogunpa market) and provided to the students. These sporting materials were kept with the teachers with the joint agreement that all students be given the opportunity to use them even if they are not enrolled in the study. It was also agreed that students should use the sporting materials only break time and extra-curricular periods. Large banners (5 by 4 feet; 2 per school) on the importance of physical activity were produced and hung at strategic places in schools (Sample in the appendix XIII).

3.12.2.6. Health talk and medical screening for teachers

Within a two-week period in February 2017, health talk sessions and medical screening specifically *blood pressure measurement, body mass index and assessment of abdominal obesity* were held for 182 Teachers across the 11 intervention schools. The Teachers also benefited through health talks and counselling on the increasing burden of NCDs and the importance and types of physical activity they can engage in. The aim of this activity was to create a positive social support for PA in schools.
Teachers who had health concerns especially high blood pressure readings were counselled by trained Nurses referred to health facilities for further care.

3.13.0 Monitoring of the intervention

The intervention activities were monitored through phone calls, WhatsApp messages to teachers to remind them to hold the class sessions and bi-weekly visits to schools to meet with the Teachers facilitating the training session to verify the implementation of the activities.

A gap noted at the commencement of the training sessions was that some students did not turn up for the sessions because they were not informed. To address this, the teachers were instructed to hand over a copy of the list of enrolled students to a responsible student, usually, a school prefect who had the mandate to always inform the students a day before the sessions about the time and venue for the classes. In addition, the teachers had a make-up session for those who missed any class. In

addition, each class commenced with a brief recapitulation of key issues discussed at the previous class.

In addition, some students misplaced their guides and these were replaced. Some classes could not hold at the scheduled time due to other conflicting assignments which the teachers had, to address this, they were encouraged and followed up to hold the class and the school authorities were continuously engaged to provide support to the teachers.

Control group

The control group received no intervention but students in the junior secondary school level received the standard physical health education classes in line with the curriculum of the Oyo State Ministry of Education.

3.14.0 Follow-up after the intervention

The experimental and control groups were followed after the 12^{th}week of the intervention. At the end of the follow-up period, immediate outcome evaluation was conducted with participants using the same questionnaire used at baseline for data collection with additional components which had questions to assess other sources of PA information in the last three months for both the EG and CG. In addition, students in the EG had questions which assessed the extent to which they enjoyed the intervention programme as well as the perceived effect of the educational materials on their motivation to be physically active.

3.15.0. Data management

Unique identifiers were assigned to the questionnaires for easy identification and recall of the instrument which were stored in jute bags placed in a closed cabinet. A coding guide was developed for sections of the tools which were open ended before data entry. Prior to data entry, all administered instruments were reviewed for random and systematic error and corrections made. Data were cleaned and coded and stored in a password secured computer for analysis.

Two statistical soft wares -the Statistical Package for Social Sciences version 22 and STATA version 11 were used for quantitative data entry and analysis. The anthropometric variables were computed using the World Health Organisation (WHO) reference population, 2007 software (Anthropometric Software Program, Version 1.0.4 (World Health Organisation, 2007).

For the qualitative data, the doctoral student listened to the interviews and compared to the transcription to identify errors/discrepancies found in the data. The transcribed data was cleaned and saved in word format. Identification codes were assigned to all individual records including audiotapes, transcripts and demographic information. Data was backed up in external saving devices and the cloud. The NVIVO software was used for coding and data analysis.

3.16.0. Method of data analysis

Descriptive and inferential statistical analysis methods were employed to analyse the quantitative data. Guided by the research questions and null hypothesis which was set at p=0.05, quantitative data were analysed and comparison of data was implemented at three levels viz: 1. baseline assessment of experimental and control groups 2. end line assessment of experimental and control groups and 3. comparison of baseline and end line assessment in experimental and control groups. The decision rule was that, if $p \leq 0.05$, then the null hypotheses will be rejected in favour of the alternative hypothesis.

For the quantitative data, there were two key primary outcome variables specifically step count measured with pedometers which is a continuous outcome variable and self-reported physical activity level which was used either as a continuous variable of an ordered categorical variable depending on the statistical test, details in Table 9.

The self-reported physical activity level was categorized into low physical activity level (<1 to ≤ 1.9), moderate (>1.9 to ≤ 3.9) and vigorous (>3.9) (Adeniyi *et al.*, 2011). For the multilevel mixed-effects linear regression, self-reported physical activity level was treated as a continuous variable. The categorisation of the

knowledge and behavioural antecedent factors was done using the 50th percentile as the cut off while the environmental and policy variables were split into two equal parts (See Table 10). For this study, the data obtained from the multi-stage fitness test was analysed as a continuous variable with higher figures indicating higher physical fitness (Andrade, Lachat, Ochoa-Aviles, Verstraeten, Huybregts, Roberfroid, Andrade, Van Camp, Rojas, Donoso, Cardon and Patrick Kolsteren, 2014).

The prevalence of overweight and obesity was determined using the WHO Body mass index for age Z scores for school age children. According to the WHO cut off points; overweight was considered to be >+1SD (equivalent to BMI 25 kg/m2 at 19 years), Obesity: >+2SD (equivalent to BMI 30 kg/m2 at 19 years), Thinness: <-2SD Severe thinness: < -3SD and Normal: > -1 to < +1 SD. A waist-to hip ratio ≥0.85 cm was the cut-off for overweight/obesity (WHO, 2008) while the systolic and diastolic blood pressures ≥ than the 90th percentile (120/80) was categorised as high (National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents, 2004).

The univariate analysis which describes the qualities of a variable at a time was used to answer all research questions through frequency and descriptive test (mean, median and standard deviation). Bivariate analysis (cross tabulation) was used to compare the differences in proportions of the primary and secondary outcome measures of the intervention and control groups. Chi-square test (X^2) was used for significance testing of the self-reported physical activity levels and other categorical independent variables while student t-test was used for step count (average steps/day) and multi stage fitness test scores. In order to assess the magnitude of the intervention, Cohen's *d* effects size estimates were calculated for differences in the mean of the primary and secondary outcome measures in the EG and CG (Cohen, 1988; Fontaine, Conn and Clauw, 2010).

At post evaluation, the effect of the intervention was tested using multilevel mixed-effects linear regression for repeated measures which adjusted for relevant potential

confounding factors. This approach ensures that the longitudinal and hierarchical structure of the data was considered in the analysis. Because of the cluster structure of the data, random effects for the cities and schools was included in all analyses.

Multilevel mixed effect model was used to determine predictors of physical activity and it accounted for lack of independence among the groups (students nested within schools). The mixed model contains both fixed and random effects. The fixed effects are similar to standard regression coefficients and are estimated directly. The random effects are not estimated directly but summarized in terms of estimated variances and co-variances e.g. random intercepts or random coefficients.

Five models were built, model 1, model 2, model 3, model 4 and model 5 (final model).

Model 1- variables include physical activity score (dependent variable) and independent variables were city, time (pre or post intervention) and interaction of city with time

Model 2- variables include physical activity score (dependent variable) and independent variables were city, time (pre-or post intervention), interaction of city with time and socio-demographic variables and behavioural antecedent factors.

Model 3- variables include physical activity score (dependent variable and independent variables were city, time (pre-or post intervention), interaction of city with time, socio-demographic variables, behavioural antecedent factors and school policies variables

Model 4- variables include, physical activity score (dependent variable) and independent variables were city, time (pre-or post intervention), interaction of city with time, socio-demographic variables, behavioural antecedent factors, school policies variables and built environment variables

Model 5 (final model) includes all significant variables from the analysis. In addition, likelihood ratio test (LR test) was used to determine which parameter contributed significantly and should remain in the model.

The general stata syntax used for the models was
mixed fixed || schreserve: || code: , options
(options= standard variation, variance-covariance structure, maximum likelihood).

All models included two random intercepts (school identification code and Individual code). An unstructured variance-covariance structure was assumed. No slope was added to the models because the random intercepts are sufficient to pick up the dependency. Maximum likelihood was used to estimate the parameters. Maximum likelihood has the ability to handle unbalance or missing data. For all models, 95% confidence intervals for the coefficients were reported. The overall effect of the intervention in the two groups was determined using testparm (a stata command that performs wald test). It tests the hypothesis after the final multilevel model whether coefficients in 2 variables (city and city interaction with time) are equal or not.

For the qualitative data, tentative aprioi themes were identified based on the research objectives and how often some features reoccurred in the data but these were modified to capture memorable and useful outliers' comments which may help aid the understanding of the data. These themes guided coding and data analysis.

Table 9: Description of outcome measures

	Description of outcome measures	**Type of Variable**
Primary Outcome Measures	The self-reported pattern of physical activity levels	Continuous or Ordered categorical
	Step count (average steps/day)	Continuous
Secondary Outcome Measures	Anthropometric Measurements (measured using body mass index)	Ordered categorical
	Children's fitness level	Continuous
	knowledge of the health benefits of physical activity	Continuous or Ordered categorical
	Attitude toward Physical activity	Continuous or Ordered categorical
	Self-efficacy	Continuous or Ordered categorical
	Perceived behavioural control	Continuous or Ordered categorical
	Social Norms and Social support,	Continuous or Ordered categorical

Table 10 : Categorisation of the scores for the behavioural, environmental and policy variables

Variable	Maximum Score	Categorisation of scores	
		Low/Negative	High/Positive
Knowledge and behavioural constructs			
Knowledge	10	<8.5	≥8.5
Attitude	90	<67	≥67
Perceived Behavioural Control	20	<15	≥15
Self-efficacy	50	<38	≥38
Subjective Norms	40	<32	≥32
Family support	12	<7	≥7
Friend support	12	<6	≥6
Teacher Support	9	<4	≥4
The school built environment constructs			
Walking Provision	5	<3	≥3
Cycling Provision	13	<7	≥7
Aesthetics	25	<12	≥12
Sport and facility provision	12	<6	≥6
Other facility	10	<5	≥5
Design of the school grounds	9	<5	≥5
Policy Constructs			
Formal Physical Health Education Policies	22	<11	≥11
Physical Health Education Content, Curriculum and Delivery	57	<28	≥28
Formal policies on break time	20	<10	≥10
Break time utilisation	15	<7	≥7

3.15 Limitation of the study

The conduct of this study was not without limitations. According to the research proposal, the multi-level intervention should commence one month after data collection. The one month is expected to serve as the timeline for data entry and preliminary analysis of the baseline data. However, immediately after baseline data collection, teachers in the public education sector embarked on a four- months strike from June to October 2016. On resumption, schools were not ready and willing to commence the intervention phase because the government gave a mandate that they must complete the ongoing 2nd term and commence and complete the third term within a short duration. Furthermore, the teachers reportedly were owed outstanding

salaries and there was a widespread apathy towards taking up additional activities. Due to this, the school authorities advised that the subsequent phase of the study should be postponed to December 2016 or January 2017.

In addition, the government gave a mandate that any student in Senior Secondary School 2 (SS2) who failed either Mathematics or English Language must repeat. Unfortunately, most parents/guardians withdrew their students. This situation had implications for the students enrolled in the study. For instance, forty-eight students in the EG and fifty-three in the CG left public secondary schools and enrolled in private schools in order to qualify and sit for the West African Examination Council and they were lost to attrition. An attempt was made to track them but the public schools did not have their new contact details. Fortunately; three (2 in the EG and 1 in the CG) were located by chance in the new private schools they had registered.

Secondly, as planned in the research proposals, Physical Health Education teachers were expected to coordinate and implement the intervention in schools considering their significant knowledge in this discipline and their potential to devote more time to field based physical exercise. Unfortunately, some schools did not have PHE teachers but the schools addressed this by designating other subject teachers who had interest in physical exercise especially those involved in coordinating sporting activities in school.

Thirdly, some studies in adolescents which compared subjective and objective measures of physical activity found acceptable correlations between self-reports and accelerometers for moderate physical activities but low correlations for vigorous activities with a tendency for adolescents who are inactive to overestimate their active times (LeBlanc and Janssen, 2010; Manios, Androutsos, Moschonis, Birbilis, Maragkopoulou , Giannopoulou, Argyri, and Kourlaba. 2013). The most valid measurement is objectively measured physical activity using pedometers and accelerometers. However, due to funding limitations, only a few of the respondents used pedometers to document their PA levels. For instance, a pedometer and a safety latch cost $17.00; purchasing a pedometer for all the 1318 participants in this study

will cost $22,406.00. To guide against false data due to over reporting, the respondents were repeatedly encouraged to be factual while completing the questionnaires. This approach sufficiently guided against over reporting thus ensuring that the data on self-reported PA was valid. In addition, some of the respondents despite repeated information and monitoring misplaced the pedometers or reset it thus losing vital information on their PA levels.

CHAPTER FOUR

RESULTS

This chapter highlights the results of the qualitative and quantitative data obtained from the baseline and end line survey. The chapter has four distinct sections - the first section outlines the qualitative data from the conduct of key informant interviews and focus group discussions with Principals/Vice principals and Teachers respectively. The second and third section covers the quantitative data obtained at baseline and end line respectively while the fourth section presents the key findings based on the hypotheses of the study.

4.0 Baseline findings

4.1 Qualitative findings at baseline

This section highlights the qualitative findings which reveal the perspective of the school authorities with regards to the physical activity levels of adolescents, factors influencing their PA behaviours, barrier and recommendations to improve their physical activity behaviours and health.

The physical activity level of adolescents

There were varying views from respondents with regards to the physical activity levels of adolescents in the public and private schools. Some respondents felt adolescents were active while others felt otherwise. Quotes below illustrate these views:

"I think their level of physical activity is low" Key Informant from a Public Secondary School.

"Based on what I experience every day, the students engage in physical activity during break time and some play table tennis or football" FGD discussant from a Private School.

"[In-school adolescents are] very very active but boys are more active than girls. They are very active and they want to try everything..... they want to do everything" Key Informant from a Private Secondary School.

According to the respondents, there was gender differential in the physical activity behaviours of adolescents, most discussants opined that males were more active than the females as expressed in the quotes below:

"*Boys are more active than girl. During break time, the males play football and walk around. But the girls just buy food at the vendors and at times they do minor things [minor PA] such as running around or doing "tenten*" FGD discussant from a Public School.

"definitely now, boys are more active ..... they have higher performance level than the girls" Key Informant from a Public Secondary School

Factors attributed to the gender differential in PA levels include the sexuality of the adolescents, the low social interaction by females and more devotion to academic activities as expressed in the quotes from key informants below:

"……definitely, we know that the feminine nature for females and the masculine nature of the boys influence their physical activity levels" Key Informant from a Public Secondary School.

*"……. you know some of them [Girls] are bookworm they don't always interact. Even if a boy is a bookworm, he will always be outside to show his strength……."*Key Informant from a Private Secondary School.

Another pertinent factor identified as contributing to the low physical activity level of females is the limited gender specific physical activity facilities and equipment for sporting activities in the schools as expressed below"

.....why girls are not fully involved in PA? ..... it is because for girls facilities for sporting/PA activities which they like are costly. Girls like sports like badminton but the equipment are expensive ……we can engage them to do [PA] but we are limited because of the equipment..... we don't have equipment for them [girls]. They also prefer table tennis which is costly. They also prefer volley ball which will not roughen their bodies..... they don't want to fall down [and get] dirty like boys… .... FGD discussant from a Public School.

Furthermore, the respondents in both public and private schools noted the lower levels of physical activity among older adolescents compared to younger ones as encapsulated in the quotes below:"

"*the junior ones are more playful. The senior ones spend more time on the phone. They want to show one thing or the other to their friends during the break time. But for the junior ones, they just have to play. If it is possible, they will remove their shirts, run around and play that football to their satisfaction***"** FGD discussant from a Public School

"*The senior classes [students in senior classes] have minimal PA levels. Even you can see it now from those running around. For the younger ones you have to caution them - don't make noise! don't roam around!***"** FGD discussant from a Private Secondary School.

Factors contributing to the lower levels of physical activity among older adolescents compared to younger ones were increasing age including maturity, external influences and heightened awareness of the opposite sex as expressed in the quotes below:

"they [older adolescents in the senor classes] add a bit of maturity to it. They are not as playful as the junior classes" FGD discussant from a Private Secondary School

"I think their level of physical activity is low, the senior set [senior students] are influenced by their environment and the females mix with guys [they interact with males], *it affects their physical activity levels* [they are self conscious about the males and it affects their physical activity behaviours]" Key Informant from a Public School.

Factors influencing the physical activity behaviours of adolescents

Several factors influencing the physical activity behaviours of adolescents were mentioned by the respondents including the poor dietary pattern and low awareness of the benefits of physical activity as illustrated in the quotes below:

"*There are factors that hinder them [adolescents]. The first factor is that most of them are not eating balanced diet and if you are not properly fed, you can't be physically active. Not only that, many of them are not aware of [the benefits of] physical fitness and their parents are illiterates. They don't participate in any exercise and you know that walking is part of the exercise which makes people fit. So when we look at it generally, there are some factors that hinder physical fitness [PA activity behaviours]***"** Key Informant from a Public Secondary School.

In addition, respondents opined that cultural or religious factors may influence the physical activity behaviours of adolescents as expressed in the quotes below:

"In fact, some culture would tell you are not supposed to mingle with a male, you are not supposed to mingle with a female [which may be inevitable during sporting activities] *all those things is making everybody want to hold his or her self thereby killing their health"* FGD discussant from a Public Secondary School.

This was buttressed with a case study as expressed by an FGD discussant below

"……. Yes, I had an example in my house during the last inter-house sport, so this girl was so keen she wanted to run. We had an external coach that came around and he told her that if she does not remove all these things [clothes and garments which cover the body in line with Islamic injunctions], *he won't allow her to run, before the*

next moment she removed everything and she was begging "please I want to run" and by the time she did it, she came out well in-fact I was even encouraged because I had thought that was the end for" FGD discussant from a Public Secondary School.

However, a respondent did not share the common views with regards to religion as a factor hindering PA as illustrated in the quote below:

"*I would say religion has no effect because those once that cover their hair or let me use the word devote Muslims, they participated fully it doesn't have any effect on physical activity to my own knowledge"* FGD discussant from a Public Secondary School.

Cultural barriers coupled with myths and misconceptions about the effect of physical activity on the females' physique were barriers mentioned by the respondents as expressed below:

"……. some culture doesn't participate [encourage participation] *they will say they can't expose themselves, even most especially the women…….because of the seriousness in the vigorous exercise, they believe women are weaker vessels and only men that should be active ..... in some culture……in some ethnic groups that is the belief"* Key Informant from a Public School

*"the society feels like the female body can easily be harmed or injured and because of the way the body structure is made up and the physiological issue [so they don't encourage physical activity]"*FGD discussant from a Private Secondary School.

*"and some people believe that when females participate in sporting activities, it would make them loose their virginity and their shape would change and become muscular..... this can make them barren, so there are taboos in participating [in sporting activities] ……. "*FGD discussant from a Public School.

"Some parent prevent their female children or wards from participating in sporting activities because they believe that they would not be able to give birth to a child

later on, so they prevent them from the activities" FGD discussant from a Public Secondary School.

"then another thing is the superstitious belief, some people believe that if a virgin exercises too often, she will become disvirgined. If they run too much .....it can make them look more like a man and they will gather muscle [build muscles]. So they discourage their female children that it makes them look like a man and they ask, who will marry you?" FGD discussant from a Private Secondary School.

These views highlight the peculiar challenges the female adolescents experience with physical activity.

Also of import is the respondents' viewpoint that the educational level of parents can influence their understanding of the benefit and value of PA for health. However, they noted that parents indulge their wards by making them depend on motorized transportation rather than active transportation.

"The level of education of the parents will determine the extent to which they will appreciate physical exercise. Our parents..... do they know the importance of physical exercise? Do they encourage it or do they appreciate it?" FGD discussant from a Public Secondary School.

".....*because nowadays, let me first start from the parents, many parents are indulging their wards. Instead of them to make them walk or trek a long distance, they prefer to give them money to take "okada" or to take taxi" Key* informant from a Public Secondary School.

School-related factors influencing the physical activity behaviours of adolescents

School related factors were identified as a major bane to physical activity among adolescents. According to the respondents, a lot of changes have occurred in the school settings over the years and these have detrimental effects on physical activity

and exercise among adolescents. For instance, the number of trained Physical Health Education Specialist Teachers has declined significantly and where they exist, their continuing education and professional development is not prioritised. The quotes below underscore this finding:

*"If you get to any school, in our own time, you will see at least one or two [PHE teachers] but now I need you to go and do the empirical something [research]. If you get to ten schools, let me limit it to ten schools, I don't think you can get more than two PHE teachers in all those schools""*Key Informant from a Public Secondary School

*"……. schools are very poor in that [staff development programmes] because we believe seminars and those workshop are not for PHE teachers, we just pick subjects. Seminar workshop on mathematics, seminar workshop on English, but for PHE teachers, is very very silent. The culture, the culture is going down, it's going down…... Some schools don't even have PHE teacher" "*Key Informant from a Private Secondary School

Furthermore, in most public and private schools, the delivery of physical health education classes are compromised due to more emphasize on its theoretical concepts to the disadvantage of practical demonstrations stemming largely from lack of equipment and sporting facilities and large students population without a corresponding number of teachers as opined in the quotes from respondents in the public and private schools below

"*Most schools lack the equipment. The lack it because they are not having it. Even, look at this our school for example, since we've resumed this term, there is no PHE lesson, we don't even have a PHE teacher"***….** FGD Discussant in a Private School.

"……..they are doing it [PHE] from JS1 to JSS3, but looking at that, they are not really doing more of the practical, they do the theoretical part, it is the fault of the government and the school administration, so they do more of the theory and we

can't really say they do physical activities" FGD discussant from a Public Secondary School.

"……. we have limited time for the lecture just 45 minutes so at times we teach them that 45minutes fully in the class then the practical week will be 45 minutes on the field and the students will be grouped because of the large population of the class" FGD Discussant in a Public School.

" In this school particularly. we don't have a large field and we don't have PHE teacher. I will say averagely with my knowledge, the schools I've taught, they don't really have that facility. Even if there's enough field, there's no man power" Key Informant from a Public School.

Financing was a major factor identified as limiting the availability of facilities and opportunities for PA in schools as illustrated in the quote below:

……*And infact let me tell you, …… I'm just saying this, when you admit a student to school, the student will pay N630 or something like that per year, out of that 630 naira, it is only 50 naira [per student per session] that is left for sport and when you talk about sports, you know you talk about first aid, the equipment or materials, you talk about the outing, whether extra-mural or intra-mural activities that will take place, it is all based on that N50 per studen*t**"** "Key Informant from a Public Secondary School.

Compounding the problem is the poor attitude of teachers, school heads and parents towards the delivery of physical health education as expressed in the quotes below:

"I can say people have different disposition to it. Why? because, some believe it is a waste of time ..... the time that they spend jumping and doing all those things, they can use it in doing other meaningful subjects and at times, even we [Teachers] will say what is PHE? this is not necessary? 'jumpology' what is PHE (scoffs) it is not necessary, we believe that mathematics, english, chemistry [subjects are important]

but when it comes to PHE we take it as if it is not necessary and it is not important and that is why many schools don't want to spend on it [invest in it]" FGD Discussant from a Private Secondary School

"We still have Physical Health Education [as a subject] *on our timetable but the periods may not be what we have for subjects like mathematics. If mathematics comes up five times in a week, possibly, PHE will be like three times you understand? So that is just it"* Key Informant from a Private Secondary School.

"……..*the laws are there, PHE is compulsory, it is there but the parents, the school management [*school authorities] *and the society has already decided on what is paramount [i.e. other core subjects like mathematics and English] and what is not paramount [other subjects like physical health education]"*FGD discussant from a Private Secondary School.

"It is a matter of interest ma, in, in private school it's a matter of interest, some proprietors do not believe in sporting activity except they force them to do one .....it's a matter of interest, it's a matter of interest" Key informant from a Private Secondary School.

In addition, the poor social support from teachers for physical activity in school which is linked to their interest in academic activities such as reading as well as the dislike of physical exercise were noted as influencing factors as reflected in the quotes below:

"……. many teachers, they hinder, they prevent the students from taking active part. Because even when you see these students playing ball or doing any other exercise, teachers may prevent them that they should go to the class and read even when it is time for them to do the exercise. So many teachers think that it is only reading reading reading that will help students but doing all these exercise too help them even their future career" Key informant from a Public Secondary School.

"- I think it is the attitude of teachers and school policy [which influence PA]. When I say the attitude of the teachers, let me use myself as an analogy. I don't like sports at all, you understand, even though I don't discourage students, but if I see any opportunity where the student can be taken away from the field to be back in classroom, I would support such, you understand because I don't like sports". Key Informant from a Private Secondary School.

Opportunities for physical activity promotion in schools

Other extracurricular opportunities for the promotion of physical activity during school hours specifically the assembly grounds, break time, after school and inter house sporting competitions were identified. With regards to school assemblies, the respondents in public schools expressed that PA through this avenue is no longer possible due to a policy directive from the State Ministry of Education to stop the conduct of school assemblies due to security threats but this still holds in private schools as highlighted in the quotes below:

" On Monday for instance we were on the assembly ground, we danced for complete one hour, acrobatic dancing, you understand for complete one hour. We do that on Wednesdays and Fridays. In fact on Friday, prayer is just for 2 minutes before the dancing then we have sport days which is Thursdays, we don't go to field, it is there on the assembly ground, so we consider it to be very important" Key Informant from a Private School.

"we use to have school assembly everyday but because of the security of the state we were directed to stop having it every day but we use to have it" Key Informant from a Public School

"We've cancelled it [School assembly], It has been cancelled, and they are now operating the class assembly……. [where] they will pray, they will sing the national anthem, national pledge, the school anthem then instruction…announcement will be passed to them, then the normal class work will commence that's it, so there are no

physical activity or sporting activity during that period" Key informant from a Public Secondary School

This constitutes a missed opportunity for the promotion of PA in school. Furthermore, the duration of break time which is another feasible opportunity for PA has been severely constricted due to the introduction of new subjects which expanded the curricula and competing academic time. This presents a challenge to public but not private schools as stated in the quotes below

" *and I observe that the private schools have two break times - short break and long break, then it used to be in the public schools before but now we don't have anything like that. We only have one period for the break" ..... because we have so many subjects .....those are not even useful. Do you know why I said it's not useful? take the instance of Security education [a new subject] which addresses those things you learn ordinarily as you are growing up, so the subjects are too many……*" FGD discussant from a Public Secondary School

After school sessions can also help promote PA, however according to teachers this opportunity is not explored due to the risk involved such as increased accidents due to the lack of teachers to supervise activities at this time as expounded in the quotes below

"……..There is nothing on ground for now [i.e. no supervision of after school activities] immediately after school hours we expect them to leave the school compound and go home reason being that we don't want any casualties. Even during school hours, we have problem keeping an eye on them, many of them at times get fractured hand, broken legs and so on, so we don't want such to go on…." FGD discussant from a Public Secondary School.

"……. we had an experience like that sometimes ago. It was after school. Younger students arranged to go and swim and casualties came out of it , they went to the deepest part of the river and unfortunately we lost the student even after that, they still make arrangement among themselves that is why we always ensure that

immediately after school, everybody goes home just because of that experience anyway….." FGD discussant from a Public Secondary School.

Inter house sports competition which holds potential for galvanizing school-wide interest in PA was identified. According to the discussants in the private schools, interhouse sports competition hold regularly but the frequency of its conduct in public schools has reduced drastically due to lack of funding and the aftermath crisis associated with the failure of losing teams to accept defeat in the spirit of sportsmanship. The quotes below illustrate these points:

"*We have interhouse sports competition every two years. We group them into houses, some may be for programmes like the 100m race, the basket ball, table tennis and other things. We also do gymnastics"* FGD discussant from a Private Secondary School.

"On the issue of inter-house sports, it's based on the interest of the principal, most of the principals do not like to be having inter-house sports competition" FGD discussant from a Public Secondary School.

……. there is hooliganism in sport especially during inter house sports. We have to invite all those military personnel, paramilitary to come and help out because they still talk about foul play and all that causes hooliganism." Key informant from a Public Secondary School.

"……..there was a certain period during this sport [inter house sports] and they were fighting…… the government should provide adequate security for the students to avoid fighting because during that period, students usually fight…. that is the reason why most of the schools don't like to endanger students [by conducting inter house sports] FGD discussant from a Public Secondary School

Finally, of import is the negative impact of the poor road network, increased accident risks and government policies on the conduct of marathon and cross country races as

reflected in the quote below: *" previously before the inter-house sports or during the time of inter-house sports, we usually take cross country race but that is no more due to government policies and because of the poor connectivity of the roads……. It's not safe*" FGD discussant from a Public Secondary School.

Multisectoral action for physical activity promotion in schools

Relevant government sectors such as the Ministries of Youth and Sports, Health, Urban and Regional Planning have crucial roles to play in the promotion of PA among adolescents. According to the discussants, the Ministries of Youth and Sports and Education used to jointly conduct activities to promote PA but this has declined in recent years as revealed in the quote below:

" Well, it was so in the past [ministry of sports engaging with the ministry of education to promote sporting activities in school] but these days it is not as serious as it used to be. I must confess, I shouldn't tell lie because in those days, you will see some coaches from the sport council and they engage the students in various sporting activities, it is no more there …….. "Key Informant from a Public Secondary School.

Recommendations

The discussants proposed recommendations to improve PA among in-school adolescents stressing the need for government to provide facilities in schools and enact laws or policies to enforce and designate certain periods for PA in schools. They also suggested that PA can be taken at senior classes. The quotes below highlight these views

"……government should try and provide sporting facilities for public schools because it will encourage both the students and the teachers, because without the facilities how can the teachers really teach those children or make them understand the importance of all these things, then secondly, the government can also encourage the physical activities by providing funds to public schools because it will make them to school especially in the area of salary, teachers need to be encouraged,

when you are encouraged you put in your best, I'm always saying it, if you are not encouraged, if you even buy these facilities some teachers may even go and sell them, but once they have something coming, they will want to use their own resources so that the students would benefit from it " FGD discussant from a Public Secondary School.

"……the government really has a major role to play, as there are some rules that are coming from the government that is guiding the school. There is a way the government can force it on the school to stipulate hours of the week. Let say like for this-this hours of the day probably within the week, the school should try to know how to implement physical activity/exercise as to know how they can schedule it.,,,,,,,,,So the government can try to enforce it on the schools" FGD discussant from a Private Secondary School.

" *and the government should encourage the students to be taking [the subject] or registering for PHE in their external exams*" FGD discussant from a Public Secondary School.

4.2 Quantitative findings at baseline

4.2.1 Respondents' socio-demographic characteristics

In total, 1318 students completed the questionnaires, 666 in Ibadan (EG) and 652 in Ogbomosho (CG).

In the experimental group, there were more respondents in the 10-14 years age group 445 (66.9%) compared to the CG,344 (52.8%) (P=0.00). The mean ages were 13.38±2.05 and 14.25±1.85 ($p<0.05$) in EG and CG respectively. In the experimental group, there were more female respondents, 377 (56.6%) compared to the control group 311 (47.7%)(P=0.00). The distribution of respondents by their school type showed that 467 (70.1%) in the EG and 425 (65.2%) in the CG attended public schools (P=0.55).

There were more Yoruba in the CG 628 (96.3%) than the EG 515 (77.3%) but fewer respondents who were Christians in the CG 447 (67.1%) than the EG 511 (78.4%) (P=0.00). For the educational attainment of mothers, 398 (59.8%) of those in the EG compared to 262 (40.2%) of those in the CG had Mothers who had post-secondary school education while 448 (67.3%) of those in the EG compared to 299 (45.9%) had Fathers who had post-secondary school education (P=0.00) (Details in Table 11).

Table 11: Frequency distribution of respondents' socio-demographic characteristics at baseline (N=1318)

Demographic Characteristics	Intervention (n=666)	Control (n=652)	Statistics	P-value
	No (%)	No (%)		
Age in years				
10-14	445 (66.9)	344 (52.8)	χ^2 =27.091	0.00
15-19	221 (33.1)	308 (47.2)	df =1	
Mean age	13.38±2.05	14.25±1.85		
Sex				
Male	289 (43.4)	341 (52.3)	χ^2 =10.476	0.00
Female	377 (56.6)	311 (47.7)	df =1	
School Type				
Public	467 (70.1)	425 (65.2)	χ^2 =3.670	0.55
Private	199 (29.9)	227 (34.8)	df =1	
Ethnic Group				
Yoruba	515 (77.3)	628 (96.3)		
Igbo	82 (12.3)	11 (1.7)		
Hausa	24 (3.6)	2 (0.3)		
Others	45 (6.8)	11 (1.7)		
Religion				
Christianity	447 (67.1)	511 (78.4)	χ^2 =21.124	0.00
Islam	218 (32.7)	140 (21.5)	df =2	
Traditional	1 (.2)	1 (.1)		
Mother's educational level				
	13 (2.0)	19 (2.9)	χ^2 =51.929	0.00
No formal education	42 (6.3)	63 (9.7)	df =4	
Primary	212 (31.8)	308 (47.2)		
Secondary	398 (59.8)	262 (40.2)		
Above secondary	1 (0.2)			
No response				
Father's educational				
No formal education	15 (2.3)	8 (1.2)	χ^2 =69.055	0.00
Primary	24 (3.6)	45 (6.9)	df =4	
Secondary	176 (26.4)	297 (45.6)		
Above secondary	448 (67.3)	299 (45.9)		
Non-response	3 (0.5)	3 (0.5)		

4.2.2. Self-reported physical activity behaviours of respondents

The frequency distributions for the questions are presented in Tables 12, 13 and 14 while the inferential statistics which outlines the statistical differences in the self-reported physical activity behaviours in the EG and CG is presented in Table 15.

The frequency distribution at baseline showed that 42.2% and 49.4% of respondents in the EG and CG respectively walked seven times or more in the last seven days while 30.9 % and 30.7% in the EG and CG respectively danced seven times or more in the last seven days. Furthermore, 21.8% and 16.6% in the EG and CG respectively participated in other games such as *"ten ten*", "*hide and seek"* and hopscotch "*suwe*" (Details in Table 12).

Almost a third (27.5%) in the experimental group and 34.4 in the control reported that they do not do or participate in physical health education classes; 44.9% and 43.1% of respondents in the EG and CG reported that during break time in the last seven days they always sit down talking or reading their books. Over 13% and 10.9% of respondents in the EG and CG respectively reported that they did not participate in any physical exercise right after school closes while 23.1% and 21.5% of the EG and CG stated that a description of their physical activity level in the past seven days can be best described as "*physical activity with very little physical effort"* (Details in Table 13).

With regards to their physical activity behaviours on specific days of the weeks in the last seven days, 34.9% and 35.9% of respondents in the EG and CG respectively reported that their extent of participation in physical activity on Monday was little while 32.1% and 35.6% of respondents in the EG and CG respectively also reported same for Tuesday (Details in Table 14).

Table 12: Respondents' participation in physical exercises in the last seven days (N=1318)

Variable	Intervention (n=666)					Control (n=652)				
	Not at all	1-2 times	3-4 times	5-6 times	7 times or >	Not at all	1-2 times	3-4 times	5-6 times	7 times or >
	%	%	%	%	%	%	%	%	%	%
Skipping	47.2	27.8	12	5	8	65.8	17	7.2	3.7	6.3
Walking for exercise	18.7	16.1	12.6	10.4	42.2	88.2	18.3	11.3	9.2	49.4
Bicycling	60	18.9	7.7	3.6	9.8	61.8	14.0	8.7	3.8	11.7
Jogging or running	24.3	22.4	18.8	9.9	24.6	25.7	23.3	18.4	9.7	22.9
Swimming	70.2	18.3	4.5	3.2	3.8	77.5	8.6	4.4	2.9	6.6
Dance	21.3	22.8	14.0	11.0	30.9	21.3	21.9	17.8	8.3	30.7
Football/Soccer	47.2	17.4	9.8	5.3	20.3	45.6	12.3	9.2	7.4	25.5
Table Tennis	61.5	19.7	7.2	3.9	7.7	72.2	10.0	7.1	3.8	6.9
Lawn Tennis	75.5	17.0	2.9	1.7	2.9	87.8	6.1	1.5	1.7	2.9
Basket ball	69.3	20.9	4.8	1.2	3.8	82.7	7.7	4.8	1.4	3.4
Weight lifting	70.3	18.9	5.6	1.1	4.1	68.7	14.7	7.5	3.7	5.4
Boxing	79.1	13.8	2.3	2.1	2.7	74.1	12.3	5.8	2.1	5.7
Wrestling	79.1	15.2	2.1	1.2	2.4	84.6	7.1	2.9	2.8	2.6
Sack race	71.8	17.0	5.3	2.1	3.8	82.3	8.4	4.1	1.5	3.7
Volley ball	72.9	18.0	5.1	2.0	2.0	83.5	8.6	3.2	1.5	3.2
Handball	66.5	18.8	6.5	3.5	4.7	71.6	12.6	6.6	4.0	5.2
Other games such as *Ten ten , Boju boju, Hide and seek, Fire on the mountain*	39.5	17.0	14.3	7.4	21.8	49.1	17.6	10.7	6.0	16.6
Hopscotch (Suwe)	66.4	14.0	6.6	3.2	9.8	67.9	13.2	7.1	2.9	8.9
Climbing trees/ poles/mountains	63.3	22.5	6.3	3.5	4.4	49.6	17.6	11.2	6.6	15.0

Table 13: Respondents' participation in physical activity in the last seven days

Variable	Intervention (n=666)	Control (n=652)
	No (%)	No (%)
Participation in PHE classes		
I don't do PHE	183 (27.5)	224 (34.4)
Hardly ever	100 (15.0)	181 (27.8)
Sometimes	220 (33.0)	125 (19.2)
Quite often	50 (7.5)	38 (5.8)
Always	113 (17.0)	84 (12.9)
The extent of PA during break time		
Sat down talking/reading	(299) 44.9	281 (43.1)
Stood around or walked around	85 (12.8)	115 (17.6)
Ran or played a little bit	174 (26.1)	129 (19.8)
Ran around and played quite a bit	78 (11.7)	90 (13.8)
Ran and played hard most of the time	30 (4.5)	37 (5.7)
The extent of PA right after school		
None	93 (14.0)	144 (22.1)
1 time last week	25.7 (171)	26.4(172)
2 to 3 times last week	36.1 (241)	32.4 (211)
4 to 5 times last week	10.7 (71)	8.2 (54)
6 to 7 times last week	13.5 (90)	10.9 (71)
Number of times involved in PA during the last weekend		
None	62 (9.8)	73 (11.4)
1 time	150 (22.5)	161 (24.7)
2 to 3 times	284 (42.7)	268 (4.1)
4to 5 times	155 (23.5)	149 (22.9)
6 to 7 times	10 (1.5)	0 (0)
Number of times involved in PA during the evenings		
None	95 (14.9)	128 (19.7)
1 time	178 (26.7)	177 (27.1)
2 to 3 times	234 (35.1)	222 (34.0)
0 to 5 times	150 (22.5)	122 (18.7)
6 to 7 times	5 (0.8)	3 (0.5)
Best description of Respondents' PA level in the last 7 days		
Very little physical effort	154 (23.1)	140 (21.5)
Sometimes did PA (1-2 times)	258 (38.7)	244 (37.4)
Often did PA (3-4 times)	145 (21.8)	144 (22.1)
Quite often did PA (5-6 times)	49 (7.4)	60 (9.2)
Very often (7 times or more)	60 (9.0)	64 (9.8)

Table 14: Respondents' extent of participation in physical activity for each day of the previous week (N=1318)

Variable	Intervention (n=666)					Control (n=652)				
	None	Little bit	Medium	Often	Very often	None	Little bit	Medium	Often	Very often
	%	%	%	%	%	%	%	%	%	%
Monday	30.9	34.3	14.7	8.6	11.4	31.6	35.9	19.0	8.6	4.9
Tuesday	26.5	32.1	19.8	11.1	10.5	26.1	35.6	22.7	10.6	5.1
Wednesday	25.9	27.8	22.7	14.0	9.8	28	31.1	21.5	12.7	6.7
Thursday	23.3	30.3	20.1	14.4	11.9	26.6	29.9	22.9	12.2	8.6
Friday	20.3	24.5	21.3	15.5	18.5	21.5	26.8	21.9	14.6	15.2
Saturday	18.2	21.8	15.0	17.6	27.5	20.5	22.9	18.3	17.0	21.5
Sunday	30.7	21.5	11.9	11.3	24.8	27.5	22.1	16.6	12.0	21.9

4.2.3. Comparison of self-reported Physical Activity levels between the experimental and control groups

A comparison of the self-reported Physical Activity (PA) levels of the respondents indicated that 174 (26.1%) in the EG and 172 (26.4%) in CG had low PA levels. Four hundred and eighty one (72.2%) in the EG and 475 (72.9%) in the CG had moderate PA levels while 11 (1.7%) in the EG and 5 (0.8%) in the CG had high PA levels. There was no significant difference in the PA levels of the EG and CG (P=0.34) (Details in Table 15). Males in both groups were more physically active than females, see Figure 6.

4.2.4 Comparison of objectively measured physical activity levels between the experimental and control groups

A comparison of the objectively measured physical activity levels assessed using a pedometer to measure the step counts showed that there were 46 respondents in the experimental group with an average step count of 28997.4 (±23110.7) while the control group had 50 participants with an average step count of 34204.4 (±23662.2). The independent sample t-test showed that there was no significant difference in the mean step count of both group (P=0.28) though respondents in the control had a slightly higher average step count, details in Table 16.

Table 15:Self-reported Physical Activity Levels of the experimental and control groups (N=1318)

Self-reported Physical Activity Level	Baseline (N=1318)		X^2	P-value
	EG (n=666) No (%)	CG (n=652) No (%)		
Self-reported Physical Activity Level				
Low	174 (26.1)	172 (26.4)	2.151	0.341
Moderate	481 (72.2)	475 (72.9)		
Vigorous	11 (1.7)	5 (0.8)		

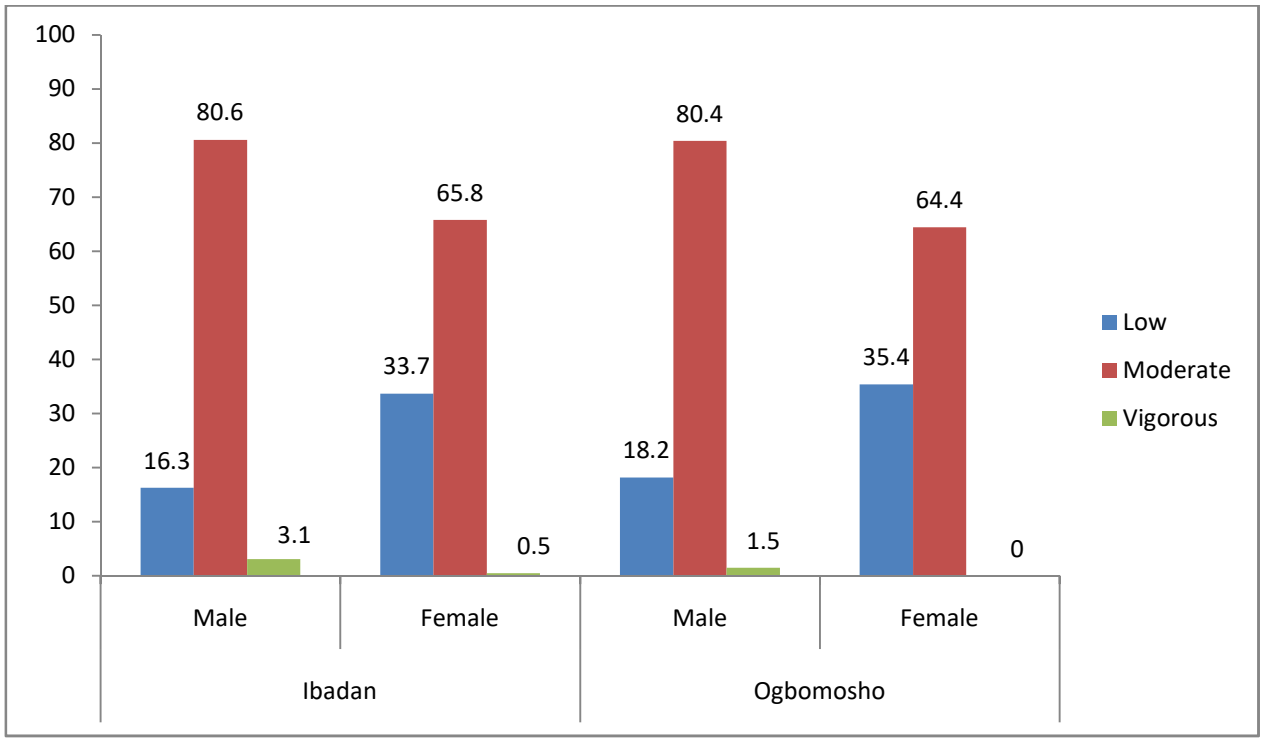

Figure 6: Percentage distribution of Self-reported Physical Activity levels of the experimental and control groups by sex (N=1318)

Table 16: Objectively measured physical activity levels of the experimental and control groups (N=96) at baseline

Objectively measured Physical Activity Level	n	Mean step counts	SD	df	t	P-value
Experimental group	46	28997.4	23110.7	94	-1.089	0.28
Control group	50	34204.4	23662.2			

4.2.5 Respondents' knowledge about Physical activity and its benefit

At baseline, knowledge about physical activity and its health benefit was measured on a 10-point knowledge scale. Table 17 describes the responses of the respondents on their knowledge of physical activity and its benefit. About 81.2% and 89.3% of the respondents in the EG and CG respectively knew that physical activity can help prevent or delay the development of high blood pressure while 90.5% and 95.4% of the respondents in the EG and CG respectively knew that young people are expected to attain at least 60 minutes of moderate to vigorous physical activity daily. Furthermore, only 55.1% in the EG and 66.5% in the CG knew that involvement in physical activity does not always require equipment. The detailed pattern of responses to the knowledge items is presented in Table 17. At baseline, the mean knowledge for the experimental and control groups were 8.4 ± 1.3 and 8.6 ± 1.1 (P=0.000) respectively.

Table 17: Respondents' knowledge about physical activity and its benefit,

Variable	Intervention (n=666)		Control (n=652)	
	Yes %	No %	Yes %	No %
Physical activity can help build and maintain healthy bones	98.0	2.0	98	2.0
Physical activity can help build muscles	95.5	4.5	95.7	4.3
Physical activity can be used to reduce body fat	92.2	7.8	92.9	7.1
Physical activity can help prevent or delay the development of high blood pressure	81.2	18.8	89.3	10.3
Physical activity can help relieve tension	91.1	8.9	92.8	7.2
Young people are expected to attain at least 60 minutes of moderate to vigorous physical activity daily	90.5	9.5	95.4	4.0
Physical activity can help improve students' concentration in class	72.2	27.8	77.5	22.5
Physical activity can be done without equipment	55.1	43.7	66.5	34.5
Dancing is a form of physical activity	94	6	96	3.7
Being physically active can help prevent boredom	84.2	15.8	87.4	12.6

4.2.6 Respondents' attitude towards physical activity

Table 18 presents respondents' attitude towards physical activity at baseline. In the EG, 18.9% of respondents strongly agreed that physical activity should not be encouraged in schools, 10.8% agreed with the statement while 12.4% were unsure. In a similar vein, 18.6% of respondents in the CG strongly agreed; 9.8% agreed while 11.7% were unsure. Almost a quarter of the respondents in the EG (*14.1% strongly agreed and 11.1% agreed)* stated that physical activity is not good for females, it makes them muscular while 21.2% were unsure. For the CG, 15.0% of the respondents strongly agreed and 12.7% agreed with the statement while 19.5% were unsure. Almost a fifth of the respondents in the EG [(*strongly agreed 13.8%); (agreed 8.3%*)] reported that they were too big to participate in physical activity while 14.7% were unsure. Similarly, about 15% of the respondents in the CG strongly agreed with the statement while 8.7% agreed. The pattern of responses to attitudinal statements is presented in Table 18.

Respondents' attitudinal inclination at baseline was measured on a 90-point attitudinal scale. At baseline, the mean attitude scores of respondents in the experimental and control group were 65.3±13.4 and 66.7±11.2 respectively.

Table 18: Respondents' attitude towards physical activity, (N=1318)

Attitude Statement	Intervention (%)					Control (%)				
	SA	A	NS	D	SD	SA	A	NS	D	SD
Physical activity can help an individual to cope with stress	37.4	31.8	21.7	5.6	3.5	46.2	29.9	11.8	6.4	5.7
Physical activity is strenuous and not fun	12.9	14.0	18.2	28.5	26.4	15.0	14.0	16.9	23.0	31.1
It provides opportunities to make new friends	31.1	39.3	17.9	7.5	4.2	44.8	32.2	12.5	6.1	4.4
Helps to keep individuals in shape	50.9	31.8	11.4	4.2	1.7	55.4	27.1	8.7	3.7	5.1
Physical activity should not be encouraged in schools	18.9	10.8	12.4	20.3	37.6	18.6	9.8	11.7	20.2	39.7
It gives students more energy	54.2	32.9	8.5	2.1	2.3	61.2	25.0	6.3	3.1	4.4
It makes students hot and sweaty	28.7	33.6	19.9	11.3	6.5	32.7	27.0	17.6	9.5	13.2
Physical activity can make students better in sports, dance or other activities	60.2	28.5	7.2	2.3	1.8	63.7	24.2	4.4	3.4	4.3
Physical activity is not good for females, it makes them muscular and look like males	14.1	11.1	21.2	29	24.6	15.0	12.7	19.5	25.2	27.3
I am now too big to participate in physical activity	13.8	8.3	14.7	28.2	35	15.2	8.7	14.9	26.1	35.1
Only Sports men and women need to participate in physical activity/exercise	11.6	10.1	14.4	29.1	34.8	15.3	11.5	10.9	22.9	39.4
Participation in physical activity make girls lose their virginity	7.8	8.0	20.9	19.2	44.1	14.7	7.1	18.9	17.3	42.0
I am always happy when we are asked to go out for physical exercises in school	53	35	6.8	3.2	2.0	62.1	28.4	3.0 %	3.7	2.8
Physical exercise should be made compulsory for students	44	33	11.5	7.4	4.1	49.7	30.5	7.5	7.5	4.8
Taking part in physical exercises and activity in school is a waste of time	7.5	8.1	15.4	29.1	39.9	12.7	6.3	16.9	26.7	37.4
Physical activity is not safe for girls during menstruation	17.9	16.1	33.9	15.6	16.5	17.9	17.9	27.5	13.8	22.9
Boys and girls who love physical exercise do not perform well in class	8.4	6.8	20.8	26.3	37.7	10.4	6.9	17.9	26.5	38.3
Physical activity/exercise easily make girls breast to sag or look like slippers	14.1	9.8	26	19.5	30.6	11.0	8.9	26.4	18.1	35.6

4.2.7 Subjective norms influencing physical activity behaviours

Subjective norms which influenced the respondents' physical activity behaviours were assessed and findings revealed that 36.9% of respondents in the EG strongly agreed that their peers/fellow students think they should be physically active during their free time on most days. On the other hand, only 27.5% felt their teachers had accepting norms with regards to their being physically active during their free time on most days. In the CG, the pattern is similar; 47.4% of the respondents strongly agreed that their best friends think they should be physically active during their free time on most days while only 34.4% felt teachers will be favourably disposed. The pattern of responses to the subjective norms statements is presented in Table 19.

Respondents' subjective norms towards physical activity at baseline were measured on a 40-point scale. At baseline, the mean score of respondents in the experimental and control group was 30.0±7.08 and 31.2±6.79.

Table 19: Respondents' subjective norms towards physical activity, (N=1318)

Statement	Intervention (n=666)					Control (n=652)				
Variable	SA %	A %	NS %	D %	SD %	SA %	A %	NS %	D %	SD %
My fellow students think I should be physically active during my free time on most days	36.9	39.6	14.1	6.6	2.7	44.2	35.7	11.4	5.5	3.2
My best friend thinks I should be physically active during my free time on most days	35.9	38.3	14.5	8.7	2.6	47.4	29.4	13.4	6.0	3.8
My physical education teacher thinks I should be physically active during my free time on most days	36.6	30.9	18.8	8.7	5.0	43.1	29.4	14	4.6	8.9
Other teachers think I should be physically active during my free time on most days	27.5	28.4	22.3	16.7	5.1	34.4	28.2	18.7	8.0	10.7
My mother or female guardian thinks I should be physically active during my free time on most days	33.2	31.8	19.5	10.2	5.3	39.0	30.5	12,4	9.2	8.9
My father or male guardian thinks I should be physically active during my free time on most days	34.1	32.0	19.7	8.9	5.3	42.0	28.4	12.3	8.3	9.0
My sister/sisters think I should be physically active during my free time on most days	30.2	33.9	19.2	11.0	5.7	39.0	32.5	12.4	8.9	7.2
My brother/brothers think I should be physically active during my free time on most days	35.3	31.7	15.6	12.0	5.4	44.5	30.1	10	7.7	7.7

4.2.8 Perceived control of physical activity behaviours

The assessment of the respondents' perceived behavioural control of their physical activity behaviours revealed that 18.9% and 25.0% in the EG and CG respectively strongly agreed that being active during their free time on most days would be challenging while 25.7% and 23.3% agreed with the statement. On the other hand, over 80% in both the EG (*strongly agreed =41.9%; agreed=40.8%*) and CG (*strongly agreed =51.7%; agreed=38.7%*) expressed that they can be physically active during their free time on most days if they want to. The pattern of responses to the statements is presented in Table 20.

Respondents' perceived behavioural control of physical activity behaviours at baseline was measured on a 20-point scale. At baseline, the mean score of respondents in the intervention and control group was 14.9±3.06 and 15.2±2.8 respectively.

Table 20: Respondents' perceived behavioural control of physical activity behaviours

Variable	Intervention (n=666)					Control (n=652)				
	SA	A	Not Sure	D	SD	SA	A	Not Sure	D	SD
	%	%	%	%	%	%	%	%	%	%
For me to be physically active during my free time on most days would be challenging	18.9	25.7	21.2	23.4	10.8	25.0	23.3	16.6	17.3	17.8
I have control over my being physically active during my free time on most days	35.3	41.0	14.1	7.8	1.8	39.3	39.1	11.2	6.4	4.0
I believe I have all the things I need to be physically active during my free time on most days	32.6	34.5	17.1	13.1	2.7	33.7	32.4	14.4	11.5	8.0
If I want to be, I can be physically active during my free time on most days	41.9	40.8	11.1	4.5	1.7	51.7	38.7	5.7	2.8	1.1

4.2.9. Respondents' self efficacy for physical activity

Table 21 presents the respondents' self-efficacy in relation to their physical activity behaviours under certain conditions. Twenty six percent of the respondents in the EG were extremely confident and 23.1% were confident in respect to their ability to be active no matter how busy their day is. In the CG, 30.2% and 25.9 were extremely confident and confident respectively in this regards. With regards to the attainment of 60 minutes of physical activity daily, 32.7% were extremely confident while 31.2% were confident of their ability in the EG compared to 32.7% and 31.2% in the CG respectively. The detailed pattern of responses to the statements which assessed self-efficacy is presented in Table 21.

Respondents' self-efficacy with regards to physical activity at baseline was measured on a 50-point scale. At baseline, the mean score of respondents in the intervention and control group was 38.3.0±7.2 and 39.2±6.5 respectively.

Table 21: Respondents' self efficacy with regards to PA behaviours

Variable	Intervention (n=666)					Control (n=652)				
	EC %	C %	NS %	NC %	ENC %	EC %	C %	NS %	NC %	ENC %
I can be physically active during my free time on most days	41.1	44.4	9.8	3.0	1.7	51.7	38.7	5.7	2.8	1.1
I can ask my parents or another adult to do physically active things/activities with me	33.5	35.9	15.2	11.6	3.8	33.9	33.0	15.5	10.4	7.2
I can be physically active during my free time on most days instead of watching the TV or playing video games	35.6	34.7	18.0	8.4	3.3	46.2	35.9	9.9	4.8	3.2
I can be physically active during my free time on most days even if it is very hot or cold outside	32.3	26.9	18.1	16.1	6.6	33.0	27.3	18	13.0	8.7
I can ask my best friend to participate in physical activities with me during my free time on most days	47.6	36.6	9.0	4.2	2.6	55.4	33.4	5.8	2.6	2.8
I can be physically active during my free time on most days even if I have to stay at home	39.6	40.4	12	5.4	2.6	48.5	35.6	9.0	4.9	2.0
I have the coordination and ability I need to be physically active during my free time on most days	37.7	35.6	18.0	6.3	2.4	44.6	34.8	10.6	6.3	3.7
I can be physically active during my free time on most days no matter how busy my day is	26.3	23.1	24.9	18.0	7.7	30.2	25.9	20.1	13.7	10.1
can set aside time for a physical activity programme for at least 60 minutes, every day of the week	32.7	31.2	20.9	10.8	4.4	37.1	28.8	19.3	9.7	5.1
I can get up early, even on weekends, to exercise	38.6	29.4	14.3	11.1	6.6	40.8	27.8	14.7	8.3	8.4

4.2.10 Social support for respondents' physical activity behaviours in the last three months

The respondents' social supports for physical activity were assessed from three dimensions, family, friends and teachers at baseline.

According to findings on family social support for physical activity, 55.% and 57.5% of the respondents in the EG and CG stated that their family members discussed physical activity/exercise with them in the last three months ; 55.6% and 60.% of the respondents in the EG and CG reported that family members talked about how much they like to be physically active and fit. Furthermore, respondents reported that family members expressed that it was improper to be physically active - 26.4% and 25.4% in the EG and CG respectively. The detailed pattern of responses to the statements which assessed family social support in the last three months is presented in Table 22.

Family social support at baseline was measured on a 12-point scale. At baseline, the mean score of respondents in the experimental and control group was 5.67±2.69 and 6.12±2.64 respectively.

With regards to social support for physical activity from friends in the last three months, 61.1% in EG and 72.2% in the CG indicated that their friends had discussed physical activity with them in the last three months respectively. In a similar pattern, 61.1% in EG and 72.7% in the CG indicated that their friends had exercised with them. Furthermore, 45.8% in the EG and 57.1% in the CG stated that their friends had encouraged them to continue with their exercise programme. The detailed pattern of responses to the statements which assessed friends' social support in the last three months is presented in Table 23

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Friends' social support at baseline was measured on a 12-point scale. At baseline, the mean score of respondents in the experimental and control group was 5.69±2.94 and 6.91±2.69 respectively.

In relations to Teachers' support for physical activity in the last three months, 43.8% and 52.3% in the EG and CG indicated that their Teachers had discussed physical activity/exercise with them in the last three months while 31.1% in the CG and 29.1% in the EC stated that they gave them helpful reminders to exercise or be physically active. Over 40% in the CG and 32.5% in the EG stated that the Teachers had included exercise on recreational outings/school excursion activities. The detailed pattern of responses to the statements which assessed Teachers' social support in the last three months is presented in Table 24.

Teachers' social support at baseline was measured on a 9-point scale. At baseline, the mean score of respondents in the experimental and control group was 3.58±2.27 and 3.69±2.15 respectively.

Table 22:Family social support for respondents' physical activity behaviours in the last three months

Variable	Intervention (n=666)			Control (n=652)		
	Yes	No	Can't Remember	Yes	No	Can't Remember
	%	%	%	%	%	%
Discussed physical activity/exercise with me	55.6	29.1	15.3	57.5	30.2	12.3
Offered to exercise with me	44.9	37.4	17.7	45.4	40.2	14.4
Exercised with me	48.3	30.2	21.5	48.6	32.1	19.3
Gave me helpful reminders to exercise or be physically active (e.g. "Are you going to exercise today?")	47.4	35.3	17.3	47.2	41.0	11.8
Gave me encouragement to stick with my exercise programme.	45.5	39.5	17.3	51.3	36.9	11.8
Complained that the time I spend exercising was too much	33.0	52.7	14.3	39.3	50.6	10.1
Complained that the time I spend exercising was too little	28.8	55.4	15.8	32.3	55.3	12.4
Criticized me or made fun of me for exercising	27.9	57.1	15.0	30.8	54.4	14.8
Told me it was not proper to exercise/be physically active	26.4	59.8	13.8	25.4	61.7	12.9
Gave me rewards for exercising or being physically active (bought me something or gave me something I like).	46.4	39.2	14.4	50.5	40.2	9.3
Included exercise on recreational outings/school excursion activities	48.3	34.6	17.1	51.2	37.9	10.9
Talked about how much they like to be physically active/exercise/or be fit.	56.6	27.0	16.4	60.0	25.8	14.2

Table 23: Friends' social support for respondents' physical activity behaviours in the last three months

Variable	Intervention (n=666)			Control (n=652)		
	Yes	No	Can't Remember	Yes	No	Can't Remember
	%	%	%	%	%	%
Discussed physical activity/exercise with me	61.1	18.0	20.9	72.2	15.0	12.8
Offered to exercise with me	60.7	17.7	21.6	71.5	15.0	13.5
Exercised with me	61.1	13.7	25.2	72.7	10.1	17.2
Gave me helpful reminders to exercise or be physically active	52.3	25.2	22.5	63.5	23.8	87.3
Gave me encouragement to stick with my exercise programme.	45.8	29.7	24.5	57.1	29.6	13.3
Complained that the time I spend exercising was too much	22.1	54.4	23.5	31.6	56.3	12.1
Complained that the time I spend exercising was too little	30.8	46.5	22.7	33.9	50.9	15.2
Criticized me or made fun of me for exercising	27.6	50.2	22.2	34.2	49.7	16.1
Told me it was not proper to exercise/be physically active	23.9	51.2	24.9	24.8	57.4	17.8
Gave me rewards for exercising or being physically active	34.4	43.5	22.1	39.0	47.1	3.9
Included exercise on recreational outings/school excursion activities	42.3	34.5	23.2	52.0	33.0	15
Talked about how much they like to be physically active/exercise/or be fit.	50.5	26.6	22.9	65.0	21.8	13.2

Table 24: Teachers' social support for respondents' physical activity behaviours in the last three months

Variable	Intervention (n=666)			Control (n=652)		
	Yes	No	Can't Remember	Yes	No	Can't Remember
	%	%	%	%	%	%
Discussed physical activity/exercise with me	43.8	25.7	30.5	52.3	27.6	20.1
Gave me helpful reminders to exercise or be physically active	29.1	36.8	34.1	31.1	44.8	24.1
Gave me encouragement to stick with my exercise programme.	32.0	34.7	33.3	38.6	38.1	23.3
Complained that the time I spend exercising was too much	20.1	46.4	33.5	27.5	47.7	24.8
Complained that the time I spend exercising was too little	19.6	45.2	35.2	23.2	52.1	24.7
Criticized me or made fun of me for exercising	17.3	48.5	34.2	19.7	52.9	25.5
Told me it was not proper to exercise/be physically active	16.8	48.5	34.7	16.1	57.1	26.8
Gave me rewards for exercising or being physically active	26.3	41.6	32.1	26.4	52.0	21.6
Included exercise on recreational outings/school excursion activities	32.5	31.7	35.8	40.5	36.7	22.8

4.2.11. Association between behavioural antecedent factors and self-reported physical activity level among the experimental and control groups

There was a significant association between self-efficacy and self-reported physical activity levels in the EC and CG. Over two thirds, 293 (76.9%) of respondents in the EG who had a high self-efficacy for PA were physically active (P=0.04) compared to 326 (77.1%) in the CG (P=0.007), (Details in Table 25).

Subjective norm was significantly associated with self-reported PA levels in the experimental group (P=0.04) but on the contrary, it had no association in the control group. The data in the table showed that in the EG, 245 (77.5%) of respondents who had a positive subjective norm about PA were active compared to 265 (74.9%) in the CG (P=0.434). (Details in Table 25).

A significant association was noted between perceived behavioural control and self-reported PA levels in the control group (P=0.012) but on the contrary, it had no association in the experimental group (P=0.541). Over two thirds -281 (73%) of respondents with a high perceived behavioural control were active and in the CG, 280 (70.2%) of respondents were active (Details in Table 25).

There was a significant association between social support from family members and self-reported PA levels in the experimental group but on the contrary, it had no association in the control group. Findings revealed that 220 (79.4%) of respondents in the EG who had a high family social support for PA were physically active compared (P=0.006) to 228 (76.5%) in the CG (P=0.128) (Details in Table 25). Social support from friends was significantly associated with self-reported PA levels in both the experimental (P=0.04) and control groups (P=0.007) but on the contrary, social support from teachers had no association with physical activity levels in both groups (P=0.91 in EG and 0.51 in CG), (Details in Table 25). In both the EC and CG, attitude towards PA was not significantly associated with self-reported physical activity level (P=0.901 in EG and 0.05 in CG), (Details in Table 25).

Table 25: Association between behavioural antecedent factors and self-reported physical activity level among the experimental and control groups

Behavioural antecedent factors	Physical Activity Level					
	Experimental Group (n=666)			Control Group (n=652)		
	Physicall y inactive n (%)	Physically active n (%)	P value	Physicall y inactive n (%)	Physically active n (%)	P value
Knowledge of PA						
Poor	70 (25.1)	209 (74.9)	0.605	47 (21.6)	171 (78.4)	0.048*
Good	104 (26.9)	283 (73.1)	χ^2 =0.267	125 (28.8)	309 (71.2)	χ^2 = 3.919
Self-efficacy						
Low	86 (30.2)	199 (69.8)	0.04*	75 (32.8)	154 (67.2)	0.007*
High	88 (23.1)	293 (76.9)	χ^2 = 4.232	97 (22.9)	326 (77.1)	χ^2 = 7.376
Subjective Norm						
Negative	103 (29.4)	247 (70.6)	0.04*	83 (27.9)	251 (72.1)	0.434
Positive	71 (22.5)	245 (77.5)	χ^2 = 4.168	89 (25.1)	265 (74.9)	χ^2 =0.612
Perceived Behavioural Control	70 (24.9)	211 (75.1)	0.541	53 (20.9)	200 (79.1)	0.012*
Low	104 (27.0)	281 (73.0)	χ^2 =0.372	119 (29.8)	280 (70.2)	χ^2 = 6.28
High						
Social Support from Family						
Low	117 (30.2)	271 (69.8)	0.006*	101 (28.8)	250 (71.2)	0.128
High	57 (20.6)	220 (79.4)	χ^2 = 7.673	70 (23.5)	228 (76.5)	χ^2 = 2.320
Social Support from Friends						
Low	80 (28.8)	197 (71.2)	0.04*	60 (34.1)	116 (65.9)	0.007*
High	88 (23.8)	282 (76.2)	χ^2 = 3.473	112 (23.5)	364 (76.5)	χ^2 =7.380
Social Support from Teachers			0.91			0.51
Low	80 (26.8)	219 (73.2)	χ^2 = 0.013	79 (25.2)	234 (74.8)	χ^2 = 0.433
High	92 (26.4)	257 (73.6)		93 (27.5)	245 (72.5)	
Attitude						
Negative	91 (25.9)	260 (74.1)	0.901	98 (29.7)	232 (70.3)	0.05
Positive	83 (26.3)	232 (73.7)	χ^2 =0.15	74 (23.0)	248 (77.0)	χ^2 = 3.785

*Statistically significant @p<0.05

4.2.13. Comparison of the cardio-respiratory fitness level of respondents in the experimental and control groups

Based on the multi-stage fitness test, a comparison of the cardio-respiratory fitness level by experimental and control group showed that respondents in EG were more fit, details in Table 26.

4.2.14 Comparison of the Body Mass Index for Age, Waist-to-Hip ratio and Blood Pressure of respondents in the experimental and control groups

A comparison of the body mass index for age of respondents in the experimental and control group showed that showed 13.1% and 9.8% were underweight; 84.9% and 88.8% were normal while 2.0% and 1.4% were overweight or obese respectively, Details in Figure **7**.

Ninety-four adolescents (14.3%) in the EG and 36 (5.6%) had high waist-to-hip ratio. With regards to the blood pressure readings, 8 (1.2%) in the EG and 51 (7.9%) in CG had high Diastolic Blood Pressure (DBP) while 24 (3.7%) and 59 (9.1%) in the EG and CG respectively had high Systolic Blood Pressure (SBP).

Table 26: Comparison of the fitness level of respondents by experimental and control groups

Study site	No.	Mean	Sd	t-value	P value
EG	588	6.10	3.37	10.6	0.00*
CG	610	4.39	2.06		

*Significant at P<0.05

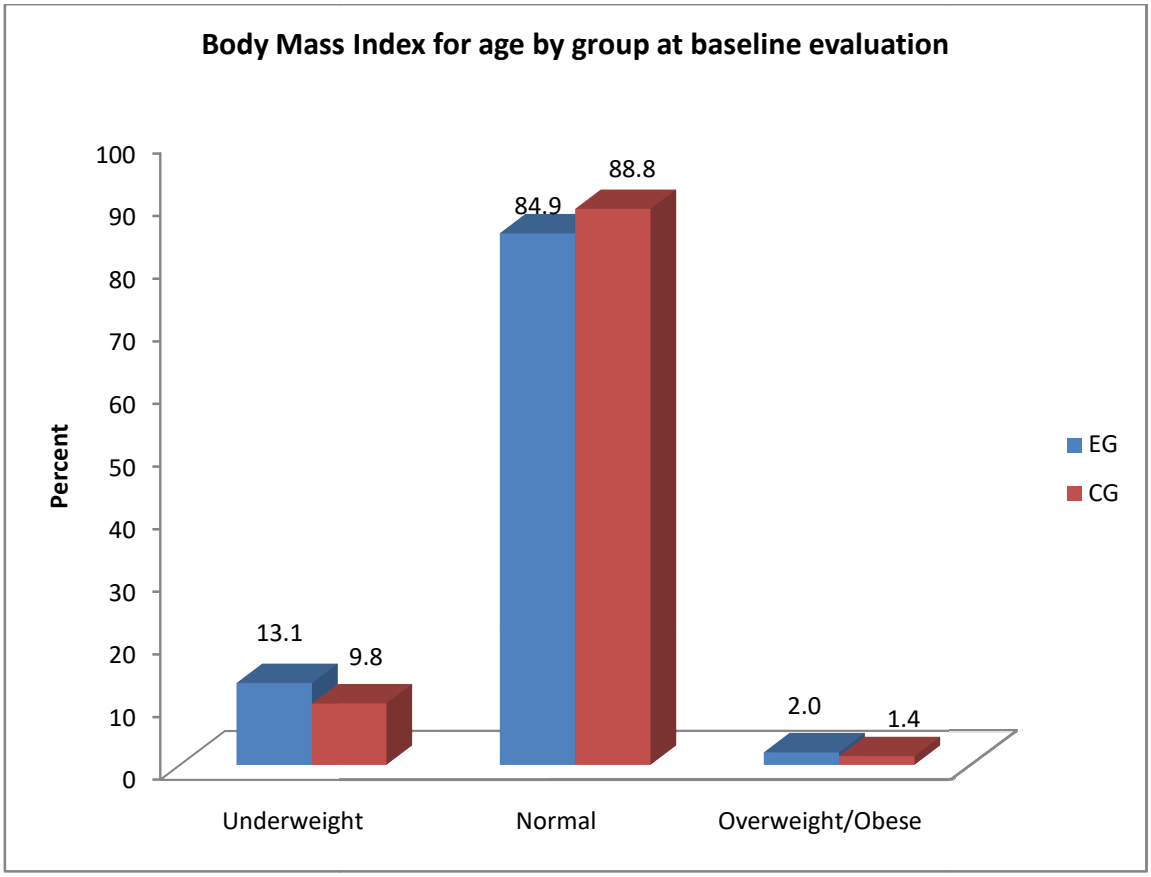

Figure 7: Body Mass Index for Age for the EG and CG

4.2.15 Factors influencing the physical activity levels of the respondents

At pre-intervention, the respondents indentified factors influencing their physical activity behaviour. Lack of time was the most frequently mentioned factor in both the experimental and control group 156 (33.2%) and 204 (36.84%) respectively. Others were fear of injuries and ill-health 88 (18.7%) and 48 (8.7%) and household and after school chores 33 (7.0%) and 84 (15.2%) in the EG and CG respectively. The detailed pattern of responses is in Table 27**.**

Constant reminder and practice 75 (28.8%) and 85 (30.1%) and provision of facilities 109 (41.9%) and 138 (48.9%) in the EG and CG respectively and were the most frequently mentioned measures identified by respondents which can help them become active. The detailed pattern of responses is in Table 28.

Table 27: Factors hindering participation in PA

Variables	EG n (%)	CG n (%)
Lack of time	156 (33.2)	204 (36.8)
Household and after school chores	33 (7.0)	84 (15.2)
Lack of support from the school	6(1.3)	1 (0.2)
Lack of support from family	21 (4.5)	36 (6.5)
Laziness	33 (7.0)	8 (1.4)
Fear of injuries and other health related reasons	88 (18.7)	48 (8.7)
No interest	44 (9.4)	53 (9.6)
School activities	17 (3.6)	35 (6.3)
No encouragement	19 (4.0)	32 (5.8)
Stress	10 (2.1)	12 (2.2)
Unfavourable environment	2 (0.4)	1 (0.2)
Poor equipment and facilities	31 (6.6)	37 (6.7)

Table 28: Factors which can promote respondents' participation in PA

Variables	EG n (%)	CG n (%)
Constant reminder and practice	75 (28.8)	85 (30.1)
Support from parents	30 (11.5)	31 (11.0)
Support from school	8 (3.1)	2 (0.7)
Provision of facilities	109 (41.9)	138 (48.9)
Reduced workload and time	0 (0.0)	17 (6.0)
Conduct of special events, recreational activities and TV programmes on PA	38 (14.6)	9 (3.2)

4.2.16. The school built environmental attributes for physical activity

An analysis of the environmental attributes of the school showed that all the schools in the EG and CG had poor provisions for walking (100%); 90.9% *[7(100%) of Public and 3 (75%) of Private]* of schools in the EG and 100% of schools in the CG had poor provision for cycling,

Sporting facility provision was poor at 72.7%of schools in the EG *[7(100%) of Public and 1(25%)] of Private schools]* and 72.7% of schools in the CG *[5(71.4%) of Public and 3(75%) of Private schools]. T*he design of the school ground was good in 63.6% of schools in the EG *[3(42.9%) of Public and 4(100%) of Private schools]*and 81.8% in the CG*[7(100%) of Public and 2(50%)of Private schools]* .

For aesthetics, 18.2% schools were categorised as low in the EG *[2(28.6%) of Public and 0(0%) of Private]* and 9.1% in the CG *[0(0%) of Public and 1(25%)of Private schools]*.

For other facility provisions, 36.4% schools were categorised as low in the EG *[3(42.9%) of Public and 1(25%) of Private]* and 54.5% in the CG *[3(42.9%) of Public and 3(75%) of Private schools]*. The pattern of responses for school built environment is presented in Table 29.

Table 29: School built environment for physical activity

Variable	*Experimental(n=11)*	*Control (n=11)*	*P-value*
	N (%)	*N (%)*	
Walking Provisions			
Poor	11 (100)	11 (100)	
Good	0 (0.0)	0 (0.0)	
Cycling Provisions			
Poor	10 (90.9)	11 (100)	0.50+
Good	1 (9.1)	0 (0.0)	
Sports Facility Provisions			
Poor	8 (72.7)	8 (72.7)	1.0+
Good	3 (27.3)	3 (27.3	
Other Facility Provisions			
Poor	4 (36.4)	6 (54.5)	0.33+
Good	7 (63.6)	3 (45.5)	
Aesthetics			
Poor	2 (18.2)	1 (9.1)	0.5+
Good	9 (81.8)	10 (90.9)	
Design of school grounds			
Poor	4 (36.4)	2 (18.2)	0.31+
Good	7 (63.6)	9 (81.8)	

+Fishers exact test

4.2.17. School policy environment for physical activity

Findings revealed that 63.6% of schools in the EG *[5(71.4%) in Public and 2(50.0%) in Private schools]* and 45.5% in the CG *[3(42.9%) in Public and 2(50.0%) in Private schools]* had poor formal physical health education policies, while all the schools were rated high (100%) with regards to the physical education content and curriculum.

Thirty six percent (36.4%) of schools in the EG *[2(28.6%) in Public and 2(50.0%) in Private schools]* had a budget for PHE compared to 45.5% in the CG *[2(28.6%) in Public and 3(75.0%) in Private schools]*. Provision of organized activities during break time was low at 18.2% in the EG *[0(0%) in Public and 2(50.0%) in Private schools]* and 36.4% in the CG *[3(42.9%) in Public and 1(25.0%) in Private schools]*.

Financial support for professional continuing education for PHE teachers was also low at 18.2% in the EG *[0(0%) in Public and 2(50.0%) in Private schools]* and 9.1% in the CG *[1(14.3%) in Public and 0(0.0%) in Private schools]*. The pattern of responses for school policy environment is presented in Table 30.

Table 30: School policy environment for physical activity

Variable	*Experimental (n=11)*	*Control (n=11)*	*P-value*
	N (%)	*N (%)*	
Formal physical health education policies			
Poor	7 (63.6)	5 (45.5)	0.335+
Good	4 (36.4)	6 (54.5)	
Physical Education Content and Curriculum			
Poor	0 (0.0)	0 (0.0)	
Good	11 (100)	11(100)	
Break time Policies			
Poor	10 (90.9)	7 (63.3)	0.26+
Good	1 (9.1)	4 (36.7)	
Break time access			
Poor	4 (36.4)	4 (36.4)	1+
Good	7 (63.6)	7 (63.3)	
Organised activities during break time			
Yes	2 (18.2)	4 (36.4)	0.60+
No	6 (54.5)	3(27.2)	
Don't know	3 (27.3)	4 (36.4)	
Financial support for PHE teachers' training			
Yes	2 (18.2)	1 (9.1)	0.33+
No	6 (54.5)	7 (63.6)	
Don't know	3 (27.3)	3 (27.3)	
Budget allocation for PHE			
Yes	4 (36.4)	5 (45.5)	0.33+
No	5 (45.5)	6 (54.5)	
Don't know	2 (18.2)	0 (0)	

+Fishers exact test

4.3. END LINE ASSESSMENT

4.3.1. Socio-demographic characteristics of respondents at end line evaluation

At end line assessment, 995 students completed the questionnaires, 493 in Ibadan (EG) and 502 in Ogbomosho (CG). The proportion of respondents who completed the study in the experimental and control group was 74% and 77% respectively though the number in both groups exceeded the minimum sample size for the study.

In the experimental group, there were more respondents in the 10-14 years age group 282 (57.2%) compared to those aged 15-19 years 211 (42.8%) while the control group had more respondents aged 15-19 years 295 (58.8%) than those in the 10-14 years age category 207 (41.2%). The mean ages were 14.1 ±2.06 and 14.9 ±1.80 ($p<0.05$) in EG and CG respectively.

In the experimental group, there were more female respondents, 277 (56.2%) compared to the control group 248 (49.4%) The distribution of respondents by their school type showed that 348 (70.6%) in the EG and 319 (63.5%) in the CG attended public schools.

There were more Yoruba in the CG 477 (95.0%) than the EG 382 (77.5%) and more Christians in the CG 395 (78.7%) than the EG 323 (65.5%). For the educational attainment of mothers, 247 (50.1%) of those in the EG compared to 223 (44.4%) of those in the CG had Mothers who had post-secondary school education while 281 (57.0%) of those in the EG compared to 253 (50.4%) had Fathers who had post-secondary school education (Details in Table 31).

Table 31: Frequency distribution of respondents' socio-demographic characteristics at end line (N=995)

Demographic Characteristics	Intervention (n=493)	Control (n= 502)	Statistics	P-value
	N (%)	N (%)		
Age in years				
10-14	282 (57.2)	207 (41.2)	χ^2 =25.368	0.00
15-19	211 (42.8)	295 (58.8)	df =1	
Mean age	14.1 ±2.06	14.9 ±1.80		
Sex				
Male	216 (43.8)	254 (50.6)	χ^2 =4.322	0.04
Female	277 (56.2)	248 (49.4)	df =1	
School Type				
Public	348 (70.6)	319 (63.5)	χ^2 =5.582	0.18
Private	145 (29.4)	183 (36.5)	df =1	
Ethnic Group				
Yoruba	382 (77.5)	477 (95.0)		
Igbo	66 (13.4)	15 (3.0)		
Hausa	12 (2.4)	) (0)		
Others	33 (6.7)	10 (2.0)		
Religion				
Christianity	323 (65.5)	395 (78.7)	χ^2 =25.489	0.00
Islam	169 (34.3)	105 (20.9)	df =3	
Traditional	1 (0.2)	2 (0.4)		
Mother's educational level				
No formal education	12 (2.4)	15 (3.0)	χ^2 =4.803	0.187
Primary	37 (7.5)	53 (10.6)	df =3	
Secondary	197 (40)	211 (42.0)		
Above secondary	247 (50.1)	223 (44.4)		
No response				
Father's educational				
No formal education	7 (1.4)	16 (3.2)	χ^2 =9.200	0.27
Primary	28 (5.7)	45 (9.0)	df =3	
Secondary	177 (35.9)	188 (37.5)		
Above secondary	281 (57.0)	253 (50.4)		

4.3.2. Self-reported physical activity behaviours of respondents

The frequency distribution for responses related to physical activity behaviours is presented in Tables 32, 33 and 34 while the inferential statistics which outlines the statistical differences in the self-reported physical activity behaviours in the EG and CG is presented in Table 35.

The self-reported physical activity behaviours of the respondents showed that 47.9% and 46.6% in the EG and CG respectively walked seven times or more in the last seven days while 30.4 % and 29.77% in the EG and CG respectively reported dancing seven times or more in the last seven days. Furthermore, 23.2% and 12.2% in the EG and CG respectively participated in other games such as *"ten ten*", "*hide and seek"* and hopscotch "*suwe*" (Details in Table 32).

About 13.8% in the experimental group and 27.5% in the control group reported that they do not do or participate in physical health education classes; 30.0% and 38.6% of respondents in the EG and CG reported that during break time in the last seven days they always sit down talking or reading their books. Three percent and 7.8% of respondents in the EG and CG respectively reported that they did not participate in any physical exercise right after school closed in the last seven days while 34.5% and 26.9% of respondents in the EG and CG stated that they were often very active in the last seven days (Details in Table 33).

With regards to their physical activity behaviours on specific days of the weeks in the last seven days, about 34.9% and 43.0% of respondents in the EG and CG respectively reported that their extent of participation in physical activity on Monday was little while 31.6% and 35.9% of respondents in the EG and CG respectively reported same for Tuesday (Details in Table 34).

Table 32: Respondents' participation in physical exercise in the last seven days

	Intervention					Control				
	Not at all	1-2 times	3-4 times	5-6 times	7 times or >	Not at all	1-2 times	3-4 times	5-6 times	7 times or >
	%	%	%	%	%	%	%	%	%	%
Skipping	33.9	33.5	15.2	7.1	10.3	29.5	51.8	10.0	**4.0**	**4.8**
Walking for exercise	14.8	11.4	14.2	11.7	47.9	17.3	7.2	14.7	14.1	46.6
Bicycling	24.1	50.1	11.2	5.5	9.0	22.3	49.2	12.9	5.0	10.6
Jogging or running	22.3	16.8	23.1	13.2	23.7	26.1	15.5	20.9	15.1	22.3
Swimming	20.9	59.6	10.5	3.9	5.1	23.7	64.9	5.2	2.8	3.4
Dance	23.7	16.0	17.0	12.8	30.4	25.9	14.5	15.3	14.5	29.7
Football	22.3	39.0	9.8	8.7	20.1	25.7	32.5	7.0	13.3	21.5
Table Tennis	24.3	54.0	7.5	4.9	9.3	20.5	61.6	8.2	4.0	5.8
Lawn Tennis	68.0	20.7	4.9	2.6	3.9	71.1	22.0	4.0	1.0	2.0
Basket ball	60.9	23.5	8.3	3.9	3.4	72.7	17.5	6.0	3.9	2.2
Weight lifting	63.0	22.7	6.7	2.7	4.9	65.1	19.7	8.0	3.2	4.0
Boxing	70.8	20.9	4.5	1.4	2.4	64.1	19.3	8.0	4	4.6
Wrestling	73.1	18.1	4.5	2.4	1.8	75.7	16.6	4.0	1.4	2.2
Sack race	62.9	22.5	6.7	4.5	3.4	70.5	17.5	7.0	3.2	1.8
Volley ball	62.5	22.1	7.7	3.9	3.9	71.5	17.9	6.2	3.2	1.2
Handball	58.4	24.1	9.3	3.0	5.	58.6	22.1	11.8	3.4	4.2
Other games such as *Ten ten , Boju boju, Hide and seek*	22.4	29.6	14.2	10.1	23.2	26.5	39.2	13.1	9.2	12.0
Hopscotch	23.9	58.4	7.3	3.0	7.4	19.9	59.2	8.4	7.2	5.4
Climbing trees/ poles/mountains	60.4	21.7	7.9	4.5	5.5	44.3	24.0	14.0	7.2	10.6

Table 33: Respondents' participation in physical activity in the last seven days

Variable	Intervention (n=493)	Control (n=502)
	No (%)	No (%)
Participation in PHE classes		
I don't do PHE	13.8	27.5
Hardly ever	6.7	20.1
Sometimes	35.3	30.5
Quite often	16.8	5.2
Always	27.4	16.7
The extent of PA during break time		
Sat down talking/reading	30.0	38.6
Stood around or walked around	17.6	13.1
Ran or played a little bit	26.2	27.1
Ran around and played quite a bit	18.9	14.3
Ran and played hard most of the time	9.3	6.8
The extent of PA right after school closes		
None	3.0	7.8
1 time last week	15.2	19.7
2 to 3 times last week	41.4	44.0
4 to 5 times last week	19.1	14.1
6 to 7 times last week	21.3	14.3
		1.0
Number of times involved in PA during the last weekend		
None	4.9	4.6
1 time	16.8	22.7
2 to 3 times	45.8	45.4
4 to 5 times	31.4	26.5
6 to 7 times	1.0	0.8
Best description of Respondents' PA level in the last 7 days		
Very little physical effort	2.6	4.8
Sometimes did PA (1-2 times)	17.8	20.7
Often did PA (3-4 times)	44.6	47.2
Quite often did PA (5-6 times)	34.5	26.9
Very often (7 times or more)	0.4	0.4

Table 34: Respondents' extent of participation in physical activity for each day of the previous week

Variable	Intervention					Control				
	None	Little bit	Medium	Often	Very often	None	Little bit	Medium	Often	Very often
	%	%	%	%	%	%	%	%	%	%
Monday	22.7	34.5	18.9	11.6	12.4	22.1	43	23.5	5.6	5.8
Tuesday	19.1	31.6	24.5	14.0	10.8	20.5	35.9	26.1	11.4	6.2
Wednesday	18.7	26.8	22.0	15.4	17.1	24.4	29.8	23.3	140	8.6
Thursday	19.3	23.7	25.8	16.0	15.2	18.2	33.6	23.4	16.2	8.6
Friday	18.7	23.3	22.7	16.8	18.5	15.0	25.3	29.3	14.2	16.2
Saturday	17.6	16.4	16.8	18.3	30.8	18.7	20.7	20.1	16.9	23.5
Sunday	26.9	21.1	12.2	12.8	27.0	27.7	18.3	17.3	14.3	22.3

4.3.3. Comparison of self-reported physical activity levels between the experimental and control groups

A comparison of the self-reported Physical Activity (PA) levels of the respondents indicated that 35 (7.1%) in the EG and 51(10.2%) in the CG had low PA levels. Four hundred and thirty-eight (89.2%)%) in the EG and 446 (88.8%) in the CG had moderate PA levels while 18 (3.7%) in the EG and 5 (1.0%) in the CG had high PA levels. There was a significant difference in the PA levels of the EG and CG (P=0.006) (Details in Table 35).

4.3.4. Comparison of objectively measured physical activity levels between the experimental and control groups

A comparison of the objectively measured physical activity levels assessed using a pedometer to measure the step counts showed that there were 45 respondents in the experimental group with an average step count of 46124.2 (±23751.9) while the control group had 48 participants with an average step count of 35573.0 (±23848.0). The independent sample t-test showed that there was a significant difference in the mean step count of both group (P=0.006), respondents in the EG had a average higher step count. Details in Table 37

Table 35: Self-reported physical activity levels of the experimental and control groups post intervention (N=995)

Self-reported Physical Activity Level	End line (N=995)		X^2	P-value
	EG (n=493) No (%)	CG (n=502) No (%)		
Low	35 (7.1)	51 (10.2)	10.276	0.006
Moderate	438 (89.2)	446 (88.8)		
Vigorous	18 (3.7)	5 (1.0)		

Table 36: Objectively measured physical activity levels of the experimental and control groups (N=93) at end line

Objectively measured Physical Activity Level	n	Mean step counts	SD	df	t	P-value
Experimental group	45	46124.2	23751.9	94	2.136	0.035
Control group	48	35573.0	23848.0			

4.3.5. Respondents' knowledge about physical activity and its benefit

At end line assessment, knowledge about physical activity and its health benefit was measured on a 10-point knowledge scale. Table 37 describes the responses of the respondents on their knowledge of physical activity and its benefit. About 86.2% and 84.9% of the respondents in the EG and CG respectively knew that physical activity can help prevent or delay the development of high blood pressure while 95.7% and 90.6% of the respondents in the EG and CG respectively knew that young people are expected to attain at least 60 minutes of moderate to vigorous physical activity daily. The detailed pattern of responses to the knowledge items is presented in Table 37.

At baseline, the mean knowledge for the intervention and control groups are 8.67 ± 1.2 and 8.53 ± 1.3 (P=0.09) respectively.

Table 37: Respondents' knowledge about physical activity and its benefit

Variable	Intervention		Control	
	Yes %	No %	Yes %	No %
Physical activity can help build and maintain healthy bones	99	1.0	98.8	1.2
Physical activity can help build muscles	94.5	5.5	95.4	4.6
Physical activity can be used to reduce body fat	93.1	6.9	92.6	7.4
Physical activity can help prevent or delay the development of high blood pressure	86.2	13.8	84.9	15.1
Physical activity can help relieve tension	91.9	8.1	91.2	8.8
Young people are expected to attain at least 60 minutes of moderate to vigorous physical activity daily	95.7	4.3	90.6	9.4
Physical activity can help improve students' concentration in class	86.2	13.8	81.1	18.9
Physical activity can be done without equipment	63.9	36.1	55	45
Dancing is a form of physical activity	96.3	3.7	92.4	7.6
Being physically active can help prevent boredom	92.9	7.1	87.6	12.4

4.3.6. Respondents' attitude towards physical activity

Table 38 presents respondents' attitude towards physical activity. In the EG, 43.9% of respondents strongly disagreed with the statement that physical activity should not be encouraged in schools compared to 33.9% in the CG. Over a third (38.3%) of the respondents in the EG strongly disagreed with the statement that physical activity is not good for females compared to 25.1% in the CG. On the other hand, only 9.3% of the respondents in the EG agreed that only sports men and women needed to participate in physical activity compared to 15.5% in the CG. The pattern of responses to attitudinal statements is presented in Table 38.

Respondents' attitudinal inclination at end line was measured on a 90-point attitudinal scale. At end line, the mean attitude scores of respondents in the intervention and control group were 69.16.3±11.3 and 64.33±12.4 respectively.

4.3.7. Subjective norms influencing physical activity behaviours

Findings from subjective norms which influenced the respondents' physical activity behaviours at end line revealed that 33.9% of respondents in the EG strongly agreed that their peers/fellow students think they should be physically active during their free time on most days. On the other hand, only 26.2% felt their teachers had accepting norms with regards to their being physically active during their free time on most days. In the CG, the pattern is similar; 31.7% of the respondents strongly agreed that their peers/fellow students think they should be physically active during their free time on most days while only 25.9% felt teachers will be favourably disposed. The pattern of responses to the subjective norms statements is presented in Table 39.

Respondents' subjective norms towards physical activity at baseline was measured on a 40-point scale. At end line, the mean score of respondents in the intervention and control group was 30.7 ±6.97 and 30.5±6.31 respectively.

Table 38: Respondents' attitude towards physical activity

Attitude Statement	Intervention					Control				
	SA %	A %	NS %	D %	SD %	SA %	A %	NS %	D %	SD %
Physical activity can help an individual to cope with stress	42.0	37.9	12.6	5.1	2.4	39.2	39.4	7.6	9.8	4.0
Physical activity is strenuous and not fun	9.3	15.8	50.1	9.0	15.8	12.5	23.9	18.6	23.5	21.5
It provides opportunities to make new friends	38.5	42.6	13.4	3.9	1.6	39.8	36.1	14.9	5.4	3.8
Helps to keep individuals in shape	48.9	38.7	5.7	3.9	2.8	44.6	36.1	11.3	3.2	4.8
Physical activity should not be encouraged in schools	13.2.	13.0	8.2	21.7	43.9	15.7	14.7	14.4	21.3	33.9
It gives students more energy	51.7	38.1	5.2	2.6	2.4	52.4	31.1	9.3	4.6	2.6
It makes students hot and sweaty	26.0	40.8	2.9	26.0	4.3	31.5	35.3	20.2	7.6	5.4
Physical activity can make students better in sports, dance or other activities	57.8	31..2	4.9	2.4	3.7	54.2	30.0	3.6	6.4	5.8
Physical activity is not good for females, it makes them muscular and look like males	6.9	11.2	16.0	27.6	38.3	12.4	20.1	19.5	22.9	25.1
I am now too big to participate in physical activity	10.5	8.5	11.8	29.2	40.0	10.8	11.2	15.8	26.5	35.7
Only Sports men and women need to participate in physical activity/exercise	9.3	9.1	10.4	29.8	41.4	15.5	16.1	12.8	23.5	32.1
Participation in physical activity make girls lose their virginity	7.3	7.9	15.1	24.7	45.0	12.0	13.7	20.3	20.3	33.7
I am always happy when we are asked to go out for physical exercises in school	46.7	42.2	4.8	3.7	2.6	51.4	33.1	5.7	5.6	4.2
Physical exercise should be made compulsory for students	40.4	35.3	11.4	7.0	5.9	37.5	37.5	11.2	8.0	5.8

Table 38: Respondents' attitude towards physical activity (contd.)

Attitude Statement	Intervention					Control				
	SA %	A %	NS %	D %	SD %	SA %	A %	NS %	D %	SD %
Taking part in physical exercises and activity in school is a waste of time	8.6	8.8	14.5	30.2	37.9	10.4	10.0	15.6	28.5	35.5
Physical activity is not safe for girls during menstruation	11.6	15.8	26.0	21.7	24.9	14.9	20.7	28.2	17.7	18.5
Boys and girls who love physical exercise do not perform well in class	5.5	6.3	13.6	30.6	44.0	9.4	10.2	18.6	26.5	35.3
Physical activity/exercise easily make girls breast to sag or look like slippers	33.5	43.2	13.6	6.5	3.2	31.7	48.6	13.1	4.4	2.2

Table 39: Respondents' subjective norms towards physical activity

Statement	Intervention					Control				
	SA %	A %	NS %	D %	SD %	SA %	A %	NS %	D %	SD %
My fellow students think I should be physically active during my free time on most days	33.9	41.8	15.0	6.1	3.2	31.7	48.6	13.1	4.4	2.2
My best friend thinks I should be physically active during my free time on most days	33.9	41.8	15.0	6.1	3.2	31.1	47.8	12.7	6.2	2.2
My physical education teacher thinks I should be physically active during my free time on most days	36.4	39.4	15.8	4.7	3.7	34.7	39.0	18.1	5.6	2.6
Other teachers think I should be physically active during my free time on most days	26.2	35.3	22.6	11.8	4.1	25.9	32.3	25.2	13.1	3.6
My mother or female guardian thinks I should be physically active during my free time on most days	30.8	40.6	17.5	8.5	2.6	30.7	36.5	15.7	12.9	4.2
My father or male guardian thinks I should be physically active during my free time on most days	33.7	38.7	15.0	8.7	3.9	34.3	38.6	13.1	10.4	3.6
My sister/sisters think I should be physically active during my free time on most days	32.0	37.1	17.5	9.3	4.1	27.1	40.0	15.9	12.0	5.0
My brother/brothers think I should be physically active during my free time on most days	36.3	36.7	14.0	7.3	5.7	36.3	37.1	12.8	9.4	4.4

4.3.8. Perceived control of physical activity behaviours

The assessment of the respondents' perceived behavioural control of their physical activity behaviours revealed that 45.0% in the EG compared to 33.9% in the CG strongly agreed that they have control over their physical activity behaviours during their free time. Furthermore, 39.1% in the EG and 24.7% in the CG strongly agreed that they have all they need to be physically active during their free time on most days. The pattern of responses to the statements is presented in Table 40.

Respondents' perceived behavioural control of physical activity behaviours at end line was measured on a 20-point scale, the mean score of respondents in the intervention and control group was 15.04±2.59 and 14.6±3.10 respectively.

4.3.9. Respondents' self efficacy for physical activity

Table 41 presents the respondents' self efficacy in relation to their physical activity behaviours under certain conditions. With regards to the attainment of 60 minutes of physical activity daily, 43.4% were extremely confident while 29.8% were confident of their ability in the EG compared to 23.3% and 26.7% in the CG respectively. Forty five percent of the respondents in the EG were extremely confident and 31.6% were confident in respect to their ability to be active instead of watching the television compared to 38.3% and 36.7%in the CG respectively. The detailed pattern of responses to the statements which assessed self-efficacy is presented in Table 41.

Respondents' self-efficacy with regards to physical activity at baseline was measured on a 50-point scale. At end line, the mean score of respondents in the intervention and control group was 40.5±6.7 and 39.4±6.1 respectively.

Table 40: Respondents' perceived behavioural control of physical activity behaviours

Statements	Intervention					Control				
	SA	A	Not Sure	D	SD	SA	A	Not Sure	D	SD
	%	%	%	%	%	%	%	%	%	%
For me to be physically active during my free time on most days would be challenging	17.0	24.5	21.0	24.7	12.8	17.1	31.3	21.3	18.7	11.6
I have control over my being physically active during my free time on most days	45.0	28.0	13.8	8.1	5.1	33.9	38.8	14.7	8.8	3.8
I believe I have all the things I need to be physically active during my free time on most days	39.1	27.4	16.8	12.6	4.1	24.7	32.1	21.1	15.5	6.6
If I want to be, I can be physically active during my free time on most days	44.8	39.6	11	3.4	1.2	40.0	40.0	10.4	7.4	2.2

Table 41: Respondents' self efficacy with regards to physical activity

Statements	Intervention					Control				
	EC %	C %	Not Sure %	NC %	ENC %	EC %	C %	Not Sure %	NC %	ENC %
I can be physically active during my free time on most days	44.8	39.6	11	3.4	1.2	45.0	41.6	8.4	3.8	1.2
I can ask my parents or other adult to do physically active things/activities with me	34.6	33.4	19.3	9.8	2.9	31.7	39.4	18.3	6.0	4.6
I can be physically active during my free time on most days instead of watching the TV or playing video games	45.2	31.6	13.6	5.5	4.1	38.8	36.7	13.7	7.4	3.4
I can be physically active during my free time on most days even if it is very hot or cold outside	32.9	30.4	24.8	9.5	2.4	28.9	31.7	21.3	12.9	5.2
I can ask my best friend to participate in physical activities with me during my free time on most days	52.1	30.4	11.0	3.9	2.6	52.2	36.7	7.3	2.4	1.4
I can be physically active during my free time on most days even if I have to stay at home	43.2	34.9	14.8	4.9	2.2	38.0	39.6	2.7	13.7	6.0
I have the coordination and ability I need to be physically active during my free time on most days	43.4	37.1	15.9	2.6	1.0	32.7	46.8	12.3	4.8	3.4
I can be physically active during my free time on most days no matter how busy my day is	30.2	24.1	30.5	10.5	4.7	23.3	26.7	26.9	12.0	11.2
I can set aside time for a physical activity programme for at least 60 minutes, every day of the week	43.4	29.8	18.7	5.9	2.2	23.3	26.7	26.8	12.0	11.2
I can get up early, even on weekends, to exercise	38.7	32.7	16.6	6.1	5.9	38.0	32.3	21.3	7.2	1.2

4.3.10. Social support for respondents' physical activity behaviours in the last three months

At end line, the respondents' social support from family, friends and teachers for physical activity was assessed and findings revealed that 50.5% and 40.2% of the respondents in the EG and CG respectively stated that their family members offered to exercise with them in the last three months; 59.0% and 54.4% of the respondents in the EG and CG reported that family members talked about how much they like to be physically active and fit. Furthermore, only 27% respondents in the EG and 39.2% in the CG reported that family criticized them or made fun of them for exercising. The detailed pattern of responses to the statements which assessed family social support in the last three months is presented in Table 42.

Family social support measured on a 12-point scale at the endlineshowed that the mean score of respondents in the experimental and control group was 6.43±3.03 and 5.93±2.90 respectively.

With regards to social support for physical activity from friends in the last three months, 63.0% in EG and 70.2% in the CG indicated that their friends had discussed physical activity with them in the last three months. In a similar pattern, 59,6% in EG and 68.9% in the CG indicated that their friends had exercised with them. Furthermore, 49.7% in the EG and 57.1% in the CG stated that their friends had encouraged them to continue with their exercise programme. The detailed pattern of responses to the statements which assessed friends' social support in the last three months is presented in Table 43.

Friends' social support measured on a 12-point scale at the end line, showed that the mean score of respondents in the experimental and control group was 6.44±3.10 and 6.79±2.95 respectively.

In relations to Teachers' support for physical activity in the last three months, 49.7% and 57.8% in the EG and CG indicated that their Teachers had discussed physical activity/exercise with them in the last three months while 36.1% in the CG and 23.1% in the EC stated that they gave them helpful reminders to exercise or be

physically active. Thirty eight percent in the EG and 34.7% in the CG stated that the Teachers had included exercise on recreational outings/school excursion activities. The detailed pattern of responses to the statements which assessed Teachers' social support in the last three months is presented in Table 44.

Teachers' social support at end line was measured on a 9-point scale and showed that the mean score of respondents in the experimental and control group was 3.67±2.56 and 3.53±1.96 respectively.

Table 42: Family social support for respondents' physical activity behaviours

Variable	Intervention			Control		
	Yes	No	Can't Remember	Yes	No	Can't Remember
	%	%	%	%	%	%
Discussed physical activity/exercise with me	59.8	24.3	15.9	59.2	26.3	14.5
Offered to exercise with me	50.5	31.4	18.1	40.2	42.8	17.0
Exercised with me	49.9	31.2	18.9	46.6	35.5	17.9
Gave me helpful reminders to exercise or be physically active	54.8	27.4	16.5	49.2	37.3	13.5
Gave me encouragement to stick with my exercise programme.	53.5	30.0	16.5	50.0	34.5	15.5
Complained that the time I spend exercising was too much	27.0	60.2	12.8	39.2	50.4	10.4
Complained that the time I spend exercising was too little	32.9	51.7	15.4	30.1	58.4	11.5
Criticized me or made fun of me for exercising	28.4	55.0	16.6	32.9	52.2	14.9
Told me it was not proper to exercise/be physically active	18.3	66.5	23.3	23.3	63.3	13.4
Gave me rewards for exercising or being physically active	32.9	43.8	23.3	48.8	38.6	12.6
Included exercise on recreational outings/school excursion activities	52.9	31.6	15.5	48.6	42.4	9.0
Talked about how much they like to be physically active/exercise/or be fit.	59.0	24.3	16.7	54.4	34.3	11.3

Table 43: Friends' social support for respondents' physical activity behaviours

Variable	Intervention			Control		
	Yes	No	Can't Remember	Yes	No	Can't Remember
	%	%	%	%	%	%
Discussed physical activity/exercise with me	63.9	13.4	22.7	70.9	14.7	14.4
Offered to exercise with me	63.5	16.4	20.1	69.5	14.7	15.8
Exercised with me	59.6	14.4	26.0	68.9	12.4	16.4
Gave me helpful reminders to exercise or be physically active	55.0	19.7	25.3	60.6	23.9	15.5
Gave me encouragement to stick with my exercise programme.	49.7	26.8	23.5	57.1	27.3	15.6
Complained that the time I spend exercising was too much	24.7	53.1	22.2	27.3	57.4	15.3
Complained that the time I spend exercising was too little	31.0	45.0	24.0	36.2	47.2	16.6
Criticized me or made fun of me for exercising	29.0	49.9	21.1	34.9	47.6	17.5
Told me it was not proper to exercise/be physically active	16.0	57.0	27.0	23.8	58.1	18.1
Gave me rewards for exercising or being physically active	32.9	43.8	23.3	39.3	43.3	17.4
Included exercise on recreational outings/school excursion activities	42.8	30.0	27.2	51.2	33.3	15.5
Talked about how much they like to be physically active/exercise/or be fit.	59.6	20.3	20.1	62.9	23.8	13.3

Table 44: Teachers' social support for respondents' physical activity behaviours

Variable	Intervention			Control		
	Yes	No	Can't Remember	Yes	No	Can't Remember
	%	%	%	%	%	%
Discussed physical activity/exercise with me	49.7	20.0	30.3	57.8	22.1	20.1
Gave me helpful reminders to exercise or be physically active	36.1	28.2	35.7	23.1	21.5	55.4
Gave me encouragement to stick with my exercise programme.	38.9	23.3	37.8	22.7	21.5	55.8
Complained that the time I spend exercising was too much	20.5	46.1	33.4	30.3	46.6	23.1
Complained that the time I spend exercising was too little	25.4	39.1	35.5	33.4	43.6	23.0
Criticized me or made fun of me for exercising	16.4	50.1	33.5	23.9	51.0	25.1
Told me it was not proper to exercise/be physically active	14.8	52.5	32.7	19.8	56.1	24.1
Gave me rewards for exercising or being physically active	28.5	39.4	32.1	28.5	50.0	21.5
Included exercise on recreational outings/school excursion activities	38.9	28.4	32.7	34.7	44.0	21.3

4.3.11. Factors influencing the physical activity levels of the respondents

At post intervention, the respondents indentified factors influencing their physical activity behaviours. Lack of time was the most frequently mentioned factor in both the experimental and control groups 87 (26.3%) and 108 (32.4%) respectively followed by fear of injuries 74 (22.4%) in the EG and ill-health 54 (16.2%) in the CG. Others were household and after school chores 49 (14.8%) and 51 (15.3%) and poor equipment and facilities 41 (12.4%) and 49 (14.7%) in the EG and CG respectively. The detailed pattern of responses is in Table 45.

Reduced workload 43 (19.0%) and 45 (18.4%) and provision of facilities 139 (61.5%) and 155 (63.5%) in the EG and CG respectively were the most frequently mentioned measures identified by respondents which can help them be active. The detailed pattern of responses is in Table 46.

4.3.12. Comparison of the cardio-respiratory fitness level of respondents in the experimental and control groups

Based on the multi-stage fitness test, a comparison of the cardio-respiratory fitness level by experimental and control group showed that respondents in EG were more fit, details in Table 47.

4.3.13. Comparison of the body mass index for age level of respondents in the experimental and control groups

A comparison of the body mass index for age of respondents in the experimental and control group showed that showed 8.9% and 10.7% were underweight; 89.0% and 88.7% were normal while 2.1% and 0.6% were overweight or obese respectively, (details in Figure 8).

Fifty-four adolescents (11.4%) in the EG and 34 (6.9%) had high waist-to-hip ratio. With regards to the blood pressure readings, 58 (12.4%) in the EG and 49 (10.5%) in CG had high Diastolic Blood Pressure (DBP) while 37 (7.9%) and 65 (13.8%) in the EG and CG respectively had high Systolic Blood Pressure (SBP).

Table 45: Factors hindering participation in PA (n= 664)

Variables	EG n (%)	CG n (%)
No encouragement	8 (2.4)	2 (0.2)
PA is stressful	24(7.3)	29 (8.7)
Unfavourable environment	3 (0.9)	0 (0.0)
Poor equipment and facilities	41 (12.4)	49 (14.7)
Lack of training	5 (1.5)	4(1.2)
Household and after school chores	49 (14.8)	51 (15.3)
Lack of time	87 (26.3)	108 (32.4)
Lack of support from family	6 (1.8)	10 (3.0)
Lack of support from the school	1 (0.3)	4(1.2)
Fear of injuries and other health related reasons	74 (22.4)	54 (16.2)
School activities	33 (10.0)	22 (6.6)

Table 46: Factors which can promote respondents' participation in PA (n=470)

Variables	EG	CG
Constant reminder and training	8 (3.5)	15 (6.1)
Support from parents	11 (4.9)	13 (5.3)
Support from school	25 (11.1)	16 (6.6)
Reduced workload and adequate time for PA	43 (19.0)	45 (18.4)
Provision of facilities	139 (61.5)	155 (63.5)

Table 47: Comparison of the Fitness level of respondents by experimental and control groups

Study site	No.	Mean	Sd	df	t-value	P value
EG	403	6.89	3.21	807	5.323	0.000*
CG	406	5.51	4.05			

*Significant at P<0.05

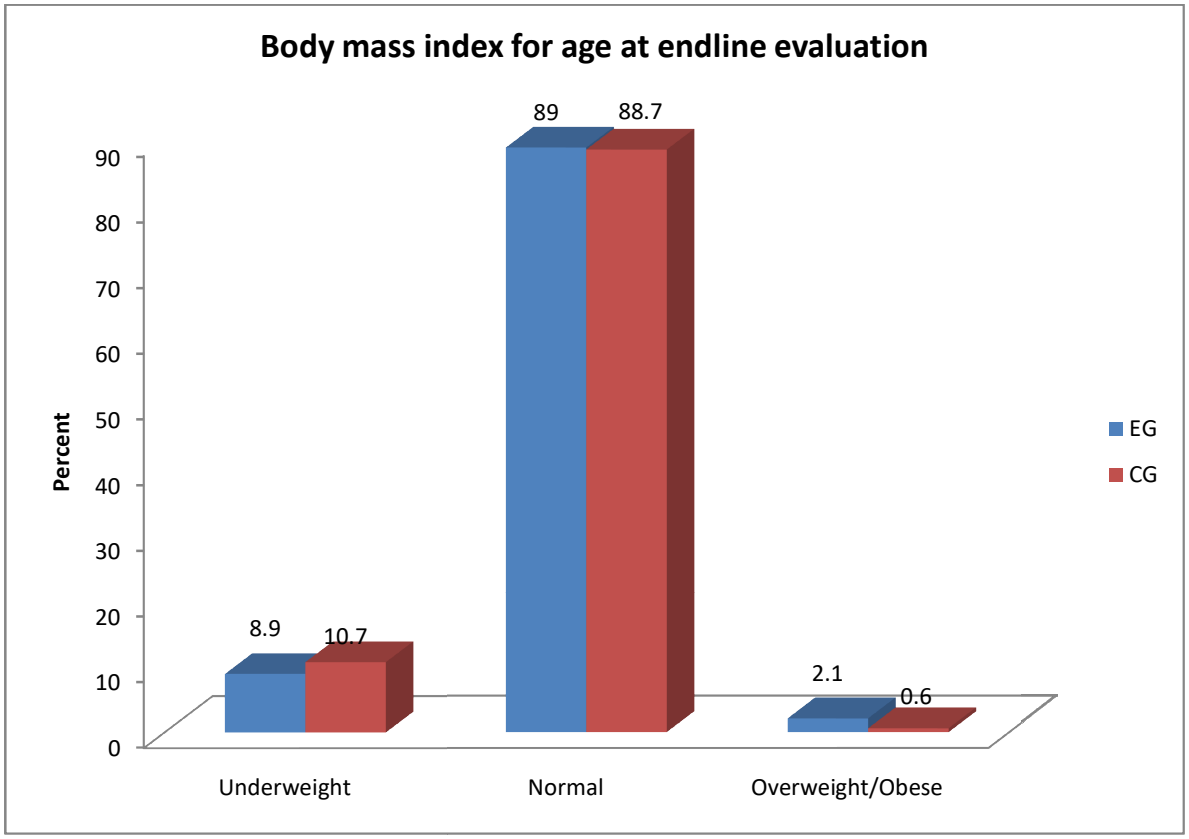

Figure 8: Body Mass Index for Age for EG and CG

4.3.14. Exposure to PA information from other sources and respondents' opinion about the multi-level intervention

In the EG and CG, 100% and 53.7% of respondents were exposed to PA information in the last three months. In the EG, 49.9% and 40.6% of the respondents enjoyed reading the physical activity cartoon to a large or a moderate extent respectively. In a similar vein, 49.2% and 42.4% of the respondents enjoyed reading the physical activity guide for health promotion to a large or a moderate extent respectively. Almost all (91.6%) of the respondents stated that they were encouraged to be physically active after reading the educational materials. Almost all of the respondents in the EG 96.6% were interested in the continuation of the intervention in their schools and 93.7% suggested its replication to other schools.

4.4. Testing of hypothesis

To evaluate the effects of the multi-level, multi-component interventions on the physical activity behaviours of secondary school students, the following hypotheses were tested

Ho: There is no significant difference between intervention and control groups with respect to the following:

- Attitude to physical activity
- Subjective norms
- Perceived behavioural control of physical activity behaviours
- Self-efficacy
- Social support from Teachers

Ho: There is no significant difference in the self-reported physical activity levels of students in the experimental group and control group before and after the intervention.

Ho: There is no significant difference in the objectively measured physical activity levels of students in the experimental group and control group before and after the intervention.

In testing these hypotheses, independent sample t-test and Chi square test was conducted at 0.05 level of significance.

4.5.1. Test of hypothesis for behavioural antecedent factors

The result of the independent sample t-test for statistical significance showed that at post intervention, there was significant difference in the attitude of respondents in the EG (M = 69.3, SD = 11.3) and CG (M = 64.3, SD = 12.4), t(993) = 6.58; p=0.000 (Table48).Therefore, we reject the null hypothesis that there is no difference in the attitude to physical activity between the EG and CG. Furthermore, Cohen's effect size value of (d=0.4) suggested a moderate practical significance. Thus, it can be inferred that the intervention influenced the attitude of the respondents in the EG with regards to PA, see details in Table 48.

There was no significant difference in the mean score of the EG (M = 30.7, SD = 6.97) and CG(M = 30.5, SD = 6.31), t(993) = 0.334; p=0.738 with regards to Subjective Norms. Thus the research failed to reject the null hypothesis and may suggest that the study did not influence the Subjective norms of respondents in the EG (Table 48). Furthermore, Cohen's effect size value (d = 0.03) suggested a low practical significance.

Post intervention, there was a significant difference in the respondents' Perceived Behavioural Control score for physical activity behaviours EG (M = 15.0, SD = 2.59) and CG (M = 14.6, SD = 3.1), t(993) = 2.414; (p=0.016) (Table 48). In addition, the difference in the Perceived Behavioural Control mean score of the EG and CG was significant. Based on this value, the null hypothesis was rejected. Cohen's effect size value (d = 0.14) suggested a small practical significance.Thus, it can be inferred that the intervention influenced the PBC of the respondents in the EG with regards to PA

The result of the independent sample t-test for statistical significance showed that at post intervention, there was significance difference in the self-efficacy of respondents in the EG (M = 40.5, SD = 6.65) and CG (M = 39.4, SD = 6.10), t (993) = 2.562;(p=0.011) (Table 48). In addition, the difference in the mean of self-efficacy score of the groups was significant. Based on this value, the null hypothesis was rejected. Cohen's effect size value (d = 0.31) suggested a small to moderate practical significance. Thus, it can be inferred that the intervention influenced the self-efficacy of the respondents in the EG with regards to PA.

The test of significance showed that there was no significant difference in the mean score of the EG (M = 3.67, SD = 2.56) and CG (M = 3.53, SD = 1.96), t (993) = 0.796; p=0.426 with regards to social

support from teachers for PA in the last three months. Thus the research failed to reject the null hypothesis and the result suggest that in the EG, the study did not influence social support from teachers for PA in the last three months (Table 48). Furthermore, the Cohen's effect size value of (*d* = 0.06) suggested a low practical significance.

Table 48: Immediate outcome evaluation of the multi-level intervention on the behavioural antecedent factors

Variables	Group	No	Mean	Std. Dev.	Df	t	*p-value	**ES (95% CI)
Attitude: Baseline score	**Intervention**	666	65.3	13.4	1316	-2.039	0.042	0.11 (0.22 – 0.01)
	Control	652	66.7	11.2				
Attitude: End line score	**Intervention**	493	69.3	11.3	993	6.583	0.000	0.42 (0.30 – 0.55)
	Control	502	64.3	12.4				
Baseline Subjective Norms score	**Intervention**	666	30.0	7.08	1316	-3.115	0.002	0.17 (0.28 -0.06)
	Control	652	31.2	6.80				
End line Subjective Norms score	**Intervention**	493	30.7	6.97	993	0.334	0.738	0.03 (-0.09- 0.15)
	Control	502	30.5	6.31				
Perceived Behavioural Control score – Baseline	**Intervention**	666	14.98	3.06	1316	-1.442	0.149	0.07 (0.18 – 0.03)
	Control	652	15.2	2.82				
Perceived Behavioural Control score- End line	**Intervention**	493	15.0	2.59	993	2.414	0.016	0.14 (0.02 – 0.26)
	Control	502	14.6	3.1				
Self efficacy – Baseline	**Intervention**	666	38.4	7.24	1316	-3.437	0.001	0.17 (-0.28 – - 0.07)
	Control	652	39.6	6.44				
Self efficacy - End line	**Intervention**	493	40.5	6.65	993	2.562	0.011	0.31 (0.06 – 0.19)
	Control	502	39.4	6.10				

***P value of the t-test statistics and **ES is the effect size of the intervention between baseline and immediate outcome evaluation computed from Cohen's d and the corresponding 95% CI.**

Table 48: Immediate outcome evaluation of the multi-level intervention on the behavioural antecedent factors (contd.)

Variables	Group	No	Mean	Std. Dev.	df	t	*p-value	**ES (95% CI)
Social Support from Teachers – Baseline	**Intervention**	666	3.58	2.27	1316	-.967	0.334	-0.05 (-0.16 – 0.05)
	Control	652	3.70	2.15				
Social Support from Teachers - End line	**Intervention**	493	3.67	2.56	993	0.796	0.426	0.06 (-0.06 – 0.19)
	Control	502	3.53	1.96				

***P value of the t-test statistics and **ES is the effect size of the intervention between baseline and immediate outcome evaluation computed from Cohen's d and the corresponding 95% CI.**

4.5.2. Test of hypothesis on the self-reported and objectively measured PA

The result of the independent sample t-test for statistical significance showed that at post intervention, there was significance difference in the self-reported PA scores of respondents in the EG (M = 2.90, SD = 0.60) and CG (M = 2.62, SD = 0.54), t(993) = 6.708; (p=0.000) (Table 49). Based on this value, the null hypothesis was rejected. Cohen's effect size value (d = 0.51) suggested a moderate to large practical significance. Thus, it can be inferred that the intervention influenced the self-reported PA scores of the respondents in the EG.

At post intervention, there was a significant difference in the objectively measured levels of PA between the EG (M = 46124.2, SD = 23751.9) and CG (M = 35573.0, SD = 23848.0), t(94) = 2.136; (p=0.035) (Table 49). Based on this value, the null hypothesis was rejected. Cohen's effect size value (d = 0.44) suggested a moderate to large practical significance.Thus, it can be inferred that the intervention influenced the objectively measured PA levels of the respondents in the EG.

Table 49: Immediate outcome evaluation of the multi-level intervention on the self-reported and objectively measured PA

Variables	Group	No	Mean	Std. Dev.	df	t	p-value	*ES (95% CI)
Self-reported physical activity: Baseline score	**Intervention**	666	2.45	0.64	1316	1.191	0.24	0.06 (-0.04 – 0.17)
	Control	652	2.41	0.62				
Self-reported physical activity: End line score	**Intervention**	493	2.90	0.60	993	6.708	0.000	0.51 (0.38 – 0.63)
	Control	502	2.62	0.54				
Objectively Measured PA: Baseline line score	**Intervention**	46	28997.4	23110.7	94	-1.089	0.28	-0.22 (-0.62 -0.18)
	Control	50	34204.4	23662.2				
Objectively Measured PA: End line score	**Intervention**	45	46124.2	23751.9	94	2.136	0.035	0.44 (0.03 -0.85)
	Control	48	35573.0	23848.0				

***P value of the t-test statistics and **ES is the effect size of the intervention between baseline and immediate outcome evaluation computed from Cohen's d and the corresponding 95% CI**

4.5.3. Effect of the intervention using the multilevel mixed-effects linear regression

Model 1 showed that there is evidence that the two groups (control and intervention group) differed in their mean subject specific intercept with respect to time (pre-and post). Specifically, there was a difference in the self-reported physical activity scores of the experimental (β= 0.20; CI= -0.12-0.28) and control groups after the intervention. See Table 50.

Model 2 showed that after student-level characteristics *gender, ethnic group, age, religion, mother's educational level, father's educational level, school type* and behavioural constructs *knowledge, attitude, perceived behavioural control, self-efficacy, subjective norms, friends, family and teachers social suppor*t were added to the multi-level model, there still remained evidence that the two groups (control and experimental groups) differed in their mean subject specific intercept with respect to time (pre and post). Specifically, there was a difference in the self-reported physical activity scores of the experimental (β= 0.12; CI= 0.04 -0.21)and control groups after the intervention. Female gender (β= -0.22; CI= -0.27 - -0.17) and being an adolescent aged 15 to 19 years (β=-0.14;CI= -0.19 - -0.09)were significantly negatively associated with PA. Mother's secondary (β= 0.20; CI= 0.04 -0.40) or above secondary (β=0.17; CI=0.00 – 0.33) educational level, positive attitude (β= 0.10; CI=0.06 -0.15), good self efficacy (β=0.15; CI=0.10 - 0.20), good subjective norms (β= 0.06; CI= 0.01 - 0.11), good family (β= 0.14; CI=0. 09 -0.18) and friends' social support (β= 0. 13;CI=0. 08 -0.18)were significant predictors of PA, see Table 51.

Model 3 showed that after the school policy attributes -*Formal physical health education policies, Break time policies, Break time access* were added to the multi-level model, the two groups (control and intervention group) still differed in their mean subject specific intercept with respect to time (pre and post). Specifically, there was a difference in the self-reported physical activity scores of the experimental and control groups after the intervention (β= 0.09; CI=0.01 - 0.18). Female gender (β= -0.22; CI= -0.27 - - 0.17) and being an adolescent aged 15 to 19 years (β= -0.13; CI= -0.18 - -0.08)were significantly negatively associated with PA. Positive attitude (β= 0 .10; CI=0.06 - 0.15), good self efficacy (β= 0.16; CI=0.11 - 0.21), good subjective

norms (β= 0.06; CI=0.02 - 0.11), good family (β= 0.14; CI=0.09 - 0.19)and friends' social support (β= 0. 12; CI= 0.07 - 0.17)were significantly and positively associated with PA, see Table 52.

Model four showed that after school environmental attributes - *Sports Facility Provisions, Cycling Provisions, Other Facility Provisions, Aesthetics and Design of school grounds* were added to the multi-level model, the two groups (control and intervention groups) differed in their mean subject specific intercept with respect to time (pre-and post). Specifically, there was a difference in the self-reported physical activity scores of the experimental and control groups after the intervention (β=0.10; CI= 0.01 - 0 .18). Female gender (β=-0.22; CI= -0.27 - -0.17), being an adolescent aged 15 to 19 years (β=-0.14; CI= -0.19 - -0.09) and studying in a public school (β=-0.13; CI= -0.25 - - 0.02)were significantly negatively associated with PA. Positive attitude(β=0.10; CI= 0.05 - 0.15), good self efficacy(β=0.16; CI= 0.11 - 0.21), good subjective norms(β=0.06; CI= 0.02 - 0.11), good family (β=0.14; CI= 0.09 – 019)and friends' social support (β=0.12; 0.07 -0.17)were positive predictors of PA, see Table 52.

For Model 5 which is the final model, all significant variables from the analysis were included in the model and likelihood ratio test (LR test) was used to determine which parameter contributed significantly and should remain in the model. The findings suggested that there was a difference in the self-reported physical activity scores of the experimental and control groups after the intervention, (β=0.10; CI= 0.01-0.18) see Table 53.

Table 50: Two level multilevel model showing the association intervention groups and significant variables (Model I)

Variable Parameter	Model 1 Coefficient (95% CI)	P-value
City		
Ogbomosho (CG)	1	
Ibadan (EG)	0.02 (-0.14 -0 .19)	0.794
Time		
Pre-intervention	1	
Post intervention	0.22 (0.16- 0 .28)	0.000*
City#time		
Ibadan pre- intervention	1	
Ibadan post- intervention	0.20 (0 .12- 0.28)	0.000*

Table 51: Two level multilevel model showing the association intervention groups and significant variables (Model 2)

Variable Parameter	Model 2 Coefficient (95% CI)	P-value
City		
Ogbomosho (CG)	1	
Ibadan (EG)	0.07 (-0.09 -0.22)	0.380
Time		
Pre-intervention	1	
Post intervention	0.25 (0.19 -0.31)	0.000*
City#time		
Ibadan pre- intervention	1	
Ibadan post- intervention	0.12(0.04 -0.21)	0.004*
Gender		
Male	1	
Female	-0.22 (-0.27 - - 0.17)	0.000*
Ethnic group		
Yoruba	1	
Igbo	0.06 (-0.03 – 0.16)	0.192
Hausa	-0.05 (-0.23 – 0.14)	0.640
Others	0.14 (0.03 -0.26)	0.017*
Religion		
Christianity	1	
Islam	-0.00 (-0.06 – 0.63)	1
Traditional	0.22 (0.35 – 0.79)	0.440
Mother's educational level		
No formal education	1	
Primary	0.16 (-0.02 – 0.33)	0.08
Secondary	0.20 (0.04 -0.40)	0.017*
Above secondary	0.17 (0.00 – 0.33)	0.049*
Father's educational level		
No formal education	1	
Primary	-0.15 (-0.30 -0.05)	0.147
Secondary	-0.140 (-0.32- 0.03)	0.116
Above secondary	-0.12 (-0.30 -0.05)	0.174
School type		
Private	1	
Public	-0.13 (-0.29 - 0.02)	0.100

Table 51: Two level multilevel model showing the association intervention groups and significant variables (Model 2 contd.)

Variable	Model 2	
Parameter	**Coefficient (95% CI)**	**P-value**
Age category		
10-14 years	1	
15-19 years	-0.14 (-0.19 - -0.09)	0.000*
Knowledge		
Poor	1	
Good	-0.04 (-0.09 - 0.01)	0.110
Attitude		
Negative	1	
Positive	0.10 (0. 06 -0.15)	0.000*
Perceived behavioural control		
Poor	1	
Good	0.01 (-.06 - 0.037)	0.671
Self efficacy		
Poor	1	
Good	0.15 (0.10 - 0.20)	0.000*
Subjective norms		
Poor	1	
Good	0.06 (0.01 - 0.11)	0.013*
Family support		
Poor	1	
Good	0.14 (0. 09 -0.18)	0.000*
Friend's support		
Poor	1	
Good	0.13 (0. 08 -0.18)	0.000*
Teacher's support		
Poor	1	
Good	-.03 (-0.08 -0.01)	0.161

Table 52: Two level multilevel model showing the association intervention groups and significant variables (Model 3 and 4)

Variable	Model 3		Model 4	
Parameter	**Coefficient (95% CI)**	**P-value**	**Coefficient (95% CI)**	**P-value**
City				
Ogbomosho (CG)	1		1	
Ibadan (EG)	0.08 (-0.09 - 0.25)	0.355	0.15 (0.04 - 0.27)	0.008
Time				
Pre-intervention	1		1	
Post intervention	0.28 (0.21 – 0.34)	0.000*	0.28 (0.22 - 0.33)	0.000 *
City time				
Ibadan pre- intervention	1		1	
Ibadan post- intervention	0.09 (0.01 - 0.18)	0.028*	0.10 (0.01 - 0 .18)	0.024 *
Gender				
Male	1		1	
Female	-0.22 (-0.27 - - 0.17)	0.000*	-0.22 (-0.27 - - 0.17)	0.000 *
Ethnic group				
Yoruba	1		1	
Igbo	0.06 (-0.04 – 0.15)	0.224	0.06 (-0.04 - 0.16)	0.207
Hausa	-0.06 (-0.26 - 0.13)	0.527	-0.06 (-0.25 - 0.13)	0.526
Others	0.11 (-0.00 -0 .23)	0.057	0.12 (-0.00 - 0.24)	0.051
Religion				
Christianity	1		1	
Islam	-0.01 (-0.07 – 0.06)	0.872	-0.02 (-0.08 -0.05)	0.604
Traditional	0.20 (-0.36 – 0.77)	0.481	.20 (-0.36 - 0.77)	0.485
Mother's educational level				
No formal education	1		1	
Primary	0.15 (-0.03 - 0.33)	0.118	0.14 (-0.04 – 0.33)	0.129
Secondary	0.16 (0.01 - 0.33)	0.068	0.15 (0.02 -0.33)	0.077
Above secondary	0.13 (-0.04 - 0.31)	0.121	0.13 (-0.04 -0.31)	0.138
Father's educational level				
No formal education	1		1	
Primary	-0.15 (-0.35- 0.05)	0.135	-0.15 (-0.34 -0.05)	0.141
Secondary	-0.12 (-0.30-0.05)	0.181	-0.12 (-0.30 - 0.06)	0.179
Above secondary	-0.12 (-0.30 - 0.06)	0.193	-.011 (-0.29 - 0.06)	0.198

Table 52: Two level multilevel model showing the association intervention groups and significant variables (Model 3 and 4, contd. a)

Variable Parameter	Model 3 Coefficient (95% CI)	P-value	Model 4 Coefficient (95% CI)	P-value
School type				
Private	1		1	
Public	-0.12 (-0.29 -0.05)	0.148	-0.13 (-0.25 - - 0.02)	0.022*
Age category				
10-14 years	1		1	
15-19 years	-0.13 (-0.18 - -0.08)	0.000*	-0.14 (-0.19 - -0.09)	0.000*
Knowledge				
Poor	1		1	
Good	-0.03 (-0.08 – 0.02)	0.255	-0.03 (-0.08 - 0 .02)	0.266
Attitude				
Poor	1		1	
Good	0 .10 (0.06 - 0.15)	0.000*	0.10 (0.05 - 0.15)	0.000*
Perceived behavioural control				
Poor	1		1	
Good	-0.02 (-0.06 - 0.03)	0.491	0.02 (-0.06 - 0.03)	0.528
Self efficacy				
Poor	1		1	
Good	0.16 (0.11 - 0.21)	0.000*	0.16 (0.11 - 0.21)	0.000*
Subjective norms				
Poor	1		1	
Good	0.06 (0.02 - 0.11)	0.011*	0.06 (0.02 - 0.11)	0.010*
Family support				
Poor	1		1	
Good	0.14 (0.09 - 0.19)	0.000*	0.14 (0.09 – 019)	0.000*
Friend's support				
Poor	1		1	
Good	0. 12 (0.07 - 0.17)	0.000*	0.12 (0.07 -0.17)	0.000*

Table 52: Two level multilevel model showing the association intervention groups and significant variables (Model 3 and 4, contd. b)

Variable Parameter	Model 3 Coefficient (95% CI)	P-value	Model 4 Coefficient (95% CI)	P-value
Teacher's support				
Poor	1		1	
Good	-0.03 (-0.08 - 0.02)	0.209	-0.03 (-0.08 - 0.02)	0.195
Formal physical health education policies				
Poor	1		1	
Good	0.06 (-0.12 -0.24)	0.506	-0.02 (-0.14 - - 0. 10)	0.727
Break time policies				
Poor	1		1	
Good	-0.02 (-0.25 - 0 .21)	0.843	0.02 (-0.13 -0.17)	0.799
Break time access				
Poor	1		1	
Good	-0.04 (-0.21 -0.14)	0.678	0.07 (-0.05 - 0.20)	0.256
‘				
Sports Facility Provisions				
Poor			1	
Good			0.08 (-0.09 – 025)	0.357
Cycling Provisions				
Poor			1	
Good			0.12 (-0.18 – 0.41)	0.427
Other Facility Provisions				
Poor			1	
Good			-0.37 (-0.50 - -0.24)	0.000*
Aesthetics				
Poor			1	
Good			0.08 (-0.10 - 0.25)	0.383
Design of school grounds				
Poor			1	
Good			-0.01 (-0.17 - 0.16)	0.939

Table 53: Two level multilevel model showing the association intervention groups and significant variables (final model including significant factors at p<0.05)

Significant variables	Coefficient	95% C I	P value
City			
Ogbomosho	1		
Ibadan	0.16	0.04 – 0.28	0.008**
Time			
Pre- intervention	1		
Post-intervention	0.28	0.22-0.34	0.000**
City#time			
Ibadan pre- intervention	1		
Ibadan post- intervention	0.10	0.01-0.18	0.024**
Gender			
Male	1		
Female	-0.22	-0.27- -0.17	0.000**
Mother Education			
No formal education	1		
Primary	0.15	-0.40-0.33	0.115
Secondary	0.16	0.16-0.33	0.075
Above secondary	0.14	-0.04-0.31	0.128
Father Education			
No formal education	1		
Primary	-0.15	-0.40-0.05	0.134
Secondary	-0.12	-0.30-0.06	0.184
Above secondary	-0.11	-0.29-0.06	0.204
School-type			
Private	1		
Public	-0.18	-0.29- -0.06	0.002**
Age category			
10-14	1		
15 to 19	-0.13	-0.19- -0.08	0.000**
Knowledge			
Poor	1	‘	
Good	-0.03	-0.08-0.02	0.258

Table 53: Two level multilevel model showing the association intervention groups and significant variables (final model including significant factors at p<0.05) contd.

Significant variables	Coefficient	95% C I	P value
Attitude			
Poor	1		
Good	0.11	0.06-0.15	0.000**
Self efficacy			
Poor	1		
Good	0.16	0.11-0.21	0.000**
Subjective norms			
Poor	1		
Good	0.06	0.01-0.11	0.014**
Family support			
Poor	1		
Good	0.14	0.09 – 0.19	0.000**
Friends support			
Poor	1		
Good	0.12	0.07-0.17	0.000**
Teachers support			
Poor	1		‘
Good	-0.03	-0.08-0.01	0.169
Break-time policies			
Poor	1		
Good	0.04	-0.12-0.18	0.603
Break-time access			
Poor	1		
Good	0.05	-0.07-0.16	0.410
Other Facility Provision			
Poor	1		
Good	-0.31	-0.42- -0.19	0.000**

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECCOMENDATIONS

5.0 Discussion

The broad objective of this study was to evaluate the effects of a multi-level intervention on the PA behaviours of adolescents in secondary schools in Oyo State. The intervention involved using several activities targeting the multi-layer system specifically the adolescents, teachers, school authorities and officials of the Ministry of Education. The intervention spanned 12 weeks. Key findings from the study are discussed and presented in this section.

5.1. Effect of the multi-level intervention on the physical activity behaviours of adolescents

This study adopted a multi-level, socio-ecological approach which involved targeting multiple levels by(i) increasing awareness and stimulating discussion on the growing burden of physical inactivity among adolescents in Oyo state through meetings and dialogues with officials of the ministry of education and school authorities (ii) encouraging social support in schools through health talks on NCDs and medical screening for teachers as well as the provision of school-wide educational materials (iii) enhancing the psychological mediators of physical activity among adolescents (*i.e. attitude, self-efficacy, perceived behavioural control etc)* through information, education, communication and teacher-led session and (iv) providing basic sporting equipment to promote field based PA activities.

Baseline Result

A number of implications may be observed for the findings of this study at baseline. A comparison of the Self-reported Physical Activity (SPA) levels of the respondents indicated that over a quarter of respondents in both the experimental and control groups were inactive. Furthermore, most respondents fell within the moderate range of physical activity. This value is similar to that obtained by Odunaiya *et al.*, (2015) from the study conducted among 15–18 years old adolescents in schools at Ibarapa central local government but slightly lower than the values obtained by Adeniyi *et al.*, 2011 and Odunaiya *et al.*, 2010 in Ibadan North and Ibadan South-east Local Government Areas of Oyo State respectively. However, the level of vigorous physical

activity is very low and comparable to other studies (Adeniyi *et al.*, 2011 and Odunaiya *et al.*, 2010). Multiple studies have observed that adolescents in Africa engage more in light and incidental moderate-intensity physical activity during domestic activities and active transportation but these are insufficient to meet the MVPA recommendations (Muthuri *et al.*, 2014; Wushe *et al.*, 2014; Craig *et al.*, 2013; McVeigh and Meiring (2014).These findings support the observed low physical activity level of in-school adolescents and justified the need for an intervention to increase their moderate to vigorous physical activity (Adeniyi, Odukoya, Oyeyemi, Adedoyin, Ojo, Metseagharun and Akinroye, 2016) through multiple curricula and non-curricula approaches in line with the principles of the socio-ecological model.

The effect of sex on physical inactivity was observed in the study. According to findings, a fifth of the male respondents compared to a third of the female respondents in both the experimental and control groups had very low physical activity levels. This implies that almost twice the proportions of females are inactive compared to males. Several studies have revealed that males are more active than females (Beets *et al.* 2006; Ziaee *et al.*, 2006, Adeniyi *et al.*, 2011, Muthuri *et al.*, 2014; McVeigh *et al.*, 2014; Odunaiya *et al.*, 2015, Oyeyemi *et al.*, 2016, Adeniyi *et al.*, 2016). This is similar to the study by Al-Hazzaa, Abahussain and Al-Sobayel *et al.*, 2011 in Saudi Arabia which found that female adolescents were about 2.5 times more likely to have inadequate physical activity per day compared to male adolescents.

This may be a reflection of gender disparities in Nigeria linked with the limited opportunities for social activities due to parental (Al-Hazzaa, Abahussain and Al-Sobayel *et al.*, 2011) or school restriction. Other possible associated factor is the concept of feminity which pressures females to conform to norms by appearing feminine in order to be socially and culturally accepted thus limiting their participation in PA (Craig *et al.*, 2013, Cockburn and Clarke, 2002, Witmer *et al.* 2011). It should be noted that Oyeyemi *et al.* 2016 also observed this gender disparity in Northern Nigeria. Hence, there is a need to challenge and change the norms associated with gender participation in sporting and physical activity in Nigeria. This underscores the need for more gender specific interventions for physical activity promotion among Nigerian adolescents (Oyeyemi *et al.*, 2016).

The result of the baseline also showed that adolescents in the 15-19 years age group were more inactive compared to those aged 10 to 14 years. This aligns with studies in Nigeria and globally which have found a striking decline in physical activity with increasing age (Riddoch *et al.*, 2004; Troiano *et al.*, 2008; Nader *et al.*, 2008; Adeniyi *et al.*, 2011; Dumith *et al..*, 2011,Cooper *et al..*, 2015, Odunaiya *et al.*, 2015). The observed age-related decline in physical activity is a challenge and underscores the need to target adolescents especially those in the middle and late adolescents with interventions aimed at promoting continued interest in physical activity.

Post Intervention Result

Findings from the multi-level regression analysis revealed that exposure to the intervention resulted in an increased score for physical activity among the experimental group. Positive predictive factors were having a good attitude, high self-efficacy, positivesubjective norms, positive family and friend support while the negative associated factors were being a female in the 15-19 years' age range and being a student in a public school.

The positive effect of the multi-level intervention aligns with the findings of a multilevel intervention implemented in France which resulted in improved physical activity and decreased sedentary behaviours in adolescents (Simon, Wagner, Platat, Arveiler, Schweitzer, Schlienger and Triby, 2006). This also aligns with findings of a Cochrane Systematic Review which summarized the evidence on the effectiveness of school-based interventions in promoting physical activity and fitness in children and adolescents. According to the review, there was some evidence to suggest that school-based physical activity interventions led to an improvement in the proportion of children who engaged in moderate to vigorous physical activity during school hours (, Husson and DeCorby *et al.*, 2013).

The multilevel mixed-effects linear regression found that being in the 15-19 years age group was a predictor of physical inactivity. This aligns with studies in Nigeria and globally which have found a striking decrease in physical activity with increasing age (Riddoch *et al.*, 2004; Troiano *et al.*, 2008; Nader *et al.*, 2008; Adeniyi *et al.*, 2011; Dumith *et al..*, 2011,Cooper *et al..*, 2015, Odunaiya *et al.*, 2015,). The observed age-related decline in physical activity is a challenge and underscores the need to target

adolescents especially those in the middle and late adolescents with interventions aimed at promoting continued interest in physical activity. In addition, the Ministry of Education needs to review its curriculum to ensure students in the senior secondary school continue to take physical health education as a core subject contrary to what currently exists.

According to findings of this study, attitude was a significant predictor of physical activity behaviours. In addition, the multi-level intervention significantly improved the attitude of adolescents towards PA with a Cohen's effect size value of (d=0.4) which suggested a moderate practical significance. This aligns with findings of a study conducted among adolescents in Greece which reported that attitude was a strong predictor of exercise intentions and PA behaviours (Angelopoulos, Milionis and Grammatikaki *et al.*, 2009). This underscores the need for intensified intervention efforts which focuses on improving adolescents' perception and attitude towards physical as a fun activity with a potential to maintain/improve their health.

Several studies and a published review identified self-efficacy as a consistent positive correlate and determinant of physical activity among adolescents (Bauman, Reis and Sallis *et al.*, 2012; Craggs *et al.*, 2011; Lytle, 2009; Hearst *et al.*, 2012; de Souza *et al.*, 2013). Furthermore, the higher the self-efficacy in adolescents, the higher the likelihood of being active (Park and Kim, 2008; Lytle, 2009; Peterson *et al.* 2013; Mohamadian *et al.*, 2014; Craggs, *et al.*, 2011; Hearst *et al.*, 2012; de Souza *et al.*, 2013). The multi-level intervention significantly increased the self-efficacy scores of the adolescents in the experimental group with a Cohen's effect size value of (d = 0.31) which suggested a moderate practical significance. This result aligns with findings of a Cochrane Systematic Review on School based interventions (Dobbins, Husson and DeCorby *et al.*, 2013). Thus, it can be inferred that multi-level, multi-component school based interventions have a potential to improve the self- efficacy of adolescents and invariably their PA behaviours.

Several studies have documented a relationship between Perceived behavioral control in adolescents and MVPA (Motl *et al.*, 2005, Plotnikoff *et al.*, 2013; Wang and Zhang, 2016). Hence, the relationship between the perceived behavioural control and MVPA in the CG is consistent with findings (Motl *et al.*, 2005, Plotnikoff *et al.*,

2013; Wang and Zhang, 2016). The intervention increased the adolescents PBC for PA behaviours; thus, school based interventions should also target interventions to increase adolescents PBC.

Social support from teachers has been identified as a factor which has a potential to increase the PA levels of adolescents (Koka and Hein, 2003; DeCorby, 2005; Zhang *et al.*, 2012).An intervention programme "Fit-4-Fun" which was implemented to enhance social support for physical activity provided by the classroom teachers found that it increased PA levels among primary school students (Eather *et al.*, 2013). At post intervention evaluation, findings of this study revealed that there was no significant difference in the mean score of the EG compared to CG with regards to social support from teachers for PA in the last three months. In addition, it was not a predictor of PA in adolescents according to results from the multi-level linear regression analysis. This finding aligned with result obtained from a systematic review by Mendon *et al.*, (2014) which showed that seven out of ten cross sectional research studies found no association between social support from teachers and physical activity behaviours of adolescents.

A key factor which may explain this unusual finding could be that the intervention activity focusing on teachers had insufficient dose and intensity considering the deeply ingrained negative attitude and apathy towards physical health education in secondary schools in Oyo State. It is therefore recommended that further studies should increase the frequency, and diversify approaches for engaging the teachers to support PA activities considering their critical roles in the school settings.

According to the results of the multi-level linear regression, social support from friend had a strong influence the physical activity behaviours of the adolescents. This aligns with studies which have found that adolescents who have friends who are physically active had higher levels of physical activity (Sabiston and Crooker, 2008; Deforche *et al.*, 2010; Bergh, Grydeland, Bjelland, Klepp, Anderssen, and Ommundsen, 2011; Fermino *et al.*, 2010; Martin *et al.*, 2011; Kirby *et al.*, 2011; Cheng *et al.*, 2014). Interestingly, adolescents tend to be more influenced by their peers as age increases since they share their preferences, values and standards which consequently influence behaviours including physical activity (Salvy, Haye and Bowker, *et al.*, 2012). This

observation can be linked to the inherent need for social acceptance (Duncan, Duncan and Strycker *et al.*, 2005).

In view of the result obtained from this study and in line with findings from similar studies, (Sabiston and Crocker, 2008; Deforcheet, Van Dyck and Verloigne *et al.*, 2010; Bergh, Grydeland and Bjelland *et al.*, 2011; Fermino, Rech and Hino *et al.*, 2010; Martin, McCaughtry and Flory *et al.*, 2011; Kirby, Levin and Inchley, 2011; Cheng, Mendonc¸a and Farias Júnior, 2014), it is obvious that social support especially from friends is an important construct for engaging in physical activity and it should be included in intervention programmes to increase physical activity levels in this group. Thus, experimental and interventions studies programmes should consider social support from friends and other significant others as an important strategy to promote physical activity in adolescents (Mendonça, Cheng, Mélo, and de Farias Júnior, 2014).

Though there were no family-focused activities on the multi-level intervention, parents were informed about the study through the consent forms and this may have increased awareness and aroused interest in PA thus invariably increasing family support. The results from the multi-level linear regression analysis showed that, family support was a positive predictor of the physical activity levels of the adolescents. This is similar to findings of a study which found that adolescent girls who reported lower family support had more rapid declines in physical activity levels (Dowda, Dishman, Pfeiffer, and Pate, 2007). Hence, multi-level intervention should incorporate activities targeting parents as this has a potential to increase the PA levels of adolescents.

5.3 Contextual Analysis of the Multi-level Intervention: *Gaps, Opportunities and the way forward*

There is a growing interest in multi-level interventions and its potential to transform public health programming. Despite being a catch phrase in public health, interventions adopting the multi-level, multi-component approach are limited (Schölmerich and Kawachi, 2016). In addition, the research methodology and current body of knowledge in this important area are insufficient to guide those interested in

designing and implementing multi-level interventions (Pasket, Thompson, Ammerman, Ortega and Marsteller2016; Schölmerich and Kawachi, 2016).

A key factor contributing to the dearth of information on multilevel interventions is linked to design, implementation and evaluation challenges. However, it is important to note that despite these challenges, there is a need for empirical evidence to support the feasibility and potential impacts of multi-level interventions beyond theoretical assumptions (Cleary, Gross, Zaslavsky and Taplin, 2012; Lieberman, Golden, & Earp, 2013).

As noted in this study and verified from literature, multilevel interventions have higher operational challenges and financial requirements than single-level, focused efforts (Cleary, Gross and Zaslavsky *et al.*, 2012; Schölmerich *et al.*, 2016). In addition, longer implementation duration is required to detect an effect at the population level (Richard, Gauvin and Raine, 2011). This was noted and necessitated enrolling a large population in this study to assess the effect of the multi- level intervention. Thus, the conceptualisation of multi-level interventions must be preceded by a careful contemplation guided by available evidence in the literature and a comparative cost analysis vis-a-vis single-level, focused efforts.

Another knowledge gap is the uncertainty about the added value of multilevel interventions and the contributions of each activity (Lieberman, Golden, & Earp, 2013).Assessing the effects of activities in multilevel interventions remain challenging because the approach allows for interaction among levels. A major issue to consider when evaluating a multilevel intervention is whether to assess only the combined impact of the multiple interventions compared with no intervention or the separate effects of activities which targeted different levels and the possible synergistic relationship.

The simplest approach is to assess only the combined effect of a multilevel intervention on individuals (Cleary, Gross and Zaslavsky *et al.*, 2012) as was done in this study. However, isolating the contributions and effect of each activity implemented would have provided the highest level of evidence for multi-level interventions but this will require a factorial design which is often complex and

expensive to conduct (Cleary, Gross and Zaslavsky *et al.*, 2012). In spite of this challenge, it is strongly recommended that researchers should consider the factorial study design for multi-level interventions to provide evidence and guide the selection of the most promising activities.

Community partnership and engagement is crucial for multi-level interventions considering that the approach hinges on engage multiple stakeholders and maintain community relationships (Mikkelsen, Novotny, and Gittelsohn, 2016). This approach was adopted for this study in conceptualising the intervention and sustaining its implementation. Thus researchers must give this due consideration in the design of the multi-level intervention.

Despite the challenges aforementioned, the implementation of multilevel interventions to increase the physical activity levels of adolescents within the school settings remains very relevant and appropriate as demonstrated by the result of this study. It has broader public health impact compared to single-level interventions. In addition, there is greater potential to replicate the approach in other settings (Cleary *et al.*, 2012). Hence, there is a need for further studies to test this approach to support the evidence base on multi-level interventions.

5.4. Conclusion and recommendations

Summarily, this study supports the views that physical activity behaviours are influenced by factors at several levels and justify the use of multi-level, multi-component interventions for improving the physical activity behaviours of adolescents. Furthermore, the evidence from this study suggests that schools are appropriate for the implementation of behavioural and population wide approaches for promoting the physical activity behaviours of adolescents in Nigeria despite the limitations encountered with working within this setting. With the foregoing discussions in mind, the following recommendations are proposed.

1. The study revealed that more adolescents aged 15 to 19 years were inactive. Compounding this problem is the fact that, adolescents in the senior secondary schools who are also largely in the 15 to 19 years age group do not take physical health education as a subject thus further limiting their participation in field based

activities. It is recommended that schools should implement curricula and non-curricula activities targeting older adolescents to ensure daily participation in physical activity. In addition, school authorities should assume a leadership role in promoting and ensuring that young people engage in 60 minutes of moderate and vigorous PA daily.

2. The study also revealed that female adolescents are less active; gender sensitive interventions are proposed to increase female participation in physical activity. These interventions should ensure girls find physical activity enjoyable by increasing choice and offering a wide range of innovative activities.

3. The association between social support and physical activity among the adolescents was positive and consistent. This indicates the importance of this construct and the need to consider it while designing PA intervention for this group. PA Intervention programmes developed by relevant stakeholders and researchers should also focus on other significant others (friends, parents and teachers) by increasing their ability to provide motivations and instrumental actions which will encourage adolescents to be active.

4. From the findings of this study, the majority of schools had poor surroundings and infrastructure for physical activity. Multi-sectoral approach and monetary investment are needed to improve the built environment through the collaboration of sectors such as education, urban and regional planning, environment etc. to ensure students have safe and adequate infrastructure to be active.

5. The delivery of Physical health education in schools needs to be enhanced through school policies which ensures all students irrespective of their age and gender have opportunities to participate in physical activity. In addition, there should be an adequate monetary investment to ensure adequate PHE teachers are recruited and undergo regular professional training as a way to increase opportunities for participation in PA through curricula based avenues.

5.5. Implication of findings for Health Promotion and Education

The study findings have implications for health promotion and education. It is noted that behavioural constructs such as attitude, perceived behavioural control and self efficacy were positive and significant predictors of physical activity. This justifies the need for more theory based PA interventions which are designed to improve attitude and self efficacy in adolescents. These interventions should transcend the cognitive aspect of learning and also boost their confidence through the use of multiple approaches such as role modelling, life building skills, motivational counselling etc.

In line with the principles of health promotion, the study showed that individual behaviours are influenced by extraneous factors and underscore the importance of understanding health behaviours and the contexts in which they occur; this should guide the design of holistic interventions. The design of PA interventions or other health conditions for adolescents should focus not only on intrapersonal behavioural factors but also on the multiple-level factors that influence the specific behaviour in question. This will ensure that researchers identify vast opportunities to foster the adoption and maintenance of behaviours, rather than having a traditional isolated focus on intrapersonal factors.

This study has demonstrated that school-based physical activity interventions have positive outcomes hence, the school settings should be adopted and used by public health agencies and schools authorities and regulatory boards to implement population-wide interventions that transcends educational activities which fosters favourable physical activity and other lifestyle behaviours. Parental involvement is crucial and it is important to engage them as part of school based stakeholders for the implementation of interventions focused on in-school adolescents.

Of import is the social and policy environment for PA in schools which may serve as a barrier to participation in PA. Stakeholders in the education have a pivotal role to play in ensuring adolescents are active but from the findings of the qualitative research, it is obvious they are not doing enough due to their attitudinal disposition to PA and the competing time demand for academic activities.

Furthermore, the deplorable state of the built environment for physical activity and sporting activities in schools require urgent interventions. This situation has grave implication for the holistic development of the cognitive and motor development of adolescents and necessitates intensive and targeted interventions such as public enlightenment, advocacy and policy dialogue to stakeholders to help them understand the importance of physical activity and its contributions to the development of NCDs in adulthood. Public health professional should collaborate with the schools and relevant education agencies to lobby policy makers for increased resources allocation and disbursement for the promotion of physical activity within the school system. Specifically, there is a need to recruit more Physical and Health Education Teachers to support actions and programmes aimed at increasing the PA levels of adolescents. Furthermore, policy makers need to prioritise and allocate more funding for the provision of equipment and facilities for physical exercise in school. Finally, the Ministry of Education in collaboration with the Ministry of Sports should develop and implement guidelines to ensure adolescents attain 60 minutes of MVPA daily and there should be a review of the educational curriculum to ensure all adolescents irrespective of their age offer the Physical Health Education course as a measure to promote health and wellbeing.

This study has research implication; there is need for further subgroup analysis to examine the gender and age differences and the outcome and impact of interventions that take into consideration these differentials. In addition, there is need for long term assessment of behavioural and health outcomes of multi-level, school-based physical activity interventions supported by donor and government funding which span multiple years of intervention implementation and evaluation.

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APPENDICES

APPENDIX I
List of Schools in Ibadan North-west LGA

S.No.	Name of school	Ownership
1.	Anwar-ul-Islam Grammer School Eleyele, Ibadan	Government
2.	Army Barracks Grammer School, Leutmack Barracks, Ibadan	Government
3.	Eleyele High School, Ibadan	Government
4.	Army Day High School, Leutmack Barracks, Ibadan	Government
5.	Community Secondary School, Olopomewa, , Ibadan	Government
6.	Eleyele Secondary School Eleyele, , Ibadan	Government
7.	Jericho High School, Jericho, , Ibadan	Government
8.	Community High School, Adamasingba, Ibadan	Government
9.	Oba Abass Alesinloye Grammar School, Eleyele, Ibadan	Government
10.	Sacred Heart Secondary School, Ode Oolo, Ibadan	Government
11.	Onireke Girls High School, Onireke, Ibadan	Government
12.	Urban Day Secondary School, Jericho, Ibadan	Government
13.	Anwar-L-Deen High School, Sango/Eleyele Road, Ibadan	Government
14.	Moret Comprehensive College, Adamasingba, Ibadan	Private
15.	Seed of Life College, Jericho, Ibadan	Private
16.	Allahu-S-Samad College, Ibadan	Private
17.	Lead City High School, Jericho, Ibadan	Private
18.	Shalom Christian College, Ibadan	Private
19.	Olayomi Highview College, Ibadan	Private
20.	Beechford College, Ibadan	Private
21.	St. Isabel Comprehensive Model College, Ibadan	Private
22.	Andrew Foster Memorial College for the Deaf, Onireke, Ibadan	Private
23.	His Grace College, Ibadan	Private
24.	The Crown College, Ibadan	Private
25.	Foweb's College, Eleyele, Ibadan	Private
26.	Glorious Height College, Eleyele, Ibadan	Private
27.	Tobi International High School, Jericho, Ibadan	Private
28.	Faozan College, Ibadan	Private
29.	Al-Hijrah College, Ibadan	Private
30.	'A' Markers College, Ibadan	Private
31.	Sunshine Diamond College, Ologuneru-Eruwa Road, Ibadan	Private

APPENDIX II
List of Schools in Ogbomosho North LGA

S.No.	Name of school	Ownership
1.	Aare-Ago High School, Ogbomosho	Government
2.	Adeniran Memorial Grammer School, Ogbomosho	Government
3.	An-Sarudeen High School, Ogbomosho	Government
4.	Anglican Grammer School, Sabo, Ogbomosho	Government
5.	Anglican High School, Sabo, Ogbomosho	Government
6.	Community Grammer School, Ori-Oke	Government
7.	Millennium Model Secondary School, Ogbomosho	Government
8.	Nurudeen Grammar School, Ogbomosho	Government
9.	Nurudeen High School, Ogbomosho	Government
10.	Ogbomosho Girls High School, Ogbomosho	Government
11.	Ogbomoso Grammar School, Ogbomosho	Government
12.	Ori-oke Community High School, Ogbomosho	Government
13.	Owode Community Grammar School, Ogbomoso	Government
14.	Soun High School, Ogbomosho	Government
15.	Soun Secondary School, Ogbomosho	Government
16.	Victory Model College, Ogbomosho	Private
17.	Adebolu Comprehensive College, Ogbomosho	Private
18.	Best Legacy High School, Ogbomoho	Private
19.	Akhbarudeen College, Ogbomosho	Private
20.	Ajogbe Comprehensive College, Ogbomosho	Private
21.	At-Taoheed International College, Ogbomosho	Private
22.	Women's League Secondary School, Ogbomosho	Private
23.	George Green Baptist College, Ogbomosho	Private
24.	Grace High School, Ogbomosho	Private
25.	Lautech International College, Ogbomosho	Private
26.	Mergo Baptist College, Ogbomosho	Private
27.	Morenike Comprehensive High School,	Private
28.	Kings International College, Ogbomosho	Private
29.	Anglican Modal College, Ogbomosho	Private
30.	Premier Baptist College, Ogbomosho	Private
31.	Praise Chapel College, Ogbomosho	Private
32.	Olivet Baptist College, Ogbomosho	Private
33.	Atiqa Islamic College, Ogbomosho	Private
34.	Mighty Miracle College, Ogbomosho	Private
35.	Canaanland Comprehensive College, Ogbomosho	Private
36.	Temple International Baptist Academy	Private
37.	United Gospel Faith TAB. College, Ogbomosho	Private
38.	Bomalk Resources College, Ogbomosho	Private
39.	Zion Baptist Academy, Ogbomosho	Private
40.	Science Model Academy, Ogbomosho	Private
41.	Great City Secondary School, Ogbomosho	Private
42.	King of Kings Baptist College, Ogbomosho	Private

APPENDIX III

Physical Activity Questionnaire for Adolescents

Code Number ☐

Dear Fellow student,

I am a Postgraduate student of the Department of Health Promotion & Education, Faculty of Public Health, College of Medicine, University of Ibadan.
This study is being carried out among students in secondary schools. It is designed to document adolescents' physical activity behaviours and other factors which influence your ability to be physical active as a way of preventing diseases. It would be appreciated if the questionnaire is correctly filled. Your participation is entirely voluntary and your decision whether or not to participate will involve no penalty or loss of benefits. Do not write your name, and your confidentiality is guaranteed.
Remember:

- There are no right and wrong answers, this is not an examination.
- Please answer all the questions as honestly and accurately as you can — this is very important.

If you have further questions or concerns, please contact the undersigned

Yours faithfully
Mojisola Oluwasanu,
Department of Health Promotion and Education, Faculty of Public Health, College of Medicine, University of Ibadan. Phone number: 07087957406; Email address: ope3m@yahoo.com

NOTE: Physical activity has been defined as any bodily movement produced by the skeletal muscles which result in a substantial increase in energy expenditure over resting levels (Bouchard, Blair and Haskell, 2007). These include HOME BASED ACTIVITIES such as scrubbing, washing, LEISURE ACTIVITIES AND EXERCISE such as jogging, football and ACTIVE TRANSPORTATION AND COMMUTING such as cycling walking and cycling to places.

Section One: General Demographic Information

1. Age ☐

2. Gender (1) Male (2) Female ☐

Name of School?.....

3. What class are you? (1) JSS1 (2) JSS2 (3) JSS 3 (4) SSI (5) SS2 ☐

4. Which ethnic group do you belong to? ☐
Yoruba……. ……...…...1
Igbo…….……..2
Hausa……3
Others (Specify)…..… ……..…4

5. Where do you live (which area)?.....……..

☐

6. What is your religion?
Christianity……..…...1
Islam.....….....2
Traditional.....3
Others (Specify)…….……..…4

7. Mother's/ Female Guardian's level of education
No formal western education ……..….1
Primary ……..……....2
Secondary ……3
Above secondary, (specify) ……... 4

8. Mothers/ Female Guardian's Occupation…….
……

9. Father 's/ male Guardian's level of education
No formal western education……1
Primary ……..……..2
Secondary …… 3
Above secondary, (specify) …….. 4

10. Father's/Male Guardian's Occupation……. ……

11. Does your household have the following?

T.V	(1) YES)	(2) NO
Radio	(1) YES	(2) NO
Fridge	(1) YES	(2) NO
Car	(1) YES	(2) NO
Mobile Telephone	(1) YES	(2) NO
Motorcycle	(1) YES	(2) NO
Keke Napep	(1) YES	(2) NO

12. How physically healthy are you? (tick one option)
Very healthy……..1
Moderately healthy……....2
Slightly healthy……..3
Not healthy at all ……..4

Section Two: Knowledge of Physical Activity and its benefits

13. Please tick the right option to the items listed in the section below

	Item	**Yes**	**No**
1.	Physical activity can help build and maintain healthy bones		
2.	Physical activity can help build muscles		
3.	Physical activity can be used to reduce body fat		

4.	Physical activity can help prevent or delay the development of high blood pressure		
5.	Physical activity can help relieve tension		
6.	Young people are expected to attain at least 60 minutes of moderate to vigorous physical activity daily		
7.	Physical activity can help improve students' concentration in class		
8.	Physical activity can be done without equipment		
9.	Dancing is a form of physical activity		
10.	Being Physically active can help prevent boredom		

Section three: Physical activity level

15. We are trying to find out about your level of physical activity from *the last 7 days* (in the last week). This includes - sports or dances that made you sweat or made your legs and arms feel tired, or games that made you breathe hard, like skipping, running, climbing, and others. Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Tick only one per row.)

		No	1-2 times	3-4 times	5-6 times	7 times or more
1.	Skipping					
2.	Walking for exercise					
3.	Bicycling					
4.	Jogging or running					
5.	Swimming					
6.	Dance					
7.	Football/Soccer					
8.	Table Tennis					
9.	Tennis / Badminton					
10.	Basket ball					
11.	Weight lifting					
12.	Boxing					
13.	Wrestling					
14.	Sack race					
15.	Marathon/ Cross country race					
16.	Volley ball					
17.	Handball					
18.	Gymnastics					
19.	Other games such as *Ten ten , Boju boju, Hide and seek, Fire on the mountain, Chinco*					
20.	Hopscotch (Suwe)					
21.	Climbing trees/ poles/mountains					
22.	Gymnastics					
23.	Others					

16. What do you do most often for exercises? Tick as appropriate

	Physical activity	Tick four options done most often
1.	Skipping	
2.	Walking for exercise	
3.	Bicycling	
4.	Jogging or running	
5.	Swimming	
6.	Dance	
7.	Football	
8.	Table Tennis	
9.	Lawn Tennis/Badminton	
10.	Basket ball	
11.	Weight lifting	
12.	Boxing	
13.	Wrestling	
14.	Sack race	
15.	Marathon/Cross country race	
16.	Volley ball	
17.	Handball	
18.	Other games such as *Ten ten , Boju boju, Hide and seek, Fire on the mountain*	
19.	Hopscotch (Suwe)	
20.	Climbing trees/ poles/mountains	
21.	Others	

17. Do you feel you get too much exercise, about the right amount or too little? (Tick one option)
    1. Too much
    2. About the right amount
    3. Too little

18. In the last 7 days , ***during your physical education (PE) classes*** , how often were you very active (playing hard, running, jumping, throwing)? (tick one only.)
    I don 't do PE .....….. 1
    Hardly ever 2
    Sometimes 3
    Quite often 4
    Always 5

19. In the last 7 days , what did you normally do ***at break time*** (besides eating lunch)? (Tick one option only.)
    Sat down (talking, reading, doing schoolwork).…... 1
    Stood around or walked around 2
    Ran or played a little bit 3
    Ran around and played quite a bit 4
    Ran and played hard most of the time 5

20. In the last 7 days , on how many days ***right after school*** , did you do sports, dance , or play games in which you were very active (feel tired after or breathe faster)? (Tick one option only.)

None .....…… 1
1 time last week 2
2 or 3 times last week 3
4 times last week 4
5 times last week 5

21. In the last 7 days, on how many ***evenings*** did you do sports , dance , or play games in which you were very active ? (Tick one option only.)

None .....…… 1
1 time last week 2
2 or 3 times last week 3
4 -5 times last week 4
6 or 7 times last week 5

22. ***Last weekend*** , how many times did you do sports , dance , or play games in which you were very active (feel tired after or breathe faster)? (tick one only.)

None .....…… 1
1 time last week 2
2 or 3 times last week 3
4 -5times last week 4
6 or 7 times last week 5

23. Which ***ONE*** of the following best describes you for the last 7 days ? **Read *all five* statements before ticking *ONE* answer that best describes you** (Tick one option *only*).

1. All or most of my free time was spent doing things that involved little physical effort
2. I sometimes did physical activity in my free time (e.g. played sports, went running, swimming, bike riding, did dances 1 — 2 times last week)
3. I often did physical activity in my free time (i.e. 3 — 4 times last week)
4. I quite did physical activity in my free time often (i.e. 5 — 6 times last week)
5. I very often did physical things in my free time (i.e. 7 or more times last week)

24. Tick how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for each day last week.

	None	Little bit	Medium	Often	Very often
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

25. Were you sick last week, or did anything prevent you from doing your normal physical activities within the week? (Tick one.)
    Yes 1
    No ..... 2 (If No, skip to question 27)

26. If something prevented you, what was it? _____

Section Four: Attitude towards physical activity

27. How important is participation in physical activity to you?
    1. Very important
    2. Moderately important
    3. Slightly important
    4. Not important at all

28. Please tick your opinion to the items listed below **(tick one per row)**

	Variable	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
1.	Physical activity can help an individual to cope with stress					
2.	Physical activity is strenuous and not fun					
3.	It provides opportunities to make new friends					
4.	Helps to keep individuals in shape					
5.	Physical activity should not be encouraged in schools					
6.	It gives students more energy					
7.	It makes students hot and sweaty					
8.	Physical activity can make students better in sports, dance or other activities					
9.	Physical activity is not good for females, it makes them muscular and look like males					
10.	I am now too big to participate in physical activity					
11.	Only Sports men and women need to participate in physical activity/exercise					
12.	Participation in physical activity make girls lose their virginity					
13.	I am always happy when we are asked to go out for physical exercises in school					
14.	Physical exercise should be made compulsory for students					
15.	Taking part in physical exercises and activity in school is a waste of time					
16.	Physical activity is not safe for girls during menstruation					
17.	Boys and girls who love physical exercise do not perform well in class					
18.	Physical activity/exercise easily make girls breast to sag or look like slippers					

Section Five: Subjective Norm

29. This section is designed to assess how you think other people will feel about you being physical active, **tick only one per row**

	Variable	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
1.	My fellow students think I shou ld be physically active during my free time on most days					
2.	My best friend thinks I should be physically active during my free time on most days					
3.	My physical education teacher thinks I should be physically active during my free time on most days					
4.	Other teachers think I should be physically active during my free time on most days					
5.	My mother or female guardian thinks I should be physically active during my free time on most days					
6.	My father or male guardian thinks I should be physically active during my free time on most days					
7.	My sister/sisters think I should be physically active during my free time on most days					
8.	My brother/brothers think I should be physically active during my free time on most days					

Section Six: Perceived Behavioural Control

30. This section is designed to assess your ability to be physical active, *tick only one per row*

	Variable	Strongly Agree	Agree	Not sure	Disagree	Strongly Disagree
1.	For me to be physically active during my free time on most days would be challenging					
2.	I have control over my being physically active during my free time on most days					
3.	I believe I have all the things I need to be physically active during my free time on most days					
4.	If I want to be, I can be physically active during my free time on most days					

Section Seven: Self efficacy Questionnaire

31. This section is designed to assess your self efficacy i.e. your ability to be physical active, *tick only one per row*

How confident is it that you can do each of the following?

	Variable	Extremely confident	Confident	Not sure	Not Confident	Extremely not confident
1.	I can be physically active during my free time on most days					
2.	I can ask my parents or other adult to do physically active things /activities with me					
3.	I can be physically active during my free time on most days instead of watching the TV or playing video games					
4.	I can be physically active during my free time on most days even if it is very hot or cold outside					
5.	I can ask my best friend to participate in physical activities with me during my free time on most days					
6.	I can be physically active during my free time on most days even if I have to stay at home					
7.	I have the coordination and ability I need to be physically active during my free time on most days					
8.	I can be physically active during my free time on most days no matter how busy my day is					
9.	I can set aside time for a physical activity programme for at least 60 minutes, every day of the week					
10.	I can get up early, even on weekends , to exercise					

Section Eight: Social cultural factors/Social support for physical activity

32. Does your Father/ Male Guardian engage in daily exercise? (1) Yes (2) No

33. If yes, indicate the level of physical activity of your father by ticking any of the following option. (1) Too much (2) About the right amount (3) Too little

33a. Does your father encourage you to engage in daily physical exercise? (1) Yes (2) No

34. Does your Mother/Female Guardian engage in daily exercise? (1) Yes (2) No

35. If yes, indicate the level of physical activity of your mother by ticking any of the options (1) Too much (2) About the right amount (3) Too little

35a. Does your mother encourage you to engage in daily physical exercise? (1) Yes (2) No

36. ***Tick Yes or No for all the rows, PLEASE MAKE SURE YOU FILL ALL THE BOXES. Don't tick the shaded section***.

During the past three months, my family (or members of my household) or friends or Teachers:

	Variable	**Family**			**Friends**			**Teachers**		
		Yes	**No**	**Cannot remember**	**Yes**	**No**	**Cannot remember**	**Yes**	**No**	**Cannot remember**
1.	Discussed physical activity/exercise with me									
2.	Offered to exercise with me									
3.	Exercised with me									
4.	Gave me helpful reminders to exercise or be physically active (e.g. "Are you going to exercise today?")									
5.	Gave me encouragement to stick with my exercise programme.									

	Variable	Family			Friends			Teachers		
		Yes	No	Cannot remember	Yes	No	Cannot remember	Yes	No	Cannot remember
6.	Complained that the time I spend exercising was too little									
7.	Criticized me or made fun of me for exercising									
8.	Told me it was not proper to exercise/be physically active									
9.	Gave me rewards for exercising or being physically active (bought me something or gave me something I like).									
10.	Included exercise on recreational outings / school excursion activities									
11.	Talked about how much they like to be physically active /exercise/or be fit.									

37. Do you think your school has enough facilities for physical activity (1) Yes (2) No
If Yes why do you think so?……..
……
If No why do you think so?……..
……..

38. Do you think the School authority encourages you to be physically active (1) Yes (2) No

39. If Yes why do you think so?……

If No why do you think so?……..
……

40. What are the things which make it difficult for you to be physically active??
……

41. What are the things which can help you to be physically active??
……

Section Nine: Anthropometry and fitness test (STUDENTS SHPULD NOT FILL THIS SECTION)

42. Weight (in Kg)……

43. Height (in metres) ……

44. Fitness Test……..

45. Blood Pressure …….

	Reading 1	Systolic (mmHg)
		Diastolic (mmHg)
	Reading 2	Systolic (mmHg)
		Diastolic (mmHg)
	Reading 3	Systolic (mmHg)
		Diastolic (mmHg)

46. Waist in CM …….

47. Hip in CM …….

48. Heart rate …….

SECTION TEN: INTERVENTION GROUP ONLY

49. Did you enjoy the physical activity educational programme which was done in your school?Yes (2) No

50. To what extent did you enjoy reading the cartoon titled "60 minutes of exercise and play"?(1)To a large extent (2) To a moderate extent (3) To a small extent

51. To what extent did you enjoy reading the guide titled "Physical activity for Health Promotion: A guide for Students"?To a large extent (2) To a moderate extent (3) To a small extent

52. After reading the educational materials (cartoon and physical activity guide), to what extent did the documents encourage you to be physically active ?
(1)To a large extent (2) To a moderate extent (3) To a small extent

53. Will you want the physical activity programme to continue in your school?
(1) Yes (2) No

54. Will you want the physical activity programme to be conducted in other schools?
(1)Yes (2) No

55. What else should be done to improve physical activity level of students in your school……
……

APPENDIX IV

SPEEDY School Grounds Assessment Tool
(Observational Checklist for the assessment of the School Environment)

Name of school and address……
Assessor's Name: ……. Date:
Start Time: ……
Complete Time:

1. **Access to the school**

Entrance (include an identifier)	Cars	Cyclists	Pedestrians
Entrance 1			
Entrance 2			
Entrance 3			
Entrance 4			

2. **For each entrance please record the speed limit, in kilometers per hour, on the adjacent road (if the entrance does not open onto a road then enter n/a)**

Entrance (include an identifier)	Speed limit	Road side parking is available
Entrance 1		
Entrance 2		
Entrance 3		
Entrance 4		

3. The surrounding area:

   Are the following visible from any of the entrances

		Yes 1	No 0
	Somewhere where parents can stop and drop children off		
	Somewhere where parents can park their cars		
	School bus top		
	Cycle lanes separated from the road		
	Cycle lanes on the road		
	Pavements on both sides		
	Pavements on one side of the road only		
	A marked pedestrian crossing (e.g. zebra/light controlled crossing) to assist access to school		
	Traffic calming (e.g. speed bump)		
	Signage:		
	School warning signs for road users		
	Road safety signs (e.g. look both ways)		

THE SCHOOL GROUNDS

Please indicate whether the following are present, and rate their quality:

	Variable	Number	Quality		
			Good	Adequate	Poor
	Markings on play surfaces				
	Playground equipment				

	(e.g. table tennis, basket ball)				
.	Pitches e.g. football				
.	Athletics track (e.g. grass or hard surface)				
.	Courts (e.g. tennis, basket ball, hand ball)				
.	Benches				
.	Tables				
.	Water coolers/water sources				
.	Cultivated Garden				
.	Uncovered cycle parking (No. of bikes)				
.	Covered cycle parking (No. of bikes				
.	A quadrangle OFP				
.	Other sports facility provision				

		Yes 1	No 0
.	Are there areas where children could play?		
.	Is the school grounds predominantly flat		
.	Is the school grounds predominantly sloping/undulating	0	1
.	Does the school have a hard surface playground		

AESTHETICS

Please indicate whether the following are present

		None	Some	A lot
.	Planted beds containing flowers/shrubs/small trees			
.	Trees for sitting under			
.	Ambient noise (e.g. traffic, trains, industry)			
.	Litter			
.	Outdoor art			

USAGE

Are the school grounds generally suitable for

		Very	Somewhat	Not at lot
.	Sport (organized or not)			
.	Informal games (judo, tug of war etc)			
.	General play			

OVERALL

To what extent do you agree or disagree with the following statements?

		Strongly agree	Agree	Neither	Disagree	Strongly disagree
.	The grounds are shielded from the surrounding areas by hedge/trees/fences					
.	The grounds are generally well maintained					
.	The grounds are generally free of vandalism					

39. Please estimate the total percentage cover of different surfaces where children could play

Tarmac	
Paving	
Grass	
Other safety surface	
Total	100%

40. Is the area around the school predominantly (Tick one)

Residential	
Open fields/ parks	
A mixture of the above	
Others	

APPENDIX V

SCHOOL PHYSICAL ACTIVITY POLICY ASSESSMENTFOR PHYSICAL EDUCATION/ PHYSICAL AND HEALTH EDUCATION/HEALTH EDUCATION TEACHER

Dear Ma/Sir,

I am a Postgraduate student of the Department of Health Promotion & Education, Faculty of Public Health, College of Medicine, University of Ibadan.

This study is being carried out to document adolescents ' physical activity behaviours and other factors which influence their ability to be physical activity as a way of preventing diseases.

This instrument is meant to be an inventory of the school environment and how it influences the physical activity behaviours of students. It would be appreciated if the questionnaire is correctly filled. Your participation is entirely voluntary and your decision whether or not to participate will involve no penalty or loss of benefits. Do not write your name, and your confidentiality is guaranteed.

Remember:

- **There are no right and wrong answers, this is not a test.**
- **Please answer all the questions as honestly and accurately as you can — this is very important.**

If you have further questions or concerns, please contact the undersigned

Yours sincerely,

Mojisola Oluwasanu,
Department of Health Promotion and Education, Faculty of Public Health, College of Medicine, University of Ibadan. Phone number: 07087957406; Email address: ope3m@yahoo.com

DATE OF COMPLETION:
GENDER: Female ☐ Male ☐
SCHOOL NAME AND ADDRESS:
LOCAL GOVERNMENT AREA:

SECTION A: BACKGROUND AND GENERAL QUESTIONS

1. What is your current position at this school? (check one)

1. Principal ☐
2. Vice Principal ☐
3. Physical Education/Physical Health Education /Health Education Teacher ☐
4. Subject/ Classroom Teacher ☐

5. Others (please specify) ☐

2. How long have you worked in this position at your school? ----------years
3. What class levels are taught in this school? JSS1 ☐ JSS2 ☐ JSS3 ☐
   SS1 ☐ SS2 ☐ SS3 ☐
4. Indicate what classes are taught in this school the following subjects

	Physical and health education	Physical Education	Health Sciences	Health Education
JSS1				
JSS2				
JSS3				
SS1				
SS2				

5. How many students are enrolled in your school? …… students

6. What facilities are available for physical activity at your school? (Check all that apply)
   1. Gymnasium ☐
   2. Grassy field ☐
   3. Hard surface Playground ☐
   4. Regular classroom for indoor physical activity ☐
   5. Courts for racket games ☐
   6. Field for Athletics ☐

MODULE 1. PHYSICAL EDUCATION

Formal Physical Education Policies (IF THE RESPONSE IS YES, REQUEST TO SEE A COPY OF THE DOCUMENT)

	Variable	Yes (copy available)	Yes (copy not available)	No	Don't know
	Does **the state ministry of education** have a written policy that requires your school's physical education programme to follow a specific physical health education standard or guideline?				
	Does **your school** have a written policy that requires your school 's physical education programme to follow a specific physical education standard or guideline?				
	Does **the state ministry of education** have a written policy that requires a specific number of minutes				

	per week or a specific number of days per week that students will have physical education?				
	Doesv **your school** have a written policy that requires a specific number of minutes per week or a specific number of days per week that students will have physical education?				
	Does **the state ministry of education** have a written policy that requires school physical education programs to test students ' fitness levels ? If **Yes** , what fitness test do you use ? Please indicate				
	Does your **school** have a written policy that requires your physical education program to test students ' fitness levels? If **Yes** , what fitness test do you use ? Please indicate				
	Does **the state ministry of education** have a written policy that teachers must scores students for physical education as a subject?				
	Does your **school** have a written policy that teachers must scores students for physical education as a subject?				
	Is the grading policy for physical and health education the same as it is for other core subject areas?				
	Excluding teacher evaluations, does **the state ministry of education** have a written policy that requires **the school's physical health education program** to be evaluated annually?				
	Excluding teacher evaluations , does your **school** have a written policy that requires the **physical education program** to be evaluated annually?				

General Profile of School Physical Education

18. How many physical education classes **per week** do students receive? (Provide the average) _____ classes per week
19. What is the total minutes of physical education students receive **per week**? (Provide the average) _____ minutes per week
20. What is the typical number of students in a physical education class at your school? (Provide the average class size) - _____ students
21. What percentage of the physical education program is taught by: (Must add up to 100%)
    _____% Certified Physical Education Teachers
    _____% Classroom Teachers
    _____% Other (Please specify _____

Professional Staff Development

	Variable	Yes	No	Don't know
22.	Are physical education teachers required to attend staff development and training programmes at least once per year?			
23.	Does **your school or the state government** provide financial support for physical education teacher's professional development? If **Yes**, which of the following expenses are covered? (Check all that apply) Registration for conferences ☐ Travel to conferences/Workshops ☐ Other, please specify ☐			

Physical Education Content, Curriculum, and Delivery

24. Are those who teach physical education provided with

		No	Partially	Yes
a	Goals, objectives, and expected outcomes for their classes?			
b	A physicalv education curriculum?			
c	A chart/listv describing the scope and sequence of instruction?			
d	Specific lesson plans or learning activities?			
e	Plans on how to assess or evaluate students?			

25. In general, how frequently does physical education address each of the following categories?

		Rarely	Sometimes	Often
a	Physical/Motor development			
b	Understanding movement concepts , principles , strategies , and tactics			
c	Expressive movement patterns (e.g., dance , creativity)			
d	Promoting active participation in physical activity			
e	Physical fitness development			
f	Responsible per sonal and social behavior development			
g	Valuing physical activity for health benefits beyond physical education			

h	During physical education, how often are students required to do extra physical activity for disciplinary reasons (e.g., run laps for being late; do push-ups for off task or bad behavior)?			
i	How often do classroom teachers/counselors withhold individual students from physical education classes to fulfill other academic requirements?			
j	How often do classroom teachers withhold individual students from physical education classes for disciplinary reasons?			
k	How often is the delivery of physicalhealth education compromised because of competing demands for physical education space (e.g., use of playgrounds for assemblies or party events)?			
l	Does your **school** encourage other classroom teachers to promote physical activity with their students?			

31. During bad weather, is there a space for students to be physically active during physical education class time? (1) Y☐ (2☐o (3) ☐ Don't know

32. Relative to other subject matter areas, the number of students in physical education class is typically (1) Similar ☐ (2) Smaller (3) Larger ☐

33. Describe how the **physical education program** is evaluated. (Do not include teacher evaluations)

……
……
……

Budget

34. Does your school have a budget allocation for physical education equipment and supplies? Yes ☐ No ☐ Don't Know ☐

35. If **yes,** on average how much does the school spend on physical education equipment/competitions (i.e. inter house sports) per year----------

36. If yes, how involved is the physical education teacher with decisions related to physical education fund allocation (1) Not involved ☐ (2) Somewhat ☐ involved ☐ (3) Greatly involved ☐

MODULE 2: BREAK TIME

(IF THE RESPONSE IS YES, REQUEST TO SEE A COPY OF THE DOCUMENT)

37. Does the **state ministry of education** have a written policy that specifies the duration of break time and the minutes per day that students should receive?

(1) Yes (copy available) ☐ (2) Yes (copy not available) ☐ (3) No ☐

38. If yes, how many minutes per day? …….. minutes

39. Does your **school** have a written policy (i.e. timetable) that specifies the duration of break time and the minutes per day that students should receive?

(1) Yes (copy available) ☐ (2) Yes (copy not available) ☐ (3) No ☐

40. If yes, how many minutes per day? …….. minutes

Does the **state ministry of education** have a written policy requiring that students be provided with organized activities during break time

(1) Yes (copy available) ☐ (2) Yes (copy not available) ☐ (3) No ☐

41. Does your **school** have a written policy requiring that students be provided with organized activities during break time?

(1) Yes (copy available) ☐ (2) Yes (copy not available) ☐ (3) No ☐

42. Does the **state ministry of education** have a written policy requiring break time supervisors to receive training on playground supervision?

(1) Yes (copy available) ☐ (2) Yes (copy not available) ☐ (3) No ☐

43. Does your **school** have a written policy requiring break time supervisors to receive training on playground supervision?

(1) Yes (copy available) ☐ (2) Yes (copy not available) ☐ (3) No ☐

44. Does the **state ministry of education** have a written policy that specifies a maximum student-to-supervisor ratio during break time?

1) Yes (copy available ☐ (2) Yes (copy not availa ☐ (3) No ☐

45. If **Yes**, what is the ratio? _____Students : 1 Supervisor

46. Does your **school** have a written policy that specifies a maximum student-to-supervisor ratio during break time?

(1) Yes (copy available) ☐ (2) Yes (copy not available) ☐ (3) No ☐

47. If **Yes**, what is the ratio? _____Students : 1 Supervisor

48. Does the **state ministry of education** have a written policy requiring regular maintenance of playground facilities and equipment?

(1) Yes (copy available) (2) Yes (copy not available) (3) No

49. Does your **school** have a written policy requiring regular maintenance of playground facilities and equipment?

(1) Yes (copy available ☐ (2) Yes (copy not ava ☐ e) (3) N ☐

50. On average, how many total minutes per day is allotted for break time?

(1) Less than 15 minutes of break time per day ☐ (2) 15 to 20 minutes of break time per day ☐ 3)Over 21 minutes per day ☐

51. How often do classroom teachers/counselors keep individual students from break time to fulfill academic requirements? (1) Rarely ☐ (2) Sometimes ☐ (3) Very often ☐

52. Do break time supervisors regularly provide organized activities during breaks? (e.g., walking or running programs) ? (1) Yes ☐ (2) No ☐

53. Are supervisors asked to encourage students to be physically active during break times?(1) Yes (2) No ☐

54. Who supervises break time at your school? (Check all that apply.)

(1) Classroom Teachers ☐
(2) Physical Education Teacher(s) ☐
(3) Administrators ☐
(4) Volunteers ☐
(5) Others(pls specify)…….

55.**Break time access/utilisation**

Variable	**Very often**	**Often**	**Seldom**	**Not at all**
During favorable weather conditions , are students allowed to stay indoors during break time ?				
During bad weather, can students be physically active during break time ?				
Are teachers permitted to withhold scheduled break time from students for academic reasons?				
Are teachers permitted to withhold break time from students for disciplinary reasons ?				
Is loose equipment (e.g., balls, jump ropes) available for children to play with during break time?				

15. If **Yes**, who provides it? (Check all that apply)
    (1) Individual Classroom Teachers ☐
    (2) Physical Health Education Teacher ☐
    (3) Admin/ Principals' Office ☐
    (4) Individual Students ☐
    (6) Other ☐

APPENDIX VI

IN-DEPTH INTERVIEW GUIDE FOR SCHOOL PRINCIPALS

Greetings

I am a Postgraduate student of the Department of Health Promotion & Education, Faculty of Public Health, College of Medicine, University of Ibadan. I am conducting a study titled "AMulti-level Intervention on Patterns of Physical Activity among in-school Adolescents in Oyo State, Nigeria".This study is being carried out in secondary schools to document adolescents' physical activity behaviours and the influencing factors. Specifically, I want to ask you questions on the factors (individual , social-cultural , built environment and policy) which influence the physical activity behaviours of in-school adolescents. Other questions will focus on the policies and programme activities promoting physical activities within secondary schools, level of funding, extent of implementation of physical activity policies and programmes in schools and the frequency of engagement in structured physical activity.

The questions are general but if you are uncomfortable with some of the questions, please do not feel compelled to answer any of them for any reason. I will talk to you for about 45 -60 minutes. You can decide if you want to take part in this interview. Taking part in this study will not cost you or your family anything and there is no monetary benefit. Your participation is voluntary, meaning that you do not need to participate if you don't want to. You may also leave the interview at any time. Your name and what you say to us for this study will be kept private and when it is being reported, all forms of identifiers including the names will be removed. Please I also require your consent to use a tape recorder to help me document and review the discussion later.

Share the study information sheet and request for signed consent

Demographics, TAKE NOTES (identifying information to be kept separate from interview transcripts)

Just to confirm that I have your details right…..

a. Participant's name & organisation and email/ contact details (fill in beforehand if possible):
b. Participant's title/designation and primary responsibilities:
c. What year did you start working in this organisation? What year did you start in this particular position?

REQUEST TO TURN ON RECORDERS AT THIS POINT IN THE INTERVIEW

	Question	**Probes**
1.	What do you think about the health of in-school adolescents in your school?	*Probe for* *Common diseases* *Health behaviours specifically physical activity, healthy diets, alcohol and tobacco use*
2.	In your view, what is the level of physical activity among secondary school	Probe if High or Low based on age (i.e. 10-14 and 15-19) and gender (i.e. males or females)

	students/pupils in your school	In-school adolescents attain the recommended daily target of 60 minutes of Moderate to Vigorous Physical activity
3.	What do you think about the opportunities that students have to engage in physical activity during school hours	Probe for Frequency and opportunities for engagement in structured physical activity (i.*e. sports, class based activities, regular school physical activity programmes*) Frequency and opportunities for unstructured activities (*i.e. break time, after school programmes etc*) Use of physical activity as a form of corporal punishment
4.	In your view, are there school guidelines that determine the extent to which students have opportunities for physical activity	Probe for the availability, use and compliance to *School Time table* *Curriculum for Physical Health Education*
5.	What factors influence the physical activity behaviours of in-school adolescents	Probe for Social norms including the attitude of students and teachers, Social support, Cultural factors especially gender issues Religious factors Physical/built environment, Availability of equipment and facilities School guidelines such as *School Time table, Curriculum for Physical Health Education, School inspectors who monitor activities of school/scheme of work in line with the curriculum*
6.	What are the barriers to the implementation of Physical activity in schools	Probe for Attitude of students Competing academic time Social norms and support(i.e. attitude of teachers, *parents, Parent Teachers Association etc*) Availability of Physical and Health Education staff Staff development programmes for PHE teachers *Availability of equipment and facilities* *Guidelines on physical activity in school specifically, School Time table, Curriculum for Physical Health Education* Funding and budget allocation for physical education equipment, programmes and supplies?

7.	What are the recommended activities which have the potentials of ensuring in-school adolescents attain the daily target of 60 minutes of moderate and vigorous daily activity	Probe for the appropriate interventions/activities to improve physical activity in schools Probe for the most appropriate time and setting
8.	What other actions would you recommend to facilitate physical activity in schools	*Provision of educational materials (i.e. posters and handbills) for students, Film show on different types of physical activity, Special Dance events in schools, Experience sharing by role models (i.e. Athletes), M health – sending text messages (SMS reminders), Training programme for students on how to be physically active ,Empowering students to develop fun activities aimed at promoting PA and others"*

Thank you for your time. This is the end of our discussion.

APPENDIX VII

FOCUS GROUP DISCUSSION GUIDE FOR SUBJECT/CLASS TEACHERS

Greetings

I am a Postgraduate student of the Department of Health Promotion & Education, Faculty of Public Healthv, College of Medicine, University of Ibadan. I am conducting a study titled "AMulti-level Intervention on Patterns of Physical Activity among in-school Adolescents in Oyo State, Nigeria". This study is being carried out in secondary schools to document adolescents' physical activity behaviours and the influencing factors. Specifically, I want to ask you questions on the factors (individual , social-cultural , built environment and policy) which influence the physical activity behaviours of in-school adolescents. Other questions will focus on the policies and programme activities promoting physical activities within secondary schools, level of funding, extent of implementation of physical activity policies and programmes in schools and the frequency of engagement in structured physical activity.

The questions are general but if you are uncomfortable with some of the questions, please do not feel compelled to answer any of them for any reason. I will talk to you for about 45 -60 minutes. You can decide if you want to take part in this discussion. Taking part in this study will not cost you anything and there is no monetary benefit. Your participation is voluntary, meaning that you do not need to participate if you don't want to. You may also leave the interview at any time. Your name and what you say to us for this study will be kept private and when it is being reported, all forms of identifiers including the names will be removed. Please I also require your consent to use a tape recorder to help me document and review the discussion later.

REQUEST TO TURN ON RECORDERS AT THIS POINT IN THE INTERVIEW

	Question	**Probes**
1.	Health of in-school adolescents	*Probe for* *Common diseases* *Health behaviours specifically physical activity, healthy diets, alcohol and tobacco use*
2.	Level of physical activity among students	Probe if High or Low based on age (i.e. 10-14 and 15-19) and gender (i.e. males or females) In-school adolescents attain the recommended daily target of 60 minutes of Moderate to Vigorous Physical activity
3.	Opportunities that students have to engage in physical activity during school	Probe for Frequency and opportunities for engagement in structured physical activity (i.*e. sports, class based activities, regular school physical activity programmes*) Frequency and opportunities for unstructured

		activities (*i.e. break time, after school programmes etc*) Type of PAs students engage in' Probe for those liked /those not liked What students consider as appropriate/inappropriate PAs" Use of physical activity as a form of corporal punishment
4.	Factors promoting or hindering physical activity behaviours of adolescents in school settings	Probe for Secondary school students thoughts about physical exercise in schools' Social norms including the attitude parents, teachers and school authorities Cultural factors especially gender issues Religious factors Physical/built environment, Availability of equipment and facilities Policies on physical activity in school *specifically the School Health policy, School Time table reflecting the break time, Curriculum for Physical Health Education* Role of government, teachers, parents, community, others'
5.	Recommended activities which have the potentials of ensuring in-school adolescents attain the daily target of 60 minutes of moderate and vigorous daily activity	Probe for the appropriate interventions/activities to improve physical activity in schools Probe for the most appropriate time and setting
6.	Recommended actions to facilitate physical activity in the schools	

APPENDIX VIII

Guidelines for the Multi Stage Fitness Test

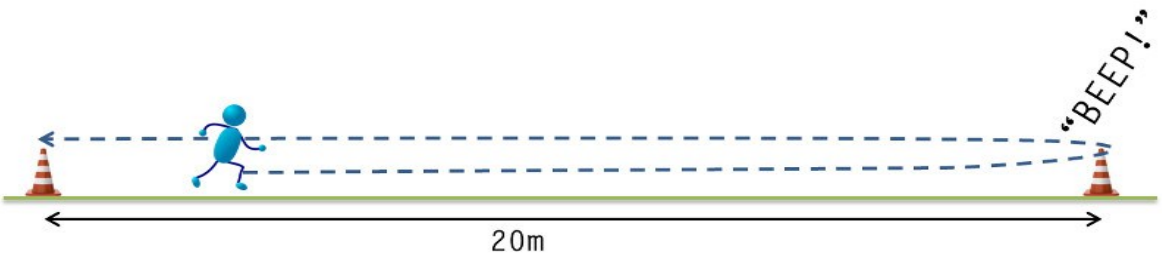
Equipment Needed

- 20 metres measuring tape
- Audio recording of the multi-stage fitness test either on an android phone of a laptop
- A speaker
- Powerbank
- Bright marking cones/containers
- Flat, non-slip play ground surface
- Basic medical supplies for first aid

Steps

- Identify a flat, non-slip play ground surface within the school compound; an athletics track field preferably
- With the measuring tape, measure 20 metres from one end of the field to the other.
- Use a bright marking cones to indicate the start and end points
- Measure out each track (one student per track), ensure there is sufficient space between each track to ensure the students don't collide which may result in injuries
- Delineate each track with a bright container/cone; the tracks should not exceed 10.
- Connect the phone or laptop to the speaker and test run the audio recording.
- If using a phone, connect the speakers to the powerbank and the phone; but if using the laptop, connect the speaker to the laptop
- Test run the audio recording by playing it for few minutes
- Arrange each student on the track; explain the importance of listening and running in tandem with the beep from the audio-recording.
- Play the audio-recording and ensure they understand the instructions
- Ensure the students are standing on the tracks, (one per student); and they stretch their bodies to warm up for the procedure
- Conduct the multi-stage test by playing the audio-recording

- Over the course of the multi-stage test, the students progress through the various level with the beeps getting faster at each new level
- When the student fails to reach the line before the beep, this becomes their highest score and the test is over
- When the students complain of exhaustion, end the test and this becomes their highest score.
- Record the highest level completed/scores in the questionnaire
- Give water to students and ask them to rest for a while in a sitting position



APPENDIX IX

ETHICAL APPROVAL

TELEGRAMS…….. TELEPHONE……..

OYO STATE: THE PACESETTER

MINISTRY OF HEALTH

DEPARTMENT OF PLANNING, RESEARCH & STATISTICS DIVISION

PRIVATE MAIL BAG NO. 5027, OYO STATE OF NIGERIA

Your Ref. No. ……..
All communications should be addressed to
the Honorable Commissioner quoting
Our Ref. No. AD 13/ 479/890 June, 2015

The Principal Investigator,
Department of Health Promotion and Education,
African Regional Health Education Centre,
Faculty of Public Health,
College of Medicine,
University of Ibadan.
Ibadan.

Attention: Oluwasanu Mojisola
Ethical Approval for the Implementation of your Research Proposal in Oyo State

This acknowledges the receipt of the corrected version of your Research Proposal titled: "Outcome of a Multi Level Intervention on the Patterns of Physical Activity among In-School Adolescents in Oyo State, Nigeria".

2. The committee has noted your compliance with all the ethical concerns raised in the initial review of the proposal. In the light of this, I am pleased to convey to you the approval of committee for the implementation of the Research Proposal in Oyo State, Nigeria.

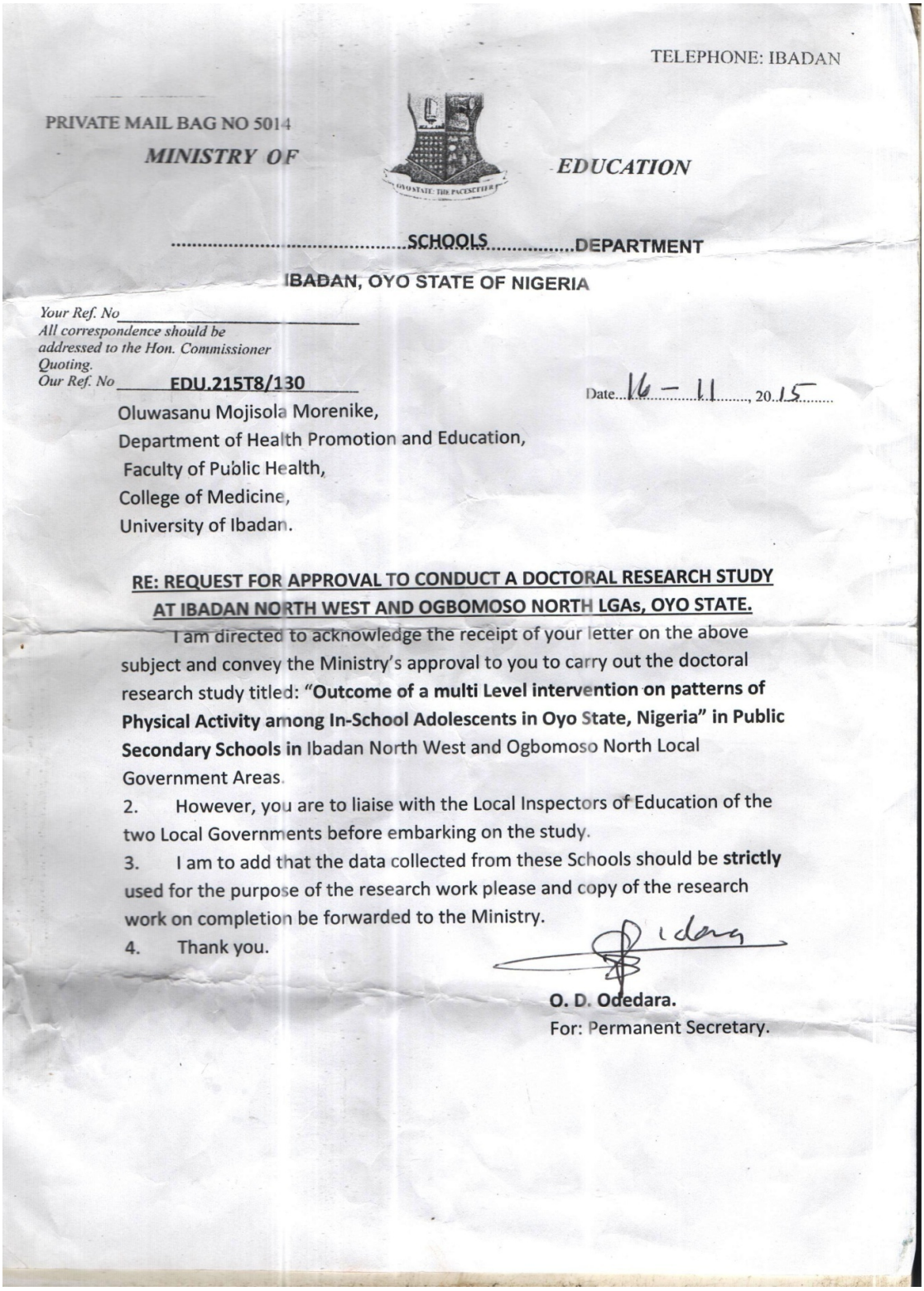
3. Please note that the committee will monitor closely and follow up the implementation of the research study. However, the Ministry of Health would like to have a copy of the results and conclusions of the findings as this will help in policy making in the health sector.

4. Wishing you all the best.

OYO STATE RESEARCH ETHICAL REVIEW COMMITTEE
Signature & Date

Sola Akande (Dr)
Director, Planning, Research & Statistics
Secretary, Oyo State, Research Ethical Review Committee

APPENDIX X: APPROVAL LETTER FROM THE MINISTRY OF EDUCATION



TELEPHONE: IBADAN

PRIVATE MAIL BAG NO 5014

MINISTRY OF *EDUCATION*

.....SCHOOLS.....DEPARTMENT

IBADAN, OYO STATE OF NIGERIA

*Your Ref. No*_____
All correspondence should be addressed to the Hon. Commissioner Quoting.
Our Ref. No EDU.215T8/130

Date 16 – 11, 2015

Oluwasanu Mojisola Morenike,
Department of Health Promotion and Education,
Faculty of Public Health,
College of Medicine,
University of Ibadan.

RE: REQUEST FOR APPROVAL TO CONDUCT A DOCTORAL RESEARCH STUDY AT IBADAN NORTH WEST AND OGBOMOSO NORTH LGAs, OYO STATE.

I am directed to acknowledge the receipt of your letter on the above subject and convey the Ministry's approval to you to carry out the doctoral research study titled: **"Outcome of a multi Level intervention on patterns of Physical Activity among In-School Adolescents in Oyo State, Nigeria" in Public Secondary Schools in** Ibadan North West and Ogbomoso North Local Government Areas.

2. However, you are to liaise with the Local Inspectors of Education of the two Local Governments before embarking on the study.

3. I am to add that the data collected from these Schools should be **strictly** used for the purpose of the research work please and copy of the research work on completion be forwarded to the Ministry.

4. Thank you.

O. D. Odedara.
For: Permanent Secretary.

APPENDIX XI

Trial Registration

26 June 2017

To Whom It May Concern:

RE: Effects of a Multi-level Intervention on the Pattern of Physical Activity among In-school Adolescents in Oyo State Nigeria.

As project manager for the Pan African Clinical Trial Registry (www.pactr.org) database, it is my pleasure to inform you that your application to our registry has been accepted. Your unique identification number for the registry is **PACTR201706002224335**

Please be advised that your trial is registered under an initiative within our system that allow us to capture data of trials that are already in progress or completed. As such, your trial registration may not adhere to the mandates set forth by the International Committee of Medical Journal Editors for registration requirements, and it is your duty to be transparent to any journal that may ask about the retrospective status of your registration.

Please note you are responsible for updating your trial, or for informing us of changes to your trial. Additionally, please provide us with copies of your ethical clearance letters as we must have these on file (via email, post or fax) at your earliest convenience if you have not already done so.

Please do not hesitate to contact us at +27 21 938 0835 or email epienaar@mrc.ac.za should you have any questions.

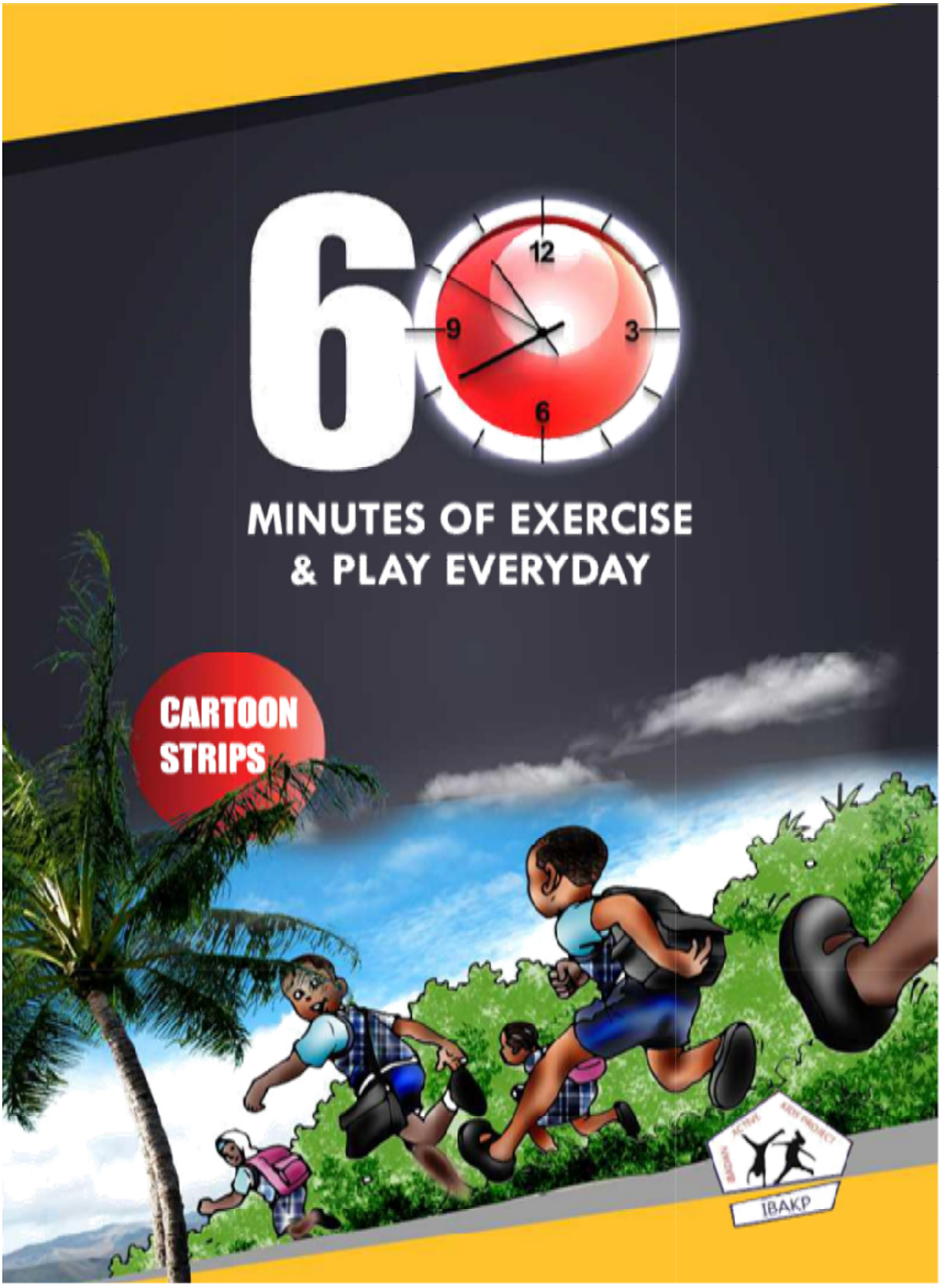
Yours faithfully,

Elizabeth D Pienaar
www.pactr.org Project Manager
+27 021 938 0835

THE SOUTH AFRICAN MEDICAL RESEARCH COUNCIL
Cochrane South Africa | PO Box 19070, Tygerberg, 7505
Tel: +27 (0)21 938 0435 | Email: cochrane@mrc.co.za | Web: www.southafrica.cochrane.org

APPENDIX XII

Educational Materials 1 – Cartoon



CHARACTERS

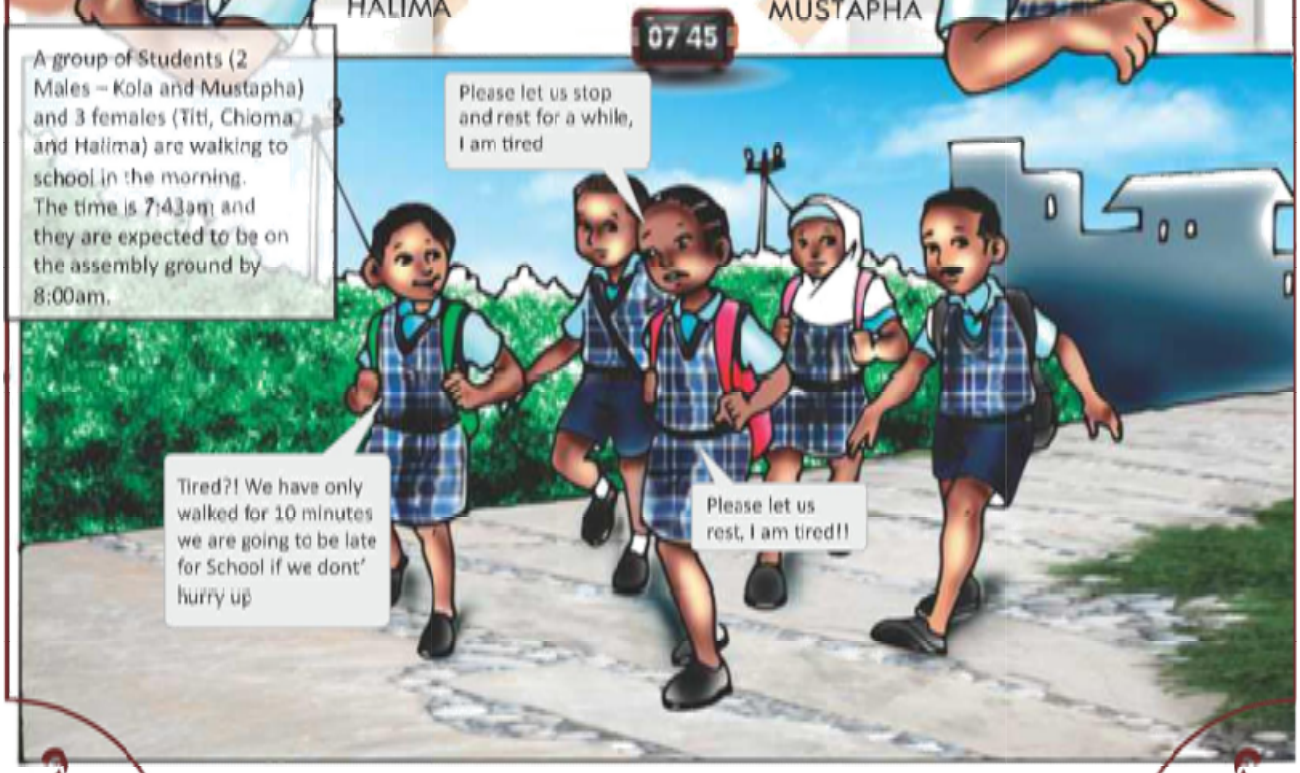
KOLA

TITI

CHIOMA

HALIMA

MUSTAPHA




Have you guys noticed that Titi is always asking that we wait and rest while going to school even when we are going to be late to school?
I am not surprised, it is because she is not physically fit.
How can she be fit when all she does is to sit around during break and talk with her class-mates. Even at home she spends her free time watching TV and playing video games.
But why are you all blaming me now? I AM A GIRL! Do you expect me to run around the field during break time? My elder sister said that it is not lady-like and it can affect my virginity.
That is not true. Exercises such as dancing, jogging, running, ten-ten, fire-on-the-mountain, hopscotch (lakan lakan) etc will not affect your virginity.
My mummy told me that BOTH MALES AND FEMALES, no matter how old or young, should spend at least 60 MINUTES everyday exercising or playing to be healthy.
Really?! I only like participating in sporting activities like dancing or skipping because I like it, I did not know it has health benefits.
Halima is right, physical activity makes you stronger, leaner and healthier, In fact, it makes me sleep better at night and concentrate well in class. That is one of the reasons why I always come first every term.


But 60 minutes for physical exercise will be too long and tiring!!!
Titi, don't you spend more than 5hours watching the TV? In fact, you spend up to 2hours daily talking to your friends.
You should be able to spend 60minutes on physical exercises to improve your health.
You can combine it with other activities. For example, when your parents send you on errands, you can run to the place or jog on the spot while watching television.
My elder brother also told me that if I participate in physical activity, I will develop muscles like boys and since I am not fat. I don't need it.
That is not true, can you remember our science teacher told us girls are different from boys. So we cannot develop muscles like them except for professional athletes who are always doing sporting activities for many hours a day.
Do you know that Kate Henshaw the popular Nigerian actress and Michelle Obama the wife of the former U.S. President are always doing different physical exercises. They look lovely and elegant and not muscular.
In addition, your body size does not matter. If you are slim or fat, you still need to be physically active to have a healthy heart.


Woah, I have learnt so much this morning but we have few equipment for physical activity in school and at home.
Halima is right, moderate and vigorous physical exercise like jogging, running or dancing can make you healthier.
You don't a ways need equipment, you can jog, run, dance, just make sure you spend 60 minutes every day doing moderate and vigorous physical exercise.
Let's all meet during break time to skip and do 'fire-on-the-mountain'.
We are the pacesetters.
That's a great idea!!, other girls and boys will like to be like us.
AM 07 58
Yes! Let's do it
Active kids, healthy kids
Let's do a race now to see who will get to school before 8:00AM.

60 MINUTES OF EXERCISE & PLAY EVERYDAY

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APPENDIX XIII

Educational Materials – 2

Physical Activity Guide for students

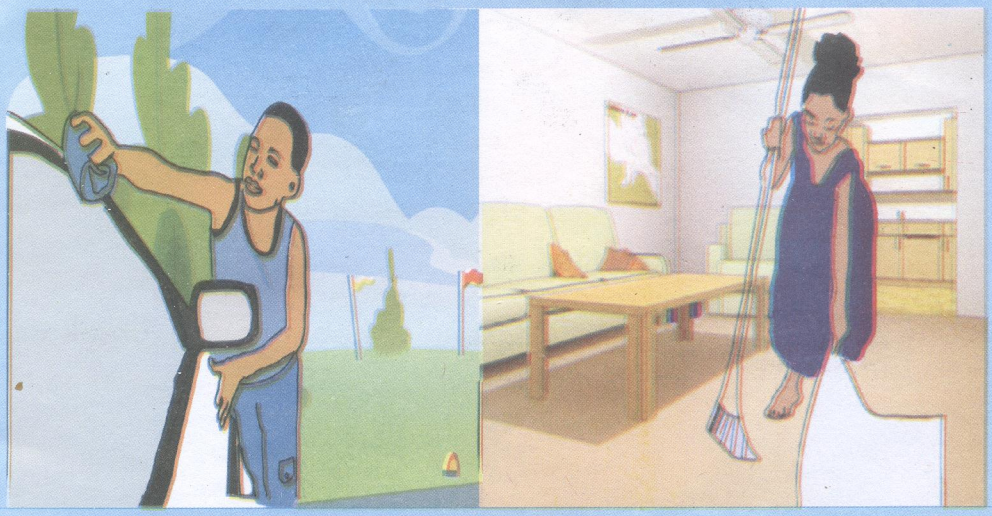
What is Physical Activity ?

Physical activity is defined as any movement of the body and the muscles which result in the use of energy

Places Where Physical Activity Can Occur

Physical activity occurs in many different setting

1) At Home:



While washing the car or cleaning the house

While walking or cycling to and from school

1

2) At school:

During physical education classes, inter-house sports, break time and extracurricular periods

Physical activity should be encouraged in schools because it is a practice that makes students physically fit and healthy

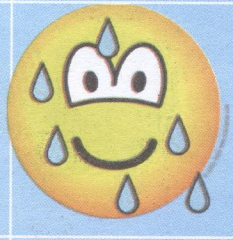
3) At you Neighbourhood:

While participating in recreation activities such as skipping, swimming, playing football, table tennis, or doing "*ten ten*", or " *fire on the mountain*" with your friends

Being Physically Active is Fun and You can Do It anytime, anywhere with or without equipment!!!

LEVELS OF PHYSICAL ACTIVITY

Physical activity can be performed at various levels. To be very healthy, you must participate in moderate and vigorous activity 60 minutes every day

Low	Moderate	Vigorous
		
Low Physical activity has very little effect on how the heart beat .	Moderate Physical activity makes the heart beat fast	Vigorous physical activity makes the heart beat very fast
Example: sitting down to watch television or playing video games on the computer. Low physically activity does not make us physically fit.	Example : Strolling ,brisk walking, farming or cutting the grass. This can make us fit and healthy to some extent.	Example: Jogging , Playing Football, skipping very fast, riding a bicycle up a hill. This is best for making us fit and healthy.

Adolescent must spend 60 minutes every day on moderate and vigorous physical activity to be healthy

4

THE COUCH POTATO

Who is a Couch Potato?

A "Couch Potato " is an individual who does little or no physical exercise BUT sits around or watches television or uses the computer for three hours or more everyday

Are you a Couch Potato?

Do you sit for long periods, OR watch the television OR use the computer everyday for 3 hours or more? IF YES, then YOU ARE A POTATO COUCH!!!!

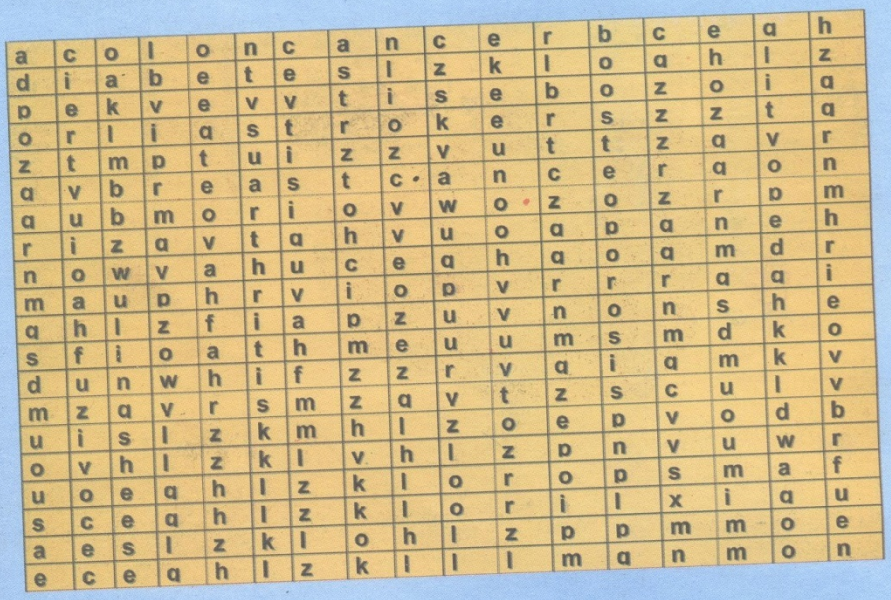
- Do you know that being a potato couch is unhealthy and very very DANGEROUS
- It can cause many diseases such as obesity, hypertension and other heart problems, cancer, diabetes, etc.

It is not too late; change your habits by being physically active!!!

5

DISEASES AND HEALTH CONDITIONS CAUSED BY PHYSICAL INACTIVITY

Student Activity: identify diseases and health conditions caused by physical inactivity in the crossword puzzle

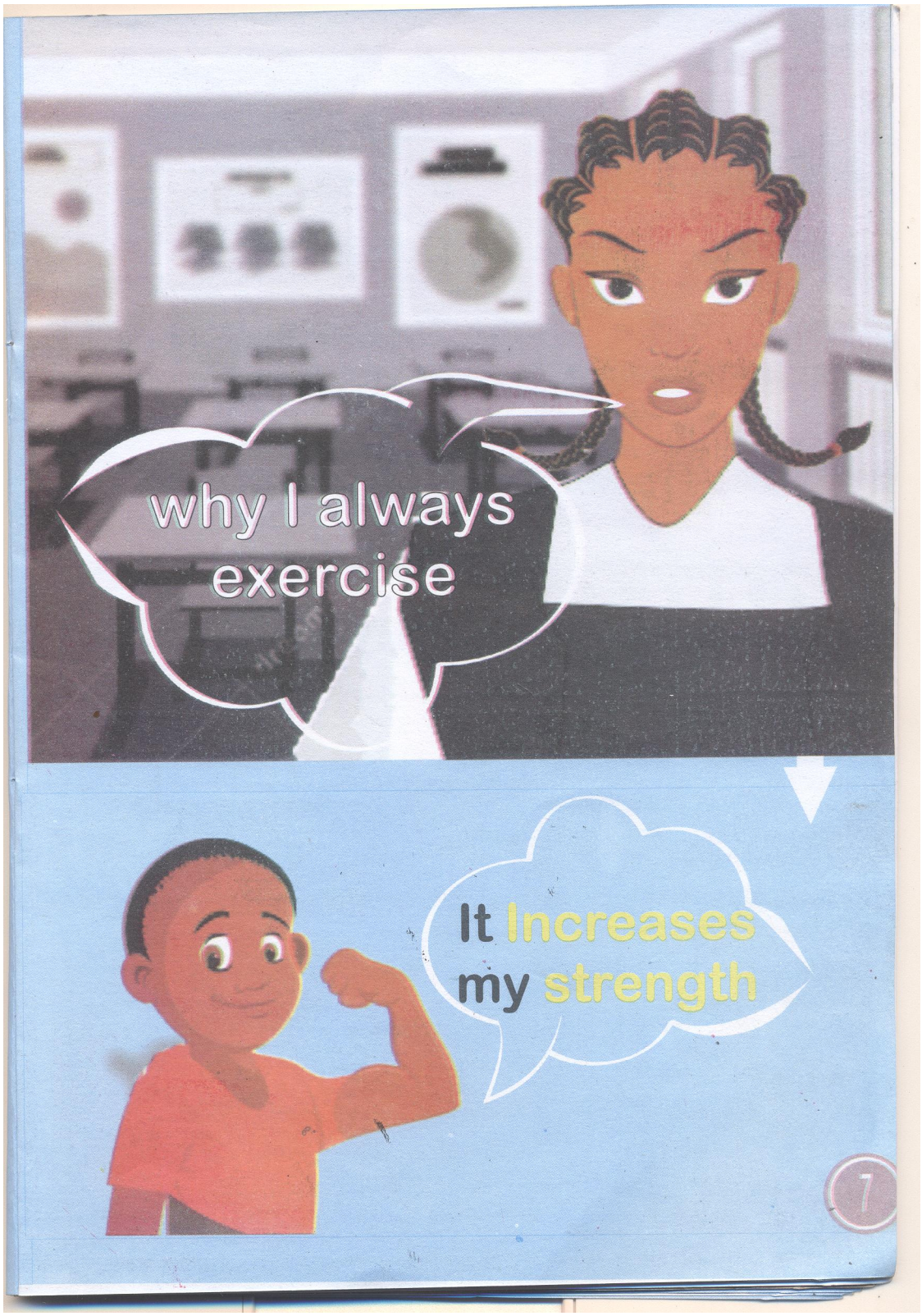


a	c	o	l	o	n	c	a	n	c	e	r	b	c	e	q	h
d	i	a	b	e	t	e	s	l	z	k	l	o	q	h	l	z
p	e	k	v	e	v	v	t	i	s	e	b	o	z	o	i	q
o	r	l	i	q	s	t	r	o	k	e	r	s	z	z	t	q
z	t	m	p	t	u	i	z	z	v	u	t	t	z	q	v	r
q	v	b	r	e	a	s	t	c	a	n	c	e	r	q	o	n
q	u	b	m	o	r	i	o	v	w	o	z	o	z	r	p	m
r	i	z	q	v	t	q	h	v	u	o	q	p	q	n	e	h
n	o	w	v	a	h	u	c	e	q	h	q	o	q	m	d	r
m	a	u	p	h	r	v	i	o	p	v	r	r	r	q	q	i
q	h	l	z	f	i	a	p	z	u	v	n	o	n	s	h	e
s	f	i	o	a	t	h	m	e	u	u	m	s	m	d	k	o
d	u	n	w	h	i	f	z	z	r	v	q	i	q	m	k	v
m	z	q	v	r	s	m	z	q	v	t	z	s	c	u	l	v
u	i	s	l	z	k	m	h	l	z	o	e	p	v	o	d	b
o	v	h	l	z	k	l	v	h	l	z	p	n	v	u	w	r
u	o	e	q	h	l	z	k	l	o	r	o	p	s	m	a	f
s	c	e	q	h	l	z	k	l	o	r	i	l	x	i	q	u
a	e	s	l	z	k	l	o	h	l	z	p	p	m	m	o	e
e	c	e	q	h	l	z	k	l	l	l	m	q	n	m	o	n

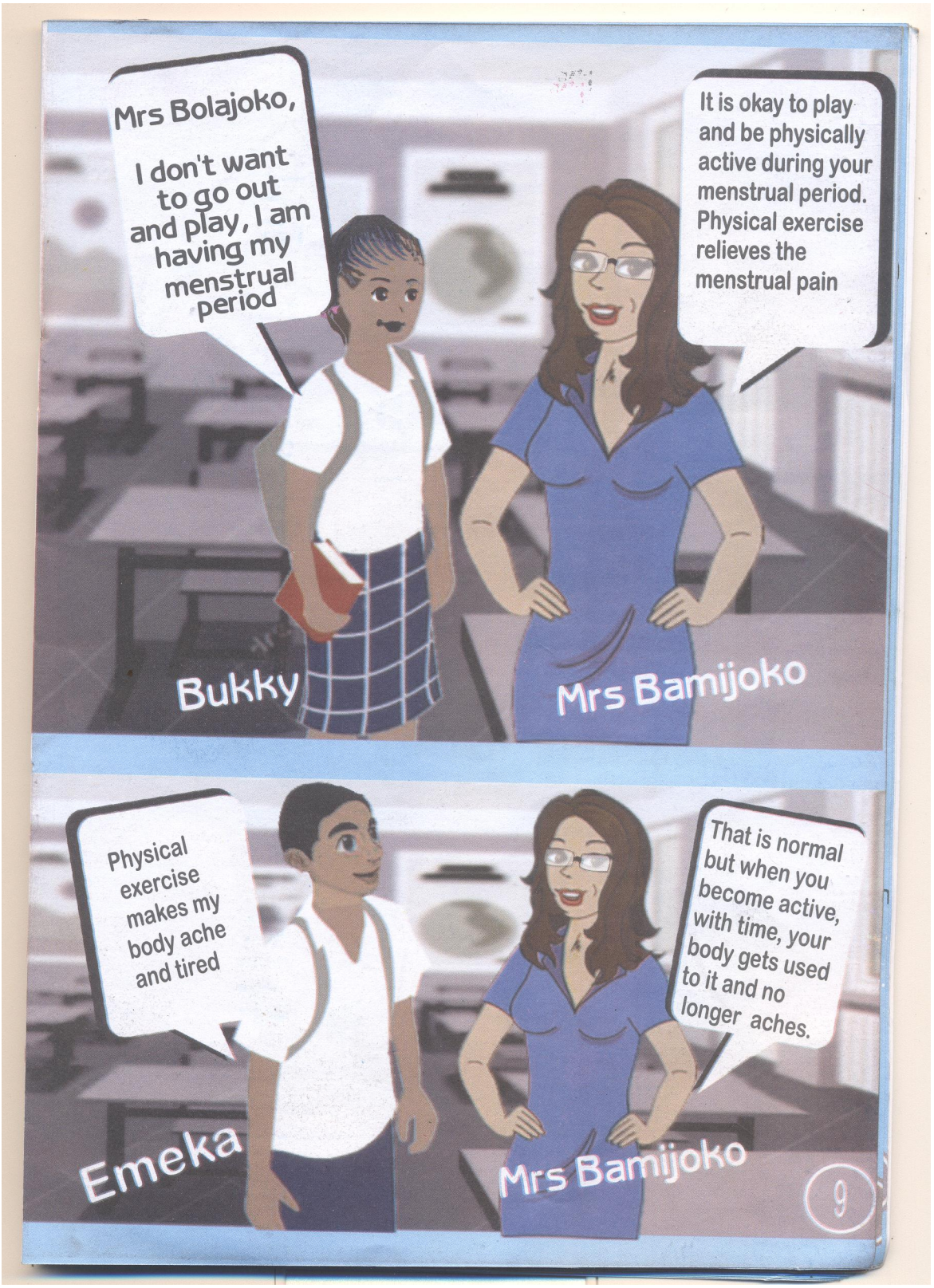
Key

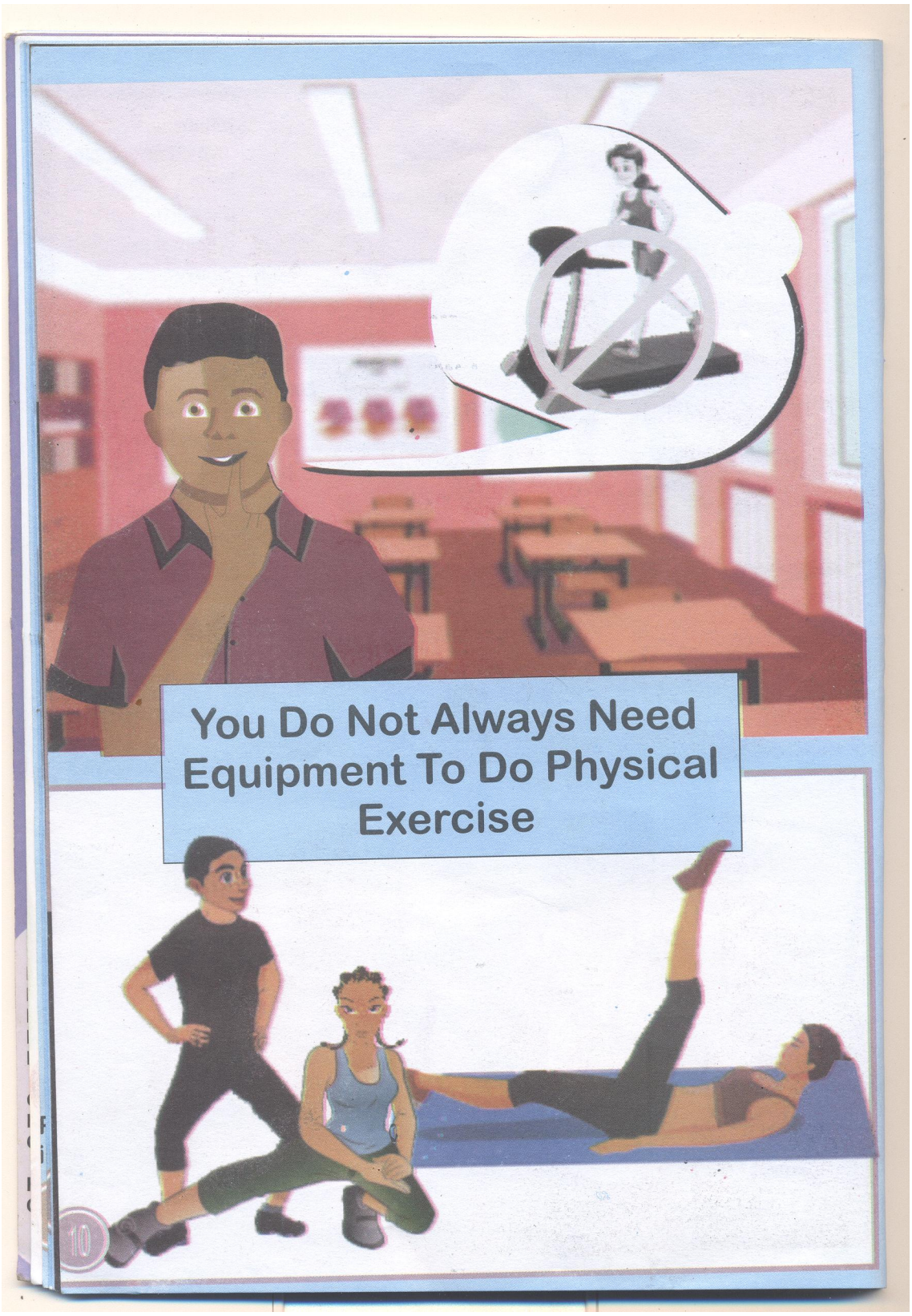
- Obesity
- Diabetes
- Breast Cancer
- Colon Cancer
- Hypertension
- Stroke
- Arthritis
- Osteoporosis

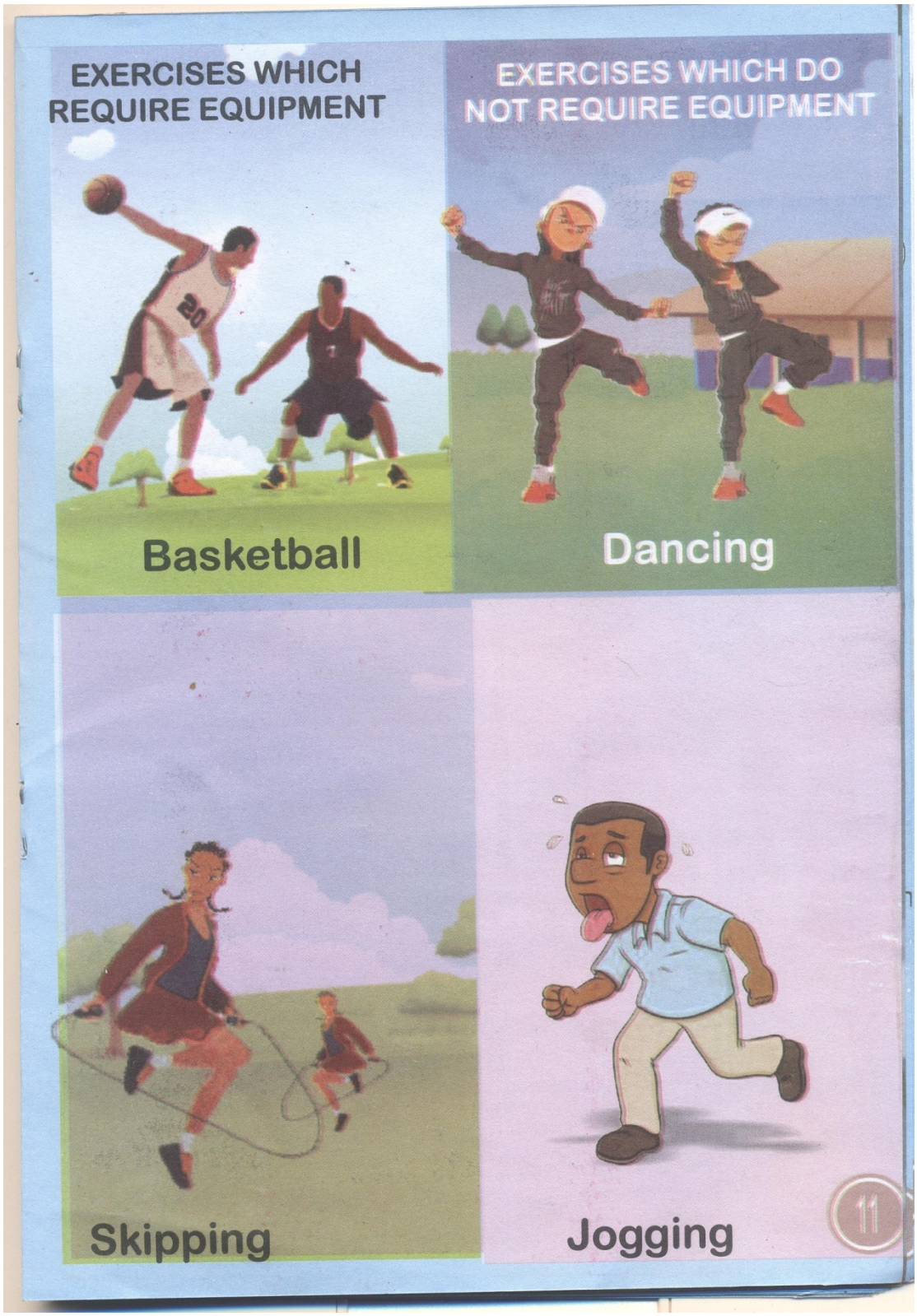
Do You Know Some Adolescents Have Some Of These Diseases; Do You Want To Be One Of Them? If No, Be Physically Active!!!!

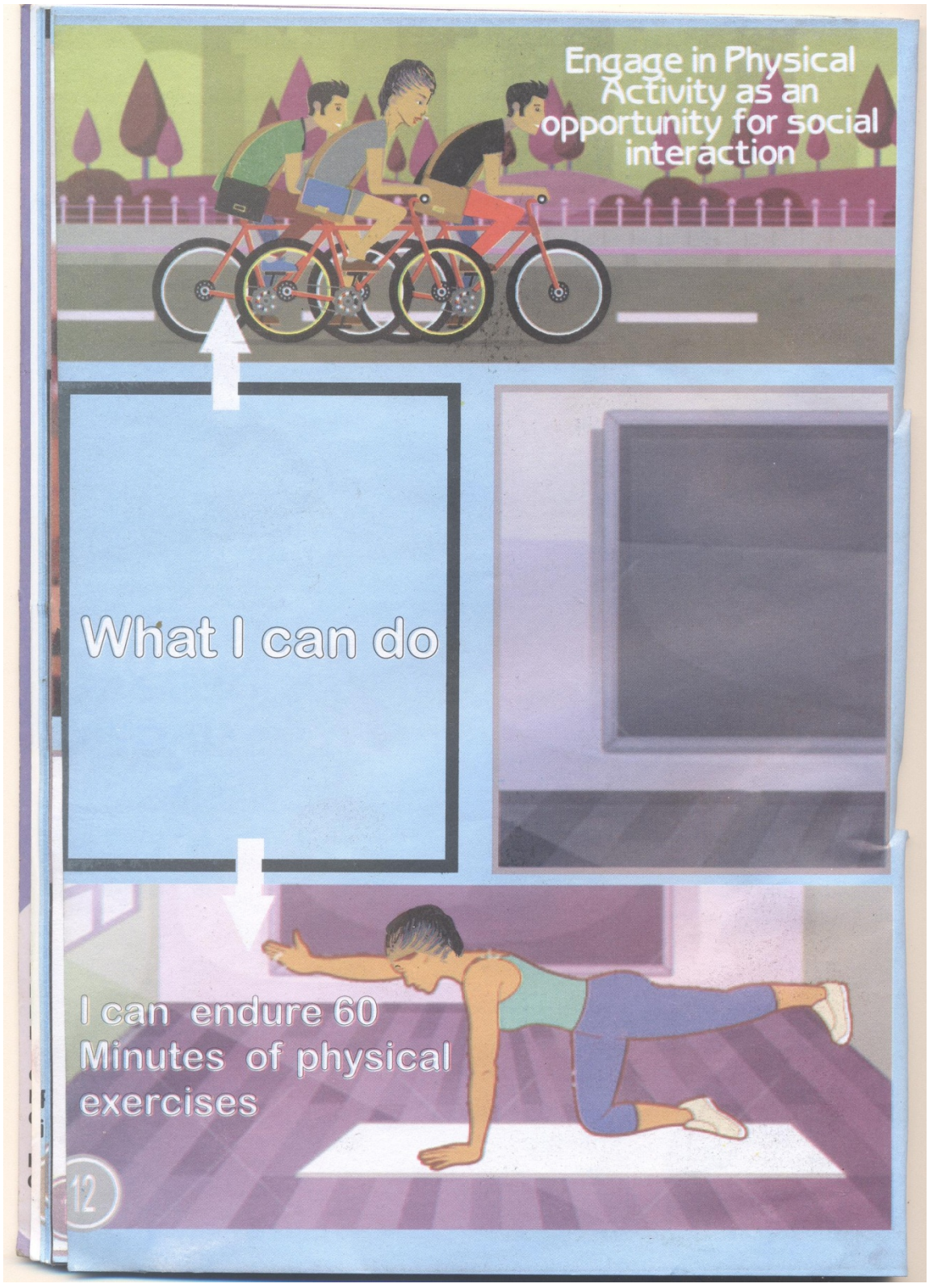

why I always exercise
It Increases my strength
7

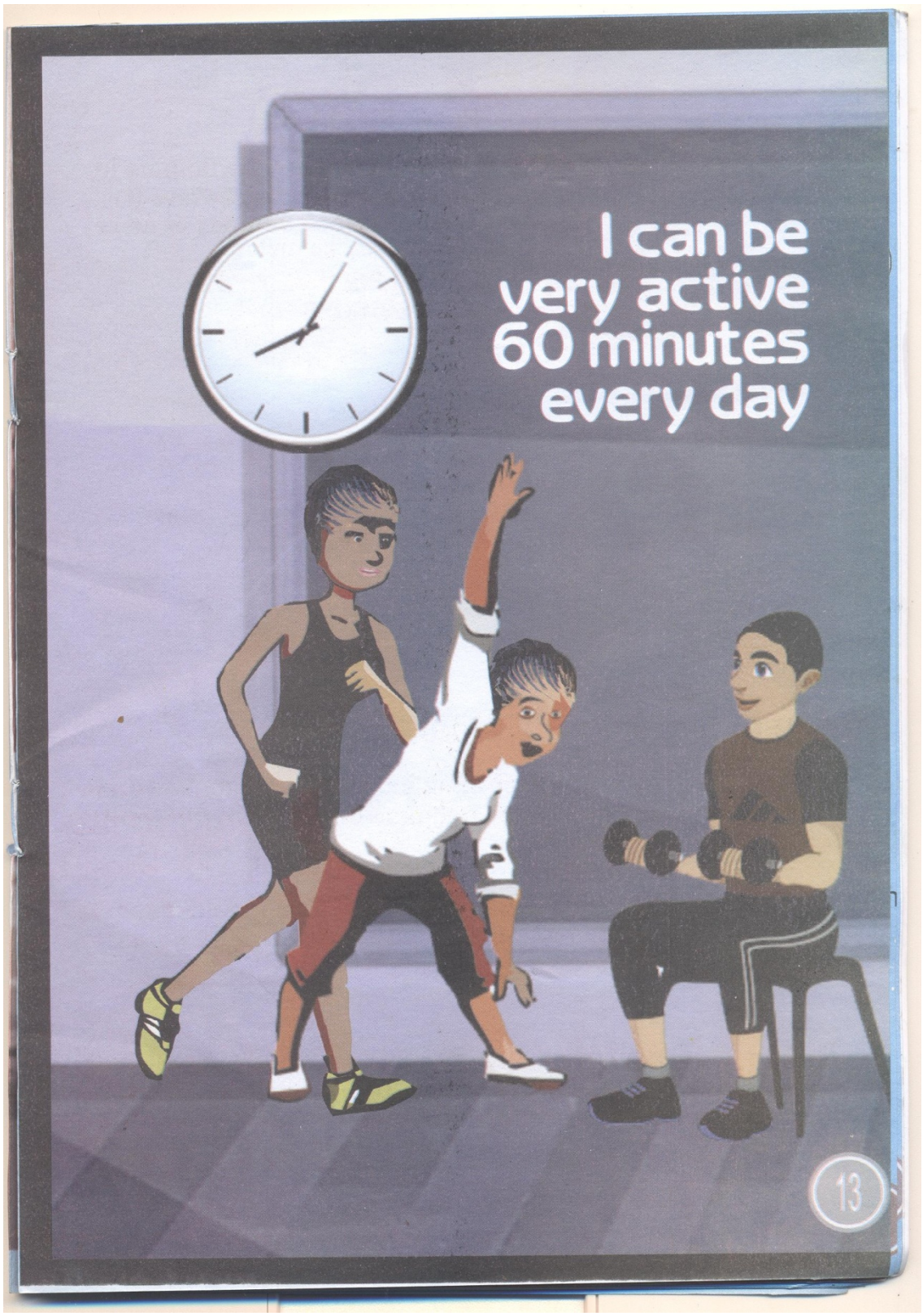

It makes me feel fit and healthy
I SLEEP BETTER
My body is slimmer
8


Mrs Bolajoko,
I don't want to go out and play, I am having my menstrual period
It is okay to play and be physically active during your menstrual period. Physical exercise relieves the menstrual pain
Bukky
Mrs Bamijoko
Physical exercise makes my body ache and tired
That is normal but when you become active, with time, your body gets used to it and no longer aches.
Emeka
Mrs Bamijoko
9


You Do Not Always Need Equipment To Do Physical Exercise
10


EXERCISES WHICH REQUIRE EQUIPMENT
EXERCISES WHICH DO NOT REQUIRE EQUIPMENT
Basketball
Dancing
Skipping
Jogging
11

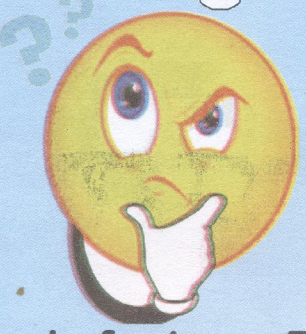

Engage in Physical Activity as an opportunity for social interaction
What I can do
I can endure 60 Minutes of physical exercises
12


I can be very active 60 minutes every day
13

Poser for the day

Many girls don't want to participate in physical exercise because they believe it can make them lose their virginity or make them muscular like males.

DO YOU BELIEVE THIS?
LET'S DISCUSS IT



Basic facts on Physical Activity

- Physical activity is good for females; it does not makes them muscular and look like males because females are different from males.

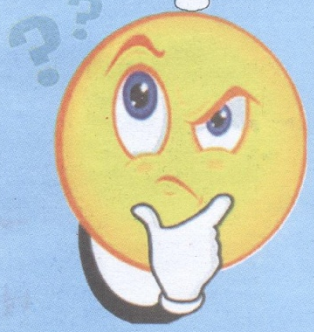
- However, professional female athletes can become muscular because they spend very long periods (at times 8-10 hours every day) doing exercise

- Participation in physical activity should not make girls loose their virginity. There are less strenuous activities like dancing and walking.These does not affect the hymen

Poser for the day

Many adolescents believe they are too old to be physically active and only sportsmen should be involved in physical exercise

DO YOU BELIEVE THIS?
LET'S DISCUSS IT



Basic facts on Physical Activity

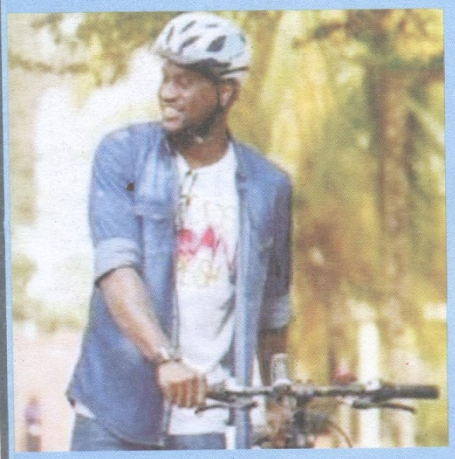
- Physical activity should be done for life
- Everybody should be involved in PA to improve their health not only sports men and women

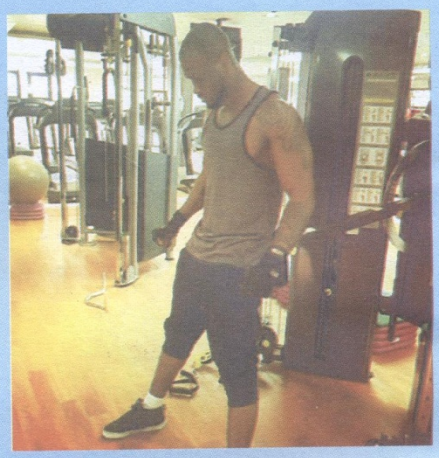
Boys Be Physically Active!!!

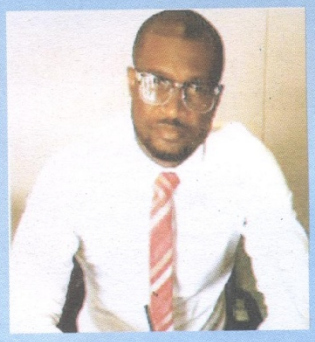
Boys prefer watching television or playing video games rather than engaging in physical exercise. This is unhealthy.

Lets look at a popular Nigerian Hip Pop artist who is physically active.

Peter Okoye, Popular Nigerian Hip Hop artist







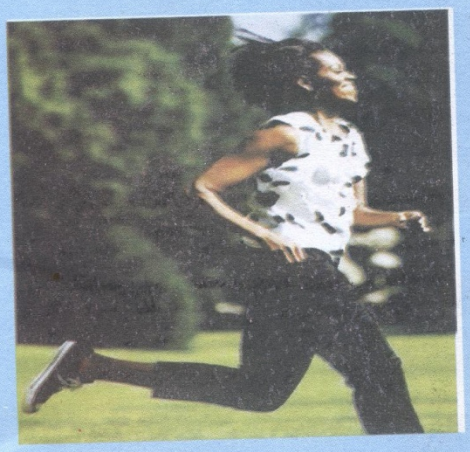
DO YOU WANT TO BE HANDSOME AND FIT LIKE HIM WHEN YOU GROW UP? THEN BE PHYSICALLY ACTIVE!!!!

16

Girls Be Physically Active!!!

Girls don't like being physically active because they are shy, self conscious of their growing body and feel it is not feminine or lady like. This should not be so. There are popular females who are very active.
Let's look at popular females who are very active

Michelle Obama, the Wife of the former President of the United States of America



She is very successful, feminine and beautiful even though she is 53 years old and has two grown children

APPENDIX XIV

TEACHERS' MANUAL FOR THE PHYSICAL ACTIVITY STUDY

Module 1:

Introduction of the physical activity programme

Instruction for Teachers

Welcome students to the Ibadan Active Kids Project and explain that it is designed to make them become healthier and more active adolescents. Explain that the training sessions will give them the opportunity to learn new, positive behaviours and to identify and change negative behaviours. Explain further that over the next few weeks, they will cover several topics that will strongly influence their habits and activity levels. Overall, the programme will equip with information and encouragement needed to build their confidence about being more active for the rest of their lives.

Set ground rules

- The time when training will commence ever week.
- Mode of asking and answering questions:
- Do not judge anybody – you are free to agree or disagree
- Freedom to ask any question and there are no silly questions.
- Time for closing of session

Definition of physical activity

Physical activity includes all the movements people make in everyday life, including walking or cycling to schools or the workplace, participating in recreational activities such as going to parks or sports center for exercise, sporting activities such as inter-house competitions and home based activities such as washing cars, sweeping the house etc.

Explain further that physical activity occurs during sleep, leisure activities, occupation related activities, transportation and home based activities and the acronym for this is **SLOTH.**

S= Sleep

L= Leisure i.e. going to the sport center to play football

O= Occupation related activities i.e. builders building houses

T= Walking or Cycling to school or workplace

H= Home based activities i.e. washing cars, sweeping the house etc

Conclude that it is important for young people to utilise every opportunity to be healthy

Places where physical activity can occur

1. ***At home***

During home based activities such as washing cars, sweeping the rooms, washing the clothes etc

2. ***At the neighbourhood***

While participating in recreation activities such as skipping, swimming in the pool or a river, playing football/table tennis, or doing games like "ten""ten", "suwe" or "fire on the mountain" with your friends at home.

3. ***In schools***

Physical activity can occur in several ways in schools. It can occur while walking from one class to the other, while cleaning the chalkboard, during activities on the assembly ground or while tidying up the classroom at the end of the day. In addition, it can occur during active commuting (walking or cycling to and from school). Dance also provides an opportunity for students to be physically active. During physical education classes, the assembly, recreation and dance programmes, inter-house sports, break time when you play and extracurricular periods

Instruction for Teachers

Ask students the following questions:

- Within the school, how easy and feasible is it to be physically active?
- How easy and feasible is it to walk or cycle to school?
- At home, how easy and feasible is it to be physically active?
- How easy and feasible is it to be physically active in your neighbourhood?

Summarise their discussions by encouraging the students that irrespective of the challenges with being active, they can decide to be active. Limited facilities, equipment, and other resources may be perceived as barriers to being active however; quality physical activity can take place even in schools where facilities and equipment are limited.

Also conclude the session by informing the students that being physically active is fun and it can be done anytime, anywhere with or without equipments.

Module 2: Levels of physical activity and benefits of being physical active

Instruction for Teachers: Welcome students and have a brief recapitulation of key issues discussed in the previous class

- Introduce the class by explaining that Physical activity can be performed at various levels.

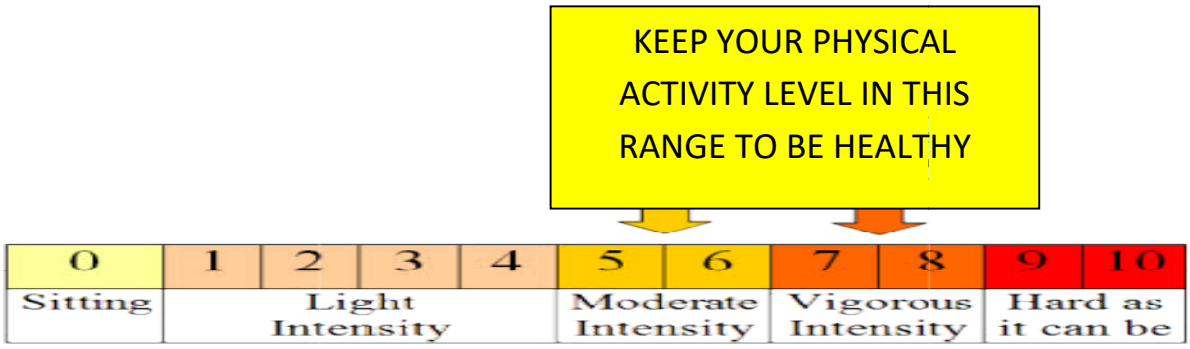
- Ask the students the following question:
    - Do you get the recommended 60 minute of moderate-to-vigorous physical activity every day?
        - If No why don't you get 60 minute of moderate-to-vigorous physical activity every day?
        - If yes, explain how you are able to achieve 60 minutes of MVPA daily

Levels of physical activity

Explain the levels of physical activity using the graphics below:

Low	Moderate	Vigorous
		
Low physical activity has very little effect on how the heart beats	**Moderate physical activity** makes the heart beat **fast**	**Vigorous physical activity** makes the heart beats **very fast**

Example: sitting down to watch television or playing video games on the computer etc	Example: Sweeping the floor, dusting the house, washing plates/cars, strolling, brisk walking, farming/ cutting the grass, swimming, skipping, dancing and riding a bicycle on a flat ground	**Example**: jogging, playing football, skipping very fast, riding a bicycle up a hill



Ways to attain 60 minutes of moderate to vigorous physical activity levels

- Be active in as many ways as possible, for example, through play, cultural activities, dance, sport and recreation, jobs, and going from place to place;
- Be active with friends and when, at home, school, and in their communities;
- Spend less than two hours a day in front of the television, computers, and computer games.

Benefits of being physically active

- It controls the body Weight.
- Regular participation in PA reduces the risk of diseases such as Cardiovascular Disease, type 2 Diabetes and some cancers.
- It strengthens the bones and muscles.
- It improves an individual's mental health and mood.
- It improves an individual's ability to do daily activities and prevent falls.
- It increases energy levels, strength, fitness and stamina
- It helps in the relaxation of the body and ability to sleep soundly

- Conclude the discussion by explaining that, to be very healthy, they must participate in moderate and vigorous physical activity 60 minutes every day.

Module 3: The concept of "couch potato" and a puzzle game to identify diseases and health conditions associated with physical inactivity"

Instruction for Teachers: Welcome students and have a brief recapitulation of key issues discussed in the previous class,

Introduction:

Ask the students if they have heard the following term "COUCH POTATO". Clarify as follows:

A couch potato is an individual who does not exercise and eats junk food. A "Couch Potato " is an individual who does little or no physical exercise BUT sits around or watches television or uses the computer for three hours or more everyday

Ask the students to respond to the following questions:

- Do you get the recommended 60 minute of moderate-to-vigorous physical activity per week?
- Do you enjoy lying around and watching the TV or looking at your phones or computers/computer games for more than 2 hours daily?
- Do you spend the majority of your day sitting?
- Explain further that even if they are physically active, being sedentary is still dangerous to their health.

How do you ensure you are not a couch potato?

- Don’t sit for too long
- Remember to move every hour.
- Go for a brisk walk with your friends rather than sitting.

Instruction to the Teacher:

Ask students the following questions:

- Do you think a couch potato is healthy?
- How can we keep from being a couch potato?

Conclude as follows: It can be hard to change habits, but try some of these tips. A little goes a long way when it comes to better health.

CROSSWORD PUZZLE

IDENTIFY SOME DISEASES AND HEALTH CONDITIONS CAUSED BY BEING PHYSICALLY INACTIVITY

a	C	o	l	o	n	c	a	n	c	e	r	b	c	e	g	h
d	I	a	b	e	t	e	s	l	z	k	l	o	g	h	l	z
p	E	k	v	e	v	y	t	i	s	e	b	o	z	o	i	q
o	R	l	j	q	s	t	r	o	k	e	r	s	z	z	t	g
z	T	m	p	t	u	i	z	z	y	u	t	t	z	q	y	r
q	Y	b	r	e	a	s	t	c	a	n	c	e	r	g	o	n
g	U	b	m	o	r	i	o	y	w	o	z	o	z	r	p	m
r	I	z	q	y	t	g	h	y	u	o	q	p	q	n	e	h
n	O	w	y	a	h	u	c	e	g	h	g	o	g	m	d	r
m	A	u	p	h	r	y	i	o	p	v	r	r	r	g	g	i
g	H	l	z	f	i	a	p	z	u	v	n	o	n	s	h	e
s	F	i	o	a	t	h	m	e	u	u	m	s	m	d	k	o
d	U	n	w	h	i	f	z	z	r	y	g	i	g	m	k	v
m	Z	q	y	r	s	m	z	q	y	t	z	s	c	u	l	v
u	I	s	l	z	k	m	h	l	z	o	e	p	v	o	d	b
o	V	h	l	z	k	l	v	h	l	z	p	n	y	u	w	r
u	O	e	g	h	l	z	k	l	o	r	o	p	s	m	a	f
s	C	e	g	h	l	z	k	l	o	r	j	l	x	i	q	u
a	E	s	l	z	k	l	o	h	l	z	p	p	m	m	o	e
e	C	e	g	h	l	z	k	l	l	l	m	q	n	m	o	n

Key

- **Obesity** is a medical condition whereby the body has excess fat which may have an adverse effect on health.
- **Diabetes** is a diseases condition often known as diabetes mellitus. It is a disease which causes too high glucose in the blood (blood sugar) either because the body is not producing sufficient insulin or the body's cells fail to respond properly to insulin, or both. Patients with this disease experience frequent urination; they become increasingly thirsty and hungry.
- **Breast Cancer**: Breast cancer is a malignant tumor (a collection of cancer cells) in the breast tissues. Signs of breast cancer may include a lump in the breast, a change in breast shape and fluid coming from the nipple.
- **Colon Cancer**: is cancer of the large intestine (colon) which is part of the digestive system
- **Hypertension: is a** medical condition which causes the blood pressure in the arteries to be always high. If untreated, this can cause other major diseases.
- **Stroke is** a medical condition due to poor blood flow to the brain and this can results in cell death.
- **Arthritis is** a medical condition which causes pains in the joints

- **Osteoporosis:** A bone disease resulting in the reduced density of bone and strength. This makes the bone fragile and break easily

Conclude the session by explaining that some adolescents have these diseases and physical activity is a key way of preventing the diseases.

Module 4: **Different types of physical activity which require as well as those which do not require equipment**

Instruction for Teachers: Welcome students and have a brief recapitulation of key issues discussed in the previous class

Introduce the session by explaining to students that limited facilities, equipment, and other resources may be perceived as barriers to PA however, quality physical activity can take place even in schools where facilities and equipment are sparse.

Ask students to brainstorm on physical exercise which require equipment

Clarify and add as follows:

- Foot ball
- Table Tennis
- Lawn Tennis
- Skipping
- Badmiton
- Weight lifting
- Boxing
- Wrestling
- Skating
- Bicycling

Ask students to brainstorm on physical exercise which do not require equipment

- Dancing
- Jogging
- Walking
- Aerobics such as squatting, lunges,
- Sit ups
- Jumping Jacks

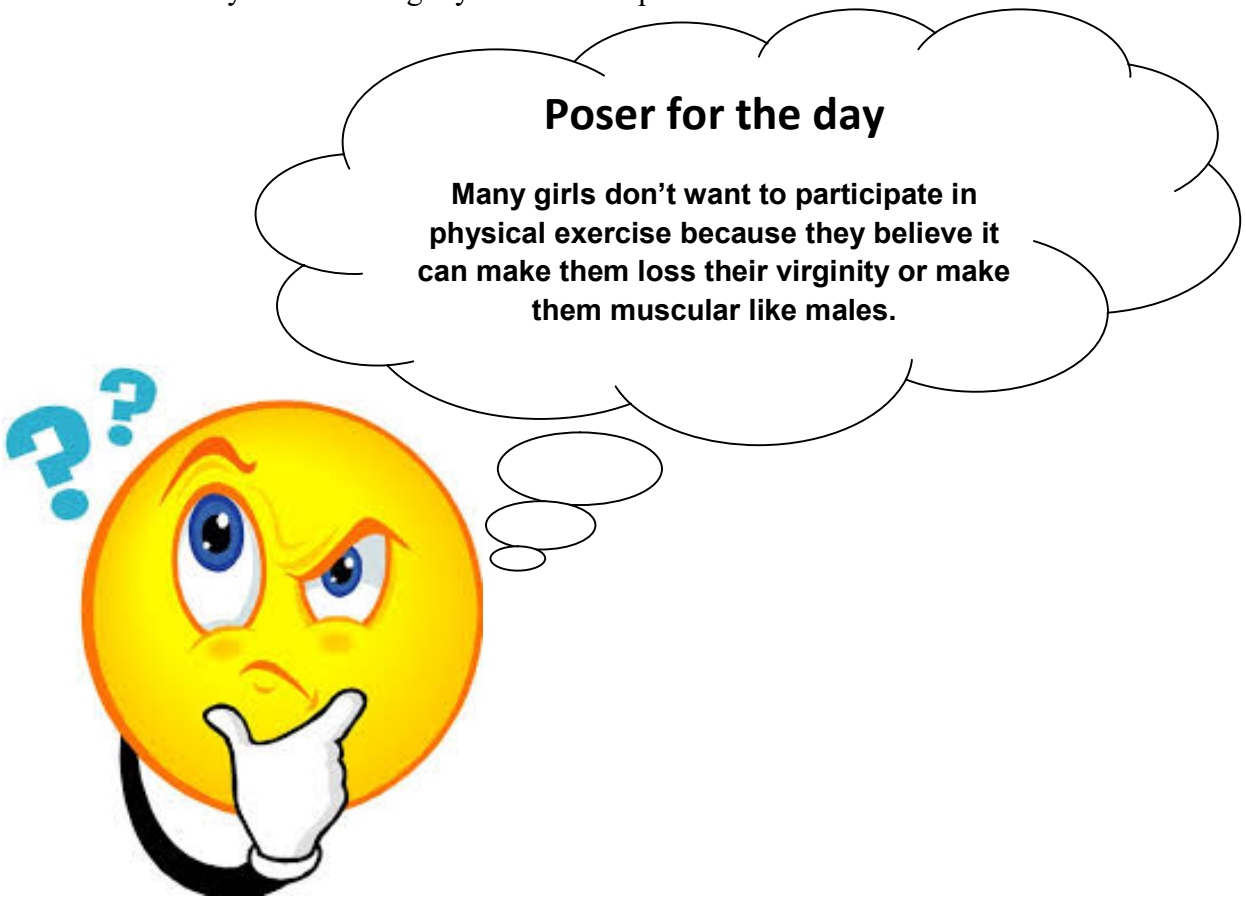
- Ask students to demonstrate some physical exercise which do not require equipment

Conclude the session by explaining that we do not always need equipments to be physically active.

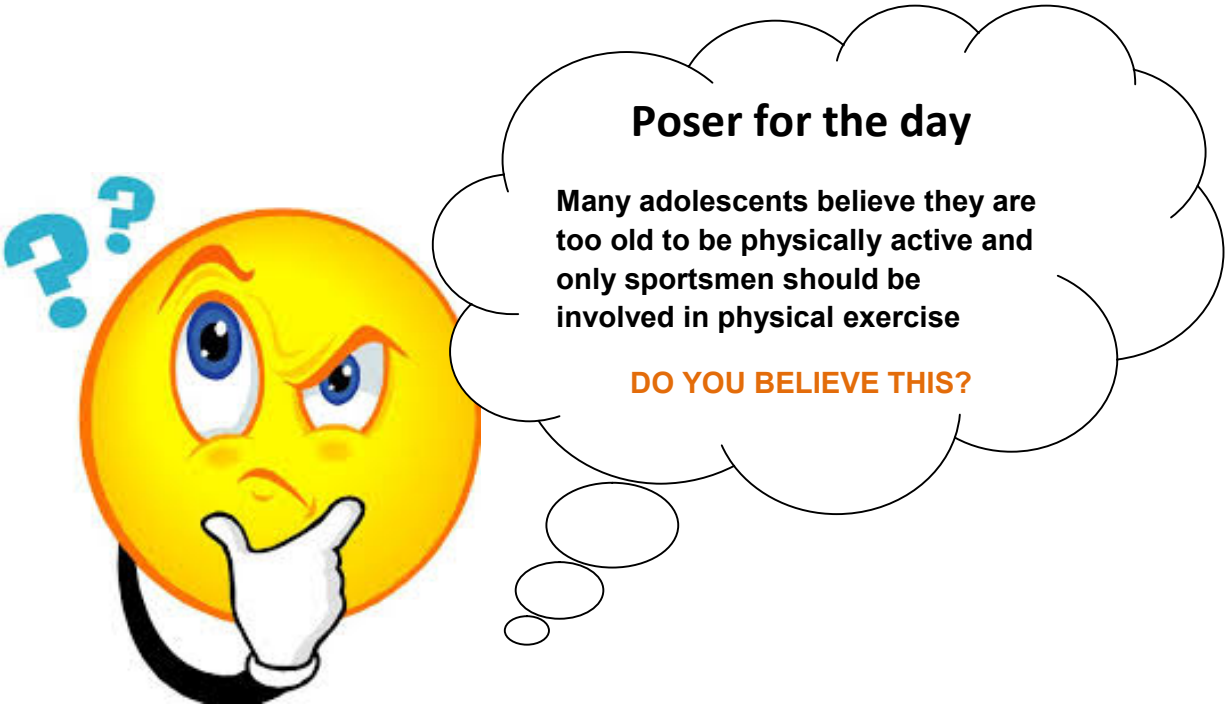
Module 5: Basic facts on physical activity and discussions to correct myths and misconceptions

Instruction for Teachers: Welcome students and have a brief recapitulation of key issues discussed in the previous class

- Commence the session by asking students about the myths and misconceptions about physical activity.
- Discuss and clarify the myths /misconceptions raised by the students.
- Discuss and clarify the following myths/misconceptions as follow:



- Physical activity is good for females; it does not makes them muscular and look like males because females are different from males.
- However, professional female athletes can become muscular because they spend very long periods (*at times 8-10 hours every day*) doing exercise
- Participation in physical activity should not make girls lose their virginity. There are less strenuous activity like dancing and these does not affect the hymen



- Physical activity should be done for life
- Everybody should be involved in PA to improve their health; not only sports men and women

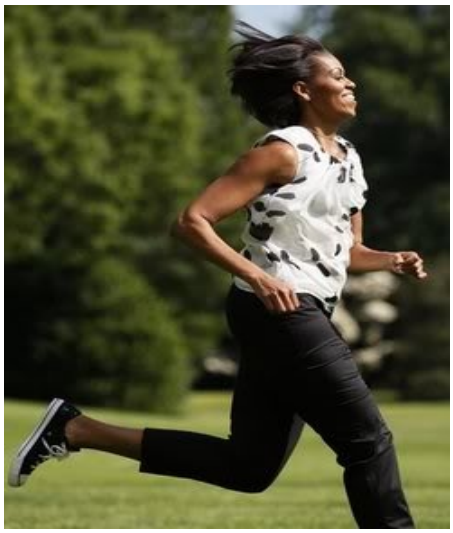
Module 6: Examples of celebrity role models who are physically active

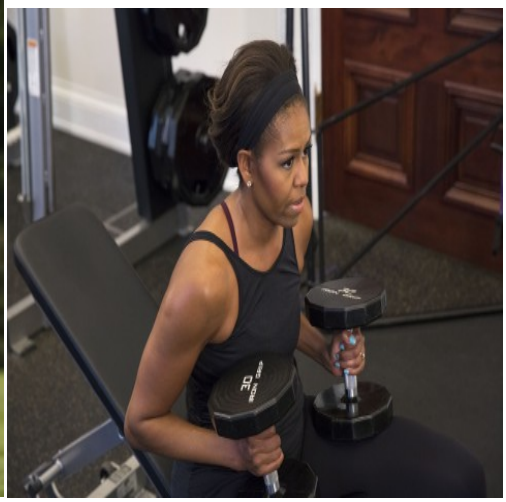
Instruction for Teachers: Welcome students and have a brief recapitulation of key issues discussed in the previous class.

Ask students to brainstorm on their celebrity role models especially those who are physically active who they will like to emulate

Discuss and inform them about the following celebrities who are physically active

Michelle Obama, the Wife of the former President of the United States of America





She is very successful, feminine and beautiful even though she is 53 years old and has two grown children

Kate Henshaw, Popular Nigerian Actress


She is very feminine, a diva and successful though she is 45 years old and has a grown child

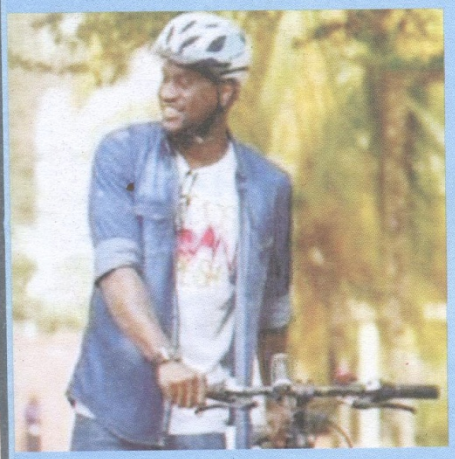
DO YOU WANT TO BE YOUNG AND BEAUTIFUL LIKE THEM WHEN YOU GROW UP, BE PHYSICALLY ACTIVE!!!!

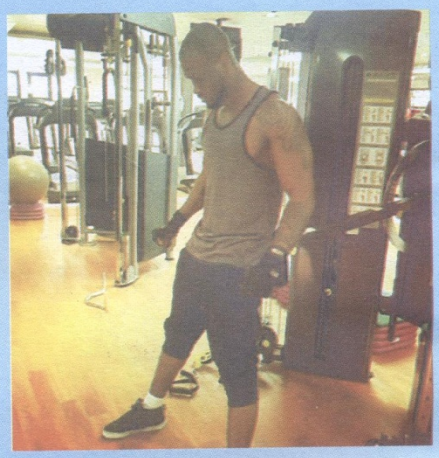
Boys Be Physically Active!!!

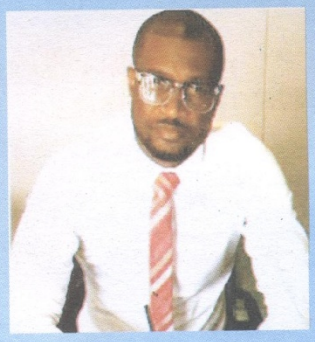
Boys prefer watching television or playing video games rather than engaging in physical exercise. This is unhealthy.

Lets look at a popular Nigerian Hip Pop artist who is physically active.

Peter Okoye, Popular Nigerian Hip Hop artist







DO YOU WANT TO BE HANDSOME AND FIT LIKE HIM WHEN YOU GROW UP? THEN BE PHYSICALLY ACTIVE!!!!

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APPENDIX XV: A sample of the banners

APPENDIX XVI

SELECTED PICTURES SHOWING DIFFERENT PHASES OF THE STUDY

Data collection at baseline assessment in a school in Ibadan

Students in Ogbomosho using pedometers to assess the objectively measured physical activity level

Blood pressure check for students by Nurses

Multi-stage fitness test in a school in Ibadan

Presentation of baseline findings by the doctoral student to officials of the Ministry of Education, School Authorities and selected students

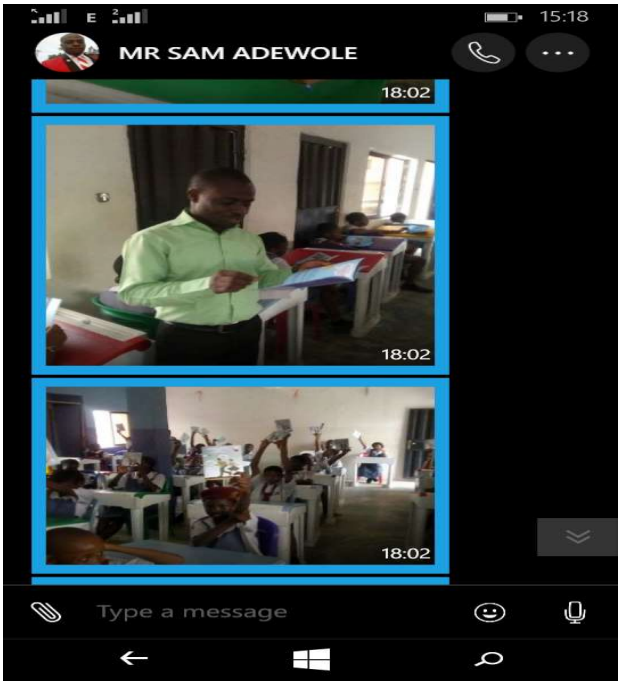
Representatives of the Ministry of Education

Group photograph after the presentation of baseline findings

Discussion with Teachers/School Heads to design the multi-level intervention

Discussion with students and the Graphic Artist to design the educational materials

A cross section of participants at the meeting for the design of the multi-level intervention



Teacher-led sessions on physical activity using the developed educational materials

Teacher-led sessions on physical activity using the developed educational materials

Provision of sporting materials and banners in schools

Provision of sporting materials and banners in schools

Students having a great time playing football using the balls provided

Students having a great time playing football using the balls provided

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APPENDIX XVII

Published Protocol for the Study