# SOCIO-ECOLOGICAL INFLUENCES ON PHYSICAL ACTIVITY IN PRIMARY SCHOOL CHILDREN: A VIEW FROM SOUTH AFRICA

By

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**DECLARATION**

I, Monika Uys, hereby declare that the work on which this dissertation/thesis is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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1. **Uys M, Draper CE, Hendricks S, de Villiers A, Fourie J, Steyn N, Lambert EV.** Fitness levels and knowledge, attitudes and behaviour of children participating in HealthKick. *American Journal of Health Behaviour*. In second round of review.
2. **Uys M, Draper CE, Hendricks S, de Villiers A, Fourie J, Steyn N, Lambert EV.** Factors influencing break-time physical activity of South African primary school learners from low-income communities. *Journal of Physical Activity and Health*. 2015, 12, 618 - 627.
3. **Uys M, Broyles ST, Draper CE, Hendricks MS, Rae D, Naidoo N, Katzmarzyk PT, Lambert EV**. Perceived and objective neighbourhood support for outside of school physical activity in South African children. *BMC Public Health*. In review.

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**LIST OF ABBREVIATIONS**

| | |
|---|---|
| **CATCH** | The Child and Adolescent Trial for Cardiovascular Health program |
| **CDC** | Centers for Disease Control and Prevention |
| **GIS** | Geographic Information Systems |
| **HDI** | Human Development Index |
| **HSPF** | Healthy School Program Framework |
| **ISCOLE** | International Study on Childhood Obesity, Lifestyle and the Environment |
| **KAB** | Knowledge, Attitude and Behaviour |
| **LICs** | Low income countries |
| **LMICs** | Low- to middle-income countries |
| **MICs** | Middle income countries |
| **MVPA** | Moderate- to Vigorous-Intensity Physical Activity |
| **NCDs** | Non-communicable diseases |
| **PA** | Physical Activity |
| **PE** | Physical Education |
| **SAPS** | South African Police Service |
| **SES** | Socio-economic status |
| **SHAPES** | School Health Action Planning and Evaluation System |
| **SHPPS** | U.S. School Health Policies and Practices Study |
| **SOPLAY** | The System for Observing Play and Leisure Activities in Youth |
| **SPEEDY** | Sport, Physical activity and Eating behaviour: Environmental Determinants in Young people study |
| **WCED** | Western Cape Education Department |
| **WHO** | World Health Organisation |

## GLOSSARY

**Human Development Index (HDI)** – a composite score based on life expectancy, gross national income, literacy and school participation

**Gini index** - reflects the extent to which the distribution of income or consumption expenditure among individuals or households within an economy deviates from a perfectly equal distribution

**Built environment** - the built environment includes all of the physical parts of where we live and work (e.g., schools, homes, buildings, streets, open spaces, and infrastructure)

**School environment** – contains both the physical (built) and psychosocial dimensions

**School built environment** – includes the school buildings and school grounds, conditions such as noise and temperature, and lighting

**School policy environment** – policies and practices at school

**School social environment** – the school culture (around physical activity)

**Neighbourhood environment** – the built environment in the neighbourhood one lives

**Physical activity** - any bodily movement produced by skeletal muscles that requires energy expenditure

**Physical fitness** - the condition of being physically fit and healthy

**Geographic information system (GIS)** - is a system designed to capture, store, manipulate, analyse, manage, and present all types of spatial or geographical data

**ABSTRACT**

The prevalence of childhood overweight and obesity has increased substantially globally with a concurrent decline in both children's physical activity and fitness levels. The socio-ecological model proposes that health behaviour, such as physical activity, is influenced by multiple factors, at an individual, social and environmental level. However, there seems to be a lack of consensus in the current literature on the factors influencing physical activity in different settings (e.g. school, neighbourhood), and across a wide range of socio-economic conditions. To our knowledge, there are no data available on the role of different environmental factors (within the school and the neighbourhood environment) in relation to children's physical activity in a South African setting. Therefore, one of the key aims of this thesis was to assess the effectiveness of a novel intervention on fitness, measures of physical activity and factors that influence physical activity. Specifically, this thesis assessed the effectiveness of a school-based, curriculum-grounded, educator-focused intervention designed to increase physical activity and healthy eating in South African primary school students in low income settings, on fitness levels and physical activity related knowledge, attitudes and behaviour (Chapter 2). Additionally, this thesis examined factors within the school environment associated with observed physical activity in children during in-school break time, self-report activity, and moderate-to-vigorous, in-school objectively-measured activity (Chapter 3-5). Furthermore, this thesis assessed the influences of parental perceptions and the neighbourhood environment on children's physical activity (Chapter 6). The overarching aim of this thesis is to examine the association between environmental constructs (physical spatial and built environment, social environment, and policy environment) and children's physical activity.

**CHAPTER 2**

**Introduction:** One of the settings in the socio-ecological model is the school setting. Since the thesis will look at influences on physical activity in primary school settings, the aim of the first chapter was to assess the effectiveness of a school-based, curriculum-grounded, educator-focused intervention, incorporating action planning, to increase physical fitness levels, and physical activity-related knowledge, attitudes and behaviour in South African primary school students in low income settings.
**Methods:** The intervention spanned three years and there were three measurement time points. Sixteen primary schools were randomly assigned as intervention (n=8) and control (n=8) schools. A selection of tests from the Eurofit testing battery was used to assess changes in fitness levels over the three years of the intervention. Anthropometric measurements included height and weight. A physical activity knowledge, attitude and behaviour (KAB) questionnaire was administered to participants. Multi-level mixed effect linear models were used to assess differences between

intervention and control schools. **Results:** No overall improvement in physical fitness was found, although sit-ups improved significantly in the intervention group ($p < 0.05$). Nor were there any overall intervention effects on determinants of physical activity behaviour. Knowledge improved in both groups ($P < 0.000$). **Conclusion:** We failed to find a specific intervention effect on fitness levels and physical activity-related KAB the learners, suggesting that a "low intensity" intervention was not effective in changing physical activity behaviour in South African primary school settings.

**CHAPTER 3**

**Introduction:** We were unable to show any significant effect of the school-based, curriculum-grounded, educator-focused intervention on physical fitness, physical activity knowledge, attitudes and behaviour. This may be due to lack of an effect, or the means by which physical activity was measured. As the intervention was structured to also focus on the school physical activity environment, using Action Planning, we hypothesised that break time physical activity may be different in intervention and control schools. **Methods:** The System for Observing Play and Leisure Activities in Youth (SOPLAY) was used to observe physical activity levels during break-times at low-income schools (4 intervention, 4 control). Categories of observed activity included: sedentary, eating, walking or vigorous physical activity. Contextual factors assessed included teacher supervision, equipment and crowding. Chi-square tests were used to determine associations between physical activity levels and contextual factors. **Results:** In the 970 observations made, 31% of students were sedentary, 14% eating, 29% walking and 26% engaged in vigorous physical activity. There were no differences in break-time physical activity between intervention and control groups (NS). With supervision, children were more likely to eat and less likely to do vigorous physical activity ($p = 0.035$). Playground crowding was associated with lower levels of vigorous activity and more sedentary behaviour ($p = 0.000$). **Conclusion:** Physical activity during break time was adversely affected by over-crowding and with the presence of supervision. The results suggest that interventions may be targeted at the school policy environment to reduce these barriers to physical activity.

**CHAPTER 4**

**Introduction:** Results from the previous chapter showed that school policy/practice (supervision of students during break-times) and built environment (over-crowding) can influence children's physical activity levels during break-time in low-income primary school settings**.** This chapter takes this investigation further by assessing the extent to which the school environment (both the policy and built environment) influences physical activity-related knowledge, attitude and behaviours.

**Methods:** Data were collected at sixteen schools participating in the HealthKick study. A formative assessment, which included a situational analysis interview with the school principal and an observational schedule of the school environment, was completed at all schools. All grade four children completed a previously-validated knowledge, attitude and behaviour (KAB) questionnaire. Inter-item reliability analysis was performed on the school physical activity index resulting in a final total of 7 items. A non-parametric equivalent of a nested linear regression model was used to assess the relationship between the school physical activity index score and each physical activity related KAB construct. **Results:** Physical activity-related behaviour was significantly related to the school physical activity index score ($p = 0.023$). However, self-efficacy, enjoyment, teacher support and the absence of perceived barriers were not significantly related to the school physical activity index. **Conclusion:** Changes to certain aspects of the school physical activity policy and built environment may affect children's physical activity behaviour.

**CHAPTER 5**

**Introduction:** Findings from the previous two chapters showed that the school built and policy environments influence physical activity in South African children. In this chapter, we aim to assess the influence of the school environment on children's physical activity on a larger sample of children from different countries that represent a range of income settings, in order to get a more global picture. **Methods:** Participants were 5961 children from 225 primary schools taking part in the International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE). Children's in-school MVPA was assessed using accelerometry. The school built and socio-cultural environments were assessed with an audit and questionnaire. Principal component analyses (PCA) were performed to identify school built and socio-cultural environment dimensions. Cluster analyses generated four types of schools with built environment dimensions, and three types of schools with socio-cultural environment dimensions. Multilevel modelling was applied to assess the influence of the school built and socio-cultural environments on children's in-school MVPA. **Results:** PCA identified four dimensions of the school built environment and two dimensions of the school socio-cultural environment. Multilevel modelling results showed that change rooms and green space were significantly associated with in-school MVPA ($p = 0.001$ and $p = 0.000$, respectively). The school built environment type with the highest score on the presence of change rooms, green space and soft surface play areas and play equipment, and a low score on play areas with supportive features contributed to significantly more in-school MVPA compared to the other types of schools ($p < 0.05$). None of the school socio-cultural environment dimensions (after-hour access and policies and practices) were significantly associated with in-school MVPA ($p = 0.186$ and $p = 0.880$, respectively).

**Conclusion:** We found that the school built environment was more strongly associated with children's in-school MVPA than the school socio-cultural environment, and that the school built environment type was a strong determinant of children's MVPA during the school day.

**CHAPTER 6**

**Introduction:** In addition to the school environment, children spend a considerable amount of their time in their home and neighbourhood environment. Therefore, factors of the neighbourhood environment may also influence physical activity behaviour of children. Furthermore, there is some evidence that children's activity levels are influenced to some degree, by their parents' perception of the neighbourhood environment. Therefore, in the final study (Chapter 6), we examined associations between parents' perceptions of the neighbourhood environment (questionnaire) as well as objective measures of the neighbourhood environment (Geographic Information Systems) and children's objectively measured out-of-school physical activity (accelerometry). **Methods:** In total, 258 parents of 9-11 year-old children, recruited from the South African sample of the International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE), completed a questionnaire concerning the family and neighbourhood environment. Objective measures of the environment were also obtained using Geographic Information Systems (GIS). Children wore an Actigraph (GT3X+) accelerometer for 7 days to measure levels of MVPA. Multilevel regression models were used to determine the association between the neighbourhood environment and MVPA out of school hours. **Results:** Parents' perceptions of the neighbourhood physical activity facilities were positively associated with children's MVPA before school ($\beta = 1.50 \pm 0.51$, $p = 0.003$). Objective measures of neighbourhood safety and traffic risk were associated with children's after-school MVPA ($\beta = -2.72 \pm 1.35$, $p = 0.044$ and $\beta = -2.63 \pm 1.26$, $p = 0.038$, respectively). These associations were significant in the low SES group ($\beta = -3.38 \pm 1.65$, $p = 0.040$ and $\beta = -3.76 \pm 1.61$, $p = 0.020$, respectively), but unrelated to MVPA in the high SES group. **Conclusion:** We found that the objective neighbourhood environment was significantly associated with children's outside of school MVPA, while the perceived neighbourhood environment had no effect.

Key findings of this thesis were that a low-touch multicomponent, school-based intervention was not effective in our low-income settings, that factors of the school environment influence children's physical activity (for example, supervision, playground density, green space) and that objective measures of the neighbourhood environment have a greater influence on children's out-of-school physical activity than parents' perceptions of the neighbourhood environment. Future interventions should be more intense, focus on changing the school built environment, include policy changes and incorporate a strong parental component.

# Chapter 1:

# LITERATURE REVIEW

## 1.1 INTRODUCTION

There has been a global decline in both children's activity levels[1-3] as well as fitness levels[4]. While physical inactivity is a risk factor for non-communicable disease[5], being physically active holds numerous health benefits and reduces chronic disease risk[6]. Physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure"[7]. Physical activity during childhood is essential for normal growth and development[8,9] and has been shown to have numerous health benefits. These benefits include improved cardiovascular risk factors[10-12], healthy body image and self-esteem[13] and increased bone density[14].

Despite knowledge of the benefits of physical activity, research has indicated that there has been a global decline in both children's activity levels[1-3] as well as fitness levels[4]. This decline in physical activity levels has not only been seen in wealthy countries, but also in LMICs such as Mozambique where a negative secular trend was found in habitual physical activity of youth (aged eight–15 years) between 1992, 1999 and 2012[15]. Physical activity guidelines recommended that children should be physically active daily or nearly every day as part of their lifestyles[16]. Specific recommendations suggest that children and adolescents should do 60 minutes or more of physical activity daily[17,18]:

- Aerobic activities: Most of the 60 or more minutes per day should be either moderate- or vigorous-intensity physical activity. Vigorous-intensity physical activity should be included at least 3 days per week.
- Muscle-strengthening activities: Include muscle-strengthening physical activity on at least 3 days of the week as part of the 60 or more minutes
- Bone-strengthening activities: Include bone-strengthening physical activity on at least 3 days of the week as part of the 60 or more minutes
- There is a general consensus that the higher the volume of physical activity, the greater the health benefit[19].

**Global physical activity levels of children**

A report on the global level of physical activity suggests that the majority (80%) of 13–15-year-olds are doing less than 60 min of MVPA per day[20]. Children are not faring any better than adolescents. For example, in Canada, only 9% of boys and 4% of girls accumulate 60 minutes of MVPA on at least 6 days a week, according to the Canadian Health Measures Survey from 2007 to 2009[21]. In England, only 2.5% of children participating in the Avon Longitudinal Study of Parents and Children (ALSPAC) met the current internationally recognised objectively measured physical activity

recommendations[22]. In the United States, 42% of children ages 6-11 years and only 8% of adolescents obtained the recommended 60 minutes of objectively measured MVPA per day[23].

It is not only children from high-income countries who do not meet the recommended physical activity guidelines, children from low-to-middle income countries are also not reaching physical activity guidelines. In Nigeria, for example, less than half (47%) of children and youth 5–19 years were reported to participate in MVPA on 3 or more days per week[24,25] and in Ghana reports range between 12%–34% of Ghanaian children and youth who meet recommendations[26].

In 2014, fifteen countries produced an Active Healthy Kids Report Card, which is a report on the status of physical activity in children in each country based on the most recent evidence[27]. The report card is designed to serve as a tool to motivate change and facilitate advocacy[27]. These fifteen Report Cards were consolidated into a global matrix to assess global variation in each of the physical activity indicators[27]. The fifteen countries were Canada, United States, Mexico, Colombia, Scotland, Ireland, England, Finland, Nigeria, Ghana, Kenya, Mozambique, South Africa, Australia and New Zealand. With regards to overall physical activity, none of the fifteen countries scored 'full marks' (interpreted as: *'we are succeeding with a large majority of children and youth (≥80%)'*), while ten countries reported low or failing grades (Interpreted as: *'we are succeeding with less than half or with very few children and youth'*). South Africa shares the fifth position with Colombia, Ghana and Finland for overall physical activity; scoring a 'D' (Interpreted as: *'we are succeeding with less than half but some children and youth ('20–39%)'*).

**Physical activity levels of South African children**

Results from the South African Youth Risk Behaviour Survey 2008 showed that less than half (43%) of adolescents participating in the survey reported sufficient vigorous physical activity to be considered health-enhancing – a decrease in prevalence of 2% from 2002[28]. Furthermore, significantly more boys participated in sufficient physical activity compared to girls (54.1% versus 35.1%). There were no other more recent national data available. However, there were data from regional studies, although these studies made use of different physical activity measurement methods, including self-report and objective measures. There are discrepancies between objective and subjective techniques, which is why differences in the prevalence of physical activity recommendations reported might exists between the studies. These studies are summarised in the table below (Table 1.1). Although the methodologies and outcomes were different across the studies, less than half of the children in each of the studies reached the recommended physical activity guidelines[29].

This means that there was no change in overall physical activity from the previous Healthy Active Kids South Africa Report Card in 2010. Bearing this in mind, there were some improvements in specific physical activity indicators from the 2010 report card ('community and the built environment' and 'government strategies and investments'). However, the overall physical activity score remained unchanged, highlighting the need for effectively influencing more priorities, policies and practices to get children more physically active.

**Table 1.1** Summary of South African studies reporting on the prevalence of children and adolescents who are sufficiently active (7-15 years)

| Reference | Study design | Sample size | Age | Location | Measures of physical activity | Findings |
|---|---|---|---|---|---|---|
| Reddy et al. (2010)[28] | Survey | 10270 children (51.5% girls and 48.5% boys) | Grades 8, 9, 10 and 11 students | All nine provinces across South Africa | Subjective:<br>- Self-administered questionnaires | In 2002, only 45% of adolescents participated in sufficient vigorous physical activity to be considered health-enhancing.<br>In 2008, this decreased to only 43% of those surveyed. Less than 1/3 of youth surveyed participated in moderate activity, and nearly 42% did little or no physical activity weekly. |
| Walter (2011)[30] | Explorative-descriptive study | 112 children (boys n=53; girls n=59) | 8 to 12 years | 3 Disadvantaged schools in Port Elizabeth, South Africa | Objective:<br>- GT1M ActiGraph accelerometers<br>Subjective:<br>- In-depth interviews | 45.5% did not meet recommended 30 min of MVPA during the school day. |
| Toriola, Monyeki (2012)[31] | Longitudinal | 283 children<br>(boys n=111 girls n=172) | 14 years | Tlokwe Local Municipality | Subjective:<br>- Short form of the International Physical Activity Questionnaire | 16% of boys and 39% of girls were insufficiently active. |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | (IPAQ) | |
| Micklesfield et al. (2014)[32] | Cross-sectional | 381 children | 11–12 years (younger group)<br><br>14–15 years (older group) | Agincourt sub-district of Mpumalanga Province | <u>Subjective:</u><br><br>- Questionnaire | Boys were more active than girls<br><br>Younger boys did 4 hrs/wk of MVPA compared to 1 hr/wk for younger girls. |

*MVPA = moderate- to vigorous-intensity physical activity, yr = year, hrs/wk = hour(s) per week. Sufficiently active = 60 min of MVPA per day. Discrepancies between the prevalence of physical activity recommendations reached reported might be attributed to the measurement of physical activity as there are discrepancies between objective and subjective techniques.*

**The role of the school setting in increase children's physical activity**

Schools are considered an important setting for physical activity interventions for children[33], as children spend a significant amount of their time at school[34] and the school setting allows an intervention to reach a large population of children from different ethnic groups and socioeconomic strata[35]. A number of previous school-based interventions targeted at physical education (PE) lessons, the school built environment and/or school physical activity (e.g. sports participation or classroom activity) have been shown to be successful in increasing children's physical activity and/or physical fitness in some settings[36-39]. There is, however, still a need to better understand the exact drivers of physical in/activity in children in order to design effective interventions, especially in LICs and MICs.

The remainder of this literature review will focus on children's physical activity in relation to the socio-ecological model and the individual, school, home and neighbourhood environments (built and social), in order to obtain a better understanding of how these factors influence physical activity in children.

## 1.2 FACTORS INFLUENCING PHYSICAL ACTIVITY IN CHILDREN: THE SOCIO-ECOLOGICAL MODEL

The Ecological Model of Active Living was developed to identify potential environmental and policy influences on physical activity and has been categorised into four specific domains: household activities, occupational activities (school for children), active recreation, and active transport[40]. This model suggests that each domain has multiple levels of influence, including individual level factors, the perceived environment, the built environment, and policies, as can be seen in Figure 1.1. The socio-ecological model suggests that there are dynamic interrelations between people and their environments – people-environment interactions are characterised by cycles of mutual influence, whereby the physical and social features of settings directly influence their occupant's health, and concurrently, the participants in settings modify the healthfulness of their surroundings through their individual and collective actions[41]. This thesis will focus on the four domains: occupational activities, household activities, active recreation and active transport. Within these domains, the school environment, the home environment and the neighbourhood environment and their respective influence on children's MVPA will be discussed.

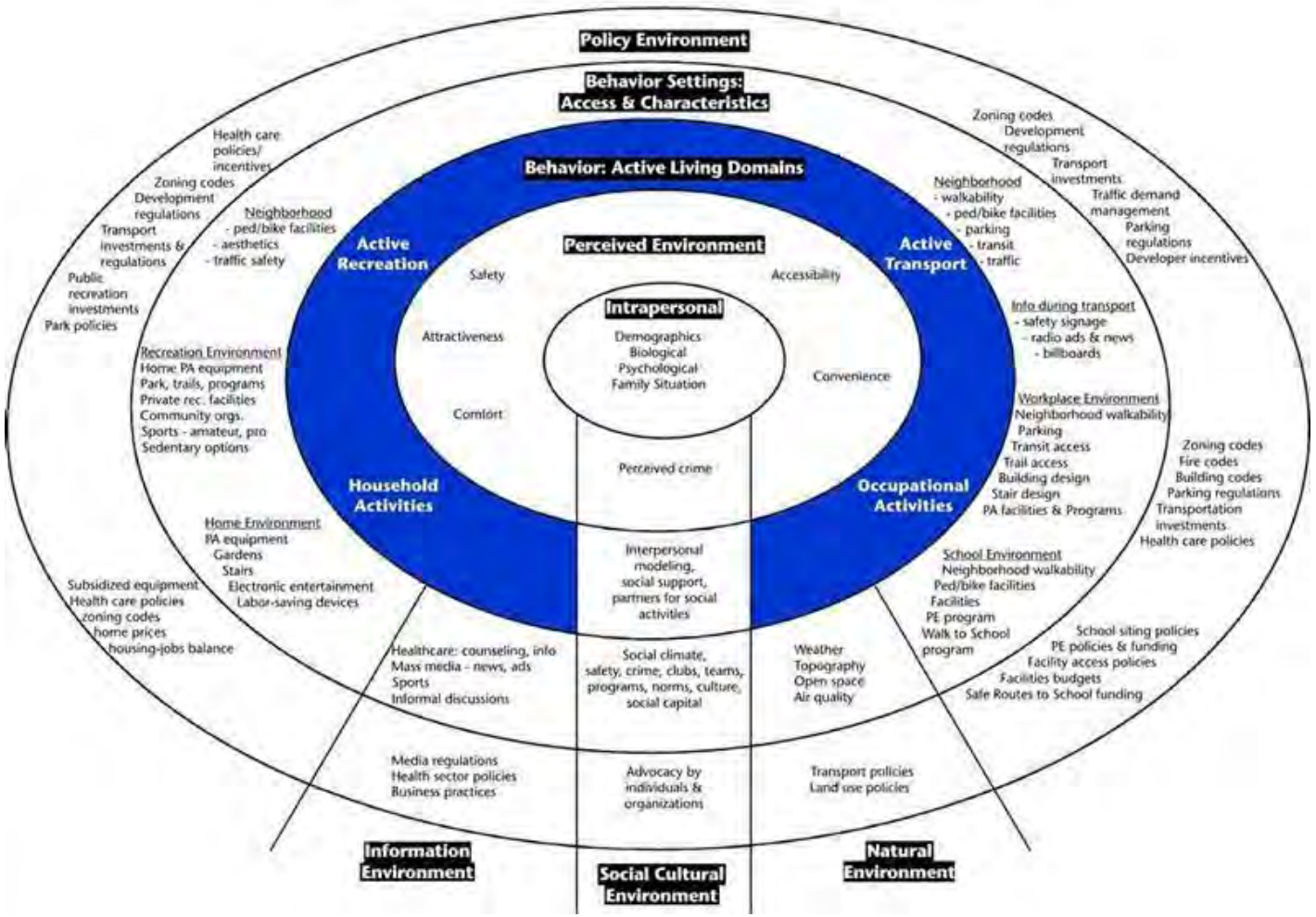


**Figure 1.1** The socio-ecological model of four domains of active living. Source: Sallis et al., 2006.

### 1.2.1 Individual level factors (intra- and interpersonal)

The intrapersonal level includes personal factors (such as perceptions and characteristics) that increase or decrease the likelihood of an individual being physically activity[40,42]. Intrapersonal level barriers for children include: lack of self-confidence and motivation, and lack of knowledge about the health benefits of being physically active[43]. Self-efficacy, which is an individual's belief that they are capable of changing their behaviours, can also be a key determinant of physical activity behaviour[44]. Other individual factors which are positively associated with physical activity among children include having positive attitudes toward physical activity[45] and enjoyment of physical activity[46].

Interpersonal level factors positively associated with physical activity among young people include friends' support for and participation in physical activity[47,48] and, among older children and adolescents, physical activity is positively associated with that of siblings[49].

Previous programmes which were designed to change health behaviours (such as participating in regular physical activity) generally focused on the individual level factors (e.g., knowledge, attitudes, and skills), but more recent research highlights the importance of environmental factors and the need for multifaceted approaches[40].

### 1.2.2 The school setting (physical environments)

The school setting provides children with a number of opportunities to engage in physical activity throughout the day and forms part of the physical environments layer of the socio-ecological model. These include break times (recess and lunchtime), physical education classes and extra-curricular activities (e.g. sports) (although extra-curricular activities fall outside the scope of this thesis)[50]. According to a recent review, children are more active on weekdays than weekends, and on weekdays, children accumulated more MVPA during school hours than outside of school[51]. This highlights the potential importance of opportunities at school for children to engage in MVPA.

#### 1.2.2.1 The school built environment

Specific attributes of the school built environment have been shown to influence children's physical activity behaviour and most schools already have sports facilities available that can be used to make physical activity part of the school day[52]. Examples of attributes previously shown to be positively associated with physical activity in children include: the number of available facilities[53-55], playing fields[56] and fixed equipment[57].

#### 1.2.2.1.1 Break times

The majority of studies assessing the influence of the school built environment on children's physical activity levels were done during break times as these are one of the major opportunities children have to use/interact with the built environment. Results of a study by Dessing et al. (2013) showed that Dutch children were most active during break times with boys engaged in MVPA 40% of the time and girls 23% of the time[58]. Bailey et al. (2011) also found break times to be crucial periods of the school day during which children engage in more MVPA and spend less time sedentary in the UK[59]. Furthermore, Bailey et al. also reported that boys engaged in greater levels of MVPA than girls, similar to Dessing et al.[58,59] and others[60-62].

**Factors influencing break time activity**

A fair amount of research has been done to investigate constructs which influence MVPA during break times. However, there is some disagreement in the literature around if and how (positive or negative) specific factors affect physical activity during break times and the long-term effect has not been assessed[63]. For example, the provision of equipment and playground markings are simple and cost-effective methods which may be effective at increasing physical activity during break times. International studies from Australia and Cyprus as well as systematic reviews found positive associations between these two factors (provision of equipment and playground markings) and physical activity during break times ('recess')[62-69]. A study from the UK found that 8 year olds did more break time physical activity than 10 year olds, and that gender differences were only observed in the 10 year olds[70]. This highlights the fact that some of the discrepancies could be attributed to different age groups between studies.

Discrepancies in the literature also exist with regards to supervision and/or encouragement from teachers. Although most studies find that supervision is associated with increased MVPA[62,63,67,68,71-73], others have found a negative association between physical activity and areas with supervision or teacher encouragement[74,75] and even no effect on MVPA[76], as summarised in Table 1.2. These studies were all done in HICs including Australia, USA and Belgium.

**Playground density and physical activity**

A review by Stanley et al. (2012) found positive associations between size of play spaces and increases in break time physical activity[65]. Cradock et al. (2007) showed that larger school campuses and play areas were positively associated with children's physical activity levels[77]. However, it is not always possible to increase the size of the school campus or change the available play areas to provide more space. A novel idea by D'Haese et al. (2013) to reduce playground density in

preschools was to split up break times and decrease the number of children sharing the playground. This resulted in a decrease in sedentary time and an increase in MVPA during break time as well as during the entire school day[78]. However, some discrepancies are also evident in results of studies investigating playground density. A review mentioned earlier by Broekhuizen et al. (2014) found no evidence of an effect of decreasing playground density and children's physical activity in studies using objective measures of MVPA, while observational studies, in contrast, did find significant associations between decreased playground density and children's physical activity[75], indicating that the measurement tool is an important consideration and highlights the need for more research using objective measures.

**Break time interventions**

The Ready for Recess intervention in the United States included staff training, activity zones and playground equipment[79]. Grade three, four and five students participated in the study. The intervention resulted in significant increases in MVPA, not only during recess, but throughout the school day[79].

In South Africa, a low cost intervention aimed at promoting MVPA through changes to the built environment saw some promising results. The intervention was done at disadvantaged schools and included nine to twelve year old children and aimed to stimulate free play by introducing playground markings for games, fixed equipment (balance beams, monkey bars, pull-up bars, tyre stations) and loose equipment (skipping ropes, Frisbees and different types of balls) at participating schools. The intervention was found to be effective in increasing children's in-school MVPA with a concurrent decrease in sedentary behaviour, in the short term[80]. There is a need for more South African studies like these.

**Table 1.2** Summary of systematic reviews on constructs of physical activity during break times, published between 2000 and 2015

| Reference | Study selection | Sample size | Age | Measures of physical activity | Findings |
|---|---|---|---|---|---|
| Escalante et al. (2014) [70] | Randomised controlled trials (RCTs) or clinical controlled trials (CCTs) that compared provision of playground markings, games equipment and/or physical structures with no intervention | Eight studies were included in the review -3 RCTs and 5 CCTs | Pre-schoolers (two to five years old) and schoolchildren (five to 12 years old) | Objective:<br><br>Vigorous and/or MVPA measured with heart rate monitors, pedometers and/or accelerometers | Playground markings (three studies):<br><br>not associated with any increase in physical activity.<br><br>Games equipment (three studies):<br><br>not associated with any increase in physical activity.<br><br>Playground markings plus games equipment (one study):<br><br>not associated with any increase in physical activity.<br><br>Playground markings plus physical structures (one study):<br><br>successfully increased moderate physical activity (by 5.9%) and vigorous physical activity (by 1.7%) for up to six weeks. |
| Broekhuizen et al. (2014)[75] | Studies published from January 2000 to September 2012 were identified. Studies had to examine the association between a (pre)school playground and physical, cognitive or social | In total, 13 experimental and 17 observational studies have been included | Children from 2 to 18 years | Objective:<br><br>Most studies used accelerometers, with the exception of three studies in which PHYSICAL ACTIVITY was assessed by observations, one study | Experimental studies:<br><br>moderate evidence - effect of the provision of play equipment.<br><br>inconclusive evidence - effect of the use of playground markings, allocating play space and for multi-component interventions. |

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| | outcomes. | | | that used pedometer, and one study that used heart rate telemetry. | no evidence - effect of decreasing playground density, the promotion of physical activity by staff and increasing recess duration on children's health.<br><br><u>Observational studies:</u><br><br>positive associations between play equipment and children's physical activity level.<br><br>In contrast to experimental studies, significant associations were also found between children's physical activity and a decreased playground density and increased recess duration. |
| Parrish et al. (2013)[81] | Examined the effects of recess-based interventions on the physical activity levels of school-aged children and adolescents published between January 2000 and April 2011. | 9 studies included. 8 studies used randomized controlled trials and 1 was a controlled trial | Children aged between 5 and 18 years | <u>Objective measures:</u><br><br>heart rate monitors<br><br>accelerometers<br><br>pedometers<br><br>direct observation<br><br>and a combination of these measures | 5 studies - positive intervention effect on children's physical activity levels.<br><br>4 studies - statistically significant increases in recess physical activity.<br><br>2 studies - significant decreases in recess physical activity. |
| Stanley et al. (2012)[65] | A review was conducted of the peer-reviewed literature, published between 1990 and January 2011 | A total<br><br>of 22 studies (12 school break time studies, 10 after-school studies) | Children aged 8–14 years | Studies needed to assess potential correlates of physical activity accrued during the school break time and after-school | <u>School break time studies:</u><br><br>thirty-nine potential correlates were identified.<br><br>gender and age were consistently associated with school break time physical activity (2 or more studies). Family affluence, access to a gym, access to four or more physical |

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| | | were included in the review. Across the 22 studies, 17 studies were cross-sectional and five studies were interventions. | | time periods. | activity programmes and the condition of a playing field were all associated with school break time physical activity Across the 22 studies, 17 studies were cross-sectional and five studies were interventions (one study).<br><br>access to loose and fixed equipment, playground markings, size of and access to play space and the length of school break time were all positively associated with changes in school break time physical activity (intervention studies). |
| Ridgers et al. (2012)[62] | Studies examining associations between physical activity and other variables, published between January 1990 and April 2011 | 53 papers were included in the review. The majority of studies were cross-sectional (n=42); focused on children (n=47); and reported MVPA as the outcome variable (n=26). | Participants aged 5–18 years | Children's physical activity was measured using objective measures, with accelerometry the most commonly used method (36% of all studies). Adolescents' physical activity was measured using subjective measures (e.g., self-report questionnaires; 71% of adolescent studies). | Positive associations were found of overall facility provision, unfixed equipment, and perceived encouragement with recess physical activity. Results revealed that boys were more active than girls. |
| Jago, Baranowski (2004)[67] | Studies published between 1970 and 2002 | 9 studies were included | Children and adolescents aged 5 to | Studies that evaluated subjective or self-reports of either physical activity | <u>Physical activity during school breaks (5 studies):</u><br><br>three studies found that interventions during school |

| | | | | | |
|---|---|---|---|---|---|
| | | | 18 years | at the intervention location or habitual activity were eligible for inclusion. The studies had to report physical activity before and after the intervention. The included studies assessed self-reported sweating, minutes of moderate to vigorous activity, self-reported physical activity, double-labelled water for energy expenditure, body fat and the Girls activity questionnaire. | breaks (painting school playgrounds, playground supervisors implementing a games curriculum, and taught playground games or introduced equipment) could increase physical activity by 17 to 60%. One study found that an increased number of physical activity sessions during the day significantly increased physical activity among boys, but not girls. One study found that structured break periods significantly increased self-reported physical activity in boys and girls. |

*MVPA = moderate- to vigorous-intensity physical activity, RCT = randomised controlled trials, CCT = clinical controlled trials (CCTs)*

It is important to note that the studies mentioned above have used different methods of measuring physical activity, which range from self-report to objective measures such as motion sensors (accelerometers and pedometers), heart rate monitoring, direct observation, and doubly labelled water [82,83]. The use of different methods of measuring physical activity could be one explanation for the diverse results found in these studies. To illustrate this, the review by Broekhuizen et al. (2014) included studies using objective measures as well as observational studies, and reported these separately. They found no effect of increasing duration of break times on physical activity in studies using objective measures, but in contrast, found an effect of increased break time duration on children's physical activity in observational studies[75], again, highlighting the importance of the measurement used, and the need for more studies using objective measures.

**Physical activity measurement**

1.2.2.1.2 Methods of physical activity measurement

Children's physical activity patterns are unique and to accurately assess these activity patterns, an instrument must be sensitive enough to record sporadic and intermittent activity[84]. The instrument used will depend on the type of research being conducted, and the research question under investigation. Warren et al. (2010) suggest that the population under study (for example children versus adults), the research question, domain of physical activity, resources, capacity for data analysis and participant burden, amongst other things, be considered carefully when selecting an appropriate instrument[83]. The use of accurate measures of energy expenditure such as doubly-labelled water, indirect calorimetry, or heart rate calibration equations may not be cost-effective or practical for large field-based studies[84].

Self-report methods have been found useful for large epidemiological studies or interventions where less precision is needed, but it has been shown in a number of studies that levels of activity differ when activity monitors were compared with self-report data[84]. Due to developmental differences, children are less likely to make accurate self-report assessment than adults[84]. Currently available activity monitors are capable of measuring total physical activity as well as components of physical activity[85]. Accelerometers present less burden to participants and are capable of detecting the intermittent activity patterns characteristic of children[86]. Table 1.3 shows a summary of a review done by Trost (2007), comparing different measurement techniques and their application specifically in studies on children[86]. While Trost concludes that the selection of a measurement tool will always depend largely on the scope and aims of the specific study, it is evident that objective measures such as accelerometry and heart rate monitoring have a great deal of utility, particularly among children[86].

*1.2.2.1.2.1 Self-report*

Self-report is a widely used tool with a low response burden for obtaining quantitative information on physical activity and it is an easy and inexpensive method for obtaining physical activity data on a large sample in a short period of time[83]. However, proxy reporters (e.g. by parents or teachers) may be required for younger children and their validity is limited by the ability of the participant or proxy to recall and report physical activity behaviour [87]. It is also difficult to assess frequency, duration and intensity of physical activity and has the potential for error due to recall and social desirability bias[83]. A detailed evaluation of self-reported physical activity instruments in young people identified three as the most suitable to use, especially for population surveillance to assess prevalence estimates: the physical activity questionnaire (PAQ-C/PAQ-A), the Youth Risk Behaviour Survey and the Teen Health Survey[88].

*1.2.2.1.2.2 Objective measures*

Motion sensors and heart rate monitors provide objective measures of physical activity, eliminating the problem with subject recall[87]. Pedometers are worn on the waist and count steps. They are reasonably priced and work well for walking, but work less well for children who do a variety of activities[89]. Heart rate monitors, on the other hand, can detect a range of activities. Limitations of heart rate monitors is that it requires a sensor attached to the chest, which could become uncomfortable over time. In addition, moderate elevations in heart rate caused by emotions could be identified as activity[89].

Accelerometry is a method for obtaining objective physical activity measurements. Accelerometers are devices that measure acceleration of the body in one to three orthogonal planes (vertical, anteroposterior, and medio-lateral)[90] by measuring the amplitude and frequency of acceleration[91]. Types of accelerometers include ActiCal and Actigraph. Output from accelerometer provide counts, which quantify the amplitude and frequency of detected accelerations and epochs, filtered acceleration signal over a user-defined time sampling interval[92]. The intensity of physical activity is then determined using a set of predetermined cut-points that have been devised to quantify intensity levels[93]. There are at least six sets of youth-specific ActiGraph cut-points which have been independently developed and published in the peer-reviewed scientific literature: Freedson/Trost [94], Puyau [95], Treuth [96], Mattocks [97], Evenson [98], and Pulsford[99]. There is though, large variation in the cut-points used to define children's moderate physical activity, vigorous physical activity and sedentary time, which may results in differences in interpretation of estimated physical activity levels, depending on which measures are used[100]. It has been suggested that Evenson cut-points be used for research on children and adolescents, because only these cut points provide acceptable

classification accuracy for all four levels of physical activity intensity and performed well among children of all ages when it was compared to four other cut points (Freedson/Trost, Puyau, Treuth and Mattocks)[101].

Strengths of using accelerometry devices include their small size and the fact that they are wireless, non-invasive, and minimally intrusive to normal subject movements during daily activities[90]. Some limitations of accelerometry are that it does not always capture upper body movement, because the instrument is mostly positioned at the waist and the devices underestimate the energy cost of walking on an incline or carrying heavy loads because the acceleration patterns remain essentially unchanged under these conditions[83]. Another limitation with accelerometry is that it is difficult to compare physical activity between studies due to differences in data collection and processing procedures, as different studies use different epoch lengths and wear time criteria.[102]

#### *1.2.2.1.2.3 Direct observation*

Direct observation is another method for obtaining objective physical activity data. Observation of entire groups for discrete periods of time (e.g., break times or physical education) may also be useful to understand variability in activity patterns since children would all be exposed to the same stimulus or opportunity to be active[84]. However, direct observation can be quite costly[87]. There are a number of tools available to observe physical activity in children. The tools designed for use at schools are the Children's Physical Activity Form (CPAF), System for Observing Fitness Instruction Time (SOFIT) and The System for Observing Play and Leisure Activity in Youth (SOPLAY). CPAF and SOPFIT are designed for physical education classes, while SOPLAY was designed for leisure setting. SOPLAY is a validated tool for directly observing physical activity and associated environmental characteristics in free play settings (e.g., break times and lunch at school)[103]. SOPLAY provides objective data on the number of participants and their physical activity levels during play and leisure opportunities in targeted areas. Separate scans are made for males and females, and simultaneous entries for contextual characteristics of areas including their accessibility, usability, and whether or not supervision, organized activities, and equipment are provided. The predominant type of activity engaged in by area users is also recorded (e.g., basketball, dance)[103].

#### *1.2.2.1.2.4 Physical fitness*

Physical fitness can be used as a proxy measure for physical activity, because regular participation in physical activity has been shown to be associated with increased exercise capacity and physical fitness [104,105]. One method for measuring physical fitness in children is the Eurofit testing battery[106]. The battery consists out of nine tests for children: the flamingo balance test (to test balance), plate

tapping (speed of limb movement), sit-and-reach (flexibility), standing broad jump (explosive leg power), handgrip test (static arm strength), sit-ups in 30 seconds (trunk strength), bent arm hang (muscular endurance) 10 x 5 meter shuttle run (running speed and agility) and the 20 meter endurance shuttle run (cardiorespiratory endurance)[106]. The Fitnessgram® is another fitness measurement tool which uses criterion-referenced fitness evaluations based on minimum standards for good health. The Fitnessgram® uses similar tests to the Eurofit, including a cardiorespiratory endurance component (PACER test), sit-ups for strength, sit-and-reach for flexibility and the shuttle run[107]. There are more than 15 fitness tests available, but the Fitnessgram® is widely used in the United States, while Eurofit are commonly used in European countries[107].

**Table 1.3** Summary of current methods to measure physical activity in children and adolescents

| Method | Valid | Affordability | Objective | Ease of administration | Easy to complete / compliance | Measure patterns, modes, and dimentions of physical activity | Non-reactive* | Feasible in large studies | Suitable for ages < 10 y | Suitable for ages > 10 y |
|---|---|---|---|---|---|---|---|---|---|---|
| Questionnaire | ✓ | ✓✓✓ | X | ✓✓✓ | ✓✓✓ | ✓✓ | ✓✓✓ | ✓✓✓ | X | ✓✓ |
| Interview | ✓✓ | ✓ | X | ✓✓ | ✓✓ | ✓✓ | ✓✓✓ | ✓✓ | ✓ | ✓✓ |
| Proxy report | ✓ | ✓✓✓ | X | ✓✓✓ | ✓ | ✓✓ | ✓✓✓ | ✓✓✓ | ✓✓✓ | ✓ |
| Diary | ✓ | ✓✓✓ | X | ✓✓ | X | ✓✓✓ | ✓ | ✓ | X | ✓ |
| Heart rate monitoring | ✓✓ | ✓✓ | ✓✓✓ | ✓ | ✓ | ✓✓ | ✓ | ✓ | ✓✓✓ | ✓✓✓ |
| Accelerometer | ✓✓ | ✓ | ✓✓✓ | ✓✓ | ✓✓ | ✓✓ | ✓✓✓ | ✓✓ | ✓✓✓ | ✓✓✓ |
| Pedometer | ✓✓ | ✓✓✓ | ✓✓✓ | ✓✓ | ✓✓ | X | ✓ | ✓✓ | ✓✓✓ | ✓✓✓ |
| Observation | ✓✓✓ | X | ✓✓ | ✓ | ✓✓✓ | ✓✓ | ✓ | ✓ | ✓✓✓ | ✓✓ |
| Doubly labelled water | ✓✓✓ | X | ✓✓✓ | ✓✓ | ✓✓ | X | ✓✓ | X | ✓✓✓ | ✓✓✓ |

x = poor or inappropriate, ✓ = acceptable, ✓✓ = good, ✓✓✓ = excellent, * = does not induce changes in physical activity behaviour as a result of the measurement process. From Trost (2007).

#### 1.2.2.1.3 Physical activity and factors of the school built environment outside of break time

Schools' sports facilities can also serve the community at large. A pilot study found that opening a schoolyard after school hours and on weekends increased the outdoor activity levels of inner-city children by 84 percent compared with a matched control community[108]. Another study found that the renovation of playgrounds significantly increased overall utilization of the playgrounds, although renovation had no impact on girl's utilization on weekends[109]. Colabianchi et al. (2011) found that having a large quantity of play features at renovated playgrounds was positively associated with utilization of the schoolyard by the community outside of school hours, in both adults and girls, while features providing shade for resting were significantly associated with greater utilization in adults and boys[110].

##### *1.2.2.1.3.1 Measurement of the school built environment*

Most of the studies to date which have investigated the association between the school built environment and children's physical activity have used questionnaires completed by staff or students[111]. One study used objective measures to assess the school built environment and the association with children's physical activity, also measured objectively[72]. Results of this study showed that the environmental characteristics explained 42% of the variance in the proportion of girls who were physically active and 59% of the variance for boys[72].

It has been shown that audit tools are a useful method for measuring the built environment[112]. Subsequently, Jones et al. (2010) developed an audit tool for the SPEEDY study[113] to objectively assess the school built environment in terms of opportunities for physical activity[111]. Although a number of audit tools have been developed to assess the physical environment of communities[112], to our knowledge this is the only available tool with acceptable reliability and good validity specifically designed for schools [114]. This school audit tool was used as part of the International Study of Childhood Obesity, Lifestyle and Environment (ISCOLE).

ISCOLE

ISCOLE collected data on over 7000 9 – 11 year old children across 12 countries (+/-500 children per site) from five major regions of the world (Eurasia & Africa, Europe, Latin America, North America, and the Pacific)[114]. The primary aim of ISCOLE was to determine the relationship between lifestyle characteristics, obesity and weight gain in a large multi-national sample of 10 year-old children, and to investigate the influence of behavioural settings and physical, social and policy environments on the observed relationships within each country. This work will form part of this thesis, with specific focus on the school built and social environment as well as the neighbourhood environment.

#### 1.2.2.2 The school policy and socio-cultural environment

In addition to the built environment, the school socio-cultural environment (policies and practices) can also influence physical activity participation, although research tends to focus more on the built environment with less research being done on the policy environment. School policies and practices such as break times, offering intramural programmes and allowing access to school physical activity facilities outside of school hours provide opportunities for physical activity[115].

##### 1.2.2.2.1 Physical education

Physical education is one of the most important physical activity related policies because it provides regular and mandated opportunities for children to engage in physical activity[116]. The aim of PE lessons is to encourage children to engage in appropriate amounts of physical activity and gain the necessary skills and knowledge to be active outside school and throughout life[117]. However, in South Africa and many countries around the world, there has been a decline in PE in schools with perceived deficiencies in curriculum time allocation, subject status, material, human and financial resources, gender and disability issues and the quality of programme delivery[118].

In South Africa, curricular changes led to the replacement of PE as a stand-alone subject to form part of a new subject called Life Orientation (LO). A study on teachers' perspectives on implementing this new subject showed that 36% of high school teachers who presented LO were not qualified PE teachers[119]. Since then, there have been more changes to the curriculum, incorporating PE back into the curriculum as part of the LO subject, although implementation has not been evaluated. The only available data on LO from South Africa is a recent study on rural youth 11–12 and 14–15 years of age which showed that less than two-thirds of boys and girls participated in weekly PE classes, and that the median time spent in PE was about 30–40 minutes per week[32]. Further to that, evidence suggests that children spend less than 40% of a PE lesson in MVPA[120]. More recently, a study by Wood et al. (2015) showed that although children did not engage in sufficient physical activity during PE, the children's physical activity was lower during playtime than during PE[121]. This reaffirms the important role that PE can potentially play in enabling children to reach physical activity guidelines. Despite the challenges surrounding PE lessons, a number of physical activity interventions, either specifically focussing on PE, or incorporating PE as one of the main components of the intervention, have shown positive results by increasing children's physical activity. These include, but are not limited to, the following:

Action Schools! BC is one example of a school-based intervention, in which PE lessons and daily physical activity were amongst the programme's components[122]. Action Schools! BC showed significant increases in physical activity levels in boys[123] as well as an increase in fitness in children in the intervention schools compared to the controls[124]. Following the positive results obtained from the Action Schools! BC intervention, the programme was scaled-up (increased uptake) with the support of the local government[125].

An example of a school-based physical activity intervention which specifically targeted PE is Sports, Play and Active Recreation for Kids (SPARK)[126]. The SPARK intervention was based in America and participants were fourth and fifth grade students across seven schools. The intervention spanned across two years. Seven primary schools were assigned to one of three conditions; specialist-led condition (intervention implemented by PE specialists), teacher-led condition (trained classroom teachers implemented the intervention) or control (usual PE as implemented by untrained classroom teachers)[126]. The SPARK intervention found significant increases in the amount of weekly physical activity during PE classes in specialist-led classes (40 min) and teacher-led (33 min), compared to control classes (18 min, $p < 0.001$). Girls in the specialist-led condition showed improvements two of the five fitness measures (abdominal strength and cardiorespiratory endurance), compared to the control group. There were no effect on physical activity outside of school[126].

The Middle School Physical Activity and Nutrition (M-SPAN) intervention was designed to increase physical activity during PE without increasing the duration or frequency of PE lessons by assisting PE teachers with revising existing programmes to increase children's MVPA[127]. The study was done at middle schools in South Carolina. Results showed a significant increase in children's MVPA during PE lessons (≈ 3 minutes per lesson)[127].

#### 1.2.2.2 Other school physical activity related policies and practices

A recent study by Carlson et al. found that children at schools with four physical activity related practices had 20 more minutes per day of MVPA during school than children at schools with none or only one physical activity related practice[128]. In addition, self-reported participation in extracurricular activities has been associated with the number of organised activities at school[71] and providing indoor physical activities has been shown to allow children to maintain physical activity levels during wet weather[129]. Furthermore, the length of break times have been found to be associated with an increase in MVPA and prevented increases in sedentary time in nine to eleven year old English schoolchildren, especially with break longer than 15 minutes[130]. There are no systematic reviews available on the role of school policies and practices on children's physical activity levels, indicating the need for more research on this topic.

### 1.2.3 School-based physical activity interventions

We have now seen how the school built environment and the school policy and socio-cultural environment can be utilized individually to influence physical activity in children. It has been shown that successful school-based interventions are designed with a whole-school approach incorporating multiple components and multiple layers of the socio-ecological model[131-134]. Recommended components include: a curriculum component, a physical education component, a physical activity component (during the school day and before/after school), a staff wellness component and family involvement[135,136]. A number of school-based interventions have used this approach and have been shown to be effective at changing children's physical activity behaviour. Provided below is a brief description of some examples of multi-component school-based interventions from different countries summarising their main findings relating to physical activity:

#### 1.2.3.1 International multi-component school-based physical activity interventions

Child and Adolescent Trial for Cardiovascular Health (CATCH) is a school-based, comprehensive intervention which was implemented in 96 primary schools from California, Louisiana, Minnesota, and Texas for three years[137]. 5106 third-grade students participated in the study. The intervention groups consisted of 2 subgroups. The first subgroup received an intervention with the following component: (1) a health education curriculum, (2) a PE programme, (3) a campus no-smoking policy and (4) a school food service intervention programme. The second subgroup also received these components with the addition of a family component[137]. The CATCH intervention resulted in a significant increase in the intensity of physical activity in PE classes in the intervention schools compared with the control schools, as well as an increase in daily vigorous activity in the intervention students compared to the controls[137]. Physical activity-related self-efficacy and perceived support for physical activity increased moderately during the first year, but subsequently declined during the last two years of the intervention[138]. The authors proposed that the high participation rates were a result of the limited requirements of time necessary and that a more intensive intervention would have had lower participation rates.

**Pathways**

The Pathways intervention was specifically developed for the participation of indigenous Americans, because they have a higher prevalence of overweight and obesity compared to the broader United States population[139]. Children (755 boys and 692 girls) in the third, fourth and fifth grades participated in the study. Pathways included four major components: (1) a food service intervention which modified foods served in the school cafeteria, (2) a PE component which aimed to increase

physical activity at school, (3) a classroom curriculum that focused on knowledge and practices related to healthy eating and lifestyle habits and (4) a family component aimed at involving parents of children participating in the programme[139]. Forty-one primary schools were included in the study and KAB questionnaires developed to measure knowledge, attitudes and behaviours related to diet and physical activity were completed three times between 1993 and 1996. Results of the Pathways intervention showed that changes in reported physical activity were higher in the intervention group than in the control group in both boys and girls at every follow-up (Figure 1.2). Physical activity tended to decline in both the control and the intervention groups, however, the decline was smaller in the intervention group compared to the control group. Physical activity-related self-efficacy increased among girls in intervention schools, but not among boys, compared to controls[139] (Figure 1.3). A limitation of the Pathways study was that it used self-report physical activity.

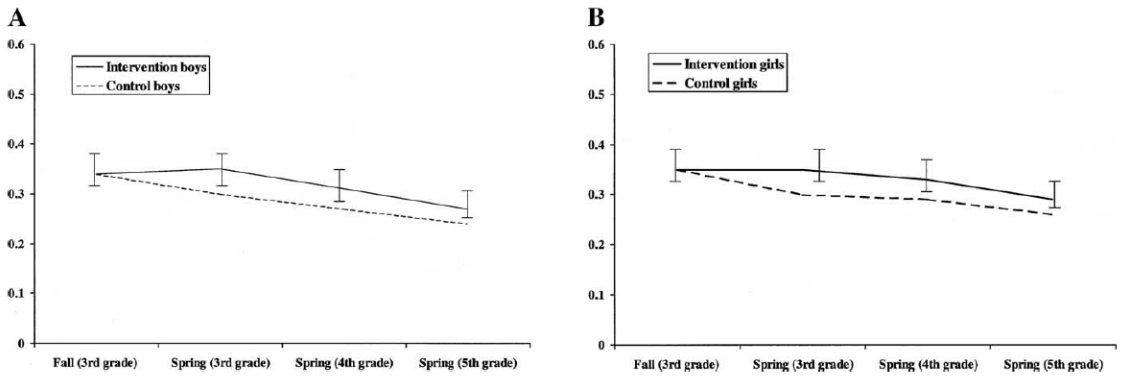


**Figure 1.2** Mean scores on physical activity in boys (A) and girls (B) in the Pathways study. From Stevens et al. 2003.

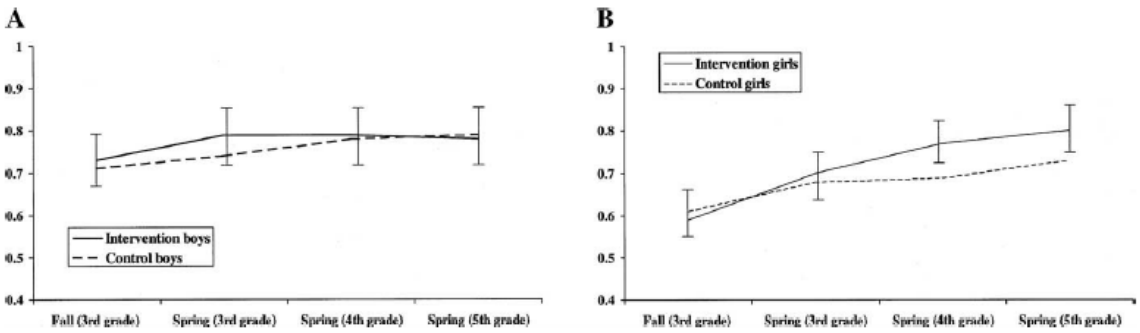


**Figure 1.3** Mean scores of physical activity self-efficacy in boys (A) and girls (B) in the Pathways study. From Stevens et al. 2003.

**Action Schools! BC**

Action Schools! BC is a whole-school model developed to assist Canadian schools in creating and implementing custom action plans to promote healthy living. Action Schools! BC was a 16 month cluster-randomised controlled trial. The Action Schools! BC model provided tools for schools and teachers to create individualised action plans that increased physical activity opportunities across six action zones: (1) school environment, (2) scheduled PE, (3) classroom action, (4) family and community, (5) extra-curricular and (6) school spirit[122,140]. The Action Schools! BC model provided teachers with training and resources. 514 Grade 4 and 5 students participated in the study. The ultimate goal was to provide students with 150 min of MVPA per week. Each teacher also received a classroom action bin which contained equipment and resources to facilitate action activities[122]. They evaluated the impact of the Action Schools! BC intervention in 10 primary schools after the 11 month interventions. They found that intervention schools delivered significantly more minutes of physical activity per week than control schools[140], as well as a 20% increase in fitness (Table 1.4), indicating that this whole-school approach which integrated physical activity throughout the school day is effective at promoting physical activity in schools.

**Table 1.4** Results of the Action Schools! BC intervention (from Reed 2008)

| | ALL ($n$=237) | UP ($n$=81) | INT ($n$=156) | UP adjusted final score | INT adjusted final score | Unadjusted % difference in change |
|---|---|---|---|---|---|---|
| Fitness (laps) | 29 (13.2) | 32 (4.3) | 27 (12.5) | 31 (27,35) | 37 (36,39)* | +20.4% |
| SBP (mmHg) | 104 (9.6) | 104 (10.5) | 105 (9.3) | 108 (106,110) | 102(100,104)* | −5.7% |
| DBP (mmHg) | 62 (8.2) | 60 (8.2) | 63 (7.5) | 65 (62,68.6) | 63 (60,65) | −3.8% |
| BMI (kg/m$^{2}$) | 18.9 (3.6) | 19.1 (3.7) | 18.8 (3.5) | 19.4 (19.1,19.5) | 19.2 (19.2,19.6) | −1.0% |
| Blood (n) | 60 | 23 | 37 | | | |
| TC mmol/L | 4.5 (0.6) | 4.5 (0.6) | 4.3 (0.7) | 4.3 (4.1,4.5) | 4.1 (4.0,4.2) | −4.6% |
| TC:HDL | 3.3 (0.9) | 3.3 (0.8) | 3.2 (0.8) | 3.3 (3.1,3.5) | 3.1 (3.0,3.3) | −6.0% |
| LDL mmol/L | 2.6 (0.6) | 2.5 (0.5) | 2.5 (0.6) | 2.5 (2.4,2.7) | 2.4 (2.3,2.5) | −0.4% |
| ApoB g/L | 0.7 (0.1) | 0.7 (0.1) | 0.7 (0.1) | 0.7 (0.6, 0.7) | 0.6 (0.6, 0.7) | −4.5% |
| CRP mg/L | 1.4 (2.3) | 2.3 (2.8) | 0.9 (0.9) | 0.9 (0.5,1.4) | 0.8 (0.5,1.2) | −10.5% |
| Fg g/L | 2.9 (0.5) | 2.9 (0.5) | 2.9 (0.5) | 2.0 (1.9,2.1) | 1.9 (1.9,2.0) | −2.0% |

Subject numbers for blood variables are provided. Data are mean (SD). Columns 3–5 show final (June 2004) (adjusted for baseline) score by group (final and 95% CI). Percent difference refers to how much higher or lower INT percent change is compared with UP percent change (INT % change – UP % change).
AS! BC = Action Schools, British Columbia (Canada). UP = usual practice, INT = intervention, SBP = systolic blood pressure, DBP = diastolic blood pressure, BMI = body mass index, TC = total cholesterol, TC:HDL = ratio of TC to high-density lipoprotein, LDL = low- density lipoprotein, Apo B = apolipoprotein B, CRP = C-reactive protein, Fg = fibrinogen.

**Kinder-Sportstudie (KISS)**

The Kinder-Sportstudie (KISS) was a school-based physical activity programme implemented in primary schools in Switzerland during 2005/2006 and included 540 children (six to 13 years) across 15 schools[141]. The KISS programme included three components: (1) the addition of two PE lessons per week to the existing three lessons per each week, (2) short daily activity breaks and (3) physical activity homework. Results of the intervention showed increased aerobic fitness, in-school MVPA and all day MVPA in the intervention group compared to the controls[142].

**SPACE study**

The SPACE study consisted of seven intervention and seven control schools located in Denmark. Children (N=1348, 11-13 years) participated in the study[143]. The intervention began in 2010. Intervention components included: (1) upgrading of outdoor areas, (2) development and building of specially designed playgrounds for adolescents, called Play spots, (3) improvement of safety for active transport to and from school, (4) establishing an after school fitness programme, (5) formulation and implementation school physical activity policies, (6) educating teachers as ''kick-starters'' to facilitate and motivate physical activity during break times, (7) implementing school play patrol - older students trained to initiate play and games for minors during school break times, (8) establishing mandatory outdoor break times and/or free access to school gym/sports hall during break times, (9) establishing school traffic patrol - older students help minors cross the streets near the school, (10) educating and training students in safe cycling and (10) implementing school project/theme week once a year focus on learning about and doing physical activity during school lessons[143]. Results showed a significant association with in-school and break time physical activity, despite a lack of overall effect on physical activity.

**School-based intervention in China**

In China, a 12 week school-based physical activity intervention was conducted in 2012[37]. Children (N=921, aged seven to 15 years) participated in the study. The intervention included: (1) improvement of PE, (2) extracurricular physical activities for overweight/obese students, (3) physical activity at home and (4) health education lectures for students and parents. The intervention resulted in a decrease in BMI, skinfold thickness, fasting glucose and an increase in MVPA in the intervention group compared to the control group[37].

**School-based intervention in Italy**

A multicomponent intervention to promote a healthy lifestyle was conducted on 209 fourth grade children from Bologna, Italy during 2008/2009[144]. The intervention was focussed on teachers and parents. Teachers and parents of both intervention and control schools attended meetings with professionals to reinforce the importance of healthy nutrition and regular physical activity[144]. Children in the intervention group received talks by experts trained in physical activity for children during the school day. New recreational physical activities were also implemented and children received pedometers. Parents received additional motivational meetings as well as weekly telephone calls. At the 8-month follow-up, children in the intervention arm increased their outdoor activities and decreased screen time, with no changes observed in the children in the control arm[144].

**Lifestyle Education for Activity Program (LEAP)**

The Lifestyle Education for Activity Program (LEAP) intervention was specifically designed to increase physical activity in girls[145]. The intervention was conducted at 24 high schools in South Carolina, USA. 2744 girls in the eighth and ninth grade (48.7% African American, 46.7% White) participated in the study. Intervention components included changing instructional practices and changes to the school environment. The intervention group reported a higher prevalence of vigorous physical activity, compared to control schools, with 45% of girls in the intervention schools participating in an average of at least one 30-minute block of vigorous physical activity per day compared to 36% of girls in control schools[146].

**Active Teen Leaders Avoiding Screen-time (ATLAS) intervention**

The Active Teen Leaders Avoiding Screen-time (ATLAS) intervention was a cluster randomized controlled trial conducted in schools from low-income communities in New South Wales, Australia[147]. Adolescent boys (N=361, aged 12-14 years) at risk of obesity participated in the study. The intervention included: (1) teacher professional development, (2) provision of fitness equipment to schools, (3) face-to-face physical activity sessions, (4) lunchtime student mentoring sessions, (5) researcher-led seminars, (6) a smartphone application and Web site and (7) parental strategies for reducing screen-time. There were no significant intervention effects on physical activity or BMI, but results showed an increase in muscular fitness as well as a decrease in screen-time[147].

The interventions described above increased physical activity in different ways. Some studies showed increases in break time physical activity, but not overall physical activity, while others increased daily activity. This might be explained by the "activitystat" hypothesis. This hypothesis suggests that increases in physical activity at certain times are accompanied by decreases in physical activity at other times in order to maintain a consistent total activity level[148]. One study found no evidence of physical activity displacement middle-school girls in the short term[149], however, a more recent study on boys and girls showed results which support the hypothesis[150].

1.2.3.2 South African school-based physical activity interventions

In South Africa, a MIC, only a limited number of school-based interventions have been done. Herewith a summary of the school-based interventions from South Africa:

The Physical Activity in the Young Study (PLAY) was conducted on adolescents from a low socio-economic area in the North-West Province of South Africa[151]. The Play study assessed changes in physical activity over three years. The intervention consisted of a 60 minute physical activity

programme delivered twice per week in 2004 and three times per week in 2005. The programme was divided into three components to include aerobic exercise, sports participation and strength and flexibility exercises [151]. After the intervention, the boys in the intervention group had significantly higher physical activity levels compared to baseline. In contrast, all girls and boys from the control group, showed declining levels in physical activity. In a different study, girls identified boys as a barrier to physical activity, by hindering girls with negative reactions (such as taunting and name calling)[152]. Future interventions a physical activity programme should consider presenting separate sessions for boys and girls.

**South African school-based intervention on Grade 6 students**

A school-based intervention on 256 Grade 6 students was done by Naidoo et al (2009). The aims of this intervention were to increase the physical activity of student by implementing a classroom-based physical activity intervention and to promote physical activity during break times and after school hours[153]. It was a curriculum-based intervention which introduced physical activity and healthy nutrition habits into the classroom. The teachers were trained and provided with materials to use throughout the regular classroom lessons. Six month pre- to post intervention measurements showed some promising results with a significant increase in the average number of sports participated in by each student during LO classes and an increase in afterschool activities[153].

**Making the Difference programme (MTDP)**

Another South African intervention that promotes healthy lifestyles by focussing on nutrition and physical activity is the Making the Difference programme (MTDP) – an intervention sponsored by a major retailer which is implemented in four of the nine provinces in South Africa[154]. The MTDP includes educator manuals which are aligned with the curriculum on topics such as the importance of a healthy, balanced diet and exercise, healthy snacking and encouraging children to be active (for example laying out a physical activity track on the school grounds). MTDP also offers 'mom tours' – educational visits to stores for students and parents by a network of trained dieticians and a healthy tuckshop guide[154]. In 2009 participating schools in the Western Cape were evaluated for effectiveness by Jacobs et al. (2013). They assessed students' knowledge of, attitudes towards, and behaviour in relation to nutrition and physical activity using questionnaires. Their results showed no differences between intervention and control groups with regards to physical activity or sedentary behaviour. However, they did find a significant difference between the groups in terms of a reduction in perceived barriers to physical activity and increased physical activity self-efficacy in the active group[154].

Even though there is some data available, there is clearly a need for more South African school-based interventions. In response to a recognised need for physical activity (and nutrition promotion) in schools, a school-based, curriculum-grounded, educator-focused intervention to increase physical activity and healthy eating in South African primary school students in low income settings, called HealthKick, was developed[155].

**HealthKick**

HealthKick, a whole-of-school health promotion programme developed for primary schools in low-income communities, targeting healthy eating and physical activity by creating a school environment which is supportive of a healthy lifestyle[155]. Theoretically, HealthKick encompassed all levels of the socio-ecological model: intra- and interpersonal, organisational (school) and the community[156]. Schools were drawn from the second and third lowest economic quintiles, based on ranking by the Western Cape Education Department. The HealthKick study included eight intervention and eight control schools, from urban and rural areas. HealthKick was designed as a 'low-touch' (or limited contact) intervention[157,158]. The intervention schools received a HealthKick toolkit which contained an educator's manual, a resource guide, a resource box and a physical activity resource bin. The intervention schools were ultimately responsible for implementing the intervention, and were referred to as co-implementation schools. The control schools only received the resource guide. As part of the intervention, schools underwent 'action planning' (based loosely on the Action Schools BC! Model discussed previously), and were required to identify specific strategies they would use to achieve their HealthKick goals within the stipulated action areas. The four areas were: school food and nutrition environment, school physical activity and sport environment, staff health and chronic disease, and diabetes awareness[155]. The fitness, physical activity-related knowledge, attitude and behaviour, and the school environment sections of the HealthKick intervention will form part of this thesis.

### 1.2.4 Active transport

Outside of school, active transport provides another opportunity for habitual physical activity[159]. In addition, a systematic review showed that active commuting to school had other health benefits, including lower BMI and increased fitness[160]. Safety concerns, lack of time and the nature of the natural and built environment has been identified as barriers to active transport to school[161] and distance to school, provision of safe walking paths and the age of the child influences parental decisions regarding their child's use of active transport[162]. A systematic review of the association between the physical environment and active transportation in children showed that active

transport was associated with walkability, density and accessibility. General safety and traffic safety were associated with active transport in North America and Australia, but not in Europe[163]. The review only included studies conducted in North America, Europe and Australia. In South Africa, rural children have to walk long distances to school[164], and a systematic review of active transport in children in Africa showed that rates of active transport to and from school are lower in urban areas and in higher SES schools and evidence suggests that motorised travel are gradually replacing high-energy expenditure activities[165]. However, very few studies in the review used objective measures of travel behaviour.

### 1.2.5 The home and neighbourhood environment

#### 1.2.5.1 Family support for physical activity

Family can be the seedbed for a physically active life[166,167]. Parents are particularly important as role models, encouragers, and facilitators of physical activity in children[168]. Their roles include everything from buying equipment and providing transport to practice, to paying fees and providing encouragement, to participating in physical activity with their children or role modelling a physically active lifestyle[168,169]. In addition, a recent scoping review found the style of parenting to be important and showed that, specifically, an authoritative parenting style had a positive impact on the health behaviours of adolescents[170]. Cleland et al. (2011) found maternal role modelling, paternal reinforcement of and support for physical activity, and maternal and sibling co-participation in physical activity to be positively associated with MVPA[169]. Other factors which have been shown to be important in raising active children include: parent support for physical activity[171] and parental MVPA[172]. A physical activity intervention based in South Africa showed that the number of self-reported moderate physical activity sessions per week increased with the frequency of social support from family and friends[173]. Even more, Cozett et al. (2014) found that even though parental influence (different dimensions of parental support including role-modelling, encouragement, involvement, and facilitation), peer influence, perceived physical activity self-efficacy and perceived physical activity competence were all significantly related to self-reported physical activity of adolescents (eleven to thirteen year olds) residing in the Western Cape, parental influence was the strongest predictor of physical activity overall[174].

#### 1.2.5.2 Perceived neighbourhood support for physical activity

Positive perceptions of the neighbourhood environment are thought to increase the likelihood of being physically active among children by increasing outdoor play[175]. As such, the supportiveness of children's local environment may be a particularly important determinant of their ability to be active[167]. Parent perceptions of the neighbourhood environment have been associated with physical

activity in children, including accessibility (i.e.: proximity to play areas)[176] and safety (i.e.: children whose parents perceived their neighbourhoods as unsafe watched more television and participated in less physical activity)[177,178]. Furthermore, having more restrictive physical activity rules was negatively associated with children's weekday MVPA in neighbourhoods with high perceived 'stranger danger'[172].

However, there have been inconsistent findings on the role of the neighbourhood environment on children's physical activity behaviour. According to a recent review, only 34% of studies found positive associations between the perceived environment and children's physical activity[179]. A possible explanation for the mixed results is that studies have used both parental and children's perceptions. In contrast to the study by Tappe et al. (2013) mentioned earlier which found a positive association between parental perceptions of facilities and children's physical activity, Haerens et al. (2009) found that adolescents' perceived accessibility of neighbourhood facilities was not related to engagement in leisure time sports[71]. Children have less autonomy in their behavioural choices, with parents present as important decision makers for their children's physical activity behaviour[180]. For this reason, parental perceptions of the neighbourhood environment may be of greater importance than the perception of children themselves.

Another aspect of the neighbourhood environment which has been shown to be important in influencing children's physical activity behaviour is social cohesion – features of society, including the absence of latent social conflict and the presence of strong social bonds[181]. Children who live in areas with higher social cohesion tend to have higher levels of physical activity[182].

#### 1.2.5.3 Objective neighbourhood support for physical activity

While the perceived environment has a direct influence on physical activity, the objective environment also has the potential to influence physical activity, although most studies investigating associations between the neighbourhood environment and physical activity rely on perceptions as a measure of the environment[183]. One advantage of using objective measures over perceived measures of the neighbourhood environment is that it avoids the possible systematic biases in the misreporting of environmental perceptions. For example, less educated groups, or groups with low self-efficacy for physical activity, may be more likely to perceive their physical activity environment inaccurately[183].

Studies that have used objective measures of neighbourhood crime have found that higher levels are associated with lower prevalences of walking or physical activity in children[184,185]. Proximity to parks has also been studied using objective measures and results showed positive associations with

physical activity in children[186,187]. A recent meta-analysis on the associations of objectively measured built environment and youth MVPA found only small effects of the objective features in the neighbourhood environment that encourage play and/or walking on youth MVPA. They also found that children do not benefit to the same extent as adolescents from features of the neighbourhood environment that encourage walking and those designed or used for neighbourhood play. Play facilities, parks, playgrounds and features that facilitate walking had negative effects on children's MVPA, but positive effects on adolescents' MVPA. Furthermore, van Loon et al. (2014) demonstrated a positive association between number of parks and MVPA and a negative association between recreation sites and MVPA in a sample of eight to eleven year old children[188].

It is clear that the available evidence on objective measures of the neighbourhood environment and children's MVPA shows mixed results. It is important that future research include objective measures of the neighbourhood in addition to perceptions, as this could provide useful information to inform interventions and possibly even impact urban design. Tools to measure the objective environment include observational surveys and geographic information systems (GIS). Using observational surveys has the added benefit of including data on features which are not commonly incorporated into GIS databases (e.g. sidewalk width) and features which are best assessed through direct observation (e.g. landscape maintenance)[112]. A drawback is that in-person observations are time-consuming. Analysing GIS-based data takes time and requires trained personnel, however, using GIS is the most feasible way to generate objective measures of the built environment involving individuals or neighbourhood dispersed across large areas[189].

### 1.3 SUMMARY AND CONCLUSION

Participation in physical activity by children can take place in a variety of settings, and may be influenced by a many different factors. However, there seems to be a lack of consensus in the current literature on the factors influencing physical activity in these different settings (e.g. school, neighbourhood), as discussed earlier in this literature review. To our knowledge, there is no data available on the role of different environmental factors (within the school and the neighbourhood environment) and the association of these factors with children's physical activity in a South African setting. The only available African data, to our knowledge, is a study by Oyeyemi et al. (2014) on Nigerian adolescents whereby they assessed physical activity and perceptions of the neighbourhood environment with self-report questionnaires[190]. They found that access to destinations was associated with active transport to school and residential density and availability of infrastructure were associated with leisure-time MVPA. None of the seven environmental attributes measured were associated with physical activity in girls[190]. However, there are no data available on the school

environment (built or social), or the neighbourhood environment in children (not adolescents) in Africa. There is need for more research to be done on this topic to allow us to clearly understand which factors are the drivers of physical activity in children within these different domains. This knowledge will enable us to develop informed interventions to target the global problem of physical inactivity in children.

## 1.4 AIMS AND OBJECTIVES OF THIS THESIS

The overall aim of this thesis is to examine the association between environmental constructs (physical spatial and built environment, social environment, and policy environment) and children's physical activity. Therefore, the aims of this thesis will be addressed in five different chapters with the following objectives:

**Chapter 2:**

To assess the effectiveness of a school-based, curriculum-grounded, educator-focused intervention to increase physical activity and healthy eating in South African primary school students in low income settings (HealthKick) on fitness levels and physical activity related knowledge, attitudes and behaviour of primary school children in low-income settings.

**Chapter 3:**

To assess factors that influence physical activity levels during break times in South African primary school children in low-income settings.

**Chapter 4:**

To assess whether or not school physical activity policies, practices and built environment are related to children's physical activity-related knowledge, attitudes and behaviours in South African primary school settings in low-income settings.

**Chapter 5:**

To characterise the relationship between the school built environment and policies and practices related to physical activity in primary schools from 12 different countries and children's objectively measured physical activity during school hours.

**Chapter 6:**

To determine the extent to which parents' perceptions of the neighbourhood environment, as well as objective measures of the neighbourhood environment, are associated with South African primary school children's objectively measured MVPA outside of school hours and on weekend days.

**HealthKick**

HealthKick is a school-based dietary and physical activity health intervention in low-income communities, aimed at reducing diabetes risk factors[6]. School were drawn from the second and third lowest economic quintiles, based on ranking by the Western Cape Education Department. The HealthKick study included eight intervention and eight control schools, from urban and rural areas. HealthKick encompasses all levels of the Social Ecological model: intra- and interpersonal, organisational and community level. Areas where the intervention can (potentially) impact the physical activity policy and environment at school level includes resources for physical activity and sport, opportunities for physical activity and sport, support for teachers to be agents of change, and implementation of the curriculum. As part of the intervention, schools are required to identify specific strategies they would use to achieve their HealthKick goals within the stipulated zones. The four action zones were: School food and nutrition environment, School physical activity and sport environment, Staff Health and Chronic disease and diabetes awareness.

The HealthKick intervention was designed in such a manner that the intervention schools had to take the lead in implementing the intervention, with the research team present in a facilitating role. For this reason, the intervention schools were referred to as co-implementation schools and the control schools as self-implementation schools, with the intervention itself being referred to as a 'low touch' intervention. Co-implementation schools nominated a HealthKick 'champion' to be in charge of health promotion in their school and act as the contact person dealing with the research team. To assist co-implementation schools with implementing selected strategies, they received a HealthKick toolkit (containing a resource guide, a resource box and a physical activity resource bin). The self-implementation schools received some printed materials and resources, but did not receive assistance from the research team in implementing suggested strategies.

**Candidate's role in the HealthKick study**

The candidate was involved with data collection of HealthKick and did the data analyses of the HealthKick chapters. The second HealthKick chapter was conceptualised by the candidate who selected the observational tool, conducted data collection and analysis.

## Chapter 2:

# FITNESS LEVELS AND KNOWLEDGE, ATTITUDES AND BEHAVIOUR OF CHILDREN PARTICIPATING IN HEALTHKICK

In review:

**Uys M, Draper CE, Hendricks S, de Villiers A, Fourie J, Steyn N, Lambert EV.** Fitness levels and knowledge, attitudes and behaviour of children participating in HealthKick. *American Journal of Health Behaviour*. In second round of review.

## 2.1 RATIONALE

Regular physical activity during childhood is associated with improvements in physiological and psychological health[191], including increased physical fitness (both cardiorespiratory fitness and muscular fitness), reduced body fatness, reduced risk of premature cardiovascular disease and type-2 diabetes, enhanced bone health, reduced symptoms of depression and anxiety and enhanced self-esteem[18]. Physical activity guidelines recommend that children engage in at least 60 minutes of moderate-to-vigorous intensity physical activity per day for the maintenance of health and wellbeing[18]. Physical activity patterns in childhood tend to track into adulthood[192]. For this reason, it is important to intervene early.

A strong positive relationship between the amount of physical activity and aerobic fitness has been established in adults[193]. This relationship also exists in children, although it is generally a moderate correlation[194]. Nevertheless, physical inactivity and poor physical fitness are both independent risk factors for chronic disease as well as premature mortality among adults[195,196]. Furthermore, a recent review of the relationship between physical activity, physical fitness and overweight in children[197] identified two longitudinal studies that reported an inverse relationship between body mass index and physical fitness – subjects with a low fitness level at baseline had a higher risk of becoming overweight or obese compared to those who had high initial fitness levels[198,199]. Obesity was shown to be linked to an increased mortality and morbidity. However, obesity is often associated with modifications of physical activity level. Physical activity level itself affects the health status of the individual and thus may be a confounding variable in the obesity-mortality/morbidity relationship[200]. The benefits of adequate physical activity in childhood includes direct improvements in childhood health status; evidence is accumulating that more active children generally display healthier cardiovascular profiles, are leaner and develop higher peak bone masses than their less active counterparts[201]. Health consequences of childhood obesity include hyperlipidaemia, hepatic steatosis and glucose intolerance[202]. In addition to the health benefits physical activity provides, it is also strongly related to academic performance[203]; is essential to developing social and emotional bonds, and helps build confidence and resilience[204].

The socio-ecological model proposes that health behaviour is influenced by multiple levels including individual, social and environmental factors[156], and therefore focuses on the interrelationships between individuals and the social, physical and policy environment[205]. For this reason, it is important to target all these areas when trying to improve physical activity in children in schools. A previous study which used this approach and created a physical activity permissive environment

showed positive results in adolescent in the long-term prevention of age-related decreases in physical activity[206]. This chapter describes the development of and evaluation of the effectiveness of a school-based, curriculum-grounded, educator-focused intervention, incorporating Action Planning, to increase physical fitness levels, and physical activity-related knowledge, attitudes and behaviour in South African primary school students in low income settings.

An individual's diet and physical activity habits are influenced by their knowledge of and attitudes towards these behaviours[207]. Intervention Mapping uses behavioural theory and research evidence to develop specific learning and change objectives for the target population[208]. One of these theories, the health belief model, theorises that in order for behaviour change to take place, an individual must first believe that change is both possible and beneficial, and that the benefits of changing outweigh any perceived costs of making the change[209]. The social cognitive theory also considers the importance of an individual's knowledge and attitudes in influencing behaviour and behaviour change[210]. In addition, it also recognises the impact of external factors such as social and environmental influences on individual behaviour [44]. For example, the likelihood of a child engaging in physical activity during break time will be influenced by social factors (e.g. encouraged by parents, peers and teachers to be active), and environmental factors (e.g. the availability of facilities and equipment at school). Self-efficacy, which is an individual's belief that they are capable of changing their behaviours, can also be a key determinant of physical activity behaviour[44]. Physical activity interventions have shown positive changes in self-efficacy and enjoyment of physical activity, and these determinants have also been proven to mediate physical activity change in children and adolescents[211,212].

Schools have been identified as an important setting for health interventions[35]. Intervention programmes that include the following components appear to have better success rates: incorporation of a nutrition-based curriculum by trained teachers; a physical activity programme/component; a parental/family component and a food service or tuck-shop intervention with the intervention grounded in a relevant behavioural change theory[118].

There is evidence that most South African children do not engage in sufficient amounts of physical activity to be beneficial to their health. The South African National Youth Risk Behaviour Survey of 2008 reported that only 29.3% of students participated in adequate moderate physical activity and 43.2% participated in adequate vigorous physical activity, with boys doing significantly more vigorous physical activity than girls[28].

*HealthKick*

In response to a recognised need for physical activity (and nutrition promotion) in schools, the HealthKick intervention was developed[155]. This was a whole-of-school health promotion programme developed for primary schools in low-income communities, targeting healthy eating and physical activity by creating a school environment which is supportive of a healthy lifestyle[155]. This thesis will focus on the physical activity outcomes of the intervention and the dietary outcomes will not be presented here. The dietary outcomes have been analysed and reported elsewhere. HealthKick incorporated many levels of the social ecological model: intrapersonal (diet, choices and habits, knowledge, self-efficacy and beliefs, fitness levels, awareness), interpersonal (priorities for parents, encouragement from family and peers, role models), organisational (resources for physical activity and sport, opportunities for physical activity and sport, encouragement from teachers, implementation of curriculum) and community level (socioeconomic circumstances, food insecurity, lack of resources for physical activity and sport, social norms around physical activity and nutrition). This current study forms part of the evaluation of the HealthKick intervention. Table 2.1 highlights the components of the HealthKick intervention with a summary of the HealthKick goals, toolkit and action zones (Table 2.1). The HealthKick intervention has been described in detail elsewhere[155,158,213]. HealthKick was designed as a 'low-touch' (or limited contact) intervention. The intervention schools received a HealthKick toolkit which contained an educator's manual, a curriculum manual, a resource box and a physical activity resource bin. The intervention schools were ultimately responsible for implementing the intervention, and were referred to as co-implementation schools. The control schools only received a booklet with "tips" for healthy schools and a guide to resources that could be accessed to assist in creating a healthier school environment. As part of the intervention, schools were required to identify specific strategies they would use to achieve their HealthKick goals within the stipulated action areas. The four action areas were: school food and nutrition environment, school physical activity and sport environment, staff health and chronic disease and diabetes awareness. The toolkit contained lesson plans, guides and physical activity equipment which teachers could use to increase the children's physical activity, and ultimately, improve their fitness from regular engagement in physical activity.

**Table 2.1** Components of the HealthKick intervention

| Goals | HealthKick toolkit | Action zones and areas of action within each zone |
|---|---|---|
| **Eat a variety of foods every day**<br><br>**Eat more different kinds of fruit and vegetables every day** | **Educator's manual:**<br>• essential component of the intervention<br>• action planning process guide<br>• a booklet for each action area containing guidelines for prioritising action as well as strategies to address identified priorities<br>•the South African food-based dietary guidelines<br>• a poster listing the behaviour outcomes desired for the children<br>• a poster for listing planned actions<br>• in 2011 a healthy lifestyle guide for teachers was included | **School food and nutrition environment:**<br>• tuck shop<br>• vendors<br>• fundraising or foods for special events<br>• lunch boxes<br>• food as a reward for good behaviour<br>• nutrition education<br>• national school nutrition programme<br>• vegetable garden |
| **Eat less fat and oily food**<br><br>**Eat less sugar and sweet foods, such as cakes, doughnuts, etc.** | **Curriculum support manual:**<br>• a curriculum support manual integrating the HK goals with the existing Life Orientation curriculum, developed by an expert in a format familiar to educators | **School physical activity and sport environment:**<br>• break time (recess)<br>• physical education classes<br>• improve sport and extramural sport<br>• family and community involvement |
| **Eat a regular healthy breakfast daily**<br><br>**Bring healthy lunchboxes to school as a daily routine** | **Resource box:**<br>• printed materials relating to a healthy lifestyle and its role in the school curriculum | **Staff health:**<br>• staff health awareness and health promotion<br>• food and nutrition behaviours<br>• physical activity behaviours<br>• role modelling |
| **Be more physically active during school time**<br><br>**Be more physically activity after school** | **Physical activity bin:**<br>• basic equipment such as skipping ropes, balls, bean bags, stopwatches and whistles | **Chronic disease and Diabetes awareness:**<br>• lesson plans<br>• posters<br>• student take-home activities<br>• national awareness days and activities<br>• health checks<br>• parent talks |

The aim of this study was to assess the impact of the HealthKick intervention on physical fitness levels, and physical activity-related knowledge, attitudes and behaviours of primary school children.

## 2.2 METHODS

### 2.2.1 Study design

HealthKick ran for three years and had three measurement periods: all baseline assessments were done in 2009, with follow-up assessments in 2010 and 2011.

### 2.2.2 School recruitment

Sixteen primary schools from a representative sample of 100 primary schools (provided by the Western Cape Education Department ) from two education districts in the Western Cape Province of South Africa were randomly assigned as intervention (n=8) and control (n=8) schools for the HealthKick intervention study. Eligibility for participation in the study by schools was determined by the formative findings of the 100 schools and included whether the principal expressed the need for a health promotion programme to be implemented in the school, the availability of at least one grass field or access to community sport facilities, the presence of a shop or vendor selling food items at the school, unhealthy diet and lack of physical activity among students and teachers selected as a top health priority by the school principal, the view of the education district level managers of the potential of schools to effect changes, distance from the research office and school size (schools with less than 50 grade 4 students were excluded). Eligible schools were stratified by site (urban versus rural), poverty level (quintile 1 and 2 versus quintile 3 schools according to poverty indices stipulated by the Western Cape Education Department) and school size (schools with less than 100 grade 4 students versus schools with more than 100 grade 4 students). In both the intervention and control group, four schools were from urban settings, and four from rural settings. The selection of schools has been described in detail elsewhere[157].

Efficacy trials determine whether an intervention produces the expected results under ideal circumstances while effectiveness trials measure the degree of beneficial effect under “real world” settings[214]. As the HealthKick intervention was intended to achieve outcomes in a “real world setting”, the study aimed to assess effectiveness as opposed to an efficacy. The research team was involved in the implementation of the intervention, but only in an advisory capacity, with the staff at the intervention schools leading the intervention to develop capacity within the school for health promotion activities through an action planning process[157].

### 2.2.3 Participants

In 2009, all Grade 4 students were invited to participate in the study (n=1035 children from intervention schools and n=908 children from control schools), of which 503 were recruited from the intervention schools and 499 children were recruited from the control schools. In 2010, all Grade 5 students were invited to participate in the study (n=949 children from intervention schools and n=900 children from control schools). A total of 526 children were recruited from the intervention schools and 546 children from the control schools participated in the study during 2010. In 2011 all Grade 6 students were invited to participate in the study (n=1021 children from intervention schools and n=930 children from control schools), of which 532 children from the intervention schools and 556 children from the control schools participated. Figure 2.1 shows a flow diagram of HealthKick participants. All children who returned a signed consent and assent forms were included in the study. There were no other exclusion criteria.

The parent/guardian of each student gave written consent for children to take part in the fitness testing and the children gave verbal assent before the tests were conducted. They were informed that they were free to withdraw at any time. The study was approved by the Research Ethics Committee of the Faculty of Health Sciences, University of Cape Town (Ref no. 486/2005).

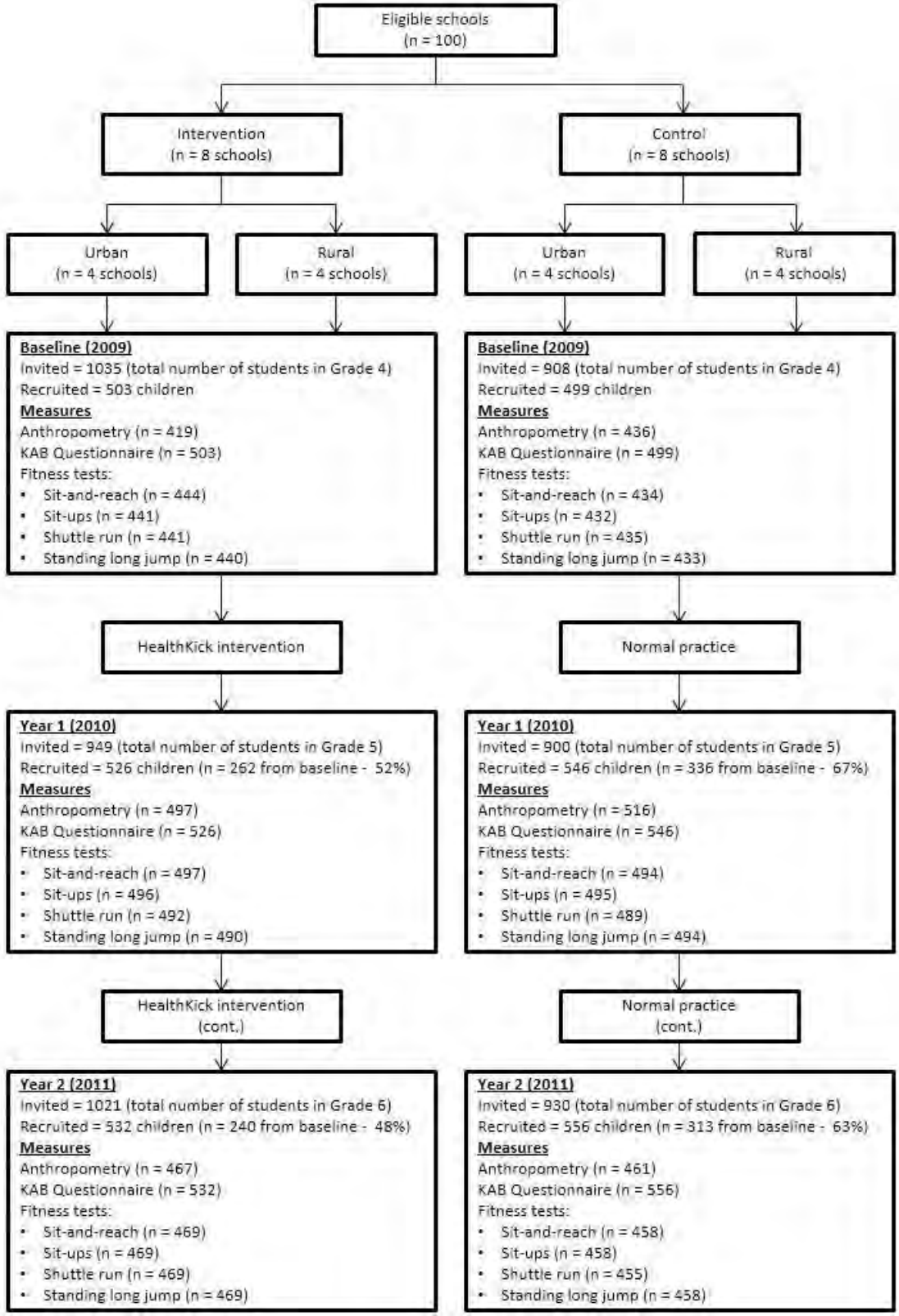


**Figure 2.1** Flow chart of HealthKick participants

### 2.2.4 Instruments and procedures

#### 2.2.4.1 Anthropometric measurements

Standing height was measured to the nearest millimetre using a portable stadiometer. Body mass was measured on a calibrated electronic scale to the nearest 0.1 kg. Body mass index (BMI) was calculated as body mass divided by height squared (kg/m2).

#### 2.2.4.2 Physical fitness

Fitness levels were assessed using a modified version of the Eurofit test battery[106]. These included the sit-and-reach test to measure flexibility, standing long jump to measure explosive leg power, sit-ups to measure trunk strength and 5 metre shuttle run test which measures running speed and agility. Students were allowed two opportunities to perform each test. The better of the two scores were used for analysis.

#### 2.2.4.3 Knowledge, attitude and behaviour

Students completed a questionnaire, developed by the HealthKick research team, which asked about their general attitude towards physical activity, physical activity knowledge, social support, self-efficacy, perceived barriers and enjoyment. The validity and reliability of the questionnaire has been evaluated in a study which took place in the Western Cape during 2009. Four intervention and five control schools (n = 325 Grade 4 children) participated in the study[154]. The questionnaire was administered by a fieldworker in the home language of the children at each school.

The questionnaire consisted of four knowledge questions (e.g. 'Are you doing physical activity when you are walking to school?'), three questions to assess enjoyment (e.g. 'Do you have fun when you are doing physical activity'), two questions relating to behaviour (e.g. 'Do you take part in sport at school or for a club'), five questions to assess the presence of environmental barriers (e.g. 'There is organised sport at my school'), three self-efficacy questions (e.g. 'I do not know how to play sports and games very well, I am sometimes chosen last for games') and social support (including family, peer and teacher support) was assessed with six questions (e.g. 'My parents do not allow me to do sport'). The questions were multiple choice questions with 'yes', 'no' and 'don't know/not sure/sometimes' as options for answers. Points were awarded as follows: two for 'yes', one for 'sometimes' and 0 for 'no', 'not sure' and 'don't know'. The points for each determinant (knowledge, attitude, behaviour, etc.) were added to come up with a final score for each determinant.

### 2.2.5 Data Analysis

Descriptive statistics (mean ± standard deviation) were calculated to describe the anthropometric characteristics of the children at baseline. Independent t-tests were used to assess gender and intervention group differences at baseline. Stata 12 (StataCorp Inc, College Station, Texas) was used to perform all statistical analyses. Mixed-effects multi-level linear regression was used for each outcome, taking clustering and repeated measurement into account. Each model included seven fixed effects: school type (control schools=0 and intervention schools=1), measurement year (baseline/year 1/year 2), interaction between group and year (effect of intervention over time, i.e. the difference between groups in change from baseline), geographical location (urban/rural), gender, BMI and age, with schools entered as the random part of the model. For each outcome measure, the Cohen's d effect sizes between the intervention and control group is reported. Data reported as beta coefficient and 95% confidence interval. Statistical significance was set at $P < 0.05$.

## 2.3 RESULTS

The descriptive anthropometric characteristics and baseline fitness levels of the children, stratified by gender are shown in Table 2.2. Boys from the control group had a lower BMI and scored better in the sit-ups, shuttle run and standing long jump at baseline compared to the intervention boys ($p < 0.05$). There were no significant differences in anthropometric measurements between the intervention and control girls, but the control girls did more sit-ups and jumped further at baseline compared to the intervention girls ($p < 0.05$).

**Table 2.2** Descriptive Baseline Anthropometric and Fitness Level Data, stratified by gender

| | **Boys** | | **Girls** | |
|---|---|---|---|---|
| | **Intervention (n=239)** | **Control (n=232)** | **Intervention (n=260)** | **Control (n=266)** |
| **Age (Years)** | 10.1 ± 1.0 | 10.2 ± 1.2 | 9.7 ± 0.9 | 9.7 ± 1.0 |
| **Sit-and-Reach (cm)** | 17.2 ± 6.6 | 16.8 ± 6.5 | 18.4 ± 6.2 | 18.2 ± 6.0 |
| **Sit-Ups** | 13.8 ± 6.4 | 17.1 ± 6.0* | 9.8 ± 5.5 | 12.0 ± 6.2* |
| **Shuttle Run (sec)** | 52.8 ± 11.8 | 49.5 ± 7.3* | 53.2 ± 6.9 | 52.5 ± 9.3 |
| **Standing Long Jump (cm)** | 162.6 ± 21.7 | 167.2 ± 18.4* | 147.9 ± 19.2 | 154.8 ± 20.0* |
| **Weight (kg)** | 30.8 ± 7.2 | 30.1 ± 5.5 | 29.7 ± 6.8 | 30.9 ± 7.9 |
| **Height (cm)** | 133.6 ± 7.0 | 134.4 ± 7.2 | 132.5 ± 7.8 | 133.7 ± 6.9 |
| **BMI (kg/m2)** | 17.2 ± 3.0 | 16.6 ± 1.9* | 16.8 ± 2.9 | 17.2 ± 3.3 |

Data reported as mean ± standard deviation; * = significant differences between intervention and control groups.

### 2.3.1 Multilevel modelling results

#### 2.3.1.1 Physical fitness

2.3.1.1.1 Sit-and-reach

Results of the multilevel modelling analyses are displayed in Table 2.3. Sit-and-reach scores were not different at baseline (p = 0.516). Participants from the intervention group scored lower in the sit-and-reach test than the control group in 2010, although not significantly (β = -0.15, p = 0.789), but the difference was significant in 2011 (β = -1.29, p = 0.027) (Table 2.3). The intervention group's sit-and-reach scores decreased from 2009 to 2010 (p = 0.000) and remained unchanged from 2010 to 2011 (p = 0.663). Sit-and-reach scores for the control group also decreased from 2009 to 2010 (p = 0.000), but then increased from 2010 to 2011 (p = 0.002) (Figure 2.2).

2.3.1.1.2 Sit-ups

Baseline sit-up scores were significantly different between intervention and control groups (p = 0.000), with the control group scoring higher than the intervention group. Sit-up scores improved in the intervention group from 2009 to 2010, while the control group showed a decrease (β = 2.17, p = 0.000). The intervention group showed a further improvement from 2010 to 2011, with controls also improving in sit-ups scores (β = 1.52, p = 0.001) (Table 2.3, Figure 2.2.)

2.3.1.1.3 Shuttle Run (10 x 5m, speed and agility)

Baseline shuttle run scores were not different between groups (p = 0.280). There was no difference in shuttle run scores between intervention and control groups in 2010 (β = 0.85, p = 0.338). However, there was a difference in 2011 (β = 3.32, p = 0.000) (Table 2.3). Both intervention and control groups showed a significant decline in shuttle run scores (i.e. slower time) in 2010 (p = 0.035 and p = 0.002, respectively), followed by a significant increase in both groups in 2011 (p = 0.021 and p = 0.000, respectively) (Figure 2.2).

2.3.1.1.4 Standing Long Jump

At baseline, the control group scored significantly better in the standing long jump compared to the intervention group (p = 0.000). Standing long jump scores improved in the intervention and control groups from 2009 to 2010, with no significant difference between groups (β = 1.71, p = 0.352). In 2011, significant differences were seen between the two groups (β = -5.75, p = 0.002), with the controls reaching significantly further distances during the standing long jump compared to the

previous year (p = 0.000). On the other hand, the intervention group remained unchanged over the same period (p = 0.156) (Table 2.3, Figure 2.2).

2.3.1.1.5 Summary of fitness results (Table 2.3, Figure 2.2)

Sit-up scores increased significantly over time from baseline to year 1, and from year 1 to year 2 in the intervention group, compared to the control group. Sit-and-reach, shuttle run and standing long jump scores had no significant between group differences from baseline to year 1, and were better in the control group compared to the intervention group from year 1 to year 2. The effect sizes for all the fitness measures were small (< 0.2).

**Table 2.3** Results of Multilevel Model Analysis of Fitness Tests between Intervention and Control Groups at Different Time Points

| | **2009 – 2010** | | | | **2010 - 2011** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Coefficient[a] (β)** | **95% CI[b]** | **Effect size** | ***p*** | **Coefficient[a] (β)** | **95% CI[b]** | **Effect size** | ***p*** |
| **Sit-and-Reach (cm)** | -0.15 | -1.3 - 1.0 | -0.01 | 0.789 | -1.29 | -2.4 – (-0.1) | -0.07 | **0.027** |
| **Sit-Ups** | 2.17 | 1.2 - 3.1 | 0.14 | **0.000** | 1.62 | 0.7 - 2.6 | 0.11 | **0.001** |
| **Shuttle Run (sec)** | 0.85 | -0.9 - 2.6 | 0.03 | 0.338 | 3.32 | 1.6 - 5.1 | 0.12 | **0.000** |
| **Standing Long Jump (cm)** | 1.71 | -1.9 - 5.3 | 0.03 | 0.352 | -5.75 | -9.4 - -2.1 | -0.10 | **0.002** |

[a] Each multilevel linear regression model included group (intervention/control), year, interaction between group and year (effect of intervention over time, i.e. the difference between groups in change from baseline), area (urban or rural), gender, BMI and age as fixed effects, and school as random effects. [b] Confidence interval.

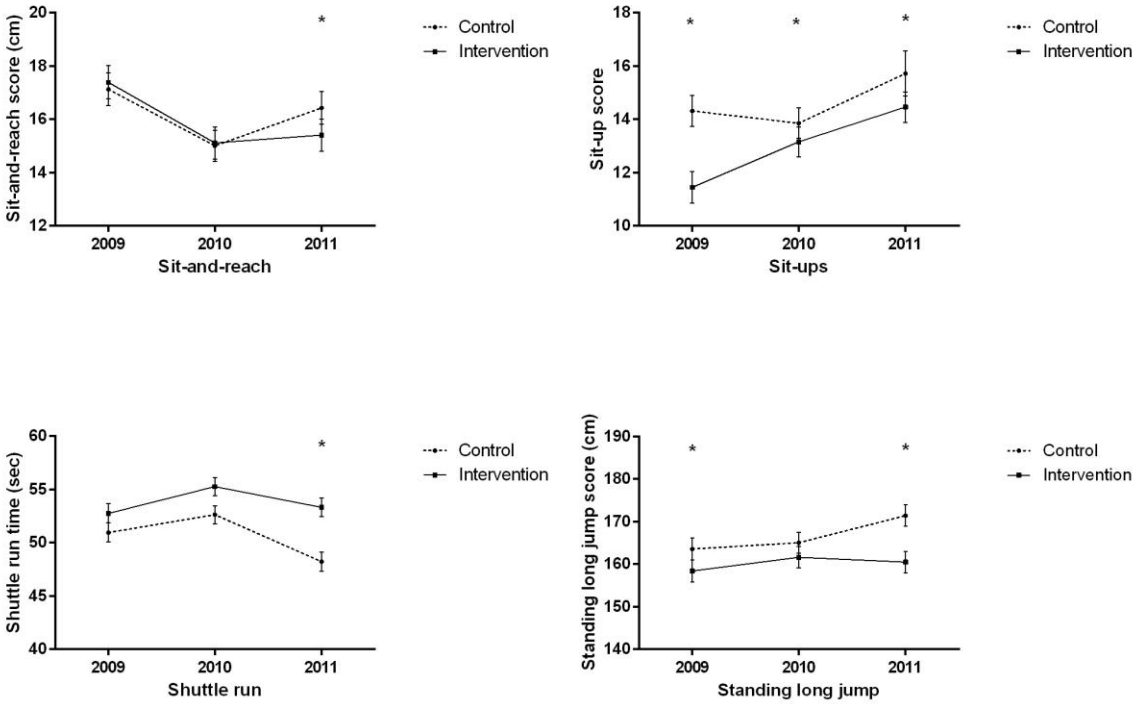


**Figure 2.2** Adjusted Means of Fitness Test Outcome Measures for Intervention and Control Schools at Baseline (2009), Year 1 (2010) and Year 2 (2011). * = Significant difference between groups.

#### 2.3.1.2 Knowledge, attitude and behaviour

Table 2.4 shows the results of the multilevel modelling analyses for the KAB constructs obtained from the questionnaire. Knowledge scores were higher in the intervention group at baseline, compared to the control group ($p = 0.009$). Intervention and control groups showed improvements in physical activity-related knowledge from 2009 to 2010 ($p = 0.001$ and $p = 0.044$, respectively). Although, no difference between intervention and control schools was seen in 2010 ($\beta = -0.07$, $p = 0.610$). In 2011, the control group scored significantly higher than the intervention group ($\beta = -0.48$, $p = 0.001$) (Table 2.4, Figure 2.3). Self-reported physical activity behaviour was not different between groups at baseline ($p = 0.938$). Behaviour increased in both groups, but was still not significantly different in 2010 ($\beta = 0.13$, $p = 0.308$). In 2011, the intervention schools scored significantly lower compared to the control schools ($\beta = -0.44$, $p = 0.001$) (Table 2.4). Physical activity behaviour remained unchanged in the control schools throughout the years ($p = 1.000$ for 2010, and $p = 0.547$ for 2011). Physical activity behaviour did not change from 2009 to 2010 in the intervention group ($p = 0.258$), but decreased significantly from 2010 to 2011 ($p = 0.000$) (Figure 2.3). The perception of environmental barriers were not different between groups at baseline ($p = 0.978$). The number of

perceived environmental barriers to physical activity was not different between the groups in either 2010 (β = 0.08, p = 0.487) or 2011 (β = -0.02, p = 0.833).

The intervention and control groups perceived their environment to have fewer barriers to physical activity from 2010 to 2011 (p = 0.000 for both groups) (Table 2.4, Figure 2.3). Social support scores were not different between groups at baseline (p = 0.441). There were no difference between intervention and control groups with regards to social support for physical activity (β = 0.07, p = 0.734 for 2010 and β = -0.17, p = 0.397 for 2011) (Table 2.4, Figure 2.3). Baseline scores for enjoyment were not different between groups (p = 0.346). The enjoyment score was not significantly different between the two groups in 2010 (β = 0.02, p = 0.812). In 2011 the control group had a significantly greater increase in enjoyment compared to the intervention group (β = -0.27, p = 0.008) (Table 2.4, Figure 2.3). Baseline self-efficacy scores were similar between groups (p = 0.237). There were no significant differences between intervention and control groups in 2010 (β = -0.16, p 0.868). In 2011 the intervention group scored significantly lower in self-efficacy compared to the control group (β = -0.38, p = 0.000) (Table 2.4, Figure 2.3).

2.3.1.2.1 Summary of KAB results (Table 2.4, Figure 2.3)

There were no differences between the intervention and control group from baseline to year 1 for any of the KAB constructs. Changes in knowledge, behaviour, enjoyment and self-efficacy scores were significantly higher in the control group compared to the intervention group from year 1 to year 2. The effect sizes for all the KAB constructs were small (< 0.2).

**Table 2.4** Results of Multilevel Model Analysis of Ecological Factors between Intervention and Control Groups at Different Time Points

| | 2009 – 2010 | | | | 2010 - 2011 | | | |
|---|---|---|---|---|---|---|---|---|
| | **Coefficient (β)** | **95% CI** | **Effect size** | ***p*** | **Coefficient[a] (β)** | **95% CI[b]** | **Effect size** | ***p*** |
| **Knowledge** | -0.07 | -0.4 - 0.2 | -0.01 | 0.610 | -0.48 | -0.8 – (-0.2) | -0.09 | **0.001** |
| **Behaviour** | 0.13 | -0.1 - 0.4 | 0.03 | 0.308 | -0.44 | -0.7 – (-0.2) | -0.10 | **0.001** |
| **Enjoyment** | 0.02 | -0.2 - 0.2 | 0.01 | 0.812 | -0.27 | -0.5 – (-0.1) | -0.08 | **0.008** |
| **Self-efficacy** | -0.16 | -0.2 - 0.2 | -0.01 | 0.868 | -0.38 | -0.6 – (-0.2) | -0.12 | **0.000** |
| **Environmental barriers** | 0.08 | -0.1 - 0.3 | 0.02 | 0.487 | -0.02 | -0.2 - 0.12 | -0.01 | 0.833 |
| **Social support** | 0.07 | -0.3 - 0.5 | 0.01 | 0.734 | -0.17 | -0.6 - 0.2 | -0.02 | 0.397 |

[a] Each multilevel linear regression model included group (intervention/control), year, interaction between group and year (effect of intervention over time, i.e. the difference between groups in change from baseline), area (urban or rural), gender, BMI and age as fixed effects, and school as random effects. [b] Confidence interval.

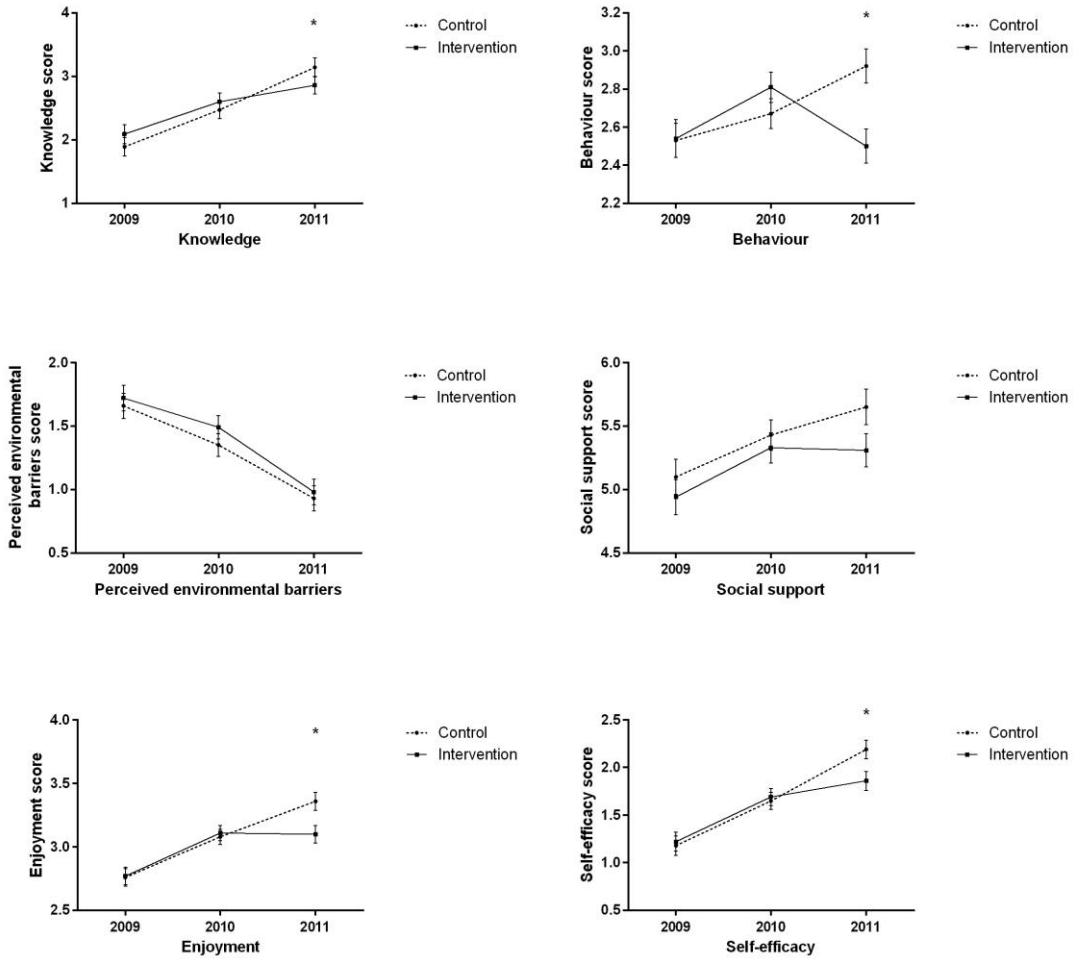


**Figure 2.3** Adjusted Means of Determinants of Physical Activity Behaviour Outcome Measures for Intervention and Control Schools at Baseline (2009), Year 1 (2010) and Year 2 (2011). * = Significant difference between groups.

## 2.4 DISCUSSION

The overall aim of the HealthKick intervention was to promote healthy eating and increase physical activity participation in children. The focus of this intervention was to theoretically create a school environment which was supportive of a healthy lifestyle to reduce risk factors of chronic diseases, particularly diabetes.

The first aim of this specific study was to assess the extent to which fitness levels had improved as a result of changes made to the school physical activity and sport environment as part of the intervention. A systematic review of school-based interventions focussing on physical activity delivery showed that the majority of studies was effective at increasing fitness[215]. In our study,

however, there were only improvements in the sit-up scores over the three years of the HealthKick intervention. This is similar to another school-based physical activity intervention in South Africa that increased short-term physical activity participation, and significantly improved trunk strength (sit-ups), but not other fitness components[153]. A school-based physical activity promotion programme in Belgium also found no specific improvement in physical fitness, despite showing a lesser decline in moderate-to-vigorous physical activity levels in the intervention schools compared to the control schools[216].

The second aim of this study was to assess whether the HealthKick intervention would be able to improve the physical activity-related knowledge, attitude and behaviours of the students participating in the intervention. The results showed an increase in children's physical activity-related knowledge and self-efficacy. Children perceived their environment to have fewer barriers for physical activity, although, similar to the fitness findings, these improvements were seen in both groups and as such cannot be attributed to the intervention. Similar findings were seen in the Child and Adolescent Trial for Cardiovascular Health (CATCH) programme[217] as well as a recent study by Puma et al. (2013) which also did not find improvements in physical activity-related determinants of behaviour[218]. Similar to our findings, the study by Verstraete et al. (2007) also failed to show improvements in physical activity-related determinants of behaviour[219].

A possible reason for the lack of effect could be the manner in which the physical activity component of the intervention was structured. For example, a review by Kriemler et al. (2011) found that all school-based interventions promoting physical activity which showed improvements in fitness, focused on physical education (PE) classes by increasing the number of PE lessons per week[220]. Another method which has been shown to be successful in improving fitness is the use of PE specialists to implement the programme[132]. Furthermore, all the studies in the review were effective, whereas only half of the studies using other methods of measuring fitness (e.g. Eurofit) showed increased fitness levels. This indicates that the method of measuring fitness may also be an important consideration[132]. Successful school-based interventions should include a curricular component, physical activity, healthy food-service and family involvement[135]. This needs to be of sufficient duration and provide an adequate and effective dose of physical activity[215]. The HealthKick intervention incorporated all of these suggested components, and was sufficient in duration considering that other interventions running from 24 to 36 weeks in duration reported increases in fitness levels[215]. Therefore, it is likely that the low intensity of the intervention was the reason for the lack of effect. However, HealthKick was specifically developed to be a 'low-touch' intervention, but it seems as though a 'low-touch' approach is not effective in these settings and that a more intensive intervention is needed. This is supported by findings from a process evaluation which was

held every year of the intervention, as well as focus groups at the end of the intervention. Preliminary results suggest that only 25.9% of actions planned under the school physical activity and sport environment action zone were actually carried out (results reported elsewhere, De Villiers, in press). Preliminary results of the focus group discussions revealed that teachers felt a more structured and higher intensity approach would have been better (De Villiers, in press). These results are confirmed by Resnicow et al. (1992) and Puma et al. (2013) who observed that the effectiveness of this type of intervention is related to the intensiveness of the programme[218,221]. The physical activity-related goals of HealthKick were to 1) be more physically active during school time and 2) be more physically active after school. HealthKick did not incorporate specific prescribed exercise programmes aimed at targeting specific fitness goals, make use of PE specialists or increase the number of PE lessons as was the case in some other interventions[142,217,222].

There is evidence that teacher support[223], ability and enthusiasm[224] is also related to the effectiveness of intervention programmes. An evaluation of the HealthKick action-planning process revealed that barriers which hindered the process included workload and lack of time[213]. Despite these barriers, far more benefits were identified during the focus group discussions, including curriculum-related benefits, improvements in the school environment and perceived benefits on staff health (De Villiers, in press) and teachers found the idea of the programme interesting, and could immediately recognise possible benefits for the entire school community[213]. Furthermore, the study was designed with diffusion of innovation in mind so that the HealthKick toolkit could be adopted by other schools in a similar setting, which includes frequent curriculum changes[225], administrative burdens and limited resources[226].

Although this study did not find significant improvements in either fitness levels or determinants of physical activity behaviour, this lack of effect in itself is still an important finding from which we can learn. Components of the HealthKick intervention were based on the framework from Action Schools! BC[122] and the School Health Index of the National Centre for Chronic Disease prevention[227]. While Action Schools! BC showed positive results, we did not see the same improvements in our setting. Undoubtedly, certain programmes may not translate successfully into different settings, despite adjusting certain aspects to be setting-specific. Although we have gained valuable knowledge from other intervention programmes being done in other parts of the world, it may be necessary to spend more time adapting best practice programmes to specific settings.

**Strengths and Limitations**

A limitation of the study is that although the KAB questionnaire was validated, we could not control for self-report bias. Another limitation of this study is that the process evaluation focussed mainly on the teachers and did not measure the process very well with respect to participants. This was due to the fact that the intervention was mainly designed around the teachers and creating an environment permissive to physical activity and did not intervene on the participants directly. Future interventions should be designed to intervene and be evaluated on individual level. Measuring the participation process is particularly important as it will lead to the development of more effective interventions[228].

## 2.5 CONCLUSION

Based on these results alone, we are unable to determine if a more "hands on" approach (more teacher training, greater co-implementation, ongoing monitoring, and more administrative support and "buy in") would have been more successful, or whether there are other aspects of the schools setting that may have been amenable to intervention to create an activity-permissive environment. Future school-based interventions in South Africa should be designed to be more intense.

## Chapter 3:

# FACTORS INFLUENCING BREAK TIME PHYSICAL ACTIVITY OF SOUTH AFRICAN PRIMARY SCHOOL STUDENTS FROM LOW-INCOME COMMUNITIES

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## 3.1 RATIONALE

The main finding of the previous chapter was that a low-touch school-based intervention was not successful in changing children's fitness levels or physical activity-related knowledge, attitudes and behaviour in low-income South African settings. This chapter focusses on another outcome in the school setting, namely break-time physical activity. For this reason, this next chapter will assess the influence of factors on children's observed physical activity during break-times. Evidence regarding the influence of factors of the school built and policy environment on children's physical activity is required to design effective interventions.

Non-communicable diseases (NCDs) have increased globally[229] to such an extent that it is the cause of 60% of deaths worldwide[230]. Eighty percent of these deaths occur in low- and middle income countries (LMICs)[231]. One of the major risk factors for NCDs is physical inactivity[232]. At the same time, children have become less active[1] and more overweight[233]. Undeniably, physical activity plays an important role in the physical, social and emotional development of the child[204]. Evidence also suggests that childhood physical activity behaviour[234], as well as obesity[235,236], tracks into adulthood with physical activity levels decreasing as children grow[237].

The school environment consists of three parts: the school built environment which refers to the school buildings and school grounds, the school policy environment which includes the policies and practices at the school and the school social environment which refers to the school culture. Results from a recent review showed that school grounds are important locations for total physical activity in children[238].The school environment provides a setting which is suitable for promoting physical activity participation for two reasons. Firstly, children spend a significant amount of their time at school[34]. Secondly, the school environment provides an opportunity for children to be physically active who may otherwise not engage in physical activity in their home environment due to the presence of physical activity barriers. In low-income settings these barriers include, but are not limited to, family obligations, the lack of safe areas to play, the lack of facilities and cost of participating in different activities[239].

Typically, there are two main opportunities for children to be physically active during the school day: during physical education (PE) and at break time (recess)[240]. Most physical activity studies in school settings look at physical activity during PE[33]. In recent years however, time allocated to PE have been reduced in South Africa[241] and other countries[242]. Currently in South Africa, one hour per week is allocated to PE for intermediate phase students (Grade 4 to 6) as part of the Life Orientation

curriculum. This means that children cannot reach their daily target requirement of 60 minutes of physical activity per day[18] through PE alone.

Outside of PE, break times provide children with daily physical activity opportunities at school[243]. Since the recommended 60 minutes of physical activity per day can be accumulated throughout the day, break time is an ideal opportunity to encourage children to contribute to their daily physical activity target requirement[240]. With that said, physical activity during break periods are discretionary; therefore it is important to understand the factors influencing children's physical activity behaviour during these periods.

Ridgers et al. (2011) suggests that factors related to the school built environment and policies may contribute to, or discourage physical activity participation in children. For example, renovation of playgrounds[244] and playground markings[68], as well as teacher supervision and the availability of loose equipment (such as balls and skipping ropes)[68] have all been shown to affect children's participation in physical activity. Still, there are little data on the influences of the school built and policy environment on break time physical activity in children from LMIC settings, where obesity and related health risks are greatest and resources are least available[245].

The objectives of the present study were to a) objectively measure voluntary physical activity of students during break times and b) investigate whether these physical activity levels differs between schools taking part in the HealthKick intervention, and c) assess the impact of contextual factors on these physical activity levels. We hypothesised that break time physical activity in the intervention schools may have increased, in part, as a result of the availability of loose equipment (balls, skipping ropes, cones, etc.) provided in the physical activity resource bins (for example to hand out the loose equipment during break times for the students to use), implementation of the recommended physical activity actions suggested in the educators manual (for example to set-up a playground circuit with the loose equipment provided) or ideas from the resource guide.

## 3.2 METHODS

### 3.2.1 Study design

This was a quasi-experimental post-test only study with the observations done only during the intervention, without pre- and post-test measurements. There was no significant difference between any of the physical activity levels between the designated groups (intervention and control schools) at this stage of the intervention and as such data were combined from here on forward. Schools were observed during a two-week period, with one school observed per day. This ensured that all observations were done in similar weather conditions.

### 3.2.2 Participants

Eight schools (four intervention and four control) from the urban areas participating in the HealthKick intervention were used for this study (described in previous chapter). This study conducted during the second year of the HealthKick intervention (Figure 3.1). The study was approved by the Research Ethics Committee of the Health Sciences Faculty of the University of Cape Town (HREC REF: 486-2005).

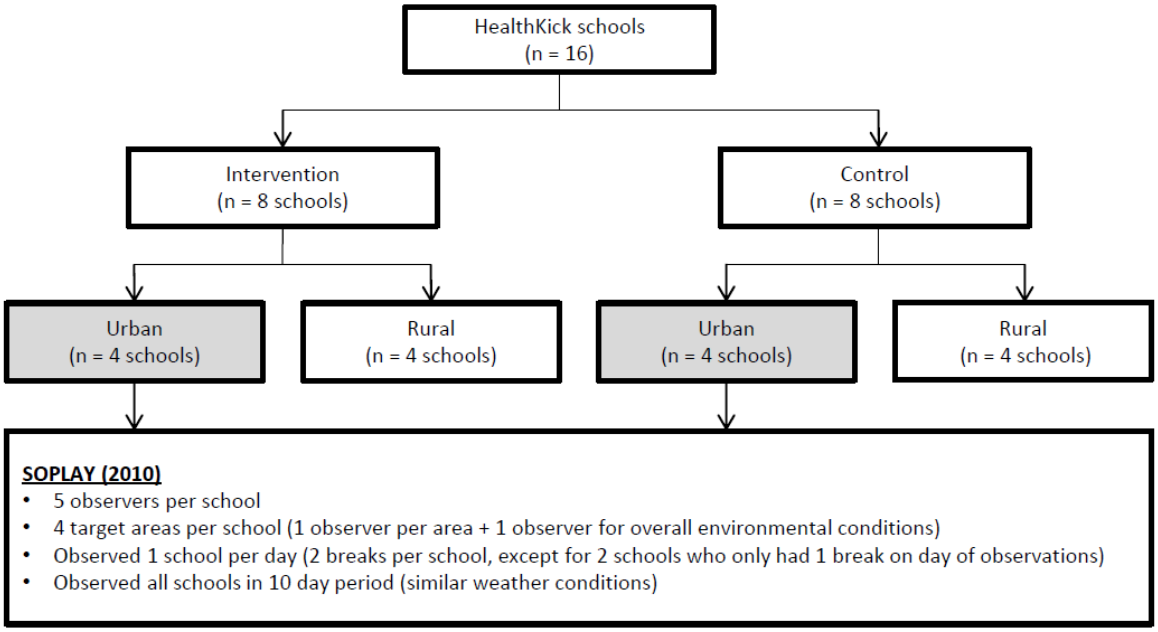


**Figure 3.1** Flow chart of the HealthKick schools in this study (only urban schools)

### 3.2.3 RESEARCH TOOLS

#### 3.2.3.1 Observational Tool: System for Observing Play and Leisure Activities in Youth (SOPLAY)

The System for Observing Play and Leisure Activities in Youth (SOPLAY) was used to observe physical activity levels during break times. SOPLAY is a technique developed to take systematic and periodic scans of individuals and external factors in pre-selected target areas[103]. Each scan records the activity of each individual within a target area as being: sedentary (lying down, sitting or standing), walking, or very active.

#### 3.2.3.2 Amendments to standard SOPLAY protocol

According to the SOPLAY protocol[103], observations should be performed by scanning each target area from left to right, with girls being scanned first, and then the boys. In our settings, it was not possible to scan girls and boys separately, as school uniforms look similar and many girls have short hair, which meant that they could easily be mistaken for a boy. To avoid misclassifying genders, we did a single scan from left to right, which included both girls and boys.

We introduced an additional category called 'eating'. In contrast to American schools (where the SOPLAY technique was developed) in which students have a separate lunch period (for eating) and a break for playing (recess), break time in South African schools provides the opportunity for eating and playing. As such, it was hypothesised that eating will interfere with the children's physical activity and we wanted to assess what proportion of children spend their time eating (time which could otherwise be used for playing).

Another amendment made to the SOPLAY protocol was to use a dictaphone to record the different activity categories during the observations instead of a three-buttoned counter (due to lack of availability). Time to perform the scans was brief, therefore short key words to code for the different categories: 'sit' or 'stand' for sedentary, 'walk' for walking, 'play' for vigorous activity and 'eat' for eating while engaged in sedentary behaviour or walking were created. Upon completion of data collection, the recordings were transcribed onto paper by the researcher. Recording for the transcription were played-back at a slow speed while school, observer, break and activity was entered into a spread sheet. Lastly, the size of each target area at every school was measured using a measuring wheel. This was to determine the student density (the number of students per area in meters squared) of each target area. Target areas were determined by obtaining an aerial view map of each school's playground from Google Maps [246]. Thereafter, a construct of the school's playground was developed (Figure 3.2). Using this construct, target areas were mapped out during break depending on the number of students occupying an area. Areas that were off-limits to students during break times were not selected as target areas. Care was taken to ensure that the four main target areas included grounds with and without markings, as well as different surfaces such as grass, sand and tar. Each target area was further subdivided into two areas (A and B), to allow the relevant fieldworker to do focused observations over a smaller area.

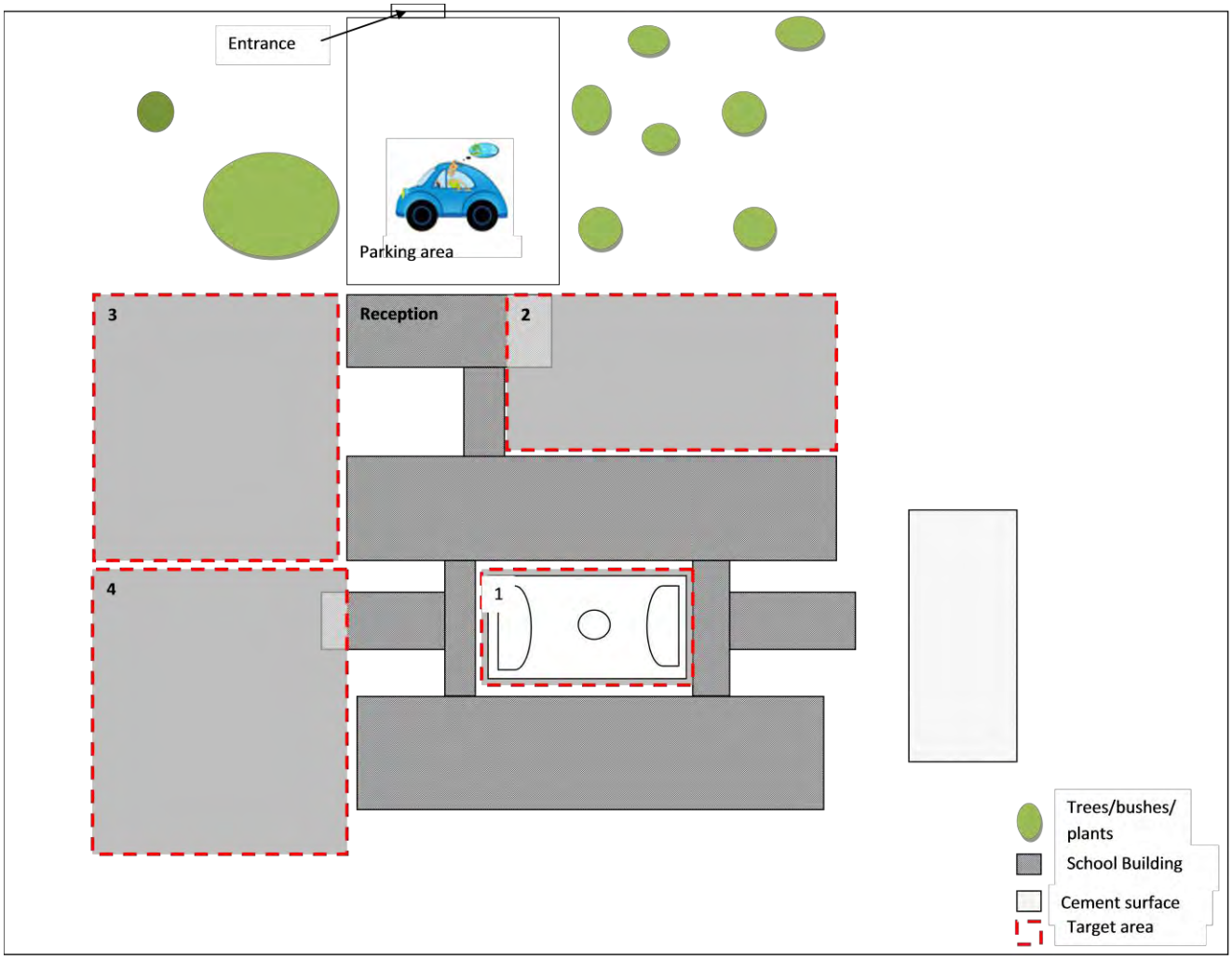


**Figure 3.2** Development of map of school grounds.

### 3.2.3.3 Observations

Five fieldworkers were trained to do the observations. Training consisted of three sessions, presented by myself, along with my co-supervisor. My co-supervisor and I familiarised ourselves with the protocol by watching the SOPLAY training DVDs which are available to order at no cost from the Active Living Research website (http://activelivingresearch.org/soplay-system-observing-play-and-leisure-activity-youth). The first session consisted of watching the training DVD and doing the exercises on the DVD. The second training session was a practical session where we did a pilot run at a local school. Here we took video scans as well. The last training session consisted of watching the videos recorded at the school the previous day, until all technicians agreed on the scoring. The same five fieldworkers did all observations with one fieldworker per target area (four target areas per school), and an additional fieldworker to note environmental conditions.

Observations began three minutes after the school bell rang for break time to allow students enough time to disperse out of their classrooms and into the play areas. A scan was then performed every three minutes; alternating between A and B within a target area until the end of break (Figure 3.3). The fieldworker had to ensure that both areas A and B were scanned an equal number of times during each break. Observations were done during both the first and second break at all schools, except for two schools that did not have a second break on that particular observation day.

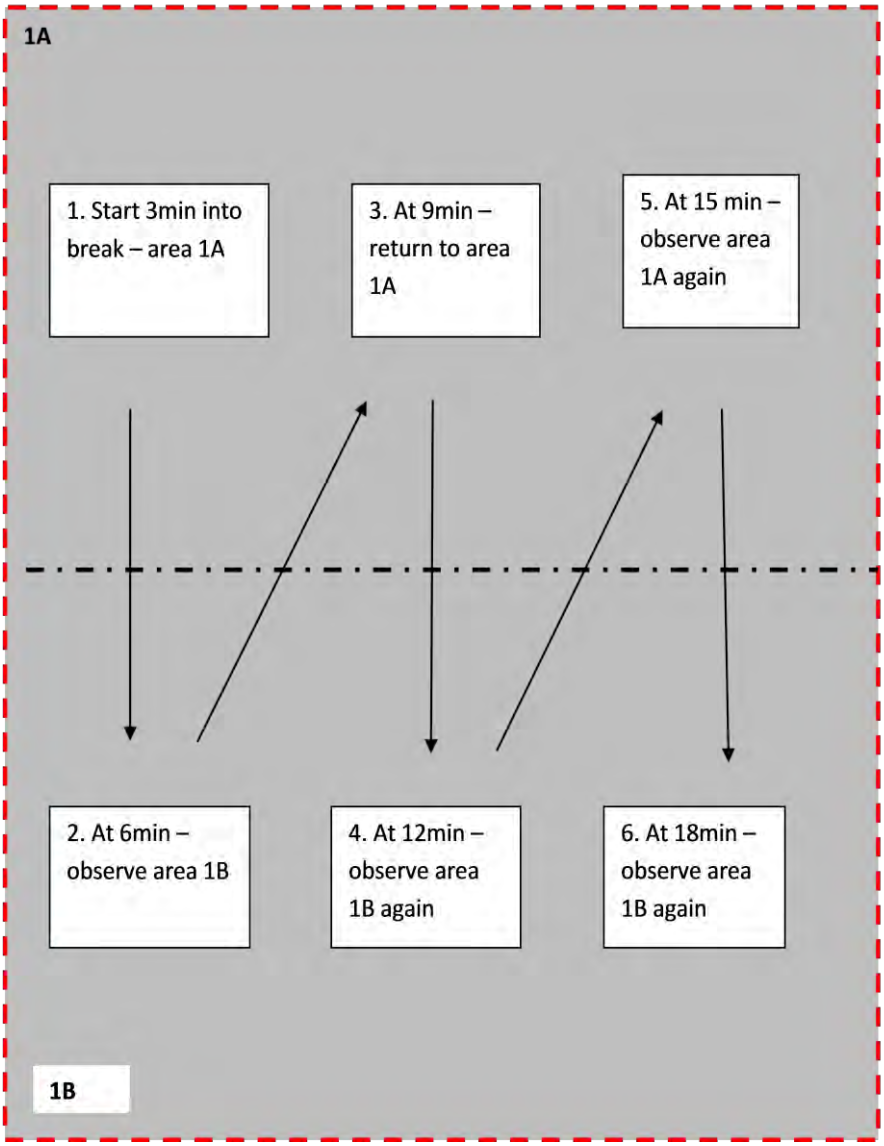


**Figure 3.3 Procedure for observing a target area.** For target area 1, subdivide area in two equal areas: 1A and 1B. Start in area 1A. After bell has gone, wait three minutes before beginning with the first scan. When scan is completed, move to area 1B. At six minutes into the break, begin the scan. This will be the first scan for area 1B, but the second overall scan for area 1. Thereafter, return to area 1A and continue the same steps until the end of break is reached. An equal amount of scans should be done in both area 1A and 1B, therefore, if you are done with area 1B and need to return to area 1A with less than six minutes left of break, scans should be stopped at that moment.

#### 3.2.3.4 Environmental Conditions

The environmental conditions of target areas were also assessed using the following criteria according to the SOPLAY protocol:

- Accessibility: students are able and allowed to access the area during break times.
- Usability: area is usable for physical activity (e.g. not too wet for play).
- Area improvements: addition of line markings, netball hoops or painted games.
- Supervision: a teacher or prefect is available to react in the case of an emergency.
- Surface type: hard surface (tar, paving or concrete) or soft surface (grass or sand).
- Loose equipment: equipment students brought to school from home (jumping ropes, rugby or soccer balls, and cricket bats).

### 3.2.4 Data Analysis

All analyses were done using STATA 11 (StataCorp, College Station, Texas). The primary outcome measured was level of physical activity. Chi-square tests were used to determine whether or not there were any differences in environmental characteristics relating to physical activity between intervention and control schools. Chi-square tests were also used to calculate differences in the proportions of physical activity levels with and without certain environmental conditions (the presence or absence of area improvements, supervision and loose equipment) as well as with different area densities. Different areas were classified according to student density quartiles: low student density areas (first quartile: 0.06 to 0.43 students per $100m^2$), low-to-medium student density areas (second quartile: > 0.43 to 1.05 students per $100m^2$), medium-to-high student density (third quartile: > 1.05 to 2.34 students per $100m^2$) and high student density areas (fourth quartile: > 2.34 to 28.7 students per $100m^2$). Significance was set at $p < 0.05$.

## 3.3 RESULTS

### 3.3.1 Differences in break time physical activity levels between intervention and control schools who took part in the HealthKick intervention

A total of 970 scans were made across the eight schools during break times. Three hundred and forty-two scans were not analysed as there were no children in the area at the time of the scan.

Overall, 31% of observed students were sedentary, 14% were eating, 29% were classified as walking and 26% were engaging in vigorous physical activity during break times (Table 3.1).

**Table 3.1** Proportion of children participating in different levels of physical activity during leisure time at school

| | Intervention | | | | | Control | | | | | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | Mean | SD | Min | Max | % | Mean | SD | Min | Max | % |
| Sedentary | 31.74 | 13 | 12 | 1 | 49 | 30.37 | 17 | 15 | 1 | 93 | 30.93 |
| Eating | 13.85 | 7 | 9 | 1 | 48 | 14.49 | 10 | 14 | 1 | 56 | 14.23 |
| Walking | 30.23 | 9 | 7 | 1 | 37 | 28.45 | 10 | 10 | 1 | 53 | 29.18 |
| Vigorous | 24.18 | 10 | 8 | 1 | 37 | 26.70 | 8 | 8 | 1 | 52 | 25.67 |
| Total | 100 | 10 | 10 | 1 | 49 | 100 | 12 | 13 | 1 | 93 | 100 |

SD = standard deviation

### 3.3.2 Break times

The first break ranged in length from 15 to 30 minutes (average of 21 minutes) and the second break from 15 to 25 minutes (average of 18 minutes). The proportions of different activity levels did not differ between the first and the second break (Table 3.2). More students were eating during the first break than during the second break (16% during the first break and 11% during the second break), although this was not significant ($X^2 = 5.580$, df = 3, p = 0.134).

**Table 3.2** Proportion of children participating in different levels of physical activity during the first break compared to the second break

| | First Break | Second Break |
|---|---|---|
| Sedentary (%) | 29.98 | 32.58 |
| Eating (%) | 16.21 | 10.76 |
| Walking (%) | 28.36 | 30.59 |
| Vigorous (%) | 25.45 | 26.06 |

(— two of control schools did not have a second break on the day of the observations)

### 3.3.3 Environmental factors

#### 3.3.3.1 Area Improvements

The proportion of different levels of physical activity in areas with some improvements did not differ from areas without any improvements ($X^2 = 0.503$, df = 3, p = 0.918). There was no significant difference between intervention and control schools.

#### 3.3.3.2 Supervision

Only 55% of schools had supervision during break times. Chi-square tests showed that the presence or absence of supervision had an overall effect on activity levels ($X^2$ = 8.620, df = 3, p = 0.035). In the areas that did not have any supervision, a greater proportion of students were being sedentary (32% vs. 30%). Areas being supervised had a higher proportion of students eating than unsupervised areas (17% vs. 11%). In the areas where supervisors were present, the proportion of students participating in vigorous physical activity was lower than in unsupervised areas (24% vs. 28%). There was no significant difference between intervention and control schools.

#### 3.3.3.3 Surface Type

The surface type did not have any effect on physical activity levels (Table 3.3). The proportion of different levels of physical activity in areas with hard surfaces did not differ from areas with soft surfaces ($X^2$ = 1.213, df = 3, p = 0.750). There was no significant difference between intervention and control schools.

#### 3.3.3.4 Loose Equipment

The proportion of students participating in vigorous physical activity were higher when loose equipment was available (27% vs. 19%), although not significantly ($X^2$ = 6.631, df = 3, p = 0.085) (Table 3.3). No significant difference between intervention and control schools was found.

**Table 3.3** Proportion of children participating in different levels of physical activity by environmental conditions

| | Area Improvements | | Supervision * | | Surface Type | | Loose Equipment | |
|---|---|---|---|---|---|---|---|---|
| | Yes | No | Yes | No | Hard | Soft | Yes | No |
| Sedentary (%) | 29.91 | 31.43 | 29.88 | 32.42 | 30.24 | 31.91 | 30.90 | 31.06 |
| Eating (%) | 14.33 | 14.18 | 16.87 | 10.47 | 15.21 | 12.81 | 13.23 | 19.25 |
| Walking (%) | 30.53 | 28.51 | 29.17 | 29.18 | 29.20 | 29.15 | 28.92 | 30.43 |
| Vigorous (%) | 25.23 | 25.89 | 24.08 | 27.93 | 25.35 | 26.13 | 26.95 | 19.25 |

* Significant overall effect, p < 0.05

### 3.3.4 Student density of scan areas

Student density had an overall effect on the proportions of the different activity levels ($X^2$ = 90.950, df = 9, p = 0.000). The proportion of students engaging in sedentary behaviour in areas with a low student density was 18%, compared to 50% in areas with a high student density. In areas with a low

student density, the proportion of students engaging in vigorous activity was much higher than in areas with a high student density (28% and 13%, respectively) (Table 3.4).

**Table 3.4** Proportion of children participating in different levels of physical activity by student density of scan areas

| | **Low student density (Large area, few children)** | **Low-to-medium student density (Medium area, few children)** | **Medium-to-high student density (Medium area, a lot of children)** | **High student density (Small area, a lot of children)** |
|---|---|---|---|---|
| Sedentary (%) | 17.55 | 25.91 | 31.25 | 49.58 |
| Eating (%) | 24.90 | 11.34 | 8.75 | 11.76 |
| Walking (%) | 29.39 | 32.39 | 29.58 | 25.21 |
| Vigorous (%) | 28.16 | 30.36 | 30.42 | 13.45 |

Student density = students per 100m$^2$

## 3.4 DISCUSSION

The main aim of this study was to objectively measure voluntary physical activity of South African students during break times. Although the majority of students were active during break times, a large proportion was engaged in sedentary activities. By being more active during break times, students may increase their chances of reaching their recommended physical activity daily target of 60 minutes. As such, school break times could be used as a setting for physical activity interventions to increase students' physical activity levels.

The second aim of this study was to investigate whether the proportion of students engaging in physical activity during break times differs between intervention and control schools participating in the HealthKick intervention. The intervention was designed in such a way that the schools were able to choose the strategies they would use to reach the HealthKick goals (through the action planning process) and it was their responsibility to implement the chosen strategies. It was found that there were no significant differences between the proportions of different levels of physical activity between the control and the intervention schools at this stage of the intervention, demonstrating that a low-intensity intervention may not be sufficient to change overall physical activity behaviour. Although this finding is not ideal, it is still an important finding as it can inform future research to design interventions that would be more appropriate in a South African setting. Some of the 'actions' recommended to the intervention schools were to have an activity track laid out on the playground as well as to have colourful markings on the playground. Unfortunately none of the

schools chose to implement these actions at the time of the observations. (One school did have newly painted playground markings, but it was in an area that was off limits to students during break times, possibly because it was located in an indoor quad and children were only allowed to play outside).

There were no significant differences between the proportions of students who were physically active between the first and the second break. The proportion of students eating during break time (14%) highlights the importance of this additional 'eating' category. Performing the observations without this category could mean that a small portion of students might not be counted, or could be counted as being sedentary which implies that they are choosing to be sedentary. Instead, break time is also the only time students can eat their snack or lunches. Overall, South African students have much less time to play than their overseas counterparts. Although their first break is more or less the same duration (15 to 30 minutes) as recess in the UK (15 to 20 minutes)[59] and Canada (15 to 25 minutes)[247], their second break (15 to 25 minutes) is much shorter than the lunch break in overseas schools which ranges from 35 to 50 minutes in Canada[247] to 45 to 65 minutes in the UK[59]. The addition of the 'eating' category could therefore provide a more realistic perspective of what is happening on the playground during break times in settings, such as South Africa, where break time is much shorter and used for eating and playing. Furthermore, although school feeding schemes have been successful at reducing underweight in students, there is now an increase in the prevalence of overweight/obesity among South African students[248], demonstrating the need to shift the focus toward promoting physical activity, along with addressing under-nutrition.

The final aim of this study was to assess the impact of environmental factors on physical activity levels during break times. A review of interventions proposed to increase children's break time physical activity found that interventions based on playground marking, game equipment, or a combination of the two, did not increase children's physical activity during break times. However, interventions which used playground markings and physical structures (such as goal posts, basketball hoops and fences) did increase break time physical activity[249]. This was further corroborated by our results, where we found no differences in areas with loose equipment or improvements (such as playground markings). The presence of supervision is normally thought to enhance physical activity participation[68,72], however our study demonstrated similar findings to McKenzie T.L, (2010)[74] who showed a decrease in vigorous activity levels in areas that were supervised. With that said, the role of the supervisor during break time is not fully understood, and highlights an area for future research. It is possible that South African teachers' main priority would be to ensure that there is order on the playgrounds since there is, in general, a lot of unruly behaviour (such as bullying) on

schools grounds. In a 2007 study, over a third of South African adolescents were involved in bullying behaviour[250]. Teachers could instead be trained to promote physical activity on the playground.

Evidently, student density was a very strong determinant for break time physical activity. In small areas with a great number of students, half of the students were participating in sedentary behaviour and very few were participating in vigorous activity. Less dense areas (even medium-to-high densities) had more than double the proportion of students engaging in vigorous activity demonstrating that overcrowding on playgrounds has a negative impact on physical activity levels. An intervention study which decreased playground density in preschools resulted in a decrease in sedentary time and an increase in both light-to-vigorous and moderate-to-vigorous physical activity[251]. This was achieved by dividing classes in two groups and scheduling different times for recess for the two groups. Lastly, measuring the target areas and determining the student density is not part of the standard SOPLAY protocol, but could be a useful additional tool.

**Strengths and Limitations**

A limitation of this study was that two of the control schools did not have a second break on the day of the observations. Furthermore, the observations were done at a small number of schools, all from low-income areas. This was a quasi-experimental post-test only study. This means that we took a 'snap shot' of break time physical activity levels at the HealthKick schools at a certain point in time. We were thus not able to determine an intervention effect on break time physical activity levels. However, future studies should include both pre- and post-test measurements and should also be done on a greater number of schools, incorporating schools from middle and high income areas in order to compare between low- and high-income areas. Furthermore, our control group received some resources, which means that they were not a true control group, but given the challenges of school-based research, it was not possible to have a true control group. A strength of this study is that it was the first time this observation protocol was used in a South African setting.

**Practical implications**

As mentioned above, teachers could be trained to promote physical activity on the playground to increase physical activity participation. However, to avoid adding additional responsibility to a teacher's already full schedule, another option could be to train senior students to become 'Play Leaders' as recommended in the HealthKick educators' manual. It would be their responsibility to encourage play on the playground by demonstrating different activities and providing new game ideas to the rest of the students and encouraging students who might not normally be active to join in the games. This approach has been used previously in a project called "Healthy Buddies"[252] a

health promotion programme in primary schools based on older children teaching younger children. After the intervention, both older and younger students showed an increase in healthy-living knowledge, behaviour and attitude, as well as smaller increases in weight. The authors suggest that this type of student-led teaching may be an efficient and feasible way of promoting healthy lifestyles.

## 3.5 CONCLUSION

To promote break-time based physical activity it seems essential to target factors such as overcrowding and teacher supervision that present as barriers. This would alleviate the need for teachers to direct their time toward crowd control. Teachers would then be available to implement strategies that engage students in schoolyard based physical activities.

## Chapter 4:

## THE RELATIONSHIP BETWEEN A SCHOOL PHYSICAL ACTIVITY INDEX SCORE AND CHILDREN'S PHYSICAL ACTIVITY-RELATED KNOWLEDGE, ATTITUDE AND BEHAVIOUR

## 4.1 RATIONALE

Results from the previous chapter showed that school policy/practice (supervision of students during break-times) and built environment (over-crowding) can influence children's physical activity levels during break-time in low-income primary school settings. An individual's physical activity habits are influenced by their knowledge of and attitudes towards these behaviours[207] and these were investigated in Chapter 2. This chapter takes this investigation further by assessing the extent to which the school environment (both the policy and built environment) influences physical activity-related knowledge, attitude and behaviours.

Physical activity is essential for childhood health and development[194] and has been positively related to academic performance in children[253,254]. Insufficient physical activity among children is associated with increased risk for obesity and other cardiovascular diseases[255]. Characteristics of the built environment have been shown to be a contributing factor to the declining levels of physical activity[256]. In the case of children, the school environment is an import setting due to the fact that children spend a large part of their day at school[34]. The school environment provides several opportunities throughout the day to contribute to children's recommended 60 minutes of moderate-to-vigorous physical activity per day, including break-time, physical education classes and extra-curricular activities[50].

Numerous studies have found that children' physical activity during the school day is related to characteristics of the school physical activity environment, such as the amount of grassed area per student (Martin et al., 2012), playground markings (Willenberg L.J et al., 2010) and loose equipment[64,257]. In addition to the built environment, the school social environment (policies and practices around physical activity) is also important for children's physical activity[128,258].

The socio-ecological model proposes that health behaviour are influenced not only by intrapersonal factors, but focuses on the interrelationships between individuals and the social, physical and policy environment[259]. The school built and policy environments form part of the organizational level of the socio-ecological model[156]. The majority of the studies investigating the school built or policy environment looked at how it influences physical activity behaviour[260-262]. The effect of the school built or policy environment on physical activity related knowledge and attitudes have been less studied.

The objective of this study was to investigate whether the school physical activity policies, practices and built environment were related to physical activity-related knowledge, attitudes and behaviours of children participating in the HealthKick intervention.

## 4.2 METHODS

### 4.2.1 Study population

The data for this study were collected from the sixteen HealthKick schools and included a principal interview with all sixteen schools as well as the baseline knowledge, attitude and behaviour questionnaire of the Grade 4 children participating in HealthKick (Figure 4.1).

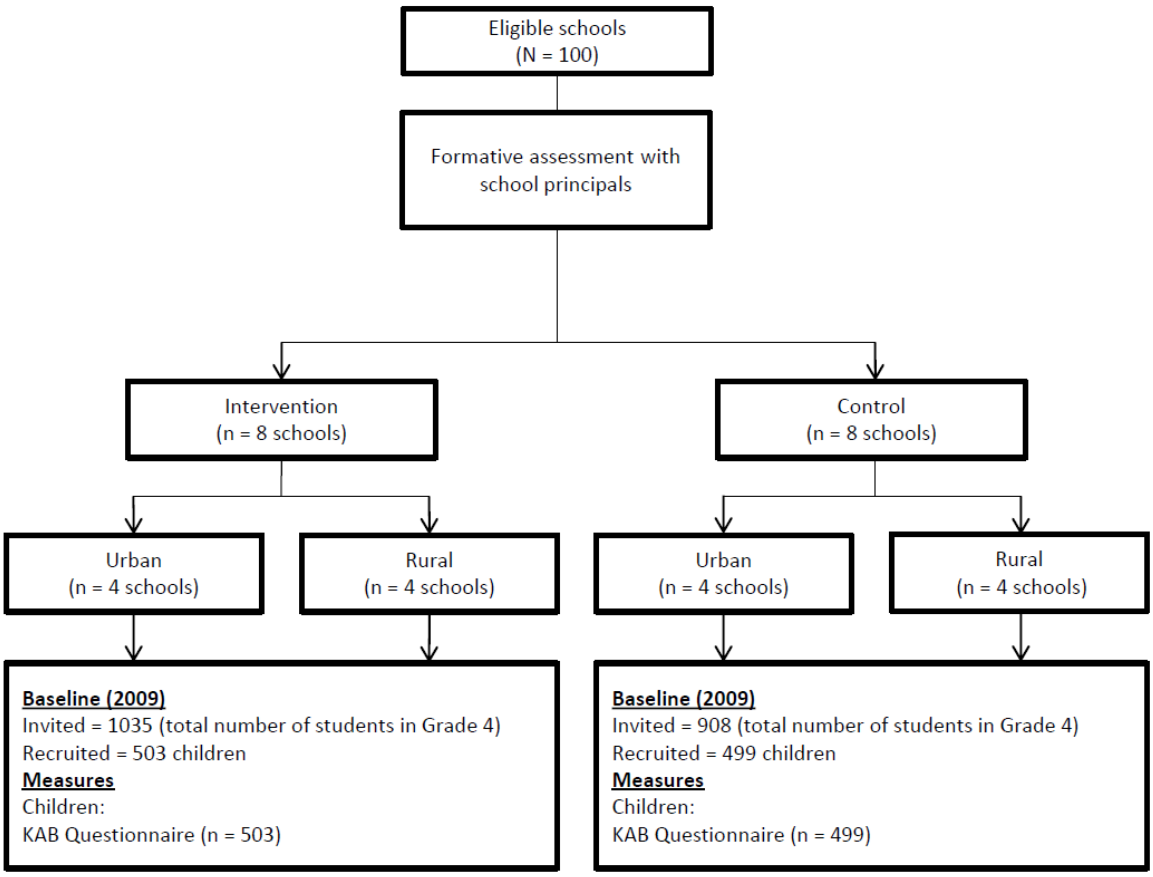


**Figure 4.1** Flow chart of participants in the study (baseline participants of HealthKick study)

### 4.2.2 Formative assessment

A formative assessment was conducted at all sixteen schools. This was comprised of a situational analysis and an observational schedule. The situational analysis was in the form of a structured interview with the school principal or designee and was based on the CDC's School Health Index[263,264]. The purpose of the situational analysis was to gather information about the school's policies and practices around healthy eating and physical activity as well as general demographic

information (e.g. number of children). An example of the questions relating to physical activity in the formative assessment are listed in Table 4.1. The observational schedule was used by the research team, and involved the technician walking around on the school premises to gather information about the school built environment (e.g. number of sport fields, equipment available, facilities and safety). The observer was part of the team who developed the observational schedule and was thus familiar with the instrument.

**Table 4.1** Example of questions in the formative assessment

| Question | How interviewee could respond |
|---|---|
| How many structured physical activity sessions per week are currently in the weekly timetable for the foundation phase, intermediate phase and senior phase, respectively? | Number of sessions |
| How many of the sessions/week do children participate in physical activities outside the classroom? | Number of sessions |
| How long is each physical activity session? | Minutes |
| How long is each first break session? | Minutes |
| How long is each second break session? | Minutes |
| Is there any structured physical activity for children during break times? | Yes or no.<br>If yes, please describe |
| How many teachers/supervisors are assigned to supervise at each break? | Number of teachers |
| In the past year, have you made any improvements to the sporting facilities/playgrounds at your school? | Yes or no.<br>If yes, please describe the changes |
| In the past year, has the school received/bought any new equipment for sport and/or physical activity? | Yes or no.<br>If yes, please describe |

### 4.2.3 School physical activity index

The data from the formative assessment were used to develop a 'school physical activity index' based on the School Health Index[264], Healthy School Program Framework [97,265] and SHAPES[266] from

which a school physical activity index score were calculated for each school. The school physical activity index consisted of fifteen items and is displayed in Table 4.2. Items were reduced to seven items after inter-item reliability analysis was performed. The school physical activity index could range from one to a maximum of 16. Two items (separation of grades during break times and utilisation of community facilities for physical activity) were coded as 0 or 1 (no or yes). Supervision were ranked as 0 (no supervision during break times according to interview), 1 (there is supervision during break time according to interview) or 2 (the presence of supervision observed during playground observations. The other four items could score between 0 and 3, increasing as the number of the item increases for loose equipment (number of different types), number of sports offered and structured physical activity in timetable (amount of time) and assisting with sport scored 0 for no sports offered, 1 for teachers doing the coaching, 2 for parents doing the coaching and 3 for having an outside coach.

**Table 4.2** Description of items included in the school physical activity index

| Item | Items remaining in the school physical activity index after inter-item reliability analysis |
|---|---|
| Is there a health/safety committee at this school? | |
| Is structured physical education currently in the weekly timetable? | ✓ |
| School offers daily breaks (recess) | |
| Are students from the different phases separated at break times? | ✓ |
| Are teachers/supervisors assigned to supervise the students during break times? | ✓ |
| Are students excluded from all / part of break times as punishment for bad behaviour? | |
| Does your school offer extra-mural sports (number of sports offered)? | ✓ |
| Who assists with the coaching of sport? (teachers, parents, or outside coaches) | ✓ |
| Access to physical activity during bad weather (Is there a hall)? | |
| Overall condition of school buildings (dangerous, cement, grass, free of litter) | |
| Access to water (number of taps outside providing hygienic water (to drink and wash hands)? | |
| Number of playgrounds | |
| School utilizes community facilities to provide physical activity opportunities | ✓ |
| Facilities for physical activity | |
| Provision of loose equipment (number of different types) | ✓ |

### 4.2.4 Knowledge, attitude and behaviour questionnaire

Grade 4 children (N=941) from each of the sixteen schools completed a knowledge, attitude and behaviour (KAB) questionnaire which asked about their general attitude towards nutrition and physical activity, knowledge about nutrition and physical activity, social support, self-efficacy, the absence of perceived environmental barriers and enjoyment. The questionnaire was developed by the research team and administered by a fieldworker in the predominant home language of the students.

### 4.2.5 Knowledge, attitude and behaviour scores

Binary outcomes were created for five KAB constructs, including enjoyment, social support from teachers, self-efficacy, physical activity behaviour and the absence of perceived barriers to physical activity. Each construct, the question from which it was derived, as well as how it was scored are presented in Table 4.3.

**Table 4.3** Questions and coding used to obtain each of the five KAB constructs

| KAB construct | Question in questionnaire | Coding |
|---|---|---|
| **Self-efficacy** | 'Can you do physical activity that makes you sweat and breath hard?' | Yes – 1<br>No – 0 |
| **Enjoyment** | 'Do you have fun when you are doing physical activity?' | Yes – 1<br>No – 0 |
| **Social support from teachers** | 'Do your teachers encourage you to do physical activity?' | Yes – 1<br>No – 0 |
| **Physical activity behaviour** | 'Do you take part in sport at school or for a club, e.g. soccer, netball?' | Yes – 1<br>No – 0 |
| **No perceived barriers** | 'There is organised sport at my school?' | Yes – 1<br>No – 0* |

* a score of 1 for perceived barriers indicates a positive result meaning no perceived barriers, a score of 0 means there are perceived barriers; KAB – knowledge, attitude and behaviour

### 4.2.6 Data Analysis

Inter-item reliability analysis was performed on the school physical activity index using Statistica 11 (Statsoft, Tulsa, Oklahoma). Items which correlated least with other items were removed from the index in order to obtain an alpha of an acceptable standard (Cronbach's alpha ≥ 0.7). The school physical activity index was reduced to seven items, as indicated in Table 4.1.

A non-parametric equivalent of a nested linear regression model was performed in Statistica 11 to assess the relationship between the school physical activity index score and each physical activity related KAB construct. Significance was considered at $p < 0.05$.

**Ethical approval**

The study was approved by the Human Research Ethics Committee of the Faculty of Health Sciences, University of Cape Town (Ref no. 486/2005) and adhered to the guidelines of the Declaration of Helsinki. Approval for the research was obtained from the Western Cape Education Department and school principals gave written informed consent before being interviewed. The parent/guardian of each student gave written consent for children to complete the questionnaire and the children gave verbal assent before the tests were conducted. They were informed that they are free to withdraw at any time.

## 4.3 RESULTS

### 4.3.1 Descriptive statistics of students

There were 941 students (median age 10, IQR 1 years) from 16 schools in the analytical sample. KAB results are displayed in Table 4.4.

**Table 4.4** Descriptive statistics of students

| | **Construct** |
|---|---|
| Age | 10 (1) |
| KAB score | 1 (1) |

Data reported as median and interquartile range (IQR). KAB score = sum of the five KAB constructs (self-efficacy, enjoyment, social support from teachers, physical activity behaviour and the absence of perceived barriers).

### 4.3.2 School physical activity index and knowledge, attitudes and behaviour

The school physical activity index score ranged from six to fifteen (median 11, IQR 5). Figure 4.2 shows the school physical activity index score of each school. Physical activity related behaviour was significantly related to the school physical activity index score ($p = 0.023$). The school physical activity index score was not significantly related to any of the other constructs including self-efficacy, enjoyment, teacher support or the absence of perceived barriers ($p = 0.146$, $p = 0.693$, $p = 0.097$ and $p = 0.589$, respectively).

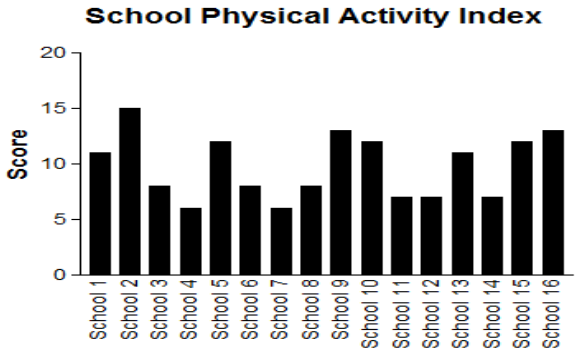


**Figure 4.1** School physical activity index scores by school

## 4.4 DISCUSSION

Physical activity levels at school are declining[267], however, it has been shown previously that certain aspects of the school built and policy environment are associated with children's physical activity[68,74,128,247] and the school can still play an important role in children's physical activity levels[267]. However, the physical activity habits of an individual are not only influenced by the built environment, but also by their knowledge of and attitudes towards these behaviours[207]. This means that by having a better understanding of the characteristics that influence knowledge and attitudes, we will ultimately be better able to influence physical activity behaviour by planning focussed and specifically structured physical activity interventions.

In this study, we undertook to explore if the school built environment, as well as the school social environment (physical activity related policies and practices) were related to children's physical activity related knowledge, attitudes and behaviours.

Our results showed that the school physical activity index was associated with physical activity behaviour. A study by Fein et al. found that the perceived school environment was related to physical activity[268]. Similar results were seen in the *eat well be active (ewba)* community intervention which did not find significant improvements physical activity behaviours, attitudes, knowledge, and perceived environments in the intervention communities[269]. A possible explanation for not finding any associations between the other constructs (knowledge, self-efficacy, etc.) could be attributed to the nature of the questionnaire – more sensitive questionnaire may find associations.

### Practical implications

The finding that changes to the school built and policy environment may lead to changes in physical activity behaviour is encouraging and could potentially have implications for future decisions around

school policy development, by encouraging schools to include the policies and features contained in the school index. However, more research is necessary to confirm this finding.

**Strengths and Limitations**

A strength of this study is that we have created a tool which could be used in future South African schools research. A limitation of the study is that the KAB questionnaire, although it has been previously validated, resulted in constructs with single item questions. Future research should use a more detailed questionnaire to obtain more sensitive KAB constructs. A further limitation is that the formative assessment was created by the research team, which validity and reliability was not assessed.

## 4.5 CONCLUSION

The positive association between the school physical activity index and self-report physical activity behaviour indicates that changes to the school built and policy environment may lead to an activity-permissive environment, and be a positive influence on physical activity behaviour in South African primary school children. This finding warrants further research into this topic. The tool we have created should be generalizable to other settings, as the components in the index are common in school across the world (such as PE, supervision and sport facilities). Further research is necessary to confirm these findings, as this is the first study of its kind in South African primary schools.

**The International Study on Childhood Obesity, Lifestyle and Environment (ISCOLE)**

The primary aim of ISCOLE is to determine the relationship between lifestyle characteristics, obesity and weight gain in a large multi-national study of 10 year-old children, and to investigate the influence of behavioural settings and physical, social and policy environments on the observed relationships within each country. Data will be collected in 12 countries (500 children per site) from five major regions of the world (Eurasia & Africa, Europe, Latin America, North America, and the Pacific). Baseline evaluations and periodic follow-up examinations will be undertaken in each country. The physical characteristics of the children will be directly measured in order to classify their body weight and adiposity status, and PA and dietary patterns will be measured with the most objective techniques currently available. A concise set of environmental measures that are feasible, valid and meaningful across the international settings included in this research will also be employed. The results of this study will provide a robust examination of the correlates of obesity and weight gain in children, focusing on both sides of the energy balance equation. The results will also provide important new information that will inform the development of lifestyle interventions to address childhood obesity that can be culturally adapted for implementation around the world.

**Candidate's role in ISCOLE**

The candidate was the coordinator for the South African leg of the ISCOLE. She also led the school environment audit team and was part of the environmental writing group. She performed data collection (including anthropometry, accelerometry and questionnaires) and data analyses and did the geographic information systems analysis for the last chapter.

## Chapter 5:

# SCHOOL CORRELATES OF IN-SCHOOL PHYSICAL ACTIVITY AMONG 10-YEAR OLD CHILDREN FROM TWELVE COUNTRIES: THE INTERNATIONAL STUDY OF CHILDHOOD OBESITY, LIFESTYLE, AND THE ENVIRONMENT (ISCOLE)

## 5.1 RATIONALE

Findings from the previous two chapters showed that the school built and policy environments were associated with in-school physical activity behaviour in South African children. However, the participants were all recruited from one South African province and only in low-income settings. In order to get a more global picture, the influence of the school environment on children's physical activity was assessed on a larger sample of children from 12 different countries, representing a range of human development, equity and income settings, as part of the ISCOLE study. This chapter will report on the association between the school environment and children's objectively measured in-school physical activity on data collected across 12 countries including low, middle and high income countries. Data for the analyses were part of the ISCOLE, but analyses were conducted by the candidate independently from the ISCOLE research team.

Physical activity participation during childhood holds numerous health benefits including increased physical fitness, favourable cardiovascular and metabolic risk profiles, motor skill development, enhanced bone health as well as improved self-esteem and body image[18,19,270,271] and is positively related to academic performance[253,254]. It is recommended that children participate in at least 60 minutes of moderate-to-vigorous physical activity per day[18]. A survey on 10 to 15 year olds from 34 countries showed that less than 50% of the children in each country achieved this guideline on 5 or more days per week[272]. More recently, the global matrix compared physical activity of children in different domains (overall physical activity, organised sport participation, active play, active transportation, sedentary behaviour, family and peers, school, community and the built environment and government strategies and investments) across fifteen countries. Results showed that ten out of the fifteen countries reported a failing grade (succeeding with less than half of children) on overall physical activity[27], signifying that childhood physical inactivity is a global problem.

The school setting is particularly important for the promotion of physical activity since children spent a significant part of their day at school[240]. The global matrix grades for the school indicator (including having physical activity related policies, offering at least 150 minutes of physical education (PE) per week, offering opportunities for physical activity in addition to PE and providing access to facilities and equipment that support physical activity) were relatively evenly distributed between the fifteen countries. Interestingly, the top five grades were from high-income countries while the bottom 4 grades were from middle- to low-income countries[27], highlighting the large disparity between countries.

Different attributes of the school built environment have been shown to influence children's physical activity levels. The availability of loose equipment[64], playground markings and increased teacher presence[68] and larger school campuses and play areas[77] have all been shown to be positively associated with children's physical activity levels. However, these studies investigated the effect of single environmental attributes on children's physical activity and was conducted on a small sample size (number of schools ranged from ten to 24). One study investigated the effect of having multiple school physical activity practices and showed that schools with four physical activity related practices accumulated 20 minutes of MVPA more than children at schools with only one or no physical activity practices[128]. This study was limited to one city in America (San Diego).

To our knowledge, no research has been done to investigate the effect of multiple school built and socio-cultural characteristics on a large sample from a broad range of geographical areas. The objective of this study was to examine the associations between the school built, policy and socio-cultural environments with the physical activity levels of children, measured objectively, during the school day in a large, multinational sample.

## 5.2 METHODS

### 5.2.1 Study design

The International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) is a multi-country cross-sectional study[114]. The following twelve countries participated in the study: Australia, Brazil, Canada, China, Colombia, Finland, India, Kenya, Portugal, South Africa, United Kingdom, and United States. The selected countries range in socio-economic status to include countries from low income (Kenya), lower-middle income (India), upper-middle income (Brazil, China, Colombia, South Africa) and high-income economies (Australia, Canada, Finland, Portugal, USA, United Kingdom)[273]. The primary aim of the ISCOLE was to determine the relationships between lifestyle behaviours and obesity in a multi-national study of children, and to investigate the influence of higher-order characteristics such as behavioural settings, and the physical, social and policy environments, on the observed relationships within and between countries[114]. Data collection took place between September 2011 and December 2013, with each country completing their data collection over 12 months, or across one school year, ensuring the inclusion of different seasons.

### 5.2.2 School recruitment

Each country identified one or more school districts (within reasonably close proximity to the local study centre). Schools were recruited according to indicators of socio-economic status in order to maximize variability within countries. For example, in Finland (very high Human Development Index),

schools were first stratified by city and then by area SES (high, low) based on socio-economic characteristics of their geographical location (educational level, if available, otherwise income level). From each of these six strata (city/SES), three to six schools were randomly selected to represent the distribution of pupils and SES within the total sampling area, while in China (medium Human Development Index), three regions (2 urban districts and 1 suburban district) of Tianjin city were selected and stratified according to three levels of socioeconomic status. Within each stratum, two schools were selected randomly from a list of all public schools, with a total of six schools to participate.

### 5.2.3 Participant recruitment

Participants were recruited in the schools from classes with the most 10-year-old students. The ISCOLE study was approved by the local ethical review board for each participating country. The sampling strategy employed differed by country; refer to Table 5.1. Principals gave consent for schools to participate; parents and participants provided individual written consent and assent, respectively. The study was approved by the Human Research Ethics Committee of the Health Sciences Faculty of the University of Cape Town (HREC REF: 288/2011).

**Table 5.1** Sampling methods employed by International Study on Childhood Obesity, Lifestyle and Environment sites (from Katzmarzyk et al., 2013)

| ISCOLE site | Sampling strategy |
|---|---|
| Australia | A stratified probability sampling frame was used, aiming to ensure that each 5th grade child in the school system has an equal chance of being selected. Schools were initially stratified into tertiles based on the Index of Community Socio-Educational Advantage (ICSEA). Schools were randomly chosen from within each ICSEA tertile, with the probability of being chosen proportional to the estimated enrolment in 5th grade. Once the required number of children was enrolled from a tertile (200 children), enrolment continued exclusively from the remaining tertiles. |
| Brazil | There is variability in socioeconomic status between schools in the region of Sao Caetano do Sul. Public schools represent the lower socio-economic strata, and private schools reflect the higher socio-economic strata. Random lists of public and private elementary schools in the region were generated, and schools were selected for each list at a ratio of 4 (public) to 1 (private). If a school refused to participate in the study, it was replaced by the school next on the list. Twenty schools were sampled (16 public and 4 private), and 5th grade students continued to be sampled in each school in order to have between 25–30 students in each school. |
| Canada | Schools were drawn from the Ottawa Region. Schools were stratified into four groups with proportional representation (English Public, French Public, English Catholic, French Catholic). All schools within each stratum were invited to participate and the first to respond were included into the study until each stratum was filled. Children in 5th grade were selected from the schools to participate. |

| | |
|---|---|
| China | Three regions (2 urban districts and 1 suburban district) of Tianjin city were selected and stratified according to three levels of socioeconomic status. Within each stratum, 2 schools are selected randomly from a list of all public schools, with a total of 6 schools to participate. If the selected school refused to join the project, it was replaced by the next randomly selected school. Each school ensured an average sample size of 85–90 grade 4th grade students. |
| Colombia | A list of public and private schools in Bogotá were selected according to the following inclusion criteria: 1) schools in urban area; 2) including boys and girls; 3) having a morning schedule; 4) enrolling students from elementary, middle and high-school; 5) belonging to January-December calendar, and 6) not being a school for a disabled population (blind, deaf, etc.). Given the distribution of students who attend public (76%) vs. private schools (24%), 15 public schools and 5 private schools were selected randomly. Schools were sorted into high SES, middle SES and low SES. The sample will result in a minimum recruitment of 600 4th, 5th and 6th grade children to obtain 500 children in 20 schools assuming an 83% response rate. |
| Finland | The sampling frame was a complete list of primary schools in the capital region (cities of Helsinki, Vantaa and Espoo, total population about 1 million or 19% of Finnish population). Schools were first stratified by city and then by area SES (high, low) based on socio-economic characteristics of their geographical location (educational level, if available, otherwise income level). From each of these 6 strata (city/SES), three to six schools were randomly selected to represent the distribution of pupils and SES within the total sampling area. A reserve list was used to account for school withdrawal. Children in 4th grade were selected from the schools to participate. |
| India | Fee structures of different private schools catering to different socio-economic status were obtained. Based on this, a classification was made into low, middle and high socio-economic status. Three to four consenting schools were selected from each stratum. If a school declined the invitation to participate in the study, another school of the same fee structure was selected. The children from 5th grade were sampled to have at least 60–70 students from each school. |
| Kenya | Non-boarding primary schools from Nairobi County were stratified into public and private (boarding schools were not sampled). The schools were then selected proportional to the distribution of public and private school attendance. Non-compliant schools were replaced with the next conveniently selected school from the group. Children in 5th grade were selected from the schools to participate. |
| Portugal | There is little variability in socio-economic status at the school level in Porto; thus schools were randomly selected from a list provided by the North Regional Education Directory Board. If a non-compliant school was found, it was replaced by the next random school selected from the group. Twenty two schools were sampled, and from each, 5th grade students were sampled in order to have 25–30 students in each school. |
| South Africa | The sampling frame was a list of all public schools within the geographic area of study eligibility. The list was stratified according to SES quintiles and at least 4 schools were randomly selected from each stratum for a total of at least 20 schools. If a school declined the invitation to participate in the study, another school of the same socio-economic quintile was randomly selected. Children in the 4th and 5th grades were selected from the schools to participate. |
| United Kingdom | The sampling frame was a complete list of primary schools in the Bath & North East Somerset and West Wiltshire regions. Schools were stratified according to size and socio-economic characteristics (e.g., free school meal entitlement). From each stratum, a proportional cluster was selected. Specifically, |

| | |
|---|---|
| | schools were randomly selected using the probability proportional to size approach and a reserve-list compiled to account for school withdrawal. Children in the 5th and 6th years were selected from the schools to participate. |
| United States | A complete list of public and private schools enrolling 4th grade students in East Baton Rouge Parish was assembled. Private schools (collectively a stratum) were sampled separately. The public schools were sorted into quartiles (strata) according to% free and/or reduced lunch. Thus, there were five strata to sample from (4 public and 1 private). All schools were placed in random order within each stratum. Each school was approached according to the random order established within each stratum until a minimum of 4 schools were selected from each stratum, for a total minimum of 20 schools across strata, resulting in a minimum enrolment of 500 4th grade children. |

### 5.2.4 Measures

#### 5.2.4.1 Participant level variables

##### 5.2.4.1.1 Physical Activity

The previous chapters in this thesis used self-report and observation techniques to measure physical activity. This study assessed physical activity objectively, providing information about the physical activity frequency, intensity and duration. The outcome of interest was participation in moderate-to-vigorous physical activity during the school day. Participants were asked to wear an Actigraph GT3X+ accelerometer (ActiGraph, of Ft. Walton Beach, FL) for seven days (plus an initial familiarisation day and the morning of the final day), including two weekend days. The devices were attached to flexible belts worn around the waist with the device securely positioned over the right hip. Participants were instructed to wear the accelerometer for 24 hours per day, only removing it when submerged in water (swimming, bathing, taking a shower). Technicians were present in the schools on most days during the specified period to assure wearing compliance. Pencil cases filled with stationary were given as incentives to the participants for regular wear. After the removal of sleep time using a validated algorithm[274], valid wear time was defined as at least four days with a minimum of ten hours of wear time per day, including at least one weekend day. Minutes of physical activity were calculated using cut-points from Evenson, et al.[98] based on intensity counts. The cut-point for MVPA was ≥ 574 per 15 second epoch. Non-wear time was defined as any sequence of at least 20 consecutive minutes of 0 activity counts[275]. School start and end times unique to each individual school were used to calculate minutes per day of MVPA during the school day.

#### 5.2.4.1.2 Anthropometry

Height was measured to the nearest millimetre using a Seca 213 portable stadiometer (Hamburg, Germany). Weight and impedance were measured using a portable Tanita SC-240 Body Composition Analyzer (Arlington Heights, IL). Body mass index (BMI) was calculated as weight (kg) divided by height squared ($m^2$). Obesity status was determined using BMI z-scores calculated based on growth reference algorithms for children and youths developed by the World Health Organisation (WHO)[276]. Briefly, categories were severe thinness (WHO z-score < -3), thinness (WHO z-score ≥ -3 and < -2), normal weight (WHO z-score ≥ -2 and ≤ 1) overweight (WHO z-score > 1 and ≤ 2) and obese (WHO z-score > 2).

### 5.2.4.2 School level variables

#### 5.2.4.2.1 School Environment Questionnaire

The school environment, including school-related policies, practices and facilities relating to physical activity and healthy eating behaviour were assessed through a questionnaire completed by school administrators or designees of participating schools. The ISCOLE school environment questionnaire was adapted from previously developed instruments, including the healthy eating and physical activity modules of the Healthy School Planner used in the Canadian School Health Action, Planning and Evaluation System (SHAPES)[277,278] and questions from the U.S. School Health Policies and Practices Study (SHPPS)[279], with the addition of two questions from the research team.

#### 5.2.4.2.2 School Audit Tool

A school audit was completed by trained technicians at each participating school. The school audit tool collects directly-observed information on the school built and food environments. The components of the school audit tool relating to the built environment were based on the school audit too used in the SPEEDY (Sport, Physical activity and Eating behaviour: Environmental Determinants in Young people) study[113], which has acceptable reliability and good construct validity[111]. A full description of the development and procedures of the school audit tool is available elsewhere[280]. Briefly, the school audit tool assesses the school built and food environment by evaluating the availability and quality of six components: walking provision, cycling provision, sport and play provision, other facility provision, design of the school grounds and aesthetics.

## 5.2.5 Data Analysis

We conducted factor analysis as data reduction method and to identify groups of variables. Analytical methods previously described were followed[281,282]. The method of extraction was principal

component analysis (PCA) as it is the most common data extraction approach[283], followed by varimax rotation. The number of components was decided by a significant jump in the slope of the scree plot and eigenvalue of > 1 and the ability to interpret the different component solutions.

Thereafter, cluster analysis with Ward's algorithm was used to identify a typology of schools based on dimensions generated by the PCA. To determine the number of clusters, the dendrogram was examined, as well as the pseudo F (PSF) and pseudo t2 (PST2) statistics.

Multilevel models were applied to assess influence of school built and policy and socio-cultural environmental factors and school types on children's in-school MVPA. The models had gender, overweight and country as fixed effects, and school as a random effect. Multilevel analyses were performed using Stata.

## 5.3 RESULTS

### 5.3.1 Descriptive statistics

Participants (N=5961, 46% boys) aged 10.4 (0.6) years were included in the study. Descriptive statistics of the participants are shown in Table 5.2.1. Overall, 2% of participants were classified as thin according to WHO criteria, 65% were of normal weight, 21% were overweight and 13% obese. Participants spent 25.6 (13.8) minutes in MVPA during school hours. It is important to note that the participants from South Africa recorded the lowest amount of in-school MVPA (16.9 ± 8.2 minutes). Descriptive characteristics of the schools are summarised in Table 5.2.2. Schools who reported the presence of snow on the day of the school audit were excluded from analysis (n=31 schools; 19 from Canada and 12 from Finland), resulting in a sample size of 225 schools. The average student to teacher ratio was 21.6 (14.4). The majority of schools (91%) reported that they have existing written policies or practices in place concerning physical activity, and 68% of schools reported that they have at least one long break (≥30 minutes in duration) per day. Schools reported to have the following facilities available on the school grounds, off the school grounds or both: an outdoor paved area (89%), a gymnasium (52%) and running track (46%). An aesthetics score were calculated on the presence of six features: planted beds containing flowers/shrubs/small trees, trees for sitting under, ambient noise, litter (the absence thereof), murals/outdoor art and the absence of graffiti. The average aesthetics score was 4.6 (1.3).

**Table 5.2.1** Descriptive statistics of participants

| | Site | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Overall** | **Australia (Adelaide)** | **Brazil (Sao Paulo)** | **Canada (Ottawa)** | **China (Tianjin)** | **Columbia (Bogota)** | **Finland (Helsinki)** | **India (Bangalore)** | **Kenya (Nairobi)** | **Portugal (Porto)** | **RSA (Cape Town)** | **UK (Bath)** | **US (Baton Rouge)** |
| n | 5961 | 491 | 494 | 116 | 501 | 857 | 324 | 553 | 502 | 686 | 468 | 478 | 491 |
| Age (years) | 10.4 (0.6) | 10.7 (0.4) | 10.5 (0.5) | 10.3 (0.3) | 9.9 (0.5) | 10.5 (0.6) | 10.4 (0.4) | 10.4 (0.5) | 10.2 (0.7) | 10.4 (0.3) | 10.3 (0.7) | 10.9 (0.5) | 9.9 (0.6) |
| Gender (%) | | | | | | | | | | | | | |
| - boys | 46 | 56 | 49 | 41 | 52 | 49 | 48 | 46 | 46 | 44 | 39 | 44 | 41 |
| - girls | 54 | 54 | 51 | 59 | 48 | 51 | 51 | 54 | 54 | 56 | 61 | 56 | 59 |
| BMI (kg/m2) | | | | | | | | | | | | | |
| - boys | 18.5 (3.5) | 18.6 (2.9) | 19.9 (4.7) | 18.6 (3.1) | 19.8 (4.4) | 17.8 (2.6) | 17.5 (2.4) | 17.7 (3.4) | 17.1 (2.8) | 19.5 (3.5) | 17.7 (3.2) | 18.2 (2.7) | 18.7 (3.6) |
| - girls | 18.4 (3.5) | 19.1 (3.5) | 19.5 (4.2) | 18.4 (3.6) | 17.9 (3.6) | 17.4 (2.4) | 17.8 (2.6) | 18.2 (3.3) | 17.3 (3.3) | 19.4 (3.4) | 18.1 (3.8) | 18.7 (3.2) | 19.0 (4.1) |
| Weight status (%) | | | | | | | | | | | | | |
| - severe thinness | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| - thinness | 2 | 1 | 2 | 0 | 2 | 2 | 2 | 4 | 4 | 0 | 2 | 1 | 0 |
| - normal weight | 65 | 62 | 53 | 69 | 56 | 75 | 76 | 63 | 76 | 53 | 71 | 69 | 60 |
| -overweight | 21 | 27 | 23 | 16 | 17 | 17 | 17 | 22 | 13 | 29 | 16 | 21 | 22 |
| - obese | 13 | 10 | 22 | 15 | 25 | 6 | 6 | 11 | 7 | 17 | 11 | 9 | 18 |
| In-school activity (minutes) | | | | | | | | | | | | | |
| - sedentary | 236.3 (62.4) | 211.1 (32.0) | 194.6 (68.4) | 213.8 (32.2) | 307.0 (43.2) | 186.7 (48.7) | 156.5 (40.2) | 243.2 (38.4) | 316.3 (56.0) | 247.6 (34.9) | 246.4 (33.4) | 223.3 (31.4) | 273.9 (8.8) |
| - light | 132.1 (4.05) | 137.3 (25.4) | 135.6 (65.6) | 143.7 (28.0) | 145.2 (37.2) | 117.3 (35.0) | 98.7 (28.2) | 141.6 (33.9) | 175.7 (44.6) | 127.6 (29.1) | 114.4 (30.3) | 126.6 (25.3) | 128.6 (30.8) |
| - MVPA | 25.6 (13.8) | 34.1 (13.3) | 24.8 (18.7) | 30.8 (10.2) | 24.4 (11.2) | 23.9 (13.0) | 26.3 (12.1) | 24.8 (11.0) | 33.5 (17.0) | 29.7 (12.9) | 16.9 (8.2) | 28.0 (11.0) | 17.3 (8.8) |

Data reported as mean and standard deviation unless stated otherwise.

**Table 5.2.2** Descriptive statistics of schools

| | Site | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Overall** | **Australia (Adelaide)** | **Brazil (Sao Paulo)** | **Canada (Ottawa)** | **China (Tianjin)** | **Columbia (Bogota)** | **Finland (Helsinki)** | **India (Bangalore)** | **Kenya (Nairobi)** | **Portugal (Porto)** | **RSA (Cape Town)** | **UK (Bath)** | **US (Baton Rouge)** |
| General: | | | | | | | | | | | | | |
| n | 225 | 26 | 24 | 7 | 6 | 20 | 13 | 10 | 29 | 23 | 20 | 26 | 21 |
| Student teacher ratio | 21.6 (14.4) | 17.5 (3.0) | 28.0 (33.7) | 16.0 (2.8) | 12.3 (3.4) | 27.2 (9.4) | 14.3 (1.9) | 22.0 (13.2) | 27.9 (12.7) | 7.9 (1.6) | 34.8 (6.5) | 23.9 (3.7) | 14.2 (4.3) |
| School Policy and Socio-cultural Environment: Have written policies or practices concerning physical activity (%) | | | | | | | | | | | | | |
| - yes | 91 | 73 | 91 | 100 | 100 | 95 | 85 | 100 | 93 | 91 | 85 | 96 | 100 |
| - no | 9 | 27 | 9 | 0 | 0 | 5 | 15 | 0 | 7 | 9 | 15 | 4 | 0 |
| Offers at least one long break per day (≥30min) (%) | | | | | | | | | | | | | |
| - yes | 68 | 92 | 25 | 86 | 50 | 60 | 77 | 100 | 100 | 43 | 15 | 100 | 48 |
| - no | 32 | 8 | 75 | 14 | 50 | 40 | 23 | 0 | 0 | 57 | 85 | 0 | 52 |
| School Built Environment: Outdoor paved area (tennis courts, basketball courts, etc) (%) | 89 | 100 | 87 | 100 | 67 | 95 | 85 | 90 | 66 | 96 | 85 | 100 | 90 |
| Gymnasium (%) | 52 | 77 | 79 | 57 | 67 | 27 | 77 | 50 | 7 | 59 | 15 | 54 | 57 |
| Running track (%) | 46 | 54 | 4 | 43 | 83 | 19 | 46 | 90 | 79 | 61 | 25 | 50 | 29 |
| Aesthetics score (max 6) | 4.6 (1.3) | 5.2 (0.9) | 4.6 (1.2) | 3.9 (1.3) | 4.8 (0.4) | 3.8 (1.6) | 3.3 (1.1) | 4.4 (1.4) | 4.7 (1.2) | 3.7 (0.9) | 5.0 (0.8) | 5.7 (0.6) | 4.4 (1.2) |

Data reported as mean and standard deviation unless stated otherwise.

### 5.3.2 Principal component analysis

5.3.2.1 The built environment

Principal component analysis (PCA) of 24 variables related to the built environment was conducted on data gathered from 225 schools. 12 items (for example outdoor paved area that can be used for active games, running track and outdoor sports fields) were eliminated because they did not contribute to a simple component structure and failed to have a primary factor loading of 0.4. PCA of the remaining 12 items, using varimax rotation was conducted. All items had a primary loading over 0.4. An examination of the Kaiser-Meyer Olkin measure of sampling adequacy suggested that the sample was factorable (KMO = 0.615), above the recommended value of 0.50. The results are shown in Table 5.3.

Three items loaded onto factor 1. This factor loads onto the availability of secure lockers, changing rooms and showers at schools (alpha = 0.831), as shown in Table 5.3. Schools that had change rooms available and showers were more likely to have secure lockers. This factor was labelled 'change rooms'.

Playground markings, paved courts for sports, benches and picnic tables combined to form the second factor (alpha = 0.667). Schools with playground markings and paved courts were also likely to have benches and picnic tables. This factor was labelled 'play areas with supportive features'.

The three items that loaded onto factor 3 related to different types of green spaces (alpha = 0.455). Schools with vegetable gardens were more likely to have wildlife gardens and trees. This factor was labelled 'green space'.

The availability of soft or grassy play areas and playground equipment loaded onto the fourth factor (alpha = 0.497). Schools with grassy or soft surface play areas were more likely to have playground equipment. This factor was labelled 'soft surface play areas and play equipment'. Inter-factor correlations between the four factors ranged from -0.049 to 0.270.

**Table 5.3** Principal component analysis of built environment items

| Item | Component 1 | Component 2 | Component 3 | Component 4 |
|---|---|---|---|---|
| Bright markings on play surfaces | | 0.481 | | |
| Grassy or soft surface play area | | | | 0.667 |
| Playground equipment (e.g. swings, slide) | | | | 0.590 |
| Paved court for sport (e.g. tennis, basketball, netball) | | 0.464 | | |
| Lockers | 0.498 | | | |
| Change rooms | 0.597 | | | |
| Showers | 0.594 | | | |
| Benches | | 0.463 | | |
| Picnic tables | | 0.539 | | |
| Gardens designed to attract wildlife | | | 0.539 | |
| Vegetable garden | | | 0.610 | |
| Trees for sitting under | | | 0.477 | |
| Eigenvalues | 2.57 | 2.18 | 1.43 | 1.24 |
| Percentage of total variance (%) | 21 | 18 | 12 | 10 |
| Number of test measures | 3 | 4 | 3 | 2 |

*Note:* Factor loadings < 0.40 are suppressed.

5.3.2.1 The policy and socio-cultural environment

A PCA with varimax rotation of 8 variables related to the policy environment was conducted on data gathered from 225 schools. One item (use physical activity as a reward) was eliminated because it did not contribute to a simple component structure and failed to have a primary factor loading of 0.4. PCA of the remaining seven items, using varimax rotation was conducted. All items had a primary loading over 0.4. An examination of the Kaiser-Meyer Olkin measure of sampling adequacy suggested that the sample was factorable (KMO = 0.524), above the recommended value of 0.50. The results are shown in Table 5.4.

Three items loaded onto factor 1. Schools who allow the community access to school facilities after hours, are more likely to also allow students access to the school premises and do not use physical activity as punishment (alpha = 0.431). This factor was labelled ‘after-hour access’.

Four items loaded onto the second factor and related to the school culture surrounding physical activity (alpha = 0.341). Schools with a committee that oversees the development of policies or practices concerning physical activity were more likely to have written policies or practices concerning physical activity in place, to integrate physical activity into other curriculum areas and to promote physical activity during special events. This factor was labelled ‘policies and practices’. The inter-factor correlation between the two factors was -0.164.

**Table 5.4** Principal component analysis of policy and socio-cultural environment items

| Item | Component 1 | Component 2 |
|---|---|---|
| Written policies or practices concerning physical activity | | 0.495 |
| Committee that oversea or guide development of policies or practices concerning physical activity | | 0.575 |
| Promote physical activity during or as part of special events | | 0.404 |
| Integrate physical activity into other curriculum areas | | 0.489 |
| Do not use physical activity as a punishment for bad behaviour | 0.424 | |
| Allow students access to facilities after school hours | 0.501 | |
| Allow community groups to use school facilities outside of school hours | 0.653 | |
| Eigenvalues | 1.48 | 1.35 |
| Percentage of total variance (%) | 21 | 19 |
| Number of test measures | 3 | 4 |

*Note:* Factor loadings < 0.40 are suppressed.

### 5.3.3 Cluster analysis

#### 5.3.3.1 The built environment

A cluster analysis was carried out using components of the built and policy environments identified by the PCA. The number of clusters was selected by examining the dendrogram, PSF and PST2 statistics, and interpretability. Table 5.5 shows that school type 1 (cluster 1) was characterised by low scores on most of the components including change rooms, green space and soft surface play areas and play equipment, except for play areas with supportive features. Cluster 2 had low scores on change rooms, play areas with supportive features and soft surface play areas and play equipment and a high score for green space. Cluster 3 had high scores for change rooms, play areas with supportive features and soft surface play areas and play equipment, and a low score for green space. Cluster 4 had high scores for change rooms, green space and soft surface play areas and play equipment and a low score for play areas with supportive features.

**Table 5.5** Cluster analysis of built environment components

| | Cluster 1 (n=23) | | Cluster 2 (n=49) | | Cluster 3 (n=52) | | Cluster 4 (n=95) | |
|---|---|---|---|---|---|---|---|---|
| | **Score** | **Rank** | **Score** | **Rank** | **Score** | **Rank** | **Score** | **Rank** |
| Change rooms | -0.74 | L | -2 | L | -0.24 | H | 1.34 | H |
| Play areas with supportive features | -0.11 | H | -0.51 | L | 1.93 | H | -0.76 | L |
| Green space | -2.24 | L | 0.55 | H | 0.15 | L | 0.18 | H |
| Soft surface play areas and play equipment | -0.48 | L | -0.33 | L | -0.07 | H | 0.33 | H |

Ranking of H indicating the score ranked in the top two; L indicating the score ranked in the lowest two among the four clusters.

5.3.3.2 The policy and socio-cultural environment

Table 5.6 showed that cluster 1 was characterised by the highest score on policies and practices and the lowest score on after-hour access. Cluster 2 had the lowest score for policies and practices and a moderate score for after-hour access. Cluster 3 scored moderately on policies and practices and the highest for after-hour access.

**Table 5.6** Cluster analysis of policy and socio-cultural environment components

| | Cluster 1 (n=70) | | Cluster 2 (n=60) | | Cluster 3 (n=92) | |
|---|---|---|---|---|---|---|
| | **Score** | **Rank** | **Score** | **Rank** | **Score** | **Rank** |
| After-hour access | -0.75 | L | -0.68 | M | 1.02 | H |
| Policies and practices | 0.74 | H | -1.42 | L | 0.36 | M |

Ranking of H indicating the score ranked the highest; M indicating the score ranked in the middle; L indicating the score ranked the lowest among the three clusters.

### 5.3.4 Multilevel modelling analysis

5.3.4.1 The built environment

Table 5.7 presents results of the multilevel modelling using built environment components generated by PCA. Two of the components, supportive features and green space, were significantly

associated with in-school MVPA (p=0.001 and p=0.000, respectively). Play areas with supportive features and component 4 were not significantly associated with in-school MVPA.

**Table 5.7** Associations between components of the built environment and children's in-school moderate- to vigorous physical activity

| | In-school MVPA | |
|---|---|---|
| **Component** | **β (SE)[a]** | ***P*** |
| Change rooms | 0.06 (0.02) | **0.001** |
| Play areas with supportive features | -0.01 (0.02) | 0.718 |
| Green space | 0.09 (0.02) | **0.000** |
| Soft surface play areas and play equipment | 0.05 (0.03) | 0.056 |

[a] = multilevel model with gender, overweight and country as fixed effects, and school as a random effect. Bold = $P < 0.05$

5.3.4.2 The policy and socio-cultural environment

Table 5.8 presents results of the multilevel modelling using policy and socio-cultural environment components generated by PCA. None of the policy and socio-cultural environment components, namely after-hour access and policies and practices, were associated with in-school MVPA (p=0.186 and p=0.880, respectively).

**Table 5.8** Associations between components of the policy and socio-cultural environment and children's in-school moderate- to vigorous physical activity

| | In-school MVPA | |
|---|---|---|
| **Component** | **β (SE)[a]** | ***P*** |
| After-hour access | 0.03 (0.02) | 0.186 |
| Policies and practices | -0.00 (0.02) | 0.880 |

[a] = multilevel model with gender, overweight and country as fixed effects, and school as a random effect. Bold = $P < 0.05$

5.3.4.3 The built environment

Table 5.9 presents results of the multilevel modelling using clusters of the built environment generated by cluster analysis. Cluster 4 was used as reference group because it had high scores on most of the components and was represented by a large number of schools, which can lead to a more stable reference comparison. All three clusters (cluster 1, cluster 2 and cluster 3) were associated with significantly less in-school MVPA, compared to cluster 4 (p=0.000, p=0.029 and p=0.047, respectively).

**Table 5.9** Associations between clusters of the built environment and children's in-school moderate- to vigorous physical activity

| | In-school MVPA | |
|---|---|---|
| **Cluster** | **β (SE)[a]** | ***P*** |
| Cluster 1[b] | -0.37 (0.10) | **0.000** |
| Cluster 2 | -0.16 (0.07) | **0.029** |
| Cluster 3 | -0.16 (0.08) | **0.047** |

[a] = multilevel model with gender, overweight and country as fixed effects, and school as a random effect. Bold = $P < 0.05$. = reference group cluster 4

5.3.4.4 The policy and socio-cultural environment

Table 5.10 presents results of the multilevel modelling using clusters of the policy and socio-cultural environment generated by cluster analysis. This time, cluster 3 was used as reference group. There was no difference in the amount of in-school MVPA in schools in cluster 1, compared to cluster 3 (p=0.982), or in schools in cluster 2, compared to cluster 3 (p=0.457).

**Table 5.10** Associations between clusters of the policy and socio-cultural environment and children's in-school moderate- to vigorous physical activity

| | In-school MVPA | |
|---|---|---|
| **Cluster** | **β (SE)[a]** | ***P*** |
| Cluster 1[b] | 0.00 (0.07) | 0.982 |
| Cluster 2 | -0.05 (0.07) | 0.457 |

[a] = multilevel model with gender, overweight and country as fixed effects, and school as a random effect. Bold = $P < 0.05$. = reference group cluster 3

**South African specific perspective**

The analyses for this study were done on data collected from 12 countries, including South Africa. It is of interest to determine how South Africa compares to the other countries in terms of having a physical activity-permissive school environment. This section is purely descriptive, as South African data formed part of the index which was created. Table 5.10 shows the percentage of South African schools that had the individual items of each of the four built environment components present at the school. Less than a quarter of South African schools had change rooms, lockers and/or showers available. 73% of schools had at least one sport facility (paved court for sports) available, but less than half of South African school had additional supportive features such as playground markings (26%), benches (32%) and picnic tables (28%). South African school showed mixed availability of the green space items with the majority of schools having trees (78%), 30% had vegetable gardens and only 5% had gardens which were designed to attract wildlife. The majority of South African schools

had play facilities available (71% had grassy or soft surface play areas and 91% had playground equipment).

**Table 5.11** Prevalence of built environment items within each component at South African schools

| Item (%) | Component 1 | Component 2 | Component 3 | Component 4 |
|---|---|---|---|---|
| Bright markings on play surfaces | | 26 | | |
| Grassy or soft surface play area | | | | 71 |
| Playground equipment (e.g. swings, slide) | | | | 91 |
| Paved court for sport (e.g. tennis, basketball, netball) | | 73 | | |
| Lockers | 10 | | | |
| Change rooms | 24 | | | |
| Showers | 20 | | | |
| Benches | | 32 | | |
| Picnic tables | | 28 | | |
| Gardens designed to attract wildlife | | | 5 | |
| Vegetable garden | | | 30 | |
| Trees for sitting under | | | 78 | |

Data reported as percentages.

Table 5.12 shows the presence of policy and socio-cultural environment items at South African schools. All seven items were present at the majority of schools (> 50%).

**Table 5.12** Prevalence of policy and socio-cultural environment items within each component at South African schools

| Item (%) | Component 1 | Component 2 |
|---|---|---|
| Written policies or practices concerning physical activity | | 88 |
| Committee that oversea or guide development of policies or practices concerning physical activity | | 61 |
| Promote physical activity during or as part of special events | | 92 |
| Integrate physical activity into other curriculum areas | | 93 |
| Do not use physical activity as a punishment for bad behaviour | 80 | |
| Allow students access to facilities after school hours | 73 | |
| Allow community groups to use school facilities outside of school hours | 66 | |

Data reported as percentages.

## 5.4 DISCUSSION

The purpose of this study was to examine the associations between the school built environment and the school policy and socio-cultural environment with children's MVPA during the school day. To our knowledge, this is the first study investigating the relationship between the school environment and children's in-school MVPA on data collected in multiple countries. Four distinct dimensions of the school built environment emerged through principal component analysis. Two of these dimensions of the school built environment were positively associated with children's in-school MVPA. The one dimension was the availability of change rooms. There are limited data on the availability of change rooms (including showers and/or lockers) at schools and its association with children's in-school MVPA. One study by O'Dea (2003) investigating benefits and barriers to physical activity in children found that the girls suggested restructuring the showers and change rooms to have doors as a strategy to increase physical activity[284].

The second dimension positively associated with children's in-school MVPA was the availability of green space, which included such attributes as the presence of a wildlife garden, a vegetable garden and trees for sitting under. The majority of studies assessing the effect of green space on children's MVPA have been done in the neighbourhood and not in the school environment. For example, Janssen and Rosu (2015) found a positive association between the amount of areas with trees in the home neighbourhood and the self-reported physical activity of 11 to 13 year old children in Canada[285], while a study on German two to nine year olds found that the availability of green spaces in the neighbourhood had no effect on objectively measured MVPA[286]. Studies which have looked at the school environment, investigated the availability of open fields[54] or grassed surface[287], as opposed to gardens. Our findings are consistent with a previous study which found that school gardens significantly increased children's in-school MVPA[288].

Cluster analysis identified four school built environment types with different combinations of the identified school built environment dimensions. School environments with supportive features such as equipment[289], playground markings[290] and sports facilities[53] have been identified as positive physical activity correlates. Conversely, Nichol et al. (2009) have shown that the cumulative effect of the school built environment had a greater effect on children's physical activity than individual characteristics[291]. The findings from our study confirm this observation. We found that the school built environment type 4 (which had the highest availability of most of the school built environment dimensions) was associated with significantly more in-school MVPA compared to type 1 and 2 which both scored low on most of the school built environment dimensions. Furthermore, type 4 schools were also associated with significantly more in-school MVPA compared to type 3 schools. This is

interesting, because type 3 schools, similar to type 4 schools, scored high on the majority of the built environment dimensions, but in different combinations than type 4 schools. This suggests that the combination of characteristics in a cluster is an important determinant of the effects it will exert on children's in-school MVPA.

Principal component analysis derived two dimensions of the school policy and socio-cultural environment. Neither of these dimensions was associated with children's in-school MVPA. There are no systematic reviews on the effect of the school policy environment on children's physical activity, highlighting the need for more research on this topic. Cluster analysis identified three policy and socio-cultural school types. None of the school policy and socio-cultural types was associated with children's in-school MVPA. This finding is not too surprising as previous research found that a lack of physical activity policy was associated with higher participation in physical activity[53]. This is in contrast to previous work by Martin et al. who found a positive association between school policies and class-time physical activity[263]. This makes sense, seeing that the classroom environment and PE lessons are controlled environments with the teachers present as the decision makers. Recess and lunch breaks, conversely, are a time when children have more freedom to choose what they want to do[292] and have the opportunity to be outdoors – giving the children a chance to use or engage with factors of the school built environment. Children are also more active during recess and lunch breaks compared to the rest of the school day[293]. Furthermore, one of the items retained in the policy and socio-cultural environment is access to school premises after school hours. This is perhaps then not surprising that the policy component is not associated with in-school MVPA. Another important factor to consider is that the answers from the school principal are subjective. Taken together, this could explain why the school built environment were associated with children's MVPA over the entire school day, and why the school policy and social-cultural environment did not have a significant impact.

**A South African specific perspective**

Observations showed that South African schools appeared to be permissive of physical activity with high availability of physical activity promoting features including paved courts for sport, playground equipment and grassy/soft play areas. However, the availability of items within the two components which were significantly related to in-school MVPA (namely change rooms and green space) was low in South African schools. In contrast, the majority of South African schools had all items within the two policy components (namely, after-hour access and policies and practices) present, but these components were not significantly associated with children's in-school MVPA. This lack of availability

of physical activity promoting components could help to explain why the children from South Africa in ISCOLE recorded the lowest amount of in-school MVPA across all 12 countries.

**Strengths and Limitations**

A strength of this study is that it is an international study representing 12 countries from a range of different income settings. The index created with these analyses could be used in future research as a tool to assess the school environment, as well as an indication of areas to focus on in future physical activity interventions. A limitation of the study is that we only had a small number of items representing the policy and socio-cultural environment. This resulted in low Cronbach's alpha values for both dimensions obtained through principal component analysis. We then performed composite reliability as a different method of measuring internal consistency. Although the internal consistency improved, it was still considered poor (<0.6).

## 5.5 CONCLUSION

Changes in the school built environment may be used to increase children's in-school physical activity. More research is necessary on how the school policy environment influence children's in-school physical activity.

## Chapter 6:

# PERCEIVED AND OBJECTIVE NEIGHBOURHOOD SUPPORT FOR PHYSICAL ACTIVITY OUTSIDE OF SCHOOL IN SOUTH AFRICAN CHILDREN

In review:

**Uys M, Broyles ST, Draper CE, Hendricks MS, Rae D, Naidoo N, Katzmarzyk PT, Lambert EV**. Perceived and objective neighbourhood support for outside of school physical activity in South African children. *BMC Public Health*. In review.

## 6.1 RATIONALE

The preceding chapters focussed on the school environment, since children spend a large part of their day at school. However, results from the previous chapter showed that South African children engage in very low levels of in-school MVPA. Children have a significant amount of discretionary time after school[294] and on weekends which are not spent in the school setting. The neighbourhood environment could therefore also influence children's physical activity levels. In fact, environmental factors in the neighbourhood such as recreational facilities and parks have been shown to have a positive effect on children's physical activity levels[295], but there is limited South African and African data available on the neighbourhood environment and children's physical activity. This chapter will assess associations between children's objectively measured out-of-school physical activity and the neighbourhood environment.

It is recommended that children participate in at least 60 minutes of moderate-to-vigorous intensity physical activity (MVPA) per day[18]. The 2008 South African National Youth Risk Behaviour Survey found that only 29.3% of adolescents participated in sufficient moderate physical activity and 43.2% in sufficient vigorous physical activity to be beneficial to their health[296], indicating that the majority do not meet the physical activity recommendations.

The socio-ecological model posits that physical activity behaviour is determined both by individual factors as well as the social (e.g. family) and the built environment (e.g. neighbourhood)[156]. While the social and built environments of neighbourhoods have the potential to influence children's participation in physical activity[179,297,298], children's outdoor time has been shown to be controlled by parents to a great extent[299,300]. For this reason, neighbourhood characteristics, as well as parents' perceptions of these characteristics, may have an impact on children's level of physical activity[299,301].

Characteristics of the neighbourhood built environment that may be associated with physical activity include accessibility and distance to recreational facilities, opportunities to be physically active, as well as aesthetic qualities[302]. However, the distribution of and access to these physical activity-promoting facilities (for example, parks and playgrounds) are not always equal between areas of different socio-economic status (SES), and as such access to these facilities becomes an environmental justice issue[303].

The neighbourhood social environment characteristics which may be associated with physical activity include the perception of social disorder (a measure of neighbourhood safety including personal safety from crime and traffic) in their neighbourhood[304]. The perception of high social disorder in a neighbourhood may cause people to spend less time outdoors[304]. Datar et al. (2013)

showed that children whose parents perceived their neighbourhoods as unsafe watched more television and participated in less physical activity[177]. Similarly, O'Conner et al. (2014) found a positive association between parental perceptions of perceived traffic safety and structure for promoting child physical activity[305].

There are limited data available on parent perceptions of the neighbourhood environment and children's physical activity in countries with low-income settings. The objectives of this study were to (1) assess whether parents' perceptions of the neighbourhood environment were associated with children's out-of-school hours and weekend day MVPA, (2) assess whether objective measures of the neighbourhood environment were associated with children's out-of-school hours and weekend day MVPA, and (3) examine whether these associations differ between different income settings.

## 6.2 METHODS

### 6.2.1 Study design

The analyses presented here are based on data which were collected in Cape Town for the South African site of the International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE). ISCOLE was designed to determine relationships between lifestyle behaviours and obesity in a multi-country study of 9-11 year-old children, and to investigate the influence of characteristics such as behavioural settings, and physical, social and policy environments, on the observed relationships within and between countries. Data were collected at sites from 12 countries (~500 children per site) from five major regions of the world (Eurasia, Africa, Europe, Latin America, North America, and the Pacific)[114].

The project was presented to the Western Cape Education Department (WCED) for approval. Thereafter, schools were randomly selected within five SES strata. Schools are classified into quintiles by the WCED according to the SES of the surrounding neighbourhood, with quintile one representing the lowest SES and quintile five the highest. At least four schools were randomly selected from each stratum for a total of 20 schools. Children in Grade 4 and/or Grade 5 who were aged between nine and 11 years were invited to participate in the study.

Data were collected from April 2012 to May 2013, incorporating all four seasons. The study was approved by the Human Research Ethics Committee of the Health Sciences Faculty of the University of Cape Town (HREC REF: 288/2011). The principals provided approval for the study to be conducted at their school, and parents or guardians provided written informed consent for their children.

### 6.2.2 Participants and parents

A total of 550 children (327 girls, 223 boys) from 20 schools, aged 9-11 years old, participated in the South African arm of ISCOLE, of which 258 children (145 girls, 113 boys) remained in the analytical dataset after excluding participants without valid accelerometry (n=34), a valid home address reported by parents on the questionnaire (n=187) and annual family income reported by parents (n=71). The mean age was 10.2 (0.6) years. The children in the analytical sample were not different from the remainder of the sample, except for height and MVPA ($p<0.05$). Figure 6.1 presents a flow diagram of participants. The proportion of families from low income households and higher quintile schools were over-represented within the analytical sample compared to the rest of the sample ($P<0.01$). Parents were asked to sign consent forms for their children to participate in the study, and in the consent form it asked if the parents would be willing to complete three questionnaires.

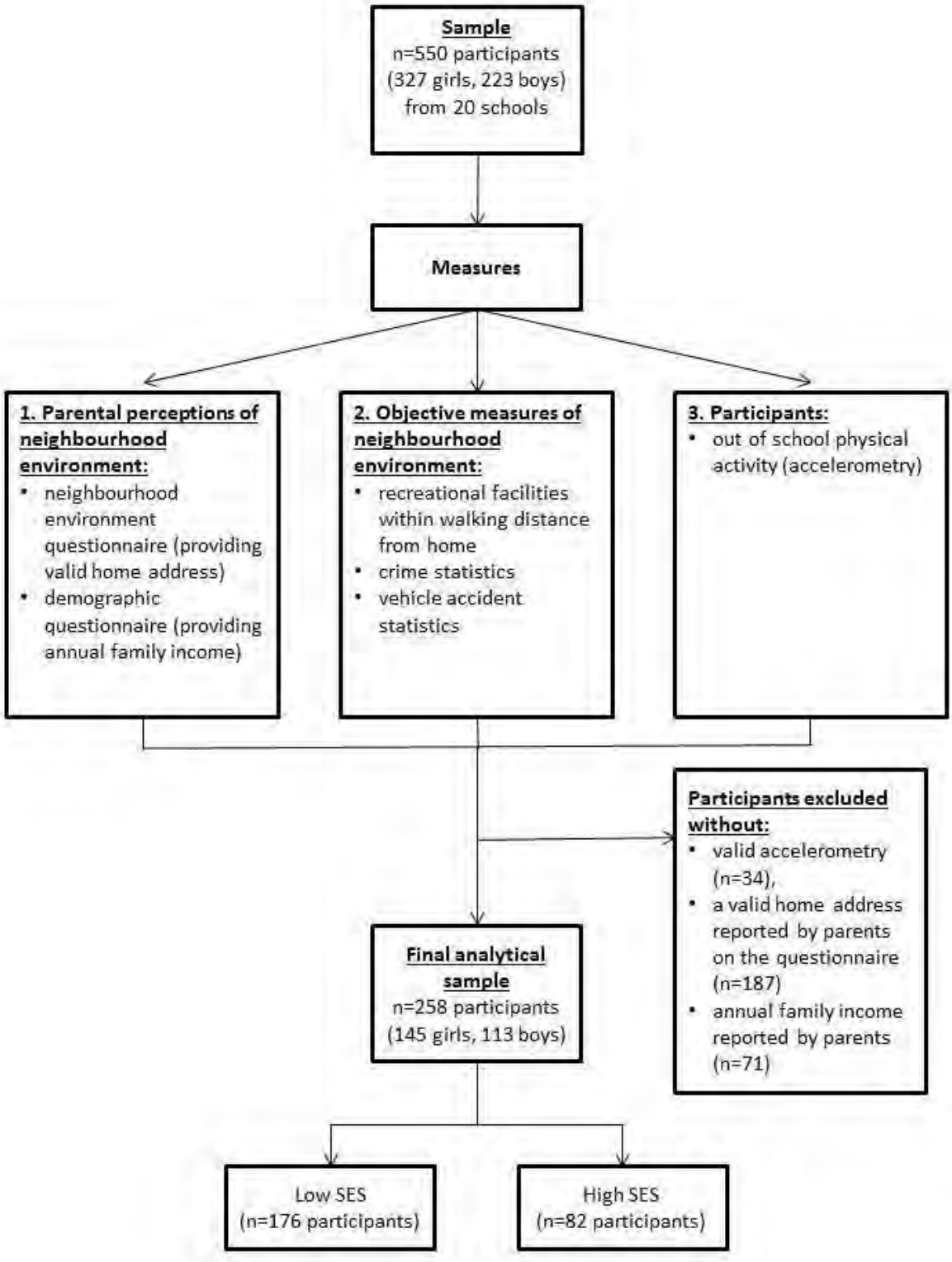


**Figure 6.1** Flow chart of study participants.

### 6.2.3 Demographic information

Parents or guardians completed a demographic and family health questionnaire developed for ISCOLE[114], which included information on basic demographics, ethnicity, family health and socio-economic factors. For this paper, we report on age, self-reported parental body mass index (BMI), parental education and parental employment status. Family income was used as a measure of SES. Participants were classified into one of four categories of annual income: < ZAR11500 (≈ < US$ 970.31; category 1), ZAR11500 – ZAR30000 (≈ US$ 970.31 - 2531.25; category 2), ZAR30001 – ZAR300000 (≈ US$ 2531.33 – US$ 25312.50; category 3) and > ZAR300000 (≈ > US$ 25312.50; category 4). The top two and bottom two categories were combined to derive low and high SES categories for analysis.

### 6.2.4 Physical activity measurements

#### 6.2.4.1 Objective physical activity measurement

Objective physical activity measurements were obtained using accelerometers (Actigraph GT3X+, Pensacola, Florida, USA). Children were asked to wear accelerometers for seven consecutive days (plus an initial familiarization day and the morning of the final day), including two weekend days. Accelerometers were attached to flexible belts and worn around the waist on the right hip at all times (including during sleep), except during bathing and other aquatic activities. After removal of sleep time using a validated algorithm[274], valid wear time was defined as at least four days with a minimum of 10 hours of awake wear time per day, including at least one weekend day. Data were processed using 15 second epochs. Physical activity intensity cut-points were applied to the data to determine the amount of time spent in MVPA. The MVPA cut-point was ≥ 574 counts per 15 second epoch[98]. Time spent in MVPA was calculated for before school and after-school periods on weekdays specific for each participant and school. Before school is considered from wake time until school start time, after-school is considered from school end time until bed time and weekend is a combination of Saturday and Sunday wake time until bed time.

#### 6.2.4.2 Mode of transport to school

Participants completed a diet and lifestyle questionnaire which included questions related to physical activity, sedentary behaviour, food consumption, sleep, health and well-being[114]. Participants were asked questions about their journey to school, including the mode of transport of the main part of their journey to school (‘walking’, ‘bicycle, roller-blade, skateboard or scooter’, ‘bus, train, tram, underground or boat’, ‘car, motorcycle or scooter’ or ‘other’) as well as how long it took them to travel to school (‘< 5 min’, ‘5-15 min’, ’16-30 min’, 31 min – 1 hour’, ‘> 1 hour’). Modes of

transport to school were grouped into active transport combining 'walking' and 'bicycle, roller-blade, skateboard or scooter'; and motorised transport which comprised of 'bus, train, tram, underground or boat' and 'car, motorcycle or scooter'. None of the participants selected the 'other' option.

### 6.2.5 Perceived neighbourhood and home environments

Parents or guardians completed a neighbourhood and home environment questionnaire, which was adapted from the Neighbourhood Impact on Kids (NIK) study survey[306] which drew on questions from other validated instruments[307-309]. The questionnaire included items related to neighbourhood social capital, the home social environment, the home and neighbourhood food environments, the home and neighbourhood physical activity environment, and neighbourhood built environment[114]. For this study, we used information on parents' perception about the neighbourhood environments relating to physical activity, as shown in Table 6.1. The following were derived from the neighbourhood and home environment questionnaire:

**Table 6.1** Questionnaire items used to construct parent perceptions

| Perceptions | Scale* | Items |
|---|---|---|
| **Proximity to community facilities** | 1-5 min, 6-10 min, 11-20 min, 21-30 min, >30 min, and don't know | Parents estimated the length of time it took to walk from home to the nearest sporting venues, recreational facilities and parks by selecting one of six options |
| **Neighbourhood safety** | Four-point scale ranging from strongly disagree=0 to strongly agree=3 | 1. 'There is a high crime rate'<br>2. 'Streets have good lighting at night'<br>3. 'I'm afraid of my child being taken or hurt by a stranger on local streets'<br>4. 'I'm afraid of my child being taken or hurt by a stranger in my yard, driveway, or common area'<br>5. 'I'm afraid of my child being taken or hurt by a stranger in a local park'<br>6. 'I'm afraid of my child being taken or hurt by a known "bad" person (adult or child) in my neighbourhood'<br>The one positive question (#2) was reverse coded so that a high score for neighbourhood safety indicated a perceived unsafe neighbourhood. |
| **Traffic safety** | Four-point scale ranging from strongly disagree=0 to strongly agree=3 | 1. 'The speed of traffic on most streets is usually slow (50 kph or less)'<br>2. 'Most drivers go faster than the posted speed limits'<br>3. 'The traffic makes it difficult or unpleasant for my child to walk'<br>4. 'There are crosswalks and robots (traffic lights) on busy streets'<br>Negatively phrased questions (#2 and 3) were reverse coded so that a high traffic safety score indicated that the neighbourhood's roads were perceived as safe. |
| **Walkability** | Four-point scale ranging from strongly disagree=0 to strongly agree=3 | 1. 'There are shops, stores, markets and places to buy things I need within easy walking distance of my home/house'<br>2. 'There is a bus, taxi, or train stop within walking distance from my home'<br>3. 'There are sidewalks on most streets'<br>4. 'There are many different routes for getting from place to place' |

| | | |
|---|---|---|
| | | 5. 'There are many interesting things to look at while walking in my neighbourhood'<br>6. 'There are many places to go within easy walking distance from my home' |
| **Social cohesion** | **Section 1:**<br>Five-point scale ranging from strongly disagree=0 to strongly agree=4 | **Section 1:**<br>1. 'People around my neighbourhood are willing to help their neighbours'<br>2. 'This is a close-knit neighbourhood'<br>3. 'People in my neighbourhood can be trusted'<br>4. 'People in my neighbourhood generally don't get along with each other'<br>5. 'People in my neighbourhood do not share the same values, attitudes or beliefs'. Negatively phrased questions were reverse coded.<br>Negatively phrased questions (#4 and 5) were reverse coded |
| | **Section 2:**<br>Four-point scale ranging from not at all=1 to extremely well=4 for item 1; seven-point scale from never=0 to almost every day=7 for item 2, which were collapsed into a five-point scale to be consistent with the other items | **Section 2:**<br>1. 'In general, how well do you feel you know your neighbours?'<br>2. 'About how often do you talk to or visit your immediate neighbours (people in the 10-20 households that live closest to you)?' |
| | **Section 3:**<br>Five-point scale ranging from very unlikely=0 to very likely=4 | **Section 3:**<br>1. 'If a group of neighbourhood children were skipping school and hanging out on a street corner, how likely is it that your neighbours would do something about it?'<br>2. 'If some children were spray-painting graffiti on a local building, how likely is it that your neighbours would do something about it?'<br>3. 'If a child was showing disrespect to an adult, how likely is it that people in your neighbourhood would scold that child?'<br>4. 'If there was a fight in front of your house and someone was being beaten or threaten, how likely is it that your neighbours would break it up?'<br>5. 'Suppose that because of budget cuts the fire station closest to you home was going to be closed down by the city. How likely is it that neighbourhood residents would organise to try to do something to keep the fire station open?' |
| **Family support for physical activity** | Never, 1-2 days, 3-4 days, 5-6 days, every day | 'How often do you or another adult in the household:<br>1. watch your child participate in physical activity or sports;<br>2. encourage your child to do sports or physical activity;<br>3. provide transport to a place where your child can do physical activity or<br>4. play sports and do a physical activity or play sports with your child'. |

*Scales were derived from Rosenberg et al., 2009, Saelens et al., 2012, Sallis et al., 2010, Sampson et al., 1997

### 6.2.6 Objectively measured neighbourhood environment

#### 6.2.6.1 Facilities for physical activity

Geographic Information Systems (GIS) (ArcGIS version 10.1)[310] were used to identify the presence of facilities for physical activity (sporting venues, recreational facilities and parks) within a residential

buffer. The source of the point data were the City of Cape Town. A 500 m radial buffer was created around each participant's home address as this distance is between one-third and one-quarter mile, a distance that provides easy access (~10 min of travel time) for children travelling on foot or bike[311,312].

6.2.6.2 Neighbourhood safety

Crime statistics for the 2012/2013 period for the neighbourhood in which each address is located were obtained from www.crimestatsa.com, which provides annual crime statistics released by the South African Police Service (SAPS). The sample represented nineteen neighbourhoods. The number of children per neighbourhood ranged from two to 45. The crime statistics used were the annual number of all crimes (including contact and contact-related crime, property-related crime, crime detected as result of police action and other serious crimes) broken down by neighbourhood.

6.2.6.3 Traffic risk

The numbers of motor vehicle accidents for the neighbourhood (by police precinct) in which each address is located during the study period (April 2012-May 2013) were obtained from the Transport for Cape Town Division of the City of Cape Town. The sample represented nineteen police precincts and the number of children per police precinct ranged from two to 47.

### 6.2.7 Data Analysis

The children of the sub-group comprised of parents who completed the questionnaires, reported on neighbourhood perceptions, annual family income and provided a valid home address were compared to the remainder of the sample, using independent t-tests for body composition and objectively measured physical activity levels. The families were compared for income levels and school quintiles using Chi Square analysis.

Descriptive statistics were computed for children's physical activity data. Multilevel linear regression models were used to determine the association between parents' perceptions of the neighbourhood environment and accelerometry-based MVPA minutes at three different time points: before school, during after-school hours and weekend days. Models were adjusted for age, gender, SES (as measured by family income) with school incorporated as a random effect. Similar models were used to determine associations between the objective neighbourhood environment and MVPA before school, during after-school hours and weekend days. To test the interaction between neighbourhood constructs (perceived and objective) and SES, the cross-product term of both variables was included in the models. When a significant interaction was found, separate models

were fitted for high and low SES. All analyses were performed using Stata (v.12, StataCorp, Texas, USA). Data reported as beta coefficient and standard error. Results were considered significant at $p < 0.05$.

## 6.3 RESULTS

### 6.3.1 Parent characteristics

Data were collected from 258 parents. The mean age of mothers was 37.8 ± 5.9 years and 41.0 ± 6.2 years for fathers. The mean BMIs for mothers and fathers were 28.3 ± 7.0 and 28.8 ± 5.0 kg/m$^2$, respectively. A total of 33% of mothers and 14% of fathers were employed full-time respectively. The majority of families (38%) had more than two children at home, and 67% of parents were currently married.

### 6.3.2 Children's physical activity

On average, participants engaged in 6 ± 4 min of MVPA before school and 39 ± 19 min after-school so that their total out-of-school MVPA on week days was 45 ± 20 min. On weekend days, participants accumulated 62 ± 33 min of MVPA. The participants' out-of-school and weekend MVPA levels taking into account SES are presented in Table 6.2. Furthermore, 66% of children in the low SES travelled to school using active transport, compared to 31% of children in the high SES group.

**Table 6.2** Moderate-to-vigorous intensity physical activity of low and high SES participants before and after school and on weekends

| | Minutes of MVPA | | |
|---|---|---|---|
| **Time-point** | **Low SES (n=176)** | **High SES (n=82)** | **Overall (n=258)** |
| Before school (min/day) | 6 ± 5 | 6 ± 4 | 6 ± 4 |
| After school (min/day) | 39 ± 19 | 36 ± 16 | 38 ± 18 |
| Weekend days (min/day) | 62 ± 33 | 57 ± 29 | 61 ± 32 |

Data are presented as mean ± SD. MVPA = moderate- to vigorous-intensity physical activity; SES = socio-economic status

### 6.3.3 Parents' perceptions of the neighbourhood environment and children's MVPA

The data presented in Table 6.3 indicate that there were no associations between parental perceptions of the neighbourhood environment and children's MVPA at all three time-points, except for the perception of neighbourhood physical activity related facilities and before school MVPA (p =

0.003). In addition, we found a significant interaction with SES at this time-point ($p = 0.005$) with a significant, positive association between before school MVPA and the number of neighbourhood perceived physical activity facilities in the low SES group ($\beta = 1.47$, $p = 0.005$). In contrast, this association in the high SES group was not significant ($\beta = -0.19$, $p = 0.554$).

**Table 6.3** Associations between parental perceptions of the neighbourhood environment and children's moderate- to vigorous-intensity physical activity before and after school, and on the weekend

| | MVPA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Before | | | After | | | Weekend | |
| **Perceptions** | **β (SE)[a]** | ***P-value for main effect*** | ***P-value for SES interaction*** | **β (SE)[a]** | ***P-value for main effect*** | ***P-value for SES interaction*** | **β (SE)[a]** | ***P-value for main effect*** | ***P-value for SES interaction*** |
| Unsafe neighbourhood | -0.7 (0.10) | 0.485 | 0.703 | -0.37 (0.42) | 0.383 | 0.649 | -0.73 (0.76) | 0.339 | 0.907 |
| Traffic safety | 0.14 (0.17) | 0.430 | 0.511 | -0.32 (0.70) | 0.644 | 0.599 | -0.81 (1.28) | 0.526 | 0.807 |
| Walkability | 0.13 (0.11) | 0.241 | 0.184 | 0.70 (0.43) | 0.105 | 0.138 | 0.61 (0.79) | 0.438 | 0.358 |
| Social cohesion | -0.05 (0.04) | 0.205 | 0.954 | -0.01 (0.17) | 0.955 | 0.927 | -0.06 (0.31) | 0.853 | 0.795 |
| Availability of PA facilities[*] | 1.50 (0.51) | **0.003** | **0.005** | 0.96 (2.26) | 0.672 | 0.926 | -1.57 (4.18) | 0.706 | 0.244 |

Data reported as beta coefficient and SE. [a] Associations between each independent variable and the dependent variable, adjusted for child age and sex, SES, and clustering by school. PA = physical activity; MVPA = moderate- to vigorous-intensity physical activity; SES = socio-economic status *Number of PA facilities within a ~10 min walk from home. P-values were determined by $p < 0.05$.

### 6.3.4 Objective measures of the neighbourhood environment and children's MVPA

Table 6.4 shows that none of the objective measurements of the neighbourhood environment, including an unsafe neighbourhood, lack of traffic safety and the availability of physical activity related facilities were associated with children's MVPA before school ($p = 0.582$, $p = 0.379$ and $p = 0.935$, respectively). After-school MVPA, however, was significantly inversely associated with an unsafe neighbourhood ($p = 0.044$) and traffic risk ($p = 0.038$), but not with the presence of PA facilities ($p = 0.893$). In addition, unsafe neighbourhoods and traffic risk both had a significant SES interaction. Children in the low SES group were less active in unsafe neighbourhoods ($\beta = -3.38$, $p = 0.040$) and areas with high traffic risk ($\beta = -3.76$, $p = 0.020$), while no such relationship was found in the high SES group ($\beta = 2.00$, $p = 0.112$ and $\beta = 1.49$, $p = 0.227$, respectively). MVPA during weekend days was not associated with any of the objective neighbourhood measures ($p = 0.950$, $p = 0.994$ and $p = 0.284$, respectively).

**Table 6.4** Relationship between objective measurements of the neighbourhood environment and children's moderate- to vigorous-intensity physical activity before and after school, and on the weekends

| Objective measurements | MVPA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Before** | | | **After** | | | **Weekend** | | |
| | **β (SE)[a]** | ***P-value for main effect*** | ***P-value for SES interaction*** | **β (SE)[a]** | ***P-value for main effect*** | ***P-value for SES interaction*** | **β (SE)[a]** | ***P-value for main effect*** | ***P-value for SES interaction*** |
| Unsafe neighbourhood (crime rates) | -0.53 (0.34) | 0.121 | 0.582 | -2.72 (1.35) | **0.044** | **0.021** | -2.44 (2.43) | 0.315 | 0.661 |
| Traffic risk (motor vehicle accidents) | -0.35 (0.33) | 0.288 | 0.379 | -2.63 (1.26) | **0.038** | **0.048** | -1.89 (2.26) | 0.404 | 0.831 |
| Availability of PA facilities* | -0.06 (0.05) | 0.267 | 0.935 | -0.03 (0.21) | 0.893 | 0.288 | -0.44 (0.38) | 0.248 | 0.090 |

Data reported as beta coefficient and SE. [a] Associations between each independent variable and the dependent variable, adjusted for child age and sex, SES, and clustering by school. PA = physical activity; MVPA = moderate- to vigorous-intensity physical activity; SES = socio-economic status * the actual number of PA facilities within 500 meters from home objectively measured using Geographic Information Systems. P-values were determined by $p < 0.05$.

### 6.3.5 Family support for physical activity

Table 6.5 shows the results of the multilevel modelling analysis to determine whether or not there were any associations between family support and the children's MVPA outside of school hours. None of the measurements of family support were associated with MVPA before school on weekdays or on weekend days. Providing transport to a place where children can do PA or play sports was, however, significantly associated with children's after-school MVPA ($p = 0.026$), independent of SES.

**Table 6.5** Relationship between family support for physical activity and children's moderate- to vigorous-intensity physical activity before and after school, and on the weekends

| Family support | MVPA | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Before | | | After | | | Weekend | | |
| | β (SE)[a] | *P-value for main effect* | *P-value for SES interaction* | β (SE)[a] | *P-value for main effect* | *P-value for SES interaction* | β (SE)[a] | *P-value for main effect* | *P-value for SES interaction* |
| Watch your child participate in PA or sports | 0.06 (0.29) | 0.837 | 0.273 | 0.89 (1.15) | 0.440 | 0.512 | 0.22 (2.08) | 0.915 | 0.111 |
| Encourage your child to do sports or PA | 0.25 (0.25) | 0.316 | 0.204 | 1.01 (0.99) | 0.307 | 0.180 | -0.41 (1.82) | 0.821 | 0.297 |
| Provide transport to a place where your child can do PA or play sports | -0.11 (0.28) | 0.703 | 0.406 | 2.41 (1.08) | **0.026** | 0.460 | 2.32 (2.02) | 0.251 | 0.742 |
| Do a physical activity or play sports with your child | 0.06 (0.29) | 0.845 | 0.319 | 1.56 (1.14) | 0.172 | 0.873 | 1.85 (2.08) | 0.373 | 0.550 |

Data reported as beta coefficient and SE. [a] Associations between each independent variable and the dependent variable, adjusted for child age and sex, SES, and clustering by school. PA = physical activity; MVPA = moderate- to vigorous-intensity physical activity; SES = socio-economic status P-values were determined by $p < 0.05$.

## 6.4 DISCUSSION

It is important to understand the association between the neighbourhood environment and the extent to which children accumulate MVPA outside of school hours to design targeted interventions to increase physical activity. The majority of studies on neighbourhood safety have focused on parental perceptions of safety rather than objective measures[313], as shown in a systematic review indicating that low levels of physical activity among children in their neighbourhood are associated with a lack of perceived neighbourhood safety[314]. And it has been argued that subjective ratings of crime are a stronger predictor of behaviour than actual crime rates[181]. In contrast, we found no association between any of the parental perceptions of neighbourhood safety, traffic safety, walkability and social cohesion and children's MVPA. This is consistent with more recent research from high income countries by Carson et al. (2010) who also found no association between perceived neighbourhood safety and children's physical activity[315] and D'Haese et al. (2013) who did not find associations between perceptions of traffic safety, stranger danger, places to be physically active or sports venues and children's MVPA[172].

In this study, we found a significant, positive association between the parents' perception of the number of facilities available for physical activity in the neighbourhood and before-school MVPA. This effect was moderated by SES, such that the positive association was only present in the low SES group. Our results showed that children in the high SES group had more access to motorised transport (61%), while the majority of children in the low SES group (66%) travelled to school using active transport, allowing the children in the low SES group the opportunity, or at least the perception thereof, to use physical activity facilities on their way to school[316].

Objective measures of both neighbourhood safety and traffic risk were negatively associated with after-school MVPA. That is, children engaged in less MVPA after school in areas with higher crime rates and greater traffic risk. This is similar to a recent study in Canada that found that objective measures of neighbourhood safety and crime were independently associated with physical activity in free-time outside of school[317], and another study found significant inverse associations between objectively measured crime rates and outdoor physical activity in girls but not in boys[185]. We also found that SES had a significant moderating effect on these two objectively measured constructs (neighbourhood safety and traffic risk). The low SES group participated in significantly less MVPA after school in neighbourhoods which were unsafe and had a high traffic risk. Neighbourhood safety and traffic risk were unrelated to MVPA in the high SES group. Children in low SES neighbourhoods don't always have the opportunity to be a member at a sports club, due to high costs[318] and are more likely to engage in less organised or more informal forms of physical activity, compared to

children in high SES neighbourhoods. For this reason, characteristics of the neighbourhood environment are probably more important for enabling physical activity in low SES neighbourhoods. These results indicate that although the perceived environment has been found to be important in some studies, in the present study, only the objective neighbourhood environment was significantly associated with children's MVPA, and therefore might have a bigger influence, at least in this setting. Furthermore, there were no associations between the objective neighbourhood environment and weekend day MVPA. This is an interesting observation and may be attributed to the time of activity. On weekend days children have more freedom about when they choose to engage in physical activity, while during the week, they have specific after-school periods when they can be active in the neighbourhood, and this could be periods where there is more traffic in the neighbourhood as opposed to quieter weekends.

In contrast to previous research[319-321], we found family support for physical activity (watching child do physical activity, providing encouragement and doing physical activity with child) to be unrelated to children's out-of-school MVPA. We found a significant, positive association between providing transport to places for physical activity or sport and after-school MVPA, but not before school or on the weekends. A possible reason for this lack of association with family support could be due to the fact that parents are burdened with work commitments and do not have time to support their children in doing physical activity.

**Strengths and Limitations**

A limitation of this study is that we can't exclude bias as the analyses only included participants whose parents returned their questionnaires, reported their annual family income and provided a valid home address which could be geocoded. The sample slightly over-represented the low income group, particularly in higher income schools. Furthermore, the study has a cross-sectional design, which limits inferences about cause-and-effect relationships. A strength of this study is the use of both perceived as well as objectively measured neighbourhood constructs. The use of objectively measured physical activity as opposed to self-report physical activity further strengthens this study.

**Practical Implications**

Results of this study found differences in associations between the objective neighbourhood environment and MVPA for weekdays and weekend days. This could mean that timing of interventions might be an important factor. For example, interventions designed to increase out-of-school MVPA could incorporate a strategy to get children active in periods with heavy traffic (afternoons), or introduce traffic calming near schools in the afternoon, while this might be less

important for interventions aiming to increase MVPA during weekends when children can move any time of day and are not restricted to periods with heavy traffic.

## 6.5 CONCLUSION

Future interventions for the promotion of physical activity in children may need to focus more strongly on modifying aspects of the neighbourhood environment rather than trying to influence parent's perceptions about their neighbourhoods and greater attention should be given to low SES areas.

# Chapter 7:

# SUMMARY AND CONCLUSIONS

## 7.1 SUMMARY

A marked decrease in the prevalence of children meeting recommended physical activity guidelines has been observed around the world[322]. There is clearly a need to implement school-based interventions aiming to increase physical activity levels of children. In order to design effective interventions, we need to understand which factors influence children's physical activity. The main objectives of this thesis were to assess the effectiveness of a school-based, curriculum-grounded, educator-focused intervention to increase physical activity and healthy eating in South African primary school students in low income settings on fitness levels and physical activity related knowledge, attitudes and behaviour (Chapter 2) and to assess which factors of the school environment influences physical activity in children (Chapter 3-5). Furthermore, this thesis aimed to assess the influences of parental perceptions and the neighbourhood environment on children's physical activity (Chapter 6).

The first study in this thesis reports findings of one of the first multicomponent, whole-of-school primary school interventions in South Africa, HealthKick. Multicomponent school-based interventions have been shown to be most successful[131,132]. The HealthKick intervention included multiple components and was specifically designed as a low-touch intervention, so that the programme would be sustainable and easily disseminated to other schools. We were, however, unable to show any significant effects of this intervention in a low-income South African primary school settings, where teachers are faced with challenges including frequent curriculum changes[225] administrative burdens and limited resources[119].

The findings of Chapter 2 led us to explore which factors of the school environment influence children's physical activity in the subsequent chapters. In Chapter 3 we observed children's physical activity during break-times in order to determine factors that influence this activity in low-income South African settings. The main findings of this study were that children's break-time physical activity was adversely affected by the presence of supervision and high density of playground areas. The finding that supervision negatively affected physical activity was surprising, as other studies have found supervision to have a positive association with physical activity[68,72]. This once again highlights that factors influencing physical activity in schools may have different effects in different settings, and these differences should be taken into account when designing future interventions.

Following on from the findings in Chapter 3, we further explored the school environment in Chapter 4, by assessing the extent to which the school environment (both built and policy) was associated with children's physical activity-related knowledge, attitudes and behaviours in low-income South

African settings. We found that the availability of facilities and policies/practices concerning physical activity at schools were associated with children's physical activity behaviour in these settings.

Previous studies have found that various individual factors (for example playground markings[68]) are associated with children's physical activity. In Chapter 5, associations between the school built and policy environment on children's objectively measured in-school physical activity were assessed across 12 countries, as part of the ISCOLE study. This is the first study of its kind to include a standardised school environmental audit from countries from different regions of the world and representing different levels of socio-economic and human development across countries and income levels within countries, along with objectively measured, in-school physical activity in children. The main findings of this study were that physical activity-related characteristics of the school environment have a cumulative effect on children's physical activity and that the built environment was more strongly associated with children's physical activity than the school policy environment. An important finding was that South African children had very low levels of in-school MVPA, in fact, the lowest of all the countries in ISCOLE. This highlights the importance for studies assessing the school environment in South Africa.

The last chapter focussed on other levels of the socio-ecological model, specifically factors within the neighbourhood environment that could influence how children choose to spend their time. We reasoned that parents control their children's activities to a large extent[299]. For this reason, associations between parents' perceptions of the neighbourhood environment as well as objective measures of the neighbourhood environment and children's objectively measured out-of-school MVPA were assessed in Chapter 6. This was the first study using objective measures of personal safety (crime statistics) and traffic safety (official statistics of motor vehicle accidents) in relation to physical activity levels in South Africa. The main findings of this study were that objective measures of the neighbourhood environment were more strongly associated to children's MVPA than parents' perceptions, and that these measures differed between SES groups.

Figure 7.1 provides an overview of the findings from this thesis and how it fits in with the socio-ecological model. The school policy environment (policy level) affected physical activity in South African children - physical activity decreased during break times with the presence of supervision. In a multinational sample, however, there were no association between the school policy environment and in-school physical activity. The neighbourhood environment (physical environment level) (specifically safety from crime, and safety from traffic) was significantly associated with children's' out-of-school MVPA. When we consider the social environment, parents' perceptions of the neighbourhood environment had no association with children's out-of-school physical activity.

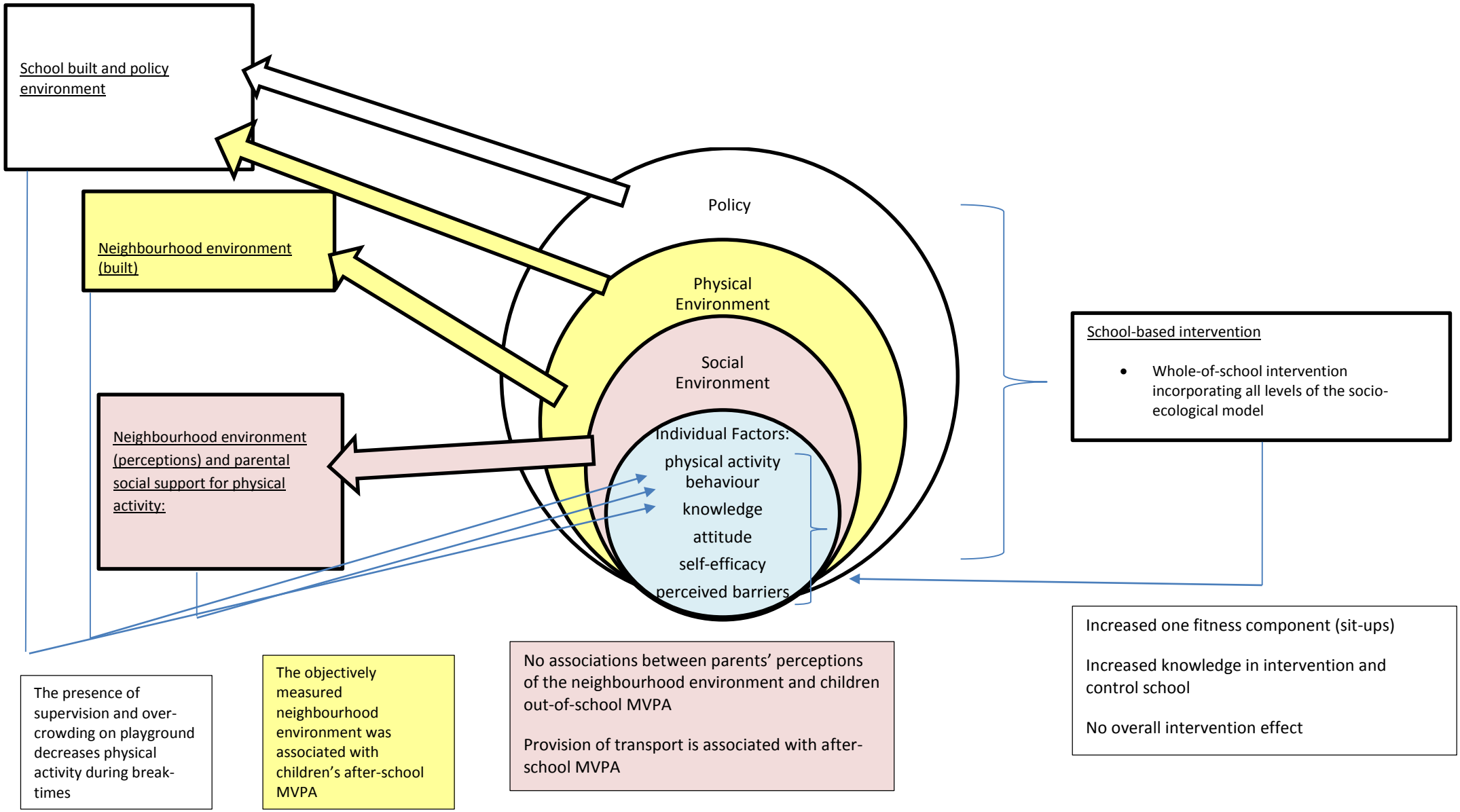


**Figure 7.1** Summary of the main findings of this thesis in relation to the ecological model in a South African setting

**Limitations of studies**

There are some limitations to the studies presented in this thesis. Firstly, there were some of issues with measurements used. These include self-reported physical activity and limited validity and reliability of the formative assessment. The design of one of the studies was another limitation – the second study used a quasi-experimental design. Another limitation was that the process evaluation used for the HealthKick intervention focussed mainly on the teachers and did not measure the process very well with respect to participants. This was due to the fact that the intervention was mainly designed around the teachers and creating an environment permissive to physical activity and did not intervene on the participants directly. Limitations of the last study is that we can't exclude bias as the analyses only included participants whose parents returned their questionnaires, reported their annual family income and provided a valid home address which could be geocoded, the sample slightly over-represented the low income group, particularly in higher income schools and the study has a cross-sectional design, which limits inferences about cause-and-effect relationships.

## 7.2 CONCLUSION

Together, these studies have identified factors of the school and neighbourhood environment which influence physical activity in children. These findings can be used to help direct future interventions aimed at increasing physical activity in children. Furthermore, these findings could be used to change South African school policies to increase physical activity in schools.

## 7.3 RECOMMENDATIONS FOR FUTURE RESEARCH AND TARGETED INTERVENTIONS

Based on the findings of this thesis, it may be beneficial to conduct additional formative research on a broader sample of South African schools (primary, and high school, different provinces and high and low income areas), and to consider the constructs that are mutable or most likely to be amenable to targeted interventions, as well as objectively measured children's physical activity is warranted. This approach would provide largely confirmatory evidence. However, the results of the current series of studies also provide some insight and direction for intervention targets, which may be implemented and subsequently evaluated.

One suggestion is to focus on the school environment. Based on findings of this thesis and previous research, one intervention that is likely to be effective is to target and upgrade playgrounds to include features which have been associated with children's physical activity (for example, green

space, playground markings and sports fields, and to ensure that loose equipment is available to children). Even small, inexpensive changes to the school environment can even be achieved in low-income settings, for example playground markings, tyres, and loose equipment, and vegetable gardens. There is a need for evaluation for the implementation of school-based interventions.

The school policy environment has been shown to be important in one of the chapters in South African schools, but not in the multicountry study. For example, findings of this thesis showed that the presence of supervision influenced observed physical activity during break time. South Africa actually have very good policies in place and it is a requirement in the national school curriculum document to offer weekly PE. It is the implementation thereof which is problematic. Teachers feel overwhelmed since a substantial number of teachers responsible for administering physical education in the curriculum are not qualified PE teachers[119].

Capacity building should be made a priority for principals and the South African National Department of Basic Education[323]. Teacher in-service training to facilitate children's physical activity during physical education classes, during and in-between classes and at break time, can be developed.

Lastly, it has been suggested that future school-based interventions should also have a strong parent component. While previous studies have shown that parents control their children's out-of-school physical activity to a great extent, and this is influenced by their perceptions of the neighbourhood environment, this finding was not strongly supported in the present study. In this case, while parents' perceptions of the neighbourhood environment were not always aligned with reality, the actual environmental constraints for physical activity were, indeed real, and were associated inversely, in particular, in low income settings. Parents could be informed of the influence of the neighbourhood environment on children's physical activity and the role they could play in encouraging their children to be physically activity and provide other forms of support (for example providing transport to physical activity facilities and doing physical activity with their children). Moreover, parents should be encouraged to participate in social mobilisation to ensure more activity-permissive environments within their neighbourhoods, through engagement with local safety and security authorities to ensure a local visible presence to reduce crime, urban planners and transport authorities, to consider neighbourhood lighting, green space and traffic calming and to increase the availability of recreational spaces. However, parents should be informed about this, especially in low-income areas where education levels are low.

This dissertation, focusing on childhood physical activity, from a South African perspective was structured using the socio-ecological model as a unifying framework. This same framework provides the means on which to build and test targeted interventions, with the emphasis on capacity-development and an activity-permissive environment in schools. It also provides a framework towards addressing issues of environmental justice in the neighbourhoods, particularly in low income communities going forward.

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**APPENDICES**

Appendix 1

# Information and consent for learners

## HealthKick Programme for Healthy Eating and Physical Activity in Primary Schools

August 2011

Dear Parent/Guardian

As you may know, the Medical Research Council, in partnership with the University of Cape Town and the Human Sciences Research Council, is involved in a school-based programme to help learners, teachers and parents improve their lifestyles. The **HealthKick** programme is sponsored by the World Diabetes Foundation. To understand the needs of our learners and teachers, and whether or not the programme is working, we are interested in finding out what learners think and know about healthy eating and physical activity. To enable us in doing this we are asking your permission to obtain the following information from your child in Grade 6:

- Weight and height measurements. They will only have to take off their shoes.
- Answer questions about healthy eating and physical activity. This is not a test but will be done in the class under supervision of the teacher and researchers.
- We also want to measure learners' fitness. Therefore, we are inviting them to participate in a youth fitness measurement.

*The researchers who do the measurements are very well trained and your child will not be harmed at all. The measurements include: a 5-metre shuttle run, sit-ups performed in 30 seconds, a standing long jump and sit and reach seated stretching. These will not take longer than 20 minutes to complete.*

This study has been approved by the Ethics Committee of the University of Cape Town, which makes sure that the research is acceptable, that there is no or minimal risk for any participating child and that nobody is forced to take part in a study. All information obtained will be processed confidentially without revealing any child's identity.

**Consent:** All learners must have written permission from parents/caregivers before they can participate in this study. If you are willing to give your permission, please complete the information on the back of this page. We will also ask your child to indicate if he/she is willing to participate. Your child will receive a small token of appreciation for participating. If you and your child decide that he/she will participate in the study, you will be free to withdraw at any time, it does not matter what the reason is. This will not count against you or your child in any way.

If you agree, would you please fill in your contact details so that we can get in touch with you later during this year:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Your Name: | | | | | | | |
| Telephone no.: | | | | | | | |
| Cell no.: | | | | | | | |
| PLEASE INDICATE WHAT TIME OF DAY SUITS YOU BEST TO RECEIVE A CALL **Tick the appropriate box**: | | | | | | | |
| MORNING | | EARLY AFTERNOON | | LATE AFTERNOON | | EVENING | |

Thank you

**Parental consent to participate:**

**Please** sign below if you consent for your child to participate in the programme.

I ……..……..…… (name of parent or legal guardian) give informed consent

on behalf of my child in Grade 6 ……..… (name of the child) to participate in this programme concerning a school-based project focused on healthy eating, physical activity and fitness measurements, described above. I have read and fully understand the information about the programme.

**Be informed that your child is free to withdraw at any time from the programme, and not undergo any measurements whatsoever, without prejudice, if he or she should wish to do so.**

| |
|---|
| **Signature of Parent/Guardian** |
| **Witness** |
| DATE: |

**Assent to participate (learner):**

I …… (name of learner) agree that I understand what is being asked of me, to participate in this research programme. I understand that I will be asked to participate in some fitness measurements including: running, jumping, sit-ups, and stretching. I understand that I can stop participating at any stage simply by saying that I would no longer like to participate. This is entirely my choice, and whatever I decide is fine, and my school, my parents, my teachers, and the helpers will respect my decision.

| |
|---|
| **Signature of learner** |
| DATE: |
| **School:** |

Appendix 2

# HealthKick

## Fitness testing

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Date: | | | | | 2 | 0 | 1 | 1 |
| Fieldworker: | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Name: | | | Code | | | | | |
| School's name: | | | | Age: | | | | |
| Gender: | Male 1 | Female 2 | | | | | | |
| **Anthropometry** | | | | | | | | |
| **Height (cm):** | | | | | | | | |
| **Weight (kg):** | | | | | | | | |
| **BMI:** | | | | | | | | |

| | | |
|---|---|---|
| **Fitness** | | |
| **Sit and reach – *best of 2*:** | **1. cm** | **2. cm** |
| **Sit-ups (Number in 30 seconds):** | | |
| **Shuttle run (Seconds):** | | |
| **Standing long jump – *best of 2*:** | **1. cm** | **2. cm** |

Appendix 3

# HealthKick

## Questionnaire for Learners

| Date | | | | | 2 | 0 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|

What is your name and surname?

Are you a girl/boy

| girl | boy |
|---|---|

How old are you today? _____

Grade 6

School: _____

L-IDcode

# Tell us about yourself and your family!

1. How many people are there living in your home, including you?

Fill in the number of people: ☐

2. How many rooms do you have in your home for sleeping?

Fill in the number of rooms: ☐

3. Which of these do you have at home?

| | | |
|---|---|---|
| 3.1 Television | **YES** | **NO** |
| 3.2 Computer | **YES** | **NO** |
| 3.3 Ordinary phone | **YES** | **NO** |
| 3.4 Radio | **YES** | **NO** |

4. Do you have a car that can be driven at your home? **YES** **NO**

5. Which of these are used for cooking at your home?

| | | |
|---|---|---|
| 5.1 Fridge | **YES** | **NO** |
| 5.2 Microwave | **YES** | **NO** |
| 5.3 Two-plate burner | **YES** | **NO** |
| 5.4 Stove with oven | **YES** | **NO** |

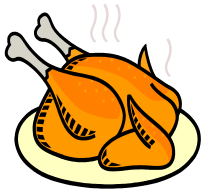
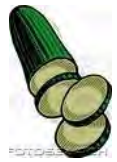
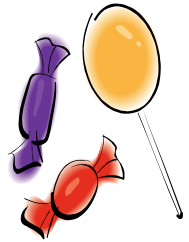
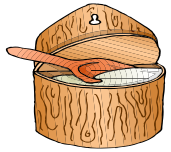
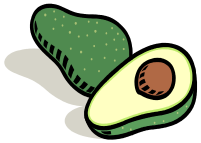
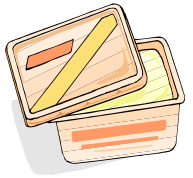
6. Does your family ever grow vegetables at home? **YES** **NO**

7. Which language is spoken at home MOST of the time?
(Tick next to the **ONE** answer you think is correct)

7.1 English ☐
7.2 Xhosa ☐
7.3 Afrikaans ☐
7.4 Other? ☐ : .....

# All about food

1. **Look at the following pictures and fill in the LETTER (A, B, C, D, E, F or G)of the food group you think best fits the answer to the questions below** (You can choose a group more than once)

| Meat, Chicken, Fish, Eggs | Brown Bread, Rice, Samp, Mealie meal | Vegetables | Fruit | Sugar, Sweets | Fats, oils | Milk, Maas, Yoghurt, Cheese |
|---|---|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **E** | **F** | **G** |
|     |    |    |    |    |    |    |

1.1. Choose the food group that you should eat the **MOST** of every day ☐

1.2. Choose the food group that you should eat the **LEAST** of every day ☐

1.3. Choose a food group that contains foods with **LOTS OF FIBRE (roughage)** ☐

1.4. Choose the food group that gives your body the best **ENERGY** ☐

1.5. Choose the food group that your **BODY uses to BUILD MUSCLES** ☐

1.6 Choose the food group that best **PROTECTS THE BODY AGAINST ILLNESSES** ☐

**For the following questions, tick next to ONE answer only**

| | | | | |
|---|---|---|---|---|
| 2. Are you allowed to choose what you want to eat at home? | **YES** | **NO** | **Sometimes** | |
| 3. Do you have school lessons where you talk about healthy eating? | **YES** | **NO** | | |

# Fruits and "veggies"

4. To keep your body healthy, how many helpings of fruit and vegetables should you eat every day? (only tick next to the **ONE** answer you think is correct)

| | |
|---|---|
| At least 1 | 1 |
| 3 or 4 | 3 |
| 5 or more | 5 |
| It doesn't matter how many | 9 |

5. Why do you think eating fruit and vegetables every day is important?

| | | | | |
|---|---|---|---|---|
| 5.1 Because they help our bodies to fight against illnesses like colds and flu | **YES** | **NO** | **Not sure** | |
| 5.2 Because they help to protect our bodies against illness such as heart disease and diabetes | **YES** | **NO** | **Not sure** | |
| 6. Do you eat vegetables? | **YES** | **NO** | **Sometimes** | |

7. If you do eat vegetables, why do you eat them?

| | | | | |
|---|---|---|---|---|
| 7.1 Because you like the taste | **YES** | **NO** | **Sometimes** | |
| 7.2 Because people at home eat vegetables | **YES** | **NO** | **Sometimes** | |
| 7.3 Because you are told to eat them | **YES** | **NO** | **Sometimes** | |
| 8. Do you eat fruit? | **YES** | **NO** | **Sometimes** | |

9. If you do eat fruit, why do you eat them?

| | | | | |
|---|---|---|---|---|
| 9.1 Because people at home eat fruit | **YES** | **NO** | **Sometimes** | |
| 9.2 Because you are told to eat them | **YES** | **NO** | **Sometimes** | |

10. When you feel like a snack, what do you eat?

| | | | | |
|---|---|---|---|---|
| 10.1 Chips | **YES** | **NO** | **Sometimes** | |
| 10.2 Sweets | **YES** | **NO** | **Sometimes** | |

| | | | | |
|---|---|---|---|---|
| 10.3 Fruit | **YES** | **NO** | **Sometimes** | |
| 10.4 Sandwich or cereal | **YES** | **NO** | **Sometimes** | |

# Healthy choices

**For the following questions, tick next to ONE answer only**

11. Is it important to eat **small** amounts of healthy fats and oils because …

| | | | | |
|---|---|---|---|---|
| 11.1 fats give you energy and keep you warm? | **YES** | **NO** | **Don't know** | |
| 11.2 fats help your body to build muscle? | **YES** | **NO** | **Don't know** | |
| 11.3 fats help you to absorb certain important nutrients? | **YES** | **NO** | **Don't know** | |

12. When you eat too much fat you can …

| | | | | |
|---|---|---|---|---|
| 12.1 become fat (overweight) | **YES** | **NO** | **Don't know** | |
| 12.2 get high blood pressure when you are older | **YES** | **NO** | **Don't know** | |
| 12.3 have a heart attack when you are older | **YES** | **NO** | **Don't know** | |
| 12.4 develop diabetes as you get older | **YES** | **NO** | **Don't know** | |

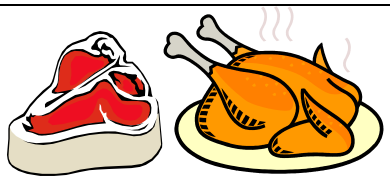
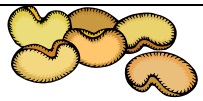
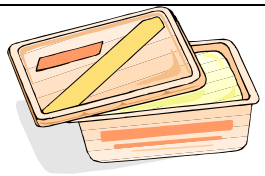
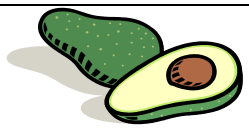
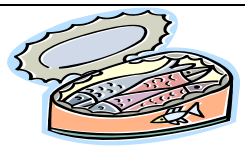
13. Eating a lot of sugar, sweets and sweet food…

| | | | | |
|---|---|---|---|---|
| 13.1 Is good for health | **YES** | **NO** | **Don't know** | |
| 13.2 Can make you fat | **YES** | **NO** | **Don't know** | |
| 13.3 Is bad for your teeth | **YES** | **NO** | **Don't know** | |
| 13.4 Can cause diabetes | **YES** | **NO** | **Don't know** | |

14. Is it important to eat enough fibre (roughage) because…

| | | | | |
|---|---|---|---|---|
| 14.1 fibre helps you go to the toilet regularly | **YES** | **NO** | **Don't know** | |
| 14.2 fibre protects you against diseases like heart disease and diabetes | **YES** | **NO** | **Don't know** | |

15. Which of the following foods contain HEALTHY fats? **Tick next to ONE answer only**

| | | Yes | No | Don't know |
|---|---|---|---|---|
| **Red meat and chicken with skin** |  | ☐ | ☐ | ☐ |
| **Chips, crisps and papa bites** |  | ☐ | ☐ | ☐ |
| **Nuts** |  | ☐ | ☐ | ☐ |
| **Soft margarine in tub** |  | ☐ | ☐ | ☐ |
| **Avocado pear** |  | ☐ | ☐ | ☐ |
| **Vetkoek and doughnuts** |  | ☐ | ☐ | ☐ |
| **Pilchards/Sardines** |  | ☐ | ☐ | ☐ |
| **Polony** |  | ☐ | ☐ | ☐ |

**For the following questions, tick next to ONE answer only**

16. Do you think you can make changes to your diet by…

| | | | | |
|---|---|---|---|---|
| 16.1 putting less margarine on your bread? | **YES** | **NO** | **Not sure** | |
| 16.2 eating fewer chips? | **YES** | **NO** | **Not sure** | |
| 16.3 buying fruit instead of chips? | **YES** | **NO** | **Not sure** | |
| 16.4 putting less sugar in your tea or coffee? | **YES** | **NO** | **Not sure** | |
| 16.5 putting less sugar on your cereal/porridge? | **YES** | **NO** | **Not sure** | |
| 16.6 eating sweets less often? | **YES** | **NO** | **Not sure** | |
| 16.7 drinking cool drinks less often? | **YES** | **NO** | **Not sure** | |
| 16.8 eating brown bread instead of white bread? | **YES** | **NO** | **Not sure** | |
| 16.9 eating more vegetables? | **YES** | **NO** | **Not sure** | |
| 16.10 eating more fruit? | **YES** | **NO** | **Not sure** | |
| 17. Is it difficult for you to eat less fat because you like fatty food too much? | **YES** | **NO** | **Not sure** | |
| 18. Is it difficult for you to eat brown bread because the shops close to your house only have white bread? | **YES** | **NO** | **Not sure** | |
| 19. Is it difficult for you to eat brown bread because most of your friends prefer eating white bread? | **YES** | **NO** | **Not sure** | |

# Healthy eating before and during school

| | | | | |
|---|---|---|---|---|
| 20. Do you eat breakfast before school? | **YES** | **NO** | **Sometimes** | |
| 21. Can you make your own breakfast? | **YES** | **NO** | **Sometimes** | |
| 22. Can you get up early enough to eat breakfast at home? | **YES** | **NO** | **Sometimes** | |

23. Is it difficult for you to eat breakfast at home because …

| | | | | |
|---|---|---|---|---|
| 23.1 the people at home do not eat breakfast? | **YES** | **NO** | **Sometimes** | |
| 23.2 there is no food in the house to eat for breakfast? | **YES** | **NO** | **Sometimes** | |

| | | | | |
|---|---|---|---|---|
| 24. Do you bring a lunchbox to school? | **YES** | **NO** | **Sometimes** | |
| 25. Is it difficult for you to take a lunchbox to school because… | | | | |
| 25.1 other children will want your food? | **YES** | **NO** | **Sometimes** | |
| 25.2 there is nothing at home to put in your lunchbox? | **YES** | **NO** | **Sometimes** | |
| 25.3 no one at home can help you to make a lunchbox? | **YES** | **NO** | **Sometimes** | |
| 25.4 you do not have a nice container to put it in? | **YES** | **NO** | **Sometimes** | |
| 26. Do you bring money to school? | **YES** | **NO** | **Sometimes** | |
| 26.1 If you answered **YES**, how many days per week do you bring money to school? | **Every day (5 days)** | **2-3 times/wk** | | |
| 26.2 How much money do you bring at a time? | **R** | | | |

# Activities at school and home and in-between

**For the following questions, tick next to ONE answer only**

| | | | | |
|---|---|---|---|---|
| 1. Are you doing physical activity when you play games, e.g. skipping, soccer? | **YES** | **NO** | **Not sure** | |
| 2. Are you doing physical activity when you are walking, e.g. walking to school? | **YES** | **NO** | **Not sure** | |
| 3. Is it important to do physical activity every day in order to keep your body healthy? | **YES** | **NO** | **Not sure** | |
| 4. Do you have fun when you are doing physical activity? | **YES** | **NO** | **Sometimes** | |
| 5. Do your teachers encourage you to do physical activity? | **YES** | **NO** | **Sometimes** | |
| 6. Does your family encourage you to do physical activity? | **YES** | **NO** | **Sometimes** | |
| 7. Do you go with your family to physical activity events at your school or in your neighbourhood, e.g. a fun run/walk? | **YES** | **NO** | **Sometimes** | |
| 8. Do you take part in sport at school or for a club, e.g. soccer, netball? | **YES** | **NO** | **Sometimes** | |
| 9. Do you do physical activity at home or in your neighbourhood after school and on weekends? | **YES** | **NO** | **Sometimes** | |

| | | | | |
|---|---|---|---|---|
| 10. There is organised sport at my school | **YES** | **NO** | **Don't know** | |
| 11. My friends do not do sport | **YES** | **NO** | **Don't know** | |
| 12. My parents do not allow me to do sport | **YES** | **NO** | **Don't know** | |
| 13. I do not like sport | **YES** | **NO** | **Don't know** | |
| 14. I am not good enough to be on a sports team | **YES** | **NO** | **Don't know** | |
| 15. There are no playgrounds or sports fields near my home to play outdoors | **YES** | **NO** | **Don't know** | |
| 16. It is not safe for children to play outdoors where I live | **YES** | **NO** | **Don't know** | |
| 17. I can't do physical activity at home or in my neighbourhood because I have to look after my brothers and sisters or do chores | **YES** | **NO** | **Don't know** | |
| 18. I can't do physical activity at home or in my neighbourhood because there is too much traffic | **YES** | **NO** | **Don't know** | |
| 19. I do not know how to play sports and games very well, I am sometimes chosen last for games | **YES** | **NO** | **Don't know** | |
| 20. Sometimes my friends make fun of me when I play sports and games outdoors with them | **YES** | **NO** | **Don't know** | |

21. On a normal weekday, how long do you spend on the computer, watch TV or sit and listen to the radio? (**Tick next to the ONE answer you think is correct**)

| | | |
|---|---|---|
| Less than 30 minutes per day | 1 | |
| 30-60 minutes per day | 2 | |
| 1-2 hours per day | 3 | |
| More than 2 hours per day | 4 | |

22. On a normal day on the weekend, how long do you spend on the computer, watch TV or sit and listen to the radio? (**Tick next to the ONE answer you think is correct**)

| | | |
|---|---|---|
| Less than 30 minutes per day | 1 | |
| 30-60 minutes per day | 2 | |

| | | |
|---|---|---|
| 1-2 hours per day | 3 | |
| More than 2 hours per day | 4 | |

23. **Look at the pictures provided below, and fill in the LETTER (A, B, C or D) of the activities which BEST answers each question**

| TV watching, reading and computers | Eating with family and friends | Doing things outside e.g. playing games, gardening | Organised/team sports |
|---|---|---|---|
| **A** | **B** | **C** | **D** |
|  |  |  |  |

23.1 Choose the activities that **YOU** like the most ☐

23.2 Choose the activities that your **FRIENDS** like the most ☐

23.3 Choose the activities that are **BEST for your health** ☐

# Diabetes and my health

**For the following questions, tick next to ONE answer only**

1. The following questions are about diabetes

| | | | | |
|---|---|---|---|---|
| 1.1 Have you ever heard of diabetes or sugar disease? | **YES** | **NO** | **Don't know** | |
| 1.2 Do you know anyone who has diabetes? | **YES** | **NO** | **Don't know** | |
| 1.3 Does anyone in your family have diabetes? | **YES** | **NO** | **Don't know** | |

2. Which of these things can cause diabetes?

| | | | | |
|---|---|---|---|---|
| 2.1 Eating lots of sugar and sweets | **YES** | **NO** | **Don't know** | |
| 2.2 Being very fat | **YES** | **NO** | **Don't know** | |
| 2.3 Eating fatty foods | **YES** | **NO** | **Don't know** | |

3. How does someone know if they have diabetes?

| | | | | |
|---|---|---|---|---|
| 3.1 They are very thirsty | **YES** | **NO** | **Don't know** | |
| 3.2 They have to pee all the time | **YES** | **NO** | **Don't know** | |
| 3.3 They lose weight | **YES** | **NO** | **Don't know** | |
| 3.4 They are often hungry | **YES** | **NO** | **Don't know** | |
| 3.5 They have sores/wounds that take a long time to heal | **YES** | **NO** | **Don't know** | |
| 3.6 They cannot see properly | **YES** | **NO** | **Don't know** | |

4. Which of the following health problems are caused by diabetes?

| | | | | |
|---|---|---|---|---|
| 4.1 Bad eyesight or blindness | **YES** | **NO** | **Don't know** | |
| 4.2 Kidney problems | **YES** | **NO** | **Don't know** | |
| 4.3 Foot problems | **YES** | **NO** | **Don't know** | |
| 4.4 Heart disease, e.g. heart attack | **YES** | **NO** | **Don't know** | |
| 4.5 Stroke | **YES** | **NO** | **Don't know** | |

# SITUATIONAL ANALYSIS 2009/10

| SECTION A: General information | *Office use* |
|---|---|
| ID/study number | 5 |
| Interviewer:…… | |
| 1. Date of completing questionnaire/observation: | 2 0 1 0 — 15 |
| 2. ED: Metropole North 1 / Overberg/Winelands 2 | |
| 3. School name: | |
| School principal: …… | |
| Name of key-respondent: …… | |
| 4. Have there been any significant changes to the number of | |
| 4.1 Educators? Yes 1 No 2 | 20 |
| 4.2 Learners? Yes 1 No 2 | |
| 4.3 Support staff, e.g. sports Yes 1 No 2 | |
| Comments: | |
| 5. Are school premises and/or facilities used for other activities/purposes outside — Yes / No 2 | |
| 5.1 If **Yes**, specify for …… | 26 |
| …… | |
| …… | |
| …… | |
| 6. During the past year, has your school been sponsored in any way? Yes 1 No 2 | |
| 6.1 If **Yes**, by what company/ies or organisation/s? | |
| …… | |
| …… | |
| 6.2 Describe the sponsorship… | |
| …… | |
| …… | 34 |

## SECTION B: Health Promotion and School Health

*Office Use*

7. How would you rate the health problems below according to importance for learners, teachers and parents?

| | | |
|---|---|---|
| (**1**) Tobacco use | (**3**) Lack of physical activity | (**5**) Overweight |
| (**2**) Substance abuse | (**4**) Unhealthy diet | (**6**) Underweight |
| (**7**) Chronic diseases of lifestyle | (**8**) Health problems related to issues of sexuality | |

Select and prioritise the present **top three** health problems. [**Show Cards**]

| | | | | | |
|---|---|---|---|---|---|
| 7.1 | Learners | 1st | | | 35 |
| | | 2nd | | | |
| | | 3rd | | | |
| 7.2 | Teachers | 1st | | | |
| | | 2nd | | | |
| | | 3rd | | | |
| 7.3 | Parents | 1st | | | |
| | | 2nd | | | |
| | | 3rd | | | 43 |

## SECTION B: Health Promotion and School Health

*Office Use*

8. To what extent are the following a concern at your school regarding the **learners** at present?

*[Circle the relevant option]*

| | | To a great extent | To some extent | Little extent | Not at all | |
|---|---|---|---|---|---|---|
| 8.1 | Poverty and unemployment in the community | 1 | 2 | 3 | 4 | 44 |
| 8.2 | Crime and violence within the school environment | 1 | 2 | 3 | 4 | |
| 8.3 | Crime and violence in the community in general | 1 | 2 | 3 | 4 | |
| 8.4 | Child abuse/neglect | 1 | 2 | 3 | 4 | |

9. During the past year, have there been any health-related programmes?

| Yes 1 | No 2 |
|---|---|
| | |

If **Yes**, describe briefly:

9.1 .....

9.2 ..... 50

10. In the past year, has any staff received development/training/workshops on health-related problems?

| Yes 1 | No 2 |
|---|---|
| | |

10.1 If **Yes**, specify what these were (e.g. HIV, LO, etc.)

.....

.....

10.2 who was responsible for these (e.g. DOH, ED, etc,):

.....

.....

11. Is toilet paper OR soap available to learners…?

| |
|---|
| In bathrooms: Yes=1; No=2; Only Toilet paper=3 |
| With educators: Yes=1; No=2; Only Toilet paper=3 |

60

***The next questions ask about school health councils, committees, or teams***

| | | | | |
|---|---|---|---|---|
| 12. | Is there a health committee at your school? | Yes 1 | No 2 | |
| 12.1 | If **Yes**, what health problems does this committee address? | | | |
| | Tobacco use prevention | Yes 1 | No 2 | |
| | Alcohol or other drug use prevention | Yes 1 | No 2 | |
| | Physical education or physical activity | Yes 1 | No 2 | |
| | Tuck shop | Yes 1 | No 2 | |
| | Vendors | Yes 1 | No 2 | |
| | Feeding Scheme | Yes 1 | No 2 | |
| | HIV/AIDS | Yes 1 | No 2 | |
| | School safety | Yes 1 | No 2 | 70 |
| | Developmental assessment and referral | Yes 1 | No 2 | |
| | Child abuse/neglect | Yes 1 | No 2 | |
| | Other: ..... | Yes 1 | No 2 | |
| | ..... | Yes 1 | No 2 | |
| 12.2 | Does this group have scheduled meetings? | Yes 1 | No 2 | |
| 12.3 | If **Yes**, how often do they meet annually? [*Number of times*] | | | |
| 12.4 | If there is not a health committee, what barriers are preventing you to establish one? | | | |
| | ..... | | | |
| | ..... | | | 80 |

ID/study number | | | | | | 5

13. What role does the School Governing Body play in issues of health in the school?

.....

.....

14. To what extent are parents in involved activities at your school?

| *[Circle the relevant option]* | To a great extent | To some extent | Little extent | Not at all |
|---|---|---|---|---|
| National School Nutrition Programme | 1 | 2 | 3 | 4 |
| Fun walk | 1 | 2 | 3 | 4 |
| Tuck shop | 1 | 2 | 3 | 4 |
| Other: ..... | 1 | 2 | 3 | 4 |

10

15. What are the barriers that prevent parent involvement at your school?

.....

.....

17

| SECTION C: Physical Activity | Office Use |
|---|---|

## INFORMATION ABOUT PHYSICAL ACTIVITY (PA) AND SPORT IN THE TIMETABLE

1.1 How many structured PA sessions per week are currently in the weekly timetable for the foundation phase? No.: [ ][ ] [ ][ ] 19

1.2 How many of the sessions/week do learners participate in physical activities outside the classroom? No: [ ][ ] [ ][ ]

1.3 How long is each physical activity session (outside)? Minutes: [ ][ ] [ ][ ]

1.4 Min/wk: [ ][ ][ ]

2.1 How many structured PA sessions per week are currently in the weekly timetable for the intermediate phase? No.: [ ][ ] [ ][ ]

2.2 How many of the sessions/week do learners participate in physical activities outside the classroom? [ ][ ] [ ][ ] 30

2.3 How long is each physical activity session (outside)? Minutes: [ ][ ] [ ][ ]

2.4 Min/wk: [ ][ ][ ]

3. How many structured PA sessions per week are currently in the weekly timetable for the senior phase? No.: [ ][ ] [ ][ ] 37

3.2 How many of the sessions/week do learners participate in physical activities outside the classroom? [ ][ ] [ ][ ]

3.3 How long is each physical activity session (outside)? Minutes: [ ][ ] [ ][ ]

3.4 Min/wk: [ ][ ][ ]

4.1 How long is each 1st break session? Minutes: [ ][ ] [ ][ ]

4.2 How long is each 2nd break session? Minutes: [ ][ ] [ ][ ]

5. Is there any structured physical activity for learners during break times? Yes 1 / No 2 [ ] 49

5.1 If **Yes**, describe these activities:

……
……

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……

5.2 If **No**, what are the barriers preventing you from arranging physical activity for learners during break times?

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……

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…… 57

| | | | | | |
|---|---|---|---|---|---|
| 6. | How many teachers/supervisors are assigned to supervise at each break time?<br>No.: | | | | 59 |
| 7. | Are learners excluded from all or part of 1st / 2nd break times as punishment for bad behaviour? | Yes 1 | No 2 | | |
| 8. | In the past year, has your school started any new sports? | Yes 1 | No 2 | | |
| 8.1 | If **Yes**, which sport/s?<br>……<br>…… | | | | 63 |

## INFORMATION ABOUT SPORTING FACILITIES

| | | | | | |
|---|---|---|---|---|---|
| 9. | In the past year, have you made any improvements to the sporting facilities/playgrounds at your school? | Yes 1 | No 2 | | 64 |
| 9.1 | If **Yes**, describe these changes:<br>……<br>……<br>……<br>…… | | | | |
| 10. | Does your school make use of community facilities? | Yes 1 | No 2 | Not available 3 | |

## INFORMATION ABOUT SPORTING EQUIPMENT

| | | | | | |
|---|---|---|---|---|---|
| 11. | In the past year, has the school received/bought any new equipment for sport and/or physical activity? | Yes 1 | No 2 | | 70 |
| 11.1 | If **Yes**, describe what:<br>……<br>……<br>……<br>…… | | | | 74 |
| 12. | What equipment is available for learners to use during break times?<br>……<br>…… | | | | 78 |

## SECTION D: Nutrition environment and policies

*Office Use*

**General**

ID/study number | | | | | | 5

1. In the past year, has your school adopted any nutrition-related policies/rules regarding LUNCHBOXES? Yes 1 | No 2 | |

1.1 If **Yes**, what policy/rules?

.....

.....

.....

| | | 10

2. In the past year, has your school adopted any nutrition-related policies/rules regarding the National School Nutrition Programme? Yes 1 | No 2 | |

2.1 If **Yes**, what policy/rules?

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.....

| | | 15

3. In the past year, has your school adopted any nutrition-related policies/rules regarding the USE FOOD AS A REWARD FOR GOOD BEHAVIOUR OR PERFORMANCE? Yes 1 | No 2 | |

3.1 If **Yes**, what policy/rules?

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.....

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| | | 20

4. In the past year, has your school adopted any nutrition-related policies/rules regarding the FOOD SERVED AT LEARNERS' PARTIES/OUTINGS? Yes 1 | No 2 | |

4.1 If **Yes**, what policy/rules?

.....

.....

.....

| | | 25

5. In the past year, has your school adopted any nutrition-related policies/rules regarding FOODS FOR FUND RAISING PURPOSES, i.e. cake sales, fêtes, bazaars, festivals | Yes 1 | No 2 | ☐ | 26

5.1 If **Yes**, what policy/rules?

.....

.....

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☐☐ ☐☐ 30

6. In the past year, has your school adopted any nutrition-related policies/rules regarding FOOD SERVED AT SCHOOL EVENTS, i.e. sports days, school plays etc.? | Yes 1 | No 2 | ☐

6.1 If **Yes**, what policy/rules?

.....

.....

.....

☐☐ ☐☐ 35

7. In the past year, has your school adopted any nutrition-related policies/rules regarding the TUCK SHOP? | Yes 1 | No 2 | ☐

7.1 If **Yes**, what policy/rules?

.....

.....

.....

☐☐ ☐☐ 40

8. In the past year, has your school adopted any OTHER nutrition-related policies/rules? | Yes 1 | No 2 | ☐

8.1 If **Yes**, what policy/rules?

.....

.....

.....

☐☐ ☐☐ 45

9. Do you as principal have any input in the administration of the tuck shop? | Yes 1 | No 2 | ☐ | 46

9.1 What do you feel your role as principal is in promoting a healthier tuck-shop?

.....

☐☐

9.2 What do you feel are the biggest barriers to establishing a healthier tuck shop?

58

## SECTION E: Tobacco Use

*Office Use*

*The next questions ask about your school's policies regarding tobacco use*

1. Do staff adhere to your school's policy with regards to the following:

| | | | | |
|---|---|---|---|---|
| 1.1 | In school buildings? | Yes 1 | No 2 | 59 |
| 1.2 | Outside buildings on the school grounds, including parking lots and playing fields? | Yes 1 | No 2 | |
| 1.3 | On school buses or other vehicles used to transport learners? | Yes 1 | No 2 | |
| 1.4 | At school events not on the school property? | Yes 1 | No 2 | |

2. Comments:

2.1 Educators: 63

2.2 Learners: 68

# Observation schedule

## SECTION A: General

*Office use*

ID/study number ☐☐☐☐☐ 5

1. Visit to School during: 1st Break=1 | 2nd Break=2 ☐

2. Describe the condition of the school buildings:

| | | | |
|---|---|---|---|
| Clean | Yes 1 | No 2 | ☐ |
| Neat | Yes 1 | No 2 | ☐ |
| Litter present | Yes 1 | No 2 | ☐ |
| In good condition | Yes 1 | No 2 | ☐ |
| In a state of disrepair | Yes 1 | No 2 | ☐ |
| Painted | Yes 1 | No 2 | ☐ |
| In need of a new coat of paint | Yes 1 | No 2 | ☐ 13 |
| Other: ..... | Yes 1 | No 2 | ☐ |

3. Number of taps outside providing hygienic water (to drink and wash ☐☐ ☐☐

3.1 Describe the condition of the area around these taps:

..... ☐☐ 18

4. Where is the HealthKick Resource Box kept?

..... ☐☐ 20

4.1 Are all the documents still in the Resource Box? Yes 1 | No ☐

5. Does it look as if the Resource Box has been used? Yes 1 | No ☐ 22

## SECTION B: Physical environment

*Office use*

1. Describe the condition of the playgrounds, sports fields and facilities

..... ☐☐ 24

.....

.....

.....

2. Where is the HealthKick PA Resource Bin kept?

..... ☐☐ 32

2. 1 Does it look as if the equipment in the PA Resource Bin has been used? Yes 1 | No ☐

2. 2 Is all the equipment still in the PA Resource Bin? Yes 1 | No ☐

2. 3 Physical activity equipment that should be in the Storage bin:

*Indicate with a tick if all contents are in the bin or give the exact number*

| Items | | Comments | | |
|---|---|---|---|---|
| Hoola hoops | x20 | | | ☐ 35 |
| Skipping ropes with handles | x20 | | | ☐ |

| | | | | |
|---|---|---|---|---|
| Plastic whistle + lanyard | x2 | | | |
| Cones | x10 | | | |
| Bean bags | x20 | | | |
| Stopwatch | x1 | | | |
| Soccer balls | ±3 | | | |
| Rugby ball | x1 | | | |
| Tennis balls | x6 | | | |
| Rubber netball | x1 | | | |
| Size 3 playball | x2 | | | |
| Chalk | | | | 46 |

2. 3 Describe the condition of the equipment in the PA Resource Bin: 48

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..... 58

## SECTION C: Health environment

1. Are there any health-related posters or messages visible about?

| | | | | |
|---|---|---|---|---|
| 1.1 | Nutrition | Yes 1 | No 2 | 59 |
| 1.2 | hysical Activity | Yes 1 | No 2 | |
| 1.3 | Smoking | Yes 1 | No 2 | |

Comments:

..... 63

## SECTION D: National School Nutrition Programme (NSNP)

ID/study No: 5

2. Indicate the day of the week: Mon | Tues | Wed | Thurs | Fri 6

2.1 Date 2 0 1 0

3. Time of meal being served:

4. Number of learners being fed 14

5. Name of menu item being

| | Name of item | NSNP guideline | Is the portion size | | |
|---|---|---|---|---|---|
| | | | Smaller | Correct | Bigger |
| Starch | | 1 level ladle-spoon | | | |
| Protein | | ½ ladle-spoon | | | |
| Vegetable 1 | | 1 heaped ladle- | | | |
| Vegetable 2 | | 1 heaped ladle- | | | |
| Vegetable 3 | | 1 heaped ladle- | | | |
| Fruit 1 | | 1 medium | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fruit 2 | | 1 medium | | | | | |
| Other | | | | | | | 24 |

| 6. Proportion of learners eating all the food | Most | Half | Few | | |
|---|---|---|---|---|---|
| Grade: | | | | | |
| Grade: | | | | | |
| Grade: | | | | | 27 |

## SECTION E: Tobacco use

1. Indicate how many learners are seen smoking on the school grounds (include buildings):

| Many = 3 | Only a few = 2 | None = 1 | | 28 |
|---|---|---|---|---|

2. Indicate how many staff members are seen smoking on the school grounds (include

| Many = 3 | Only a few = 2 | None = 1 | |
|---|---|---|---|

3. Number of staff smoking where children can see them:

| Many = 3 | Only a few = 2 | None = 1 | |
|---|---|---|---|

4. Number of visitors to the school smoking on the school ground (include buildings):

| Many = 3 | Only a few = 2 | None = 1 | |
|---|---|---|---|

5. Number of signs indicating no smoking:

| | | | |
|---|---|---|---|
| On the school ground | | | 35 |
| In the building | | | |

## SECTION F: Field notes on Lunchboxes and Tuck shop

1. Describe the contents, number, etc. of lunchboxes observed: 37

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2. Describe Tuck-shop items, etc. observed: 49

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59

Appendix 5

**CONSENT TO PARTICIPATE IN A RESEARCH STUDY**

**AS A SCHOOL PRINCIPAL OR DESIGNATED PROXY**

# Title of Study: International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) – South Africa (An International Growth and Health Study)

October 2012

Dear Principal or designated proxy for the principal,

Thank you for taking the time to read this form.

**Why have <u>you</u> received this form?**

- Your school has been randomly selected to participate in an international growth and health study for children. The educational authorities in the Western Cape have agreed to allow these forms to be distributed to parents of grade 4 or 5 learners in this school, along with those from 20 to 25 other schools in the Western Cape.
- We give you this form to invite you to participate in a research study concerning growth and health in children.
- This form will provide information about the purpose of this study, what is involved, and to address any risks and benefits of this research study.
- The main goal of this research study is to gain knowledge that may help to prevent the problems associated with obesity and health in children through changes in practices and policies that we may develop from what we learn.
- You have the right to refuse to take part, or agree to take part now and change your mind at any stage later on.
- Please review this consent form carefully and ask any questions before you make a decision.
- Your participation is voluntary.
- By signing this consent form, you agree to participate in the study as it is described.

**<u>What</u> is this study about?**

Obesity and lack of physical activity are recognized as important risk factors for certain chronic diseases such as diabetes, heart disease, lung disease and cancers in adults. These problems are being experienced on a global scale. However, what is even more concerning is that obesity and inactivity are also becoming important health concerns in children and youth.

We know that 1 in every 6 South African girls, and 1 in every 8 South African boys may be overweight or obese. We also know that almost as many children in South Africa, may face

the challenge of under-nutrition. We also understand that while some of the problems of overweight in children may be related to diet and physical activity practices, we are increasingly aware that this is a complex problem, and that there are many factors which can interfere with children's growth and health. This study will try to understand these factors that may lead to childhood obesity, including the school environment for physical activity and health (policies, tuck shop items, physical education, facilities) and the neighborhood environment (safety for walking, shops nearby, access to transport).

In addition, we will want to learn something about at least 20-25 children in your school. We would like to measure their height and weight, their waist and arm measurement and a measure of body composition (fat and lean tissue) using a modified scale. We will want to ask them questions about their food intake and physical activity. We will also ask them to wear a small step counter on a belt around their waist for a week. This step counter will provide us with a measure of how much physical activity they do, and when they do it. We would also like to ask you questions about your home and family, your neighborhood, and your child.

We would like to interview you, in order to find out more about the policies and practices concerning healthy eating and physical activity at your school. We will also be observing the school and completing a checklist concerning the facilities, food service, and physical education at the school.

We will be performing these measurements in at least 500 South African 10-11 yr old school children (Grade 4 or 5 learners), in between 20-25 randomly selected schools in the Western cape, who have been invited to participate.

Once we have gathered data from all of these children, we will analyse the information locally and combine it with the data from the 11 other countries. This will allow us to better understand those factors contributing to obesity and under-nutrition, and hopefully, to help develop policies, practices and recommendations, to prevent and/or address these concerns in the future.

**Who is <u>responsible</u> for this study?**

South Africa is one of 12 countries taking part in this study. In South Africa, this study is under the direction of Professor Estelle Lambert, who is a Professor of Human Biology. She works in the UCT/MRC Research Unit for Exercise Science and Sports Medicine, which is part of the Faculty of Health Sciences at the University of Cape Town.

The overall study in these 12 countries is being managed by the Pennington Biomedical Research Center in Baton Rouge, Louisiana in the United States, which is affiliated to the Louisiana State University. The investigators who are directly responsible are Dr. Peter Katzmarzyk and Dr. Timothy Church.

**Principal Investigator (South Africa)**

Estelle Victoria Lambert

UCT/MRC Research Unit for Exercise Science and Sports Medicine

Department of Human Biology,

Faculty of Health Sciences,

University of Cape Town

(021) 65054571

(021) 6867530 (fax)

(082) 3126890 (cell)

vicki.lambert@uct.ac.za

Professor Estelle Lambert directs this study in South Africa, in which we hope to invite more than 500 South African grade 4 or 5 learners, their parents and caregivers, and school principals to participate. The South African part of this study will be added to information collected in 11 other countries, from all over the world, in 10-11 year old children. She will happy to answer any of your questions or concerns.

**Who is eligible to participate in the study? Who is not eligible?**

Children will be eligible for the study if:

- the child is enrolled in a school that has been randomly selected for this study.
- the child is in grade 4 or 5 at the time of study enrollment.
- the parent or legal guardian and the child agree to participate in the study.
- the parent or legal guardian signs the informed consent form and the learner signs the separate assent form indicating that he/she wishes to volunteer for the study.

**What will happen if you take part in the study?**

You, the principal, will be asked to complete a questionnaire about the food and physical activity policies and practices at your school. It should take less than 15 minutes to complete.

Your school will never be identified by name when the results of this study are disseminated. All children enrolled in the study will have the same measurements taken. All measurements will be confidential and will not be shown to anyone other than researchers involved in the study. School personnel will not be allowed to see the children's measurements.

We will coordinate taking the children's measurements with your school administration and teaching staff, so as to not conflict with important school activities or tests. Children's measurements will be obtained by trained research team members in a private area at the school determined by the school staff.

The measurements will include:

1. Weight
2. Height (standing and sitting)
3. Body fat – this number is calculated while the learner is standing on a weight scale
4. Waist and arm circumferences

5. Questionnaire about diet and physical activity

In addition, the children will wear a physical activator monitor for 8 days, 24 hours a day, to measure his/her normal physical activity. This monitor is worn on a flexible belt around their waist, and is the size of a matchbox. It should be removed only for bathing. The monitor is on a flexible belt that will be worn around the waist.

**What are the possible <u>risks and discomforts to the children, to you</u>?**

This is a minimal risk study. There are no aspects of the study that are anticipated to increase the risk of injury to the children. In addition, we will make every effort to make the experience of participation enjoyable for the children. The research team will be very careful to communicate in a positive and respectful way with the children, and to make sure that they understand that their participation is entirely voluntary. Some members of the research team will be able to communicate with the children in their home language.

Members of the research team have experience in school-based research, and the children's privacy will be of the utmost of importance.

Your school will not be identified in any way, and will be given a unique identifying number.

**What are the possible <u>benefits</u>?**

There are no direct benefits for the children or parents for participating in this study. We will provide the children with a small token of appreciation.

We do hope that the combined information from all of the children in the study will help us to prevent or minimize problems associated with obesity and inactivity in children, in the future.

**If you <u>do not want</u> your school to take part in the study, are there other choices?**

You can either choose to participate in the study by signing this form and returning it to the research team, or you can choose not to participate in the study by not signing the form. You have the choice at any time not to participate in this research study.

**If you have any <u>questions or problems</u>, whom can you call?**

If you have any questions about your rights and the rights as a research volunteer, you should call the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee. Professor Marc Blockman and Professor Lesley Henley are the co-chairspersons of this committee.

| | |
|---|---|
| **Professor Marc Blockman** | **Dr. Lesley Henley** |
| Research Ethics Committee | Research Ethics Committee |
| E 52 Room 23 | E 52 Room 23 |
| Old Main Building | Old Main Building |
| Groote Schuur Hospital | Groote Schuur Hospital |
| Observatory | Observatory |
| 7925 | 7925 |
| **Contact Number:** 021 406 6338 | **Contact Number:** 021 406 6338 |
| **Email:** Marc.Blockman@uct.ac.za | Email: lhenley@ich.uct.ac.za |


**All information will be kept private.**

All data will be collected in a confidential manner. Every effort will be made to maintain the confidentiality of the study records. However, someone from the research team may inspect and/or make copies the results related to the study, without identifying the children or your school by name. This will be for the purposes of analyzing the study results.

Children will be assigned a unique identity number and names will not appear on questionnaires or data collection forms. A separate secure list held at the study site will be used only to identify participants for re-contacting in the future.

**Can the study end early?**

Although unlikely, the sponsor of the study may end the study early.

**What payment will participants receive? What is any problems arise?**

No payment will be received for participating in this study. The children may receive a token of appreciation.

The University of Cape Town and its team of researchers will see to any onsite medical care for any unplanned problems occurring as a result of participating in this study. The research is covered by the University of Cape Town's No Fault Insurance Policy. If there are any medical problems during the study, and children will be referred to the relevant public health system, where they will be assisted.

**Signatures and consent:**

The study has been discussed with me and all my questions have been answered. If there is anything I don't understand, I can ask the investigator, or a member of the research team from the ISCOLE study. I have been given a copy of the signed consent form.

_____ _____ _____

Printed Name of Principal School Date

_____

Principal Signature

---

Office use only:

_____

Site Staff Member Receiving the Signed Informed Consent

_____

Date

Appendix 6

**Name of Child:_____**

**CONSENT TO PARTICIPATE IN A RESEARCH STUDY**

**FOR SCHOOL CHILDREN**

**Title of Study: International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) – South Africa** (An International Growth and Health Study)

Date

Dear Parent and caregiver,

Thank you for taking the time to read this form.

**Why have <u>you</u> received this form?**

- Your child's school has been randomly selected to participate in an international growth and health study for children. The school principal and the educational authorities in the Western Cape have agreed to allow these forms to be distributed to parents of grade 4 or grade 5 learners in this school, along with those from 20 to 25 other schools in the Western Cape.
- We give you this form to invite you and your child to participate in a research study concerning growth and health in children.
- This form will provide information about the purpose of this study, what is involved, and to address any risks and benefits of this research study.
- The main goal of this research study is to gain knowledge that may help to prevent the problems associated with obesity and health in children through changes in practices and policies that we may develop from what we learn.
- You and your child have the right to refuse to take part, or agree to take part now and change your mind at any stage later on.
- Please review this consent form carefully and ask any questions before you make a decision.
- Your participation and your child's participation are voluntary.
- By signing this consent form, you agree to participate in the study as it is described.

**<u>What</u> is this study about?**

Obesity and lack of physical activity are recognized as important risk factors for certain chronic diseases such as diabetes, heart disease, lung disease and cancers in adults. These problems are being experienced on a global scale. However, what is even more concerning is that obesity and inactivity are also becoming important health concerns in children and youth.

We know that 1 in every 6 South African girls, and 1 in every 8 South African boys may be overweight or obese. We also know that almost as many children in South Africa, may face the challenge of under-nutrition. We also understand that while some of the problems of overweight in children may be related to diet and physical activity practices, we are increasingly aware that this is a complex problem, and that there are many factors which can interfere with children's growth and health. This

study will try to understand these factors that may lead to childhood obesity, including the school environment for physical activity and health (policies, tuck shop items, physical education, facilities) and the neighborhood environment (safety for walking, shops nearby, access to transport).

In addition, we will want to learn something about your child. We would like to measure their height and weight, their waist and arm measurement and a measure of body composition (fat and lean tissue) using a modified scale. We will want to ask them questions about their food intake and physical activity. We will also ask them to wear a small step counter on a belt around their waist for a week. This step counter will provide us with a measure of how much physical activity they do, and when they do it. We would also like to ask you questions about your home and family, your neighborhood, and your child.

We will be interviewing the school principal, as well, in order to find out more about the policies and practices concerning healthy eating and physical activity at the school, and we will be observing the school also, and completing a checklist concerning the facilities, food service, and physical education at the school.

We will perform these measurements in at least 500 South African 10-11 yr old school children (Grade 4 or grade 5 learners), in randomly selected schools in the Western cape, who have been invited to participate.

Once we have gathered data from all of these children, we will analyse the information locally and combine it with the data from the 11 other countries. This will allow us to better understand those factors contributing to obesity and under-nutrition, and hopefully, to help develop policies, practices and recommendations, to prevent and/or address these concerns in the future.

**Who is <u>responsible</u> for this study?**

South Africa is one of 12 countries taking part in this study. In South Africa, this study is under the direction of Professor Estelle Lambert, who is a Professor of Human Biology. She works in the UCT/MRC Research Unit for Exercise Science and Sports Medicine, which is part of the Faculty of Health Sciences at the University of Cape Town.

The overall study in these 12 countries is being managed by the Pennington Biomedical Research Center in Baton Rouge, Louisiana in the United States, which is affiliated to the Louisiana State University. The investigators who are directly responsible are Dr. Peter Katzmarzyk and Dr. Timothy Church.

**Principal Investigator (South Africa)**

Estelle Victoria Lambert

UCT/MRC Research Unit for Exercise Science and Sports Medicine

Department of Human Biology,

Faculty of Health Sciences,

University of Cape Town

(021) 65054571

(021) 6867530 (fax)

(082) 3126890 (cell)

vicki.lambert@uct.ac.za

Professor Estelle Lambert directs this study in South Africa, in which we hope to invite more than 500 South African grade 4 or grade 5 learners, their parents and caregivers, and school principals to participate. The South African part of this study will be added to information collected in 11 other countries, from all over the world, in 10-11 year old children. She will happy to answer any of your questions or concerns.

**Who is eligible to participate in the study? Who is not eligible?**

Your child is eligible for the study if:

- Your child is enrolled in a school that has been randomly selected for this study.
- Your child is in grade 4 or grade 5 at the time of study enrollment.
- You (the parent or legal guardian) and your child agree (by signing this form) to participate in the study.
- The child signs the separate assent form indicating that he/she wishes to volunteer for the study.

Your child will not be eligible for the study if:

- You (the parent or legal guardian) do not sign this consent form, or your child does not sign the assent form indicating that they wish to volunteer for the study.

**What will happen if you take part in the study?**

You (the parent or caregiver) will be asked to complete a demographic and family health questionnaire, including your perception of your child's home, neighborhood, and school environments. You will also be asked to supply information to allow us to follow-up with the child in the future. The questionnaire can be completed by phone (if you give us permission, and some indication of when we can contact you, we will phone you) or we can visit you at your home or work to complete the questionnaire.

Alternatively, you can choose to have them sent home with your child. You can then complete the questionnaire at home. It will take about 15 minutes to complete the questionnaire. Should you choose this option, you can return the questionnaire in the pre-stamped, self-addressed envelope to the Principal Investigator, Professor Lambert, at the UCT/MRC Research Unit for Exercise Science and Sports Medicine.

All children enrolled in the study will have the same measurements taken. All measurements will be confidential and will not be shown to anyone other than researchers involved in the study. School personnel will not be allowed to see your child's measurements.

Taking the children's measurements will be coordinated with school administrators so as to not conflict with important school activities or tests. Your child's measurements will be obtained by trained research team members in a private area at the school determined by the school principal.

The measurements will include:

1. Weight
2. Height (standing and sitting)
3. Body fat – this number is calculated while your child is standing on a weight scale

4. Waist and arm circumferences
5. Questionnaire about diet and physical activity

In addition your child will wear a physical activator monitor for 8 days, 24 hours a day, to measure his/her normal physical activity. This monitor is worn on a flexible belt around their waist, and is the size of a matchbox. It should be removed only for bathing. The monitor is on a flexible belt that will be worn around the waist. A research team staff member will call you twice during the week of monitoring time to answer questions you might have. There is a possibility that your child will be asked to wear the monitor for 8 additional days. This may happen if there is some equipment failure.


**What are the possible <u>risks and discomforts</u>?**

This is a minimal risk study. There are no aspects of the study that are anticipated to increase the risk of injury to your child. In addition, we will make every effort to make the experience of participation enjoyable for your children. The research team will be very careful to communicate in a positive and respectful way with your child, and to make sure that they understand that their participation is entirely voluntary. Some members of the research team will be able to communicate with your child in their home language.

Members of the research team have experience in school-based research, and your child's privacy will be of the utmost of importance.

**What are the possible <u>benefits</u>?**

There are no direct benefits for you or your child for participating in this study. We will provide your child with a small token of appreciation (pencil crayons to help with school work, or similar) and a small token of appreciation to you (for example, a voucher for cell phone time, or a fruit bag). A book voucher will be donated to your school as a token of appreciation for their involvement in the study.

We do hope that the combined information from all of the children in the study will help us to prevent or minimize problems associated with obesity and inactivity in children, in the future.

**If you <u>do not want</u> to take part in the study, are there other choices?**

You can either choose to participate in the study by signing this form and returning it with your child to school, or you can choose not to participate in the study by not signing the form. You have the choice at any time not to participate in this research study.

Therefore, if you and your child decide to participate in the study at this time, and later decide to not participate, you are allowed to withdraw from the study.

**If you have any <u>questions or problems</u>, whom can you call?**

If you have any questions about your rights and the rights of your child as a research volunteer, you should call the University of Cape Town, Faculty of Health Sciences Human Research Ethics Committee. Professor Marc Blockman and Lesley Henley are the co-chairpersons of this committee.

**Professor Marc Blockman**

Research Ethics Committee

E 52 Room 23

Old Main Building

Groote Schuur Hospital

Observatory

7925

**Contact Number:** 021 406 6338

**Email:** Marc.Blockman@uct.ac.za

**All information will be kept private.**

All data will be collected in a confidential manner. Every effort will be made to maintain the confidentiality of the study records and those of your child's. However, someone from the research team may inspect and/or make copies the results related to the study, without identifying you or your child by name, nor your school. This will be for the purposes of analyzing the study results.

Your child will be assigned a unique identity number and names will not appear on questionnaires or data collection forms. A separate secure list held at the study site will be used only to identify participants for re-contacting in the future.

Results of the study may be published; however, we will keep your name and your child's name and any other identifying information private. Your identity will remain confidential unless, disclosure is required by law.

**Can the study end early?**

You and your child may withdraw from the study at any time without prejudice. Professor Lambert may also withdraw you and your child from the study, at any stage, but if this is necessary, she will provide an explanation to you. Possible reasons for withdrawal include an inability to wear the activity monitor. Also, although unlikely, the sponsor of the study may end the study early.

**What payment will you receive? What is any problems arise?**

No payment will be received for participating in this study. Your child may receive a token of appreciation, such as pencil crayons, erasers, stickers, etc. These gifts will be determined by coordination between school administration and the research team. You will receive a token of appreciation, which will be in the form of either a cell phone airtime voucher or and/or a gift voucher.

The University of Cape Town and its team of researchers will see to any onsite medical care for any unplanned problems occurring as a result of participating in this study. The research is covered by the University of Cape Town's No Fault Insurance Policy. If there are any medical problems during the

study, you or your child will be referred to the relevant public health system, where you will be assisted.

**Signatures and consent:**

The study has been discussed with me and all my questions have been answered. If there is anything I don't understand, I can ask the investigator, or a member of the research team from the ISCOLE study. I have been given a copy of the signed consent form. The study volunteer is a child and I certify that I am his/her legal guardian.

Printed Name and surname of Parent/Legal Guardian:_____

Relationship to Child:_____

Date of Birth of Child:_____

Sign:_____

Date: _____

**For office use only**

Site Staff Member Receiving the Signed Informed Consent: _____

Sign:_____

Date: _____

Appendix 7

**CONSENT TO PARTICIPATE IN A RESEARCH STUDY**

**FOR SCHOOL CHILDREN**

# Title of Study: International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) – South Africa (An International Growth and Health Study)

**ASSENT BY A SCHOOLCHILD TO PARTICIPATE IN A STUDY**

Name of Principal Investigator: Professor Estelle Lambert

## Telephone number: (021-6504571)

### Why am I here?

We know that people all over the world are concerned about overweight, obesity and lack of exercise. We know that these problems can sometimes even affect children. We also know that in South Africa, some people struggle to eat healthy food, and may not live where it is safe to exercise, or have the time or money to exercise. We know that some schools do not even have time or equipment for sport or physical education. In some families, it is easy to eat healthy food and some schools and neighborhoods make it easy to do physical activity.

You were invited to join in this project, because your school was selected randomly, "out of a hat". In your school, we are inviting all Grade 4 or grade 5 learners to participate in this project. We will be inviting about 500 children your age to join in this project, and children from 11 other countries will also be invited to participate.

So we would like to ask you to join other South African children to help us to understand all of these important health concerns a bit better. We hope to learn about how lifestyle and the environment affect obesity and weight gain in children 10 years of age.

### What will happen to me?

**If** you **do want** to be in the study, three things will happen:

1) You will return this form and the consent form your parents have filled out to school, and give it to your classroom teacher. You can **only** take part if your parents have filled out a consent form.
2) You will fill out some questionnaires about the food you eat, and the activity that you do; you will be weighed; we will see how tall you are; and will take a measurement of your waist and arm.

3) You will be asked to wear a step counter on a flexible belt around your waist for a whole week. This little device is about as big as a matchbox, and it should not interfere with any of your regular activities. It tells us how many steps you take, every day.

If you **do NOT want** to be in the study, you simply do not have to sign this form. Even if you sign the form, you can drop out of the study at ANY time.

**Will the study hurt? Will my results be kept private?**

There is nothing about this study that will hurt. We will take the measurements of your height and weight, in private, in case it makes you feel nervous or concerned.

**What if I have any questions?**

You can ask questions any time. You can ask now. You can ask later. You can talk to the ISCOLE study team or you can talk to someone else.

**Do I have to be in the study?**

You **don't have to** be in this study. No one will be angry with you, if you don't want to do this. If you don't want to be in the study, you simply do not have to sign this form. Even if you sign this form, you can change your mind later. You just have to tell the ISCOLE study team. If I want to be in the study, I just have to tell the ISCOLE study team. I can say yes now and change my mind later. It's up to me.

| _____ | _____ | _____ |
|---|---|---|
| Signature of Volunteer | Age | Date |

| _____ | _____ |
|---|---|
| Signature of Person Administering Informed Consent | Date |

Appendix 8

# ISCOLE Anthropometric Data Collection Form

**1. Standing Height**

1. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm
2. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm
3. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm

**2. Sitting Height**

Table/Box Height:

1. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm

**3. Total sitting height**

1. ⌊__⌋ ⌊__⌋.⌊__⌋ cm
2. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm
3. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm

☐ **Check if PT could not remove head attire for height measurements**

**3. Mid-Upper-Arm Circumference**

1. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm
2. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm
3. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm

**4. Waist Circumference**

1. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm
2. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm
3. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ cm

**5. Weight**

1. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ kg
2. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ kg
3. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ kg

**6. Body Fat**

1. ⌊__⌋ ⌊__⌋.⌊__⌋ %
2. ⌊__⌋ ⌊__⌋.⌊__⌋ %
3. ⌊__⌋ ⌊__⌋.⌊__⌋ %

**7. Impedance**

1. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ Ω
2. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ Ω
3. ⌊__⌋ ⌊__⌋ ⌊__⌋.⌊__⌋ Ω

☐ **Check if PT is wearing socks/hosiery for weight and body fat measurements**

## Accelerometer Instructions

## Wearing the Waist Monitor

**1.** Using the belt provided, lock elastic band snugly with the monitor around waist. Position the monitor so that it rests over your hip bone directly underneath your RIGHT armpit. Refer to the picture for proper placement.

**2.** Keep the monitor on for the full 24 hours a day, including when you sleep.

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

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

## Waist Monitor Instructions

Keep the monitor on for the full 24 hours a day. During this time, please live your life as you normally do.

If you have any questions please call:

_____

Appendix 10

## ISCOLE SCHOOL ENVIRONMENT QUESTIONNAIRE

## A. SCHOOL CHARACTERISTICS

**1. What is your position at this school?** ☐ Principal ☐ Vice Principal ☐ Teacher ☐ Other:_____

**2. What is the total number of learners in your school?** (Please estimate)
_____ students

**3. What is the total number of educators (full time equivalents) in your school?** (Please estimate) _____ teachers

**4. What grades are taught at your school?** _____ to _____

**5. How many days (excluding holidays) do your learners attend school during the academic school year?** _____

## B. POLICIES AND PRACTICES

For the following section, "policies" refers to any mandates issued by the state, the local school board, or any other agency, including policies developed by your school or (district/diocese), that affects your school environment and that have been officially adopted by your school or district. This section also asks about practices (what your students and staff are allowed to do on a regular basis) that you might follow to promote the health and well-being of learners.

**6. Does your school have written policies or practices concerning physical activity?**

- ☐ **Yes**, existing written policies
- ☐ **Yes**, written policies still under development
- ☐ **Yes,** practices
- ☐ No
- ☐ N/A

**7. Does your school have written policies or practices concerning healthy eating?**

- ☐ **Yes**, existing written policies
- ☐ **Yes**, written policies still under development
- ☐ **Yes,** practices
- ☐ No
- ☐ N/A

**8. Does your school have a committee that oversees or offers guidance on the development of policies and practices concerning physical activity and healthy eating at your school (e.g., health action team, school health or wellness council)?**

- ☐ **Yes**, both physical activity and healthy eating
- ☐ **Yes**, physical activity only
- ☐ **Yes,** healthy eating only
- ☐ No

## C. PHYSICAL ACTIVITY

**9. What percent of learners participate in the following extracurricular activities offered by your school?**

(Please estimate)

| | *Not available* | *Less than 10%* | *10-24%* | *25-49%* | *50%+* |
|---|---|---|---|---|---|
| a. Inter-school athletics or sports | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. Intramural athletics, sports or physical activity clubs (including dance) | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. Academic/hobby clubs (e.g., service clubs, chess, debating) | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. Arts-based clubs (e.g., drama, music, photography) | ☐ | ☐ | ☐ | ☐ | ☐ |

**10. Does your school offer late bus/transportation service to learners who participate in extra-curricular activities?**

Yes ☐ No ☐

**11. From the following list, please indicate which sports are offered in your interschool or intramural athletics programs available to learners in grade 4 or 5:**

☐ a. Not applicable, school does not offer interschool or intramural athletics to students in grade 4 or 5

| | *Varsity/ Interschool* | *Intramural* | | *Varsity/ Interschool* | *Intramural* |
|---|---|---|---|---|---|
| b. Basketball | ☐ | ☐ | j. Gymnastics | ☐ | ☐ |
| c. Volleyball | ☐ | ☐ | k. Wrestling | ☐ | ☐ |
| d. Soccer | ☐ | ☐ | l. Track & Field | ☐ | ☐ |
| e. Football | ☐ | ☐ | m. Badminton | ☐ | ☐ |
| f. Baseball/softball | ☐ | ☐ | n. Swimming | ☐ | ☐ |
| g. Rugby | ☐ | ☐ | o. Martial Arts | ☐ | ☐ |
| h.Hockey | ☐ | ☐ | p. Netball | ☐ | ☐ |
| i. Cricket | ☐ | ☐ | q. Other | ☐ | ☐ |

**For the following questions, please consider students in grades 4 or 5 when answering.**

**12. How many breaks of 15 to 29 minutes do students in grades 4 or 5 have in a day?**

☐ zero ☐ 1 ☐ 2 ☐ 3 or more

**13. How many breaks of 30 minutes or more do students in grade 4 have in a day?**

☐ zero ☐ 1 ☐ 2 ☐ 3 or more

**14. How much class time is mandated by your Province to be allotted to physical education (PE)/Daily Physical Activity (DPA) for students in grades 4 or 5?**

**_____ minutes per** *[check the box indicating the time unit]* **week** ☐ **day** ☐

☐ No specific amount is mandated

**15. Compared to the class time allotted to physical education (PE)/Daily Physical Activity (DPA) for grade 4 as mandated by your Province, do students in grades 4 or 5 in your school receive on average:**

☐ Less than the mandated amount

☐ Approximately the mandated amount

☐ More than the mandated amount

☐ No specific amount is mandated

**16. To the best of your knowledge, how well do each of the following statements characterize your school?**

| | *A lot* | *Some* | *Very little* | *Not at all* | *Don't know* |
|---|---|---|---|---|---|
| a. We use physical activity as a reward | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. We promote physical activity during or as part of special events | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. We integrate physical activity into other curriculum areas | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. We use physical activity as a punishment for bad behavior (e.g., withholding recess, administering push-ups or laps). | ☐ | ☐ | ☐ | ☐ | ☐ |

**17. Does your school promote *active transportation* to and from school in any of the following ways?**

| | *Yes* | *No* | *Don't know* |
|---|---|---|---|
| a. Identify safe routes to use for walking and cycling to and from school (e.g., with signs, in newsletters, etc.) | ☐ | ☐ | ☐ |
| b. Provide crossing guards at intersections to encourage safe walk-to-school routes | ☐ | ☐ | ☐ |

| | | | |
|---|---|---|---|
| c. Designate a 'car free zone' to provide safe walking areas around the school | ☐ | ☐ | ☐ |
| d. Allow learners to bring bicycles on school property | ☐ | ☐ | ☐ |
| e. Allow learners to bring small wheel vehicles (e.g., rollerblades, scooters, skateboards) on school property | ☐ | ☐ | ☐ |
| f. Encourage the use of helmets and safety gear for those who use bicycles and small wheel vehicles to get to school | ☐ | ☐ | ☐ |
| g. Organize occasional 'walk to school days' , walking clubs, or programmes like 'walking school buses' (where parents or older students walk around the neighbourhood and pick up walkers at designated points) | ☐ | ☐ | ☐ |

## D. SCHOOL FACILITIES

**18. Do the majority of learners at your school have regular access to any of the following during school hours*?** *During school hours means from the first bell to the last bell, including both instructional and non-instructional time (e.g., lunch).

| | *Yes, on grounds only* | *Yes, off grounds only* | *Yes, both on and off grounds* | 1.1.1 No | *Don't know* |
|---|---|---|---|---|---|
| a. Gymnasium | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. Other large room suitable for physical activity (e.g., auditorium, cafeteria, dance studio) | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. Fitness room for aerobic and/or strength training | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. Running track | ☐ | ☐ | ☐ | ☐ | ☐ |
| e. Outdoor sports field (e.g., rugby or soccer) | ☐ | ☐ | ☐ | ☐ | ☐ |
| f. Outdoor paved area (e.g., tennis courts, basketball courts, netball courts or any paved area that can be used for active games like skipping or hopscotch) | ☐ | ☐ | ☐ | ☐ | ☐ |
| g. Skating rink/arena | ☐ | ☐ | ☐ | ☐ | ☐ |
| h. Indoor swimming pool | ☐ | ☐ | ☐ | ☐ | ☐ |
| i. Secure change room lockers available for use during physical activity | ☐ | ☐ | ☐ | ☐ | ☐ |
| j. Change rooms available for use before and after physical activity | ☐ | ☐ | ☐ | ☐ | ☐ |
| k. Showers available for use before or after physical activity | ☐ | ☐ | ☐ | ☐ | ☐ |
| l. Bicycle racks | ☐ | ☐ | ☐ | ☐ | ☐ |
| m. **If yes**, are the racks in a secure area to avoid theft? | ☐ | ☐ | ☐ | ☐ | ☐ |
| n. Grassy playground area | ☐ | ☐ | ☐ | ☐ | ☐ |
| o. Playground equipment (e.g., climbing structures, swings) | ☐ | ☐ | ☐ | ☐ | ☐ |
| p. Art room | ☐ | ☐ | ☐ | ☐ | ☐ |
| q. Music room | ☐ | ☐ | ☐ | ☐ | ☐ |

**19. Do learners have access to the following facilities where they can buy foods or drinks?**

| | *Yes* | *No* |
|---|---|---|
| a. Cafeteria | ☐ | ☐ |
| b. Tuck shop | ☐ | ☐ |
| c. Shops/fast food restaurants close to school | ☐ | ☐ |
| d. Candy and potato chips vending machine | ☐ | ☐ |
| e. Drinks vending machine (e.g., coke, soft drinks, orange juice) | ☐ | ☐ |
| f. Milk vending machine/ milk program (e.g., milk, chocolate milk) | ☐ | ☐ |

**20. *Outside of school hours**, does your school permit regular learners access to the following?**
**Outside of school hours means before and/or after school, evenings and weekends. Student access may occur via school-led, community-led or informal use.*

| | *Yes* | *No* | *Don't know* | *N/A* |
|---|---|---|---|---|
| a. Gymnasium | ☐ | ☐ | ☐ | ☐ |
| b. Indoor facilities | ☐ | ☐ | ☐ | ☐ |
| c. Outdoor facilities (e.g., playing fields, paved activity areas, baseball diamond) | ☐ | ☐ | ☐ | ☐ |
| d. Equipment (e.g., basketballs) | ☐ | ☐ | ☐ | ☐ |

**21. *Outside of school hours**, does your school allow community groups to use the school facilities?**

**Outside of school hours means before and/or after school, evenings and weekends.*

Yes ☐ No ☐ Don't know ☐

## E. HEALTHY EATING

**22. Does your school provide any of the following to promote the sale of healthy food**? (Check all that apply)

| | *Cafeteria* | *Snack tuck shop* | *Vending machine(s)* |
|---|---|---|---|
| a. Healthy food choices at a reasonable/subsidized price | ☐ | ☐ | ☐ |
| b. Healthy eating promotional materials (e.g., posters) | ☐ | ☐ | ☐ |
| c. Daily healthy eating specials | ☐ | ☐ | ☐ |

| | | | |
|---|---|---|---|
| d. Healthy eating cafeteria program (e.g., Eat Smart or independent program) | ☐ | ☐ | ☐ |

**23. Does your school ensure that all students, regardless of ability to pay, have access to fruits and vegetables?**

☐ Yes, entire school year

☐ Yes, occasional/short term

☐ No

**24. Does your school offer any of the following? (Check all that apply)**

☐ Cooking classes

☐ Gardening (e.g., growing produce)

☐ Field trips to farms/farmers' markets

☐ Media literacy on special topics related to healthy eating (e.g., body image, eating disorders)

☐ Field trips to the local grocery stores or supermarkets

**25. During the past 12 months, did your school initiate/continue any of the following activities/programs at your school?**

| | *Yes* | *No* | *N/A* |
|---|---|---|---|
| a. Offered healthy food choices during breakfast program | ☐ | ☐ | ☐ |
| b. Offered healthy food choices during lunch program | ☐ | ☐ | ☐ |
| c. Offered healthy food choices in the cafeteria(s) | ☐ | ☐ | ☐ |
| d. Offered healthy food choices in the tuck shop(s) | ☐ | ☐ | ☐ |
| e. Offered healthy food choices in the vending machine(s) | ☐ | ☐ | ☐ |
| f. Organized Nutrition Month activities | ☐ | ☐ | ☐ |
| g. Stopped the sale of junk food | ☐ | ☐ | ☐ |
| h. Held "junk food free" days | ☐ | ☐ | ☐ |
| i. Stopped the sale of sugar-sweetened beverages | ☐ | ☐ | ☐ |

**26. During the past 12 months, have any of the following items been sold as part of fundraising for any school organization?**

| | *Yes* | *No* | *N/A* |
|---|---|---|---|
| a. Chocolate candy | ☐ | ☐ | ☐ |
| b. Other candy | ☐ | ☐ | ☐ |
| c. Other junk food (e.g., crisps, chips, popcorn) | ☐ | ☐ | ☐ |
| d. Sodas or 'cool drinks' or fruit drinks that are not 100% juice | ☐ | ☐ | ☐ |
| e. Sports drinks | ☐ | ☐ | ☐ |
| f. Cookies, crackers, cakes, pies and pastries, or other baked goods that are not low in fat | ☐ | ☐ | ☐ |
| g. Fruits or vegetables | ☐ | ☐ | ☐ |
| h. 100% fruit juice or vegetable juice | ☐ | ☐ | ☐ |
| i. Low-fat cookies, crackers, cakes, pastries, or other low-fat baked goods | ☐ | ☐ | ☐ |

## F. NEIGHBOURHOOD/COMMUNITY

**27. How much of a problem are the following in the neighbourhood where this school is located?**

| | *Major problem* | *Moderate problem* | *Minor problem* | *Not a problem* | *I don't know* |
|---|---|---|---|---|---|
| a. Tensions based on racial, ethnic, or religious differences | ☐ | ☐ | ☐ | ☐ | ☐ |
| b. Garbage, litter, or broken glass in the street or road, on the sidewalks, or in yards | ☐ | ☐ | ☐ | ☐ | ☐ |
| c. Selling or using drugs or excessive drinking in public | ☐ | ☐ | ☐ | ☐ | ☐ |
| d. Gangs | ☐ | ☐ | ☐ | ☐ | ☐ |
| e. Heavy traffic | ☐ | ☐ | ☐ | ☐ | ☐ |
| f. Vacant or shabby houses and buildings | ☐ | ☐ | ☐ | ☐ | ☐ |
| g. Crime in the neighbourhood | ☐ | ☐ | ☐ | ☐ | ☐ |

Appendix 11

# ISCOLE SCHOOL AUDIT TOOL

School Name: _____

Start Time: _____ Finish Time: _____

---

## I. SCHOOL BUILT ENVIRONMENT

## A. ACCESS TO THE SCHOOL

1. Please locate each entrance to the school and record its grid reference. Record whether the entrance is accessible by cars, pedestrians, and/or cyclists. (Check all that apply). Then record what mode of transportation the entrance appears to be designed for. (Check all that apply.) Determine if the entrance is an official entrance and check No or Yes. Also, for entrances that open onto a road, please record the speed limit, in miles or kilometres per hour, on the adjacent road and whether roadside parking is available.

| Grid Ref (e.g., A1) | **Is entrance accessible by...? (Check all that apply.)** | | | **Is this entrance designed for use by? (Check all that apply.)** | | | **Is this an official entrance?** | **Does the entrance open onto a road?** | **For each entrance that opens onto a road...** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Cars** | **Peds.** | **Cycls.** | **Cars** | **Peds.** | **Cycls.** | | | **Speed limit of adjacent road** | **Is roadside parking available?** |
| 1. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ N ☐ Y ☐ Not allowed | ☐ N ☐ Y → | ☐ kph | ☐ N ☐ Y |
| 2. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ N ☐ Y ☐ Not allowed | ☐ N ☐ Y → | ☐ kph | ☐ N ☐ Y |
| 3. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ N ☐ Y ☐ Not allowed | ☐ N ☐ Y → | ☐ kph | ☐ N ☐ Y |
| 4. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ N ☐ Y ☐ Not allowed | ☐ N ☐ Y → | ☐ kph | ☐ N ☐ Y |
| 5. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ N ☐ Y ☐ Not allowed | ☐ N ☐ Y → | ☐ kph | ☐ N ☐ Y |
| 6. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ N ☐ Y ☐ Not allowed | ☐ N ☐ Y → | ☐ kph | ☐ N ☐ Y |
| 7. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ N ☐ Y ☐ Not allowed | ☐ N ☐ Y → | ☐ kph | ☐ N ☐ Y |
| 8. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ N ☐ Y ☐ Not allowed | ☐ N ☐ Y → | ☐ kph | ☐ N ☐ Y |
| 9. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ N ☐ Y ☐ Not allowed | ☐ N ☐ Y → | ☐ kph | ☐ N ☐ Y |

## B. THE SURROUNDING AREA

2. Is the area around the school predominantly…? (Check one.)

Residential ☐ Open fields/ commons/ parks ☐ Business/ retail ☐ A mixture of different land uses ☐

***Are the following visible from any of the entrances?***

| | | | |
|---|---|---|---|
| 3. Somewhere where parents can stop and drop children off? | | Yes ☐ | No ☐ |
| 4. Somewhere where parents can park their cars? | | Yes ☐ | No ☐ |
| 5. A bus stop? | Yes ☐ | No ☐ | |
| 6. Cycle lanes: | | | |
| a. Separated from the road? | Yes ☐ | No ☐ | |
| b. On the road? | Yes ☐ | No ☐ | |
| 7. Pavements/sidewalks: | | | |
| a. On both sides | Yes ☐ | No ☐ | |
| b. On one side of the road only | Yes ☐ | No ☐ | |
| 8. A marked pedestrian crossing to assist access to the school | | Yes ☐ | No ☐ |
| 9. Traffic calming | Yes ☐ | No ☐ | |
| 10. Signage: | | | |
| a. School warning signs for road users | Yes ☐ | No ☐ | |
| b. Road safety signs | Yes ☐ | No ☐ | |
| c. Route signs for cyclists | Yes ☐ | No ☐ | |
| 11. Fast food restaurants | Yes ☐ | No ☐ | |

Remember to refer to the Item Definitions to help keep the study strong!

## C. THE SCHOOL GROUNDS

Please indicate whether the following features are present.

For most amenities, record whether or not the school grounds contains AT LEAST ONE FUNCTIONAL example (i.e., good or adequate quality) of that amenity, whether ALL EXAMPLES ARE NON-FUNCTIONAL (i.e., poor quality), or whether the amenity is NOT AVAILABLE.

For amenities where you are asked to assess the number of functional examples and overall quality, if available:

- Record the number of functional examples TO A MAXIMUM OF 10 (i.e., if more than 10, you can stop counting at 10 and put "10" in the space provided).
- For overall quality, use the following scale:

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Entirely or almost entirely broken down and non-functional | Mostly broken or non-functional, but some equipment can be used by students | About 50/50 functional vs. not | Mostly functional but some broken pieces | 100% or almost 100% functional |

**"Play" and other active areas**

| | Quality: At least one example that is FUNCTIONAL | Quality: All are NON-FUNCTIONAL | Amenity not available |
|---|---|---|---|
| 12. Outdoor paved area that can be used for active games | ☐ | ☐ | ☐ |
| 13. Bright or fluorescent markings on play surfaces (e.g., hopscotch, animals) | ☐ | ☐ | ☐ |
| 14. Grassy or soft surface play area | ☐ | ☐ | ☐ |
| 15. Assault course/fitness course | ☐ | ☐ | ☐ |

| | Number of different TYPES (max 10) | Overall quality (Circle one) | Amenity not available |
|---|---|---|---|
| 16. Playground equipment (e.g., swings, slide) | (#: _____) | 1 2 3 4 5 | ☐ |

**"Sports" areas**

| | Quality: At least one example that is FUNCTIONAL | Quality: All are NON-FUNCTIONAL | Amenity not available |
|---|---|---|---|
| 17. Outdoor sports fields (e.g., soccer, rugby, softball, cricket) | ☐ | ☐ | ☐ |
| 18. Running track (grass or hard surface) | ☐ | ☐ | ☐ |
| 19. Paved courts for sport (e.g., tennis, basketball including half court, netball, multicourt area) | ☐ | ☐ | ☐ |

**Other areas**

| | Quality | | |
|---|---|---|---|
| | **At least one example that is FUNCTIONAL** | **All are NON-FUNCTIONAL** | **Amenity not available** |
| 20. Other: _____ | ☐ | ☐ | ☐ |
| 21. Other: _____ | ☐ | ☐ | ☐ |
| 22. Other: _____ | ☐ | ☐ | ☐ |

**Opportunities to interact with nature**

| | Quality | | |
|---|---|---|---|
| | **At least one example that is FUNCTIONAL** | **All are NON-FUNCTIONAL** | **Amenity not available** |
| 23. A wildlife/nature garden | ☐ | ☐ | ☐ |
| 24. A vegetable garden | ☐ | ☐ | ☐ |

**Supporting features**

| | **Number of functional examples (max 10)** | **Overall quality (Circle one)** | **Amenity not available** |
|---|---|---|---|
| 25. Benches | (#: _____) | 1 2 3 4 5 | ☐ |
| 26. Picnic tables | (#: _____) | 1 2 3 4 5 | ☐ |
| 27. Drinking fountains | (#: _____) | 1 2 3 4 5 | ☐ |
| 28. Uncovered cycle parking (indicate how many bikes can be parked, to a maximum of 10)<br>Is the cycle parking in a secure area to avoid theft?<br>Y ☐ N ☐ | (#: _____) | 1 2 3 4 5 | ☐ |
| 29. Covered cycle parking (indicate how many bikes can be parked, to a maximum of 10)<br>Is the cycle parking in a secure area to avoid theft?<br>Y ☐ N ☐ | (#: _____) | 1 2 3 4 5 | ☐ |

30. Are the school grounds on a split site? Yes ☐ No ☐
31. Are the school grounds predominantly...? Flat ☐ Sloping/undulating ☐

## D. AESTHETICS

Please indicate whether the following are present:

32. Planted beds containing flowers/ shrubs/ small trees. None ☐ Some/ A lot ☐

33. Trees for sitting under None ☐ Some/ A lot ☐

34. Ambient noise (e.g., traffic, trains, industry) None ☐ Some/ A lot ☐

None, very occasional, or very little,

35. Litter localized litter in an otherwise litter-free campus ☐ Some/ A lot ☐

36. Murals/ Outdoor art None ☐ Some/ A lot ☐

37. Graffiti None ☐ Some/ A lot ☐

## E. USEAGE

Are the school grounds generally suitable for... ?

38. Sport (organized or not) Not at all ☐ Somewhat/ Very ☐

39. Informal games (kickabout, skipping, frisbee, etc.) Not at all ☐ Somewhat/ Very ☐

40. General play Not at all ☐ Somewhat/ Very ☐

## II. SCHOOL FOOD ENVIRONMENT

41. Does the school have a school shop/ store where the learners can purchase food, snacks, or drinks?

Yes ☐ No ☐

42. Does the school have vending machines available to the learners?

Yes ☐ No ☐

a. If YES, how many? _____

b. If YES, are the machines available to the students and functional (i.e., plugged in)…? (check all that apply)

Before school ☐ Between classes ☐ During recess/ breaks ☐ During lunch ☐ After school ☐

43. Please indicate which food and beverage items are available for purchase in the school shop/ store.

a. Not applicable, school does not have a school shop/store ☐

| **Food and beverage items** | **Available?** |
|---|---|
| b. 100% fruit juice or 100% vegetable juice? | ☐ |
| c. Sweetened beverages such as regular soft drinks, sports drinks, or fruit drinks that are not 100% juice? | ☐ |
| d. Diet soft drinks? | ☐ |
| e. Low-fat or skim milk (flavored or regular)? | ☐ |
| f. Full-cream white or flavoured milk | ☐ |
| g. Water? | ☐ |
| h. Fruit (fresh, frozen, canned, or dried)? | ☐ |
| i. Breadsticks, rolls, bagels, pita bread, or other bread products? | ☐ |
| j. Low-fat cookies, crackers, cakes, pastries, or other low-fat baked goods? | ☐ |
| k. Cookies, crackers, cakes, pastries, or other baked goods that are **not** low in fat? | ☐ |
| l. Low-fat or nonfat yogurt? | ☐ |
| m. Low-fat or fat-free ice cream, frozen yogurt, or sherbet? | ☐ |
| n. Ice cream or frozen yogurt that is **not** low in fat? | ☐ |
| o. Other dairy products that are **not** low in fat, such as yogurt, pudding, etc. | ☐ |
| p. Pizza, hamburgers, sandwiches, meat pies, and other baked savory pastries? | ☐ |
| q. Lettuce, vegetable, or bean salads? | ☐ |
| r. Other vegetables? | ☐ |
| s. French fried potatoes (chips)? | ☐ |
| t.Chocolate candy? | ☐ |
| u. Other kinds of candy? | ☐ |

| | |
|---|---|
| v. Salty snacks that are low in fat, such as pretzels, baked chips, or other low-fat chips? | ☐ |
| w. Salty snacks that are **not** low in fat, such as regular potato chips or cheese puffs? | ☐ |
| x. Granola or cereal bars | ☐ |
| y. Other: _____? | ☐ |

44. Please indicate which food and beverage items are available for purchase across all of the vending machines available to the learners.

    a. Not applicable, school does not have any vending machines ☐

| **Beverage items** | **Available?** | **Number of items** |
|---|---|---|
| b. 100% fruit juice or 100% vegetable juice? | ☐ | |
| c. Sweetened beverages such as regular soft drinks, sports drinks, or fruit drinks that are not 100% juice? | ☐ | |
| d. Diet soft drinks? | ☐ | |
| e. Low fat or skim milk? | ☐ | |
| f. Full-cream white or flavored milk | ☐ | |
| g. Water? | ☐ | |

| **Food items** | | |
|---|---|---|
| h. Low-fat cookies, crackers, cakes, pastries, or other low-fat baked goods? | ☐ | |
| i. Cookies, crackers, cakes, pastries, or other baked goods that are **not** low in fat? | ☐ | |
| j.Chocolate candy? | ☐ | |
| k. Other kinds of candy? | ☐ | |
| l. Salty snacks that are low in fat, such as pretzels, baked chips, or other low-fat chips? | ☐ | |
| m. Salty snacks that are **not** low in fat, such as regular potato chips or cheese puffs? | ☐ | |
| n. Nuts? | ☐ | |
| o. Trail mix (e.g., combination of nuts and dried fruit) | ☐ | |
| p. Granola or cereal bars | ☐ | |
| q. Other: _____? | ☐ | |

Appendix 12

# ISCOLE Diet and Lifestyle Questionnaire

Please read every question carefully. What answer comes to your mind first?

Choosethe box that fits your answer best and fill it in.

Remember: This is **not a test** so there are no wrong answers. It is important that you answer all the questions and that we can see your marks clearly.

You do not have to show your answers to anybody. Also, nobody who knows you will look at your questionnaire once you have finished it.

For the questions on this page, please tell about what you did *last week*.

1. On a school day, how many hours did you watch TV?
   ☐I did not watch ☐less than 1 hour ☐1 hour ☐2 hours ☐3 hours ☐4 hours ☐5 or more hours

   TV on school

   days

2. On a school day, how many hours did you play video or computer games or use a computer for something that was not school work?
   ☐I did not play ☐less than 1 hour ☐1 hour ☐2 hours ☐3 hours ☐4 hours ☐5 or more hours

   video/computer

   games or use a

   computer other

   than for school

   work on school days

3. On a school day how much time did you spend outside **before** school?
   ☐less than 1 hour ☐1 hour ☐2 hours ☐3 hours ☐4 hours ☐5 or more hours

4. On a school day how much time did you spend outside **after** school before bedtime?
   ☐less than 1 hour ☐1 hour ☐2 hours ☐3 hours ☐4 hours ☐5 or more hours

5. On a weekend day, how many hours did you watch TV?
   ☐ I did not watch ☐less than 1 hour ☐1 hour ☐2 hours ☐3 hours ☐4 hours ☐5 or more hours

   TV on weekend

   days

6. On a weekend day, how many hours did you play video or computer games or use a computer for something that wasnot school work?
   ☐ I did not play ☐less than 1 hour ☐1 hour ☐2 hours ☐3 hours ☐4 hours ☐5 or more hours

   video/computer

   games or use a

   computer other

   than for school

work on the weekend

7. On a weekend day, how much time did you spend outside?
☐less than 1 hour ☐1 hour ☐2 hours ☐3 hours ☐4 hours ☐5 or more hours

8. In the last week you were in school, on how many days did you go to physical education (PE) classes?

☐0 days ☐1 day ☐2 days ☐3 days ☐4 days ☐5 days

9. In the last week you were in school, the **MAIN** part of your journey to school was by:
   - ☐ walking
   - ☐ bicycle, roller-blade, skateboard or scooter
   - ☐ bus, train, tram, underground or boat
   - ☐ car, motorcycle or scooter
   - ☐ other _____

10. In the last week you were in school, **HOW LONG** did it take you to travel to school?

☐less than 5 minutes ☐5 - 15 minutes ☐16 - 30 minutes ☐31 minutes to 1 hour ☐ more than1 hour

11. During the past year (12 months), did you do any of these activities? (Check all that apply)

☐ sports teams ☐ dance / martial arts class ☐ art / music class ☐ none of these

12. During the past week (7 days), on how many days were you physically active for a total of at least 60 minutes per day? (all the time you spent in activities that increased your heart rate and made you breathe hard)

☐0 days ☐1 day ☐2 days ☐3 days ☐4 days ☐5 days ☐6 days ☐7 days

**Please tick the box that most sounds like you:**

| | **Disagree a Lot →** | | | | **Agree a Lot** |
|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | |
| 13. I can be physically active during my free time on most days. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 14. I can ask my parent or other adult to do physically active things with me. | ☐ | ☐ | ☐ | ☐ | ☐ |
| 15. I can be physically active during my free time on most days even if I could watch TV or play video games instead. | ☐ | ☐ | ☐ | ☐ | ☐ |

16. I can be physically active during my free time on most days even if it is very hot or cold outside. ☐ ☐ ☐ ☐ ☐

17. I can ask my best friend to be physically active with me during my free time on most days. ☐ ☐ ☐ ☐ ☐

18. I can be physically active during my free time on most days even if I have to stay at home. ☐ ☐ ☐ ☐ ☐

19. I have the skill and coordination I need to be physically active during my free time on most days. ☐ ☐ ☐ ☐ ☐

20. I can be physically active during my free time on most days no matter how busy my day is. ☐ ☐ ☐ ☐ ☐

**There are lots of reasons why people take part in physical activity. Please tick the box to show how much each of the reasons below is true for you:**

| | never true for me | a little bit true for me | sometime strue for me | for me | very true for me |
|---|---|---|---|---|---|
| 21. I take part in exercise because other people say I should | ☐ | ☐ | ☐ | ☐ | ☐ |
| 22. It's important to me to exercise regularly | ☐ | ☐ | ☐ | ☐ | ☐ |
| 23. I can't see why I should bother exercising | ☐ | ☐ | ☐ | ☐ | ☐ |
| 24. I feel like a failure when I haven't exercised in a while | ☐ | ☐ | ☐ | ☐ | ☐ |
| 25. For me, exercise is fun and I enjoy it. | ☐ | ☐ | ☐ | ☐ | ☐ |

**26.** During the past week, what time have you usually turned out the light and gone to sleep on school days?

☐☐:☐☐AM / PM (circle AM or PM)

**27.** During the past week, at what time have you usually woken up in the morning on school days**?**

☐☐:☐☐AM / PM (circle AM or PM)

**28.** During the past week, what time have you usually turned out the light and gone to sleep on weekend days?

☐☐:☐☐AM / PM (circle AM or PM)

29. During the past week, at what time have you usually woken up in the morning on weekend days?

☐☐:☐☐AM / PM (circle AM or PM)

30. During the past week, how would you rate your sleep **quality** overall (how **well** you sleep)?

☐ very good ☐ fairly good ☐ fairly bad ☐ very bad

31. During the past week, how would you rate your sleep **quantity** overall (how **much** you sleep)?

☐ very good ☐ fairly good ☐ fairly bad ☐ very bad

32. Do you have a television in your bedroom?

☐ Yes ☐ No

33. How many times do you usually eat . . . ? (Please mark only one box for each line)

| | Never | Less than once a week | Once a week | 2-4 days a week | 5-6 days a week | Once a day, every day | Every day, more than once |
|---|---|---|---|---|---|---|---|
| Fruits | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Vegetables | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Sweets (candy/chocolate) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Regular cola or soft drinks that contain sugar | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Cake, pastries & pies, or donuts | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Diet cola or sugar-free soft drinks | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Potato chips (crisps) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| French fries (chips) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Dark green vegetables (broccoli, spinach, etc.) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Orange vegetables (carrots, butternut, sweet potato, etc.) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Fruit juice | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Low fat milk (1%,2%, skim) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Full-cream milk | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Cheese | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other milk products (yogurt, chocolate milk, pudding, etc.) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Whole grain bread or cereal (oatmeal, muesli, | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| pap, etc.) | | | | | | | |
| Meat alternatives (beans, lentils, soya mince, tofu, eggs, peanut butter, etc.) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Energy drinks (Red Bull, Rock Star, Guru, etc.) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Sports drinks (Gatorade, Powerade, etc.) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Fish | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Ice cream | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Fried food such as chicken wings, chicken fingers, etc. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Fast foods such as pizza, hamburgers, etc. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

34. How many times do you usually eat the following food items **while watching television**?

| | Never | Less than once a week | Once a week | 2-4 days a week | 5-6 days a week | Once a day, every day | Every day, more than once |
|---|---|---|---|---|---|---|---|
| Potato chips, crisps or peanuts | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Fried food such as chicken wings, chicken fingers, etc. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Cookies, biscuits, chocolate or candy bars | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Ice cream | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Fast foods such as pizza, hamburgers, etc. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Fruits or vegetables | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

35. On how many days in a week do you usually have **breakfast** (more than a glass of milk or fruit juice)? Mark one box for weekdays and one box for weekend.

**Weekdays**

- ☐ I never have breakfast on weekdays
- ☐ One day
- ☐ Two days
- ☐ Three days
- ☐ Four days
- ☐ Five days

**Weekend**

- ☐ I never have breakfast on the weekend
- ☐ I usually have breakfast on only one day of the weekend (Saturday OR Sunday)
- ☐ I usually have breakfast on both weekend days (Saturday AND Sunday)

36. Does your school serve school lunches?

☐ Yes ☐ No

37. In the last week you were in school, about **how many times a week** did you eat a school lunch?

☐ 0 days ☐ 1 day ☐ 2 days ☐ 3 days ☐ 4 days ☐ 5 days

38. During thepast week**,** how many meals (breakfast, lunch or dinner) did you get that were **prepared away from home** in places such as restaurants, fast food places, food stands, grocery stores or vending machines? (please do not include meals provided as part of school breakfast or school lunch)

☐☐ meals

**How well do these statements describe you? (**Put a mark in the box that best describes how often this happens).

| | Never or Almost Never | Sometimes | Usually Always |
|---|---|---|---|
| 39. When I am worried I eat more | ☐ | ☐ | ☐ |
| 40. I eat when I am mad or angry | ☐ | ☐ | ☐ |
| 41. When I do something well I give myself a foodtreat | ☐ | ☐ | ☐ |
| 42. When I am sad I eat more | ☐ | ☐ | ☐ |
| 43. When I am happy I eat more | ☐ | ☐ | ☐ |
| 44. When I am bored I eat more | ☐ | ☐ | ☐ |
| **45.** I eat between meals even when I am not hungry | ☐ | ☐ | ☐ |

**Thinking about the last week…..** (Put a mark in the box that best describes how you felt)

| | Not at all | Slightly | Moderately | Very | Extremely |
|---|---|---|---|---|---|
| 46. Have you felt fit and well? | ☐ | ☐ | ☐ | ☐ | ☐ |
| 47. Have you felt full of energy? | ☐ | ☐ | ☐ | ☐ | ☐ |
| 48. Have you felt sad? | ☐ | ☐ | ☐ | ☐ | ☐ |
| 49. Have you felt lonely? | ☐ | ☐ | ☐ | ☐ | ☐ |
| 50. Have you had enough time for yourself? | ☐ | ☐ | ☐ | ☐ | ☐ |
| 51. Have you been able to do the things that you want to do in your free time? | ☐ | ☐ | ☐ | ☐ | ☐ |
| 52. Have your parent(s) treated you fairly? | ☐ | ☐ | ☐ | ☐ | ☐ |
| 53. Have you had fun with your friends? | ☐ | ☐ | ☐ | ☐ | ☐ |
| 54. Have you got on well at school? | ☐ | ☐ | ☐ | ☐ | ☐ |
| 55. Have you been able to pay attention? | ☐ | ☐ | ☐ | ☐ | ☐ |

56. In general, how would you say your health is?

☐ excellent ☐ very good ☐ good ☐ fair ☐ poor

**Thank you**

Appendix 13

# ISCOLE Demographic and Family Health Questionnaire- South Africa

## A. GENERAL INFORMATION

Child's Name:

Last First Middle

Name of Child's School:

Parent's or Guardian's Name:

Last First Middle

Home Address:

Street Address Apt. # Town or City State Postal/Zip Code

Nearest Cross-Street to Home:

Phone Number: ( ) E-Mail:

Area Code

How long have you lived at the current address? _____years and _____months

## B. DEMOGRAPHICS OF CHILD

Birth date _____/_____/_____ Age _____years Gender: ☐ Male ☐ Female

dd/mmm/yyyy

Example: 02/Jun/2011

To which ethnic group do you belong? (Self-Identified Ethnic Group):

- ☐ White
- ☐ Black South African
- ☐ Mixed Ancestry or "Coloured"
- ☐ Indian
- ☐ Asian
- ☐ Don't know
- ☐ Other _____

Are you of Hispanic origin? ☐ Yes ☐ No

In what country was the child born? _____

How many biological brothers and sisters does the child have? _____

What are their ages? _____yrs _____yrs _____yrs _____yrs _____yrs
_____yrs _____yrs _____yrs _____yrs _____yrs

## C. HEALTH HISTORY OF CHILD

**1.** Birth Weight: _____kgs Birth Length: ____cm

**2.** Length of Pregnancy: _____weeks

**3.** Did mother develop gestational diabetes during pregnancy with **THIS** child? ☐ Yes No ☐

**4.** Fed breast milk? ☐ Yes ☐ No If No, please skip to question 5.

Age when **COMPLETELY** stopped being fed breast milk: _____months

Age when **FIRST** fed formula: _____months

**5.** Age when **COMPLETELY** stopped drinking formula: _____months

## C. FAMILY DEMOGRAPHICS AND HEALTH

**6.** What is the marital status of the child's parents?

☐ Married or living together as married
☐ Divorced or separated
☐ Never married, single, or unmarried
☐ Widowed parent

**7.** How many people live in your household (at this address)? ____

**7a.** Who lives with the child **at this address** (check all that apply)?

☐ Biological Mother
☐ Biological Father
☐ Adoptive Mother
☐ Adoptive Father
☐ Step Mother
☐ Step Father
☐ Brother(s) or Sister(s)
☐ Grandparent(s)
☐ Other Relative(s)
☐ Friend(s)
☐ Legal Guardian(s)
☐ OTHER

**8.** What is the **COMBINED** annual income for your household (before taxes)?

- ☐ Less than R11,500
- ☐ Between 11,500-R19,000
- ☐ Between 19,000-R30,000
- ☐ Between R30,000-R65,000
- ☐ Between R65,000-R100,000
- ☐ Between R100,000-R300,000
- ☐ Between R300,000-R500,000
- ☐ More than R500,000

**9.** How many functioning motorized vehicles (car, truck, motorcycle, moped, etc.) are available for use at your house?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more

**10.** How many television sets are in your household?

- ☐ 0
- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5 or more

**11.** What best describes your type of television service for the **primary** television in the house?

- ☐ No television
- ☐ Antenna only
- ☐ No cable (pay for TV channel, such as MNET)
- ☐ Basic cable (pay for TV channel, such as MNET)
- ☐ Satellite dish and pay for TV channels (DSTV)
- ☐ Other
- ☐ Don’t know

**12.** What best describes your type of internet service?

- ☐ No internet access
- ☐ Dial-up modem
- ☐ DSL modem
- ☐ Cable modem

☐ Other
☐ Don't know

**13.** What is the **MOTHER'S** highest level of education completed?
☐ Less than high school
☐ Some high school
☐ High school diploma/GED
☐ Associate's degree or 1-3 years of college
☐ Bachelor's degree (university)
☐ Post-graduate/professional degree

**14.** How many hours per week does the **MOTHER** work outside the home?
☐ None
☐ Less than 15 hours/week
☐ Part-time (15-35 hours per week)
☐ Full time (36+ hours per week)

**15.** What is the **FATHER'S** highest level of education completed?
☐ Less than high school
☐ Some high school
☐ High school diploma/GED
☐ Associate's degree or 1-3 years of college
☐ Bachelor's degree
☐ Post-graduate/professional degree

**16.** How many hours per week does the **FATHER** work outside the home?
☐ None
☐ Less than 15 hours/week
☐ Part-time (15-35 hours per week)
☐ Full time (36+ hours per week)

**17.** Is this child adopted? ☐ Yes ☐ No

**18.** Please answer the following questions with regard to the child's **BIOLOGICAL MOTHER**:

Current height: _____cm Current weight: _____kg

Current Age: _____ years

Age at child's birth: ____ years

☐ Biological Mother's information cannot be estimated or is not known

**19.** Please answer the following questions with regard to the child's **BIOLOGICAL FATHER:**

Current height: _____cm Current weight: _____kg

Current age: _____ years

☐ Biological Father's information cannot be estimated or is not known

## ISCOLE NEIGHBOURHOOD & HOME ENVIRONMENT QUESTIONNAIRE

Where "child" is mentioned, please respond only about the child who is participating in this study. Be as accurate as you can. There are no right or wrong answers. All information is strictly confidential. (For parent or caregiver)

### A. My NEIGHBOURHOOD

| **Do you agree or disagree with the following statements?** | Strongly disagree | Somewhat disagree | Neutral | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| 1. People around my neighbourhood are willing to help their neighbours. | ○ | ○ | ○ | ○ | ○ |
| 2. This is a close-knit neighbourhood. | ○ | ○ | ○ | ○ | ○ |
| 3. People in my neighbourhood can be trusted. | ○ | ○ | ○ | ○ | ○ |
| 4. People in my neighbourhood generally don't get along with each other. | ○ | ○ | ○ | ○ | ○ |
| 5. People in my neighbourhood do not share the same values, attitudes or beliefs. | ○ | ○ | ○ | ○ | ○ |

### B. MY NEIGHBOURS AND FRIENDS

1. Think about the neighbourhood or area in which you live. In general, how well do you feel you know your neighbours?

| Not at all | Just a little | Moderately well | Extremely well |
|---|---|---|---|
| ○ | ○ | ○ | ○ |

2. About how often do you talk to or visit with your immediate neighbours (people in the 10-20 households that live closest to you)?

| Never | Once a year or less | Several times a year | Once a month | Several times a month | Several times a week | Almost every day |
|---|---|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ | ○ | ○ |

## C. NEIGHBOURHOOD RESPONSE

| **For the following statements, please mark how likely a neighbour would respond to, or take action in the following situations:** | Very unlikely | Unlikely | Neither likely nor unlikely | Likely | Very likely |
|---|---|---|---|---|---|
| 1. If a group of neighbourhood children were skipping school and hanging out on a street corner, how likely is it that your neighbours would do something about it? | ○ | ○ | ○ | ○ | ○ |
| 2. If some children were spray-painting graffiti on a local building, how likely is it that your neighbours would do something about it? | ○ | ○ | ○ | ○ | ○ |
| 3. If a child was showing disrespect to an adult, how likely is it that people in your neighbourhood would scold that child? | ○ | ○ | ○ | ○ | ○ |
| 4. If there was a fight in front of your house and someone was being beaten or threatened, how likely is it that your neighbours would break it up? | ○ | ○ | ○ | ○ | ○ |
| 5. Suppose that because of budget cuts the fire station closest to your home was going to be closed down by the city. How likely is it that neighbourhood residents would organize to try to do something to keep the fire station open? | ○ | ○ | ○ | ○ | ○ |

## D. FOODS IN THE HOME

| **How often are the following foods/drinks available in your home?** | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| 1. Chocolate candy | ○ | ○ | ○ | ○ | ○ |
| 2. Other candy | ○ | ○ | ○ | ○ | ○ |
| 3. Raw fruit (e.g., apples, oranges) | ○ | ○ | ○ | ○ | ○ |
| 4. Cakes, brownies, muffins or cookies | ○ | ○ | ○ | ○ | ○ |
| 5. Regular chips or crackers or crisps | ○ | ○ | ○ | ○ | ○ |
| 6. Baked chips, low-fat crackers, pretzels | ○ | ○ | ○ | ○ | ○ |
| 7. Raw vegetables (e.g., carrots) | ○ | ○ | ○ | ○ | ○ |
| 8. 100% fruit juice (e.g., Liquifruit, Ceres) | ○ | ○ | ○ | ○ | ○ |
| 9. Juice drinks (e.g., Sunny delight) | ○ | ○ | ○ | ○ | ○ |
| 10. Regular sodas with sugar | ○ | ○ | ○ | ○ | ○ |
| 11. Diet or sugar free sodas | ○ | ○ | ○ | ○ | ○ |
| 12. Sports drinks (e.g., Gatorade, Powerade) | ○ | ○ | ○ | ○ | ○ |

| | | | | | |
|---|---|---|---|---|---|
| 13. Fruit roll-ups or other dried fruit | ○ | ○ | ○ | ○ | ○ |
| 14. Regular, Full-cream or 2% milk | ○ | ○ | ○ | ○ | ○ |
| 15. 1% or fat-free milk | ○ | ○ | ○ | ○ | ○ |
| 16. Sweetened breakfast cereal | ○ | ○ | ○ | ○ | ○ |
| 17. Unsweetened breakfast cereal | ○ | ○ | ○ | ○ | ○ |

## E. WHERE YOU SHOP

| **When you, or the main food shopper in your home, go food shopping, how often do you go to each of these types of stores?** | Never | Rarely | Sometimes | Often | Always |
|---|---|---|---|---|---|
| 1. Large supermarket or discount warehouse | ○ | ○ | ○ | ○ | ○ |
| 2. Small to medium food store | ○ | ○ | ○ | ○ | ○ |
| 3. Convenience store or spaza shop | ○ | ○ | ○ | ○ | ○ |
| 4. Farmer's market/produce stand | ○ | ○ | ○ | ○ | ○ |
| 5. Other, specify: _____ | ○ | ○ | ○ | ○ | ○ |

## F. STORE ACCESS

| **Please indicate whether the following statements are true of the store <u>where you usually buy groceries</u>.** | Yes | No | Not applicable |
|---|---|---|---|
| 1. Close to location of my employment | ○ | ○ | ○ |
| 2. Close to my child's school | ○ | ○ | ○ |
| 3. Close to my home | ○ | ○ | ○ |

## G. FOOD SHOPPING

| **The following questions apply to the store <u>where you usually buy groceries</u>.** | Strongly disagree | Somewhat disagree | Neutral | Somewhat agree | Strongly agree |
|---|---|---|---|---|---|
| 1. Low-fat foods cost too much. | ○ | ○ | ○ | ○ | ○ |
| 2. There is a large selection of fresh fruits and vegetables. | ○ | ○ | ○ | ○ | ○ |
| 3. There is a large selection of low-fat products available. | ○ | ○ | ○ | ○ | ○ |
| 4. The condition of fresh fruits and vegetables is poor. | ○ | ○ | ○ | ○ | ○ |
| 5. Fruits and vegetables cost too much. | ○ | ○ | ○ | ○ | ○ |

## H. YOUR CHILD'S ELECTRONICS

| **Please indicate whether the following are <u>in your child's bedroom</u>.** | Yes | No |
|---|---|---|
| 1. TV | ○ | ○ |
| 2. Computer | ○ | ○ |
| 3. Video game system (non-hand held; Playstation, Xbox, etc.) | ○ | ○ |

**Does your child have the following items for his/her own use?**

| | | |
|---|---|---|
| 4. Cell phone or 2-way radio | ○ | ○ |
| 5. Hand-held videogame players (Game Boy, Sony PSP, etc.) | ○ | ○ |
| 6. Music systems (Ipod, stereo, radio, etc.) | ○ | ○ |

**For the next two questions, please think about your child's activities over the *past year*.**

## I. PLAY EQUIPMENT

| **How often during the past year has your child used these items at or around home (or in a common apartment area)?** | Not available (Don't have) | Available but never use | Once a month or less | Once every other week | Once a week or more |
|---|---|---|---|---|---|
| 1. Bike | ○ | ○ | ○ | ○ | ○ |
| 2. Basketball hoop or netball | ○ | ○ | ○ | ○ | ○ |
| 3. Jump rope | ○ | ○ | ○ | ○ | ○ |
| 4. Active video games (e.g., with dance pad, Wii, etc) | ○ | ○ | ○ | ○ | ○ |
| 5. Sports equipment (like soccer balls, rugby bats, cricket bats, racquets, sticks) | ○ | ○ | ○ | ○ | ○ |
| 6. Swimming pool | ○ | ○ | ○ | ○ | ○ |
| 7. Roller skates, skateboard, scooter | ○ | ○ | ○ | ○ | ○ |
| 8. Fixed play equipment (e.g., swing set, playhouse, jungle gym) | ○ | ○ | ○ | ○ | ○ |

## J. PLACES FOR YOUR CHILD'S PHYSICAL ACTIVITY

| **How often during the past year has your child been <u>physically active</u> (including active play) in the following places?** | Never | Once a month or less | Once every other week | Once a week | 2 or 3 times/ week | 4 times/ week or more |
|---|---|---|---|---|---|---|
| 1. Inside your home | ○ | ○ | ○ | ○ | ○ | ○ |
| 2. In your yard or common area or in your driveway | ○ | ○ | ○ | ○ | ○ | ○ |
| 3. At a neighbour's house, yard, or driveway | ○ | ○ | ○ | ○ | ○ | ○ |
| 4. In a local street, sidewalk, or vacant lot/field | ○ | ○ | ○ | ○ | ○ | ○ |
| 5. Indoor recreation or exercise facility (public or private; e.g., YMCA/Boys & Girls Club) | ○ | ○ | ○ | ○ | ○ | ○ |
| 6. Beach, lake, river, or creek | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7. Bike/hiking/walking trails, paths | ○ | ○ | ○ | ○ | ○ | ○ |
| 8. Basketball/netball court | ○ | ○ | ○ | ○ | ○ | ○ |
| 9. Other playing fields/courts (like soccer, rugby, cricket or tennis) | ○ | ○ | ○ | ○ | ○ | ○ |

| **How often during the past year has your child been <u>physically active</u> (including active play) in the following places?** | Never | Once a month or less | Once every other week | Once a week | 2 or 3 times/ week | 4 times/ week or more |
|---|---|---|---|---|---|---|
| 10. Small public park or playground | ○ | ○ | ○ | ○ | ○ | ○ |
| 11. Large public park | ○ | ○ | ○ | ○ | ○ | ○ |
| 12. Public open space that is not a park | ○ | ○ | ○ | ○ | ○ | ○ |
| 13. School grounds (during non-school hours) | ○ | ○ | ○ | ○ | ○ | ○ |

## K. GETTING AROUND IN YOUR NEIGHBOURHOOD

**Please select the answer that best applies to you and your neighbourhood. Within walking distance means within a 10-15 minute walk from your home.**

| | Strongly disagree | Somewhat disagree | Somewhat agree | Strongly agree |
|---|---|---|---|---|
| 1. There are shops, stores, markets, and places to buy things I need within easy walking distance of my home/house. | ○ | ○ | ○ | ○ |
| 2. There is a bus, taxi, or train stop within walking distance from my home. | ○ | ○ | ○ | ○ |
| 3. There are sidewalks on most streets. | ○ | ○ | ○ | ○ |
| 4. There are NOT many dead end streets. | ○ | ○ | ○ | ○ |
| 5. There are many different routes for getting from place to place. | ○ | ○ | ○ | ○ |
| 6. There is a high crime rate. | ○ | ○ | ○ | ○ |
| 7. The speed of traffic on most streets is usually slow (50 kph or less). | ○ | ○ | ○ | ○ |
| 8. Most drivers go faster than the posted speed limits. | ○ | ○ | ○ | ○ |

| | | | | |
|---|---|---|---|---|
| 9. There are many interesting things to look at while walking in my neighbourhood. | ○ | ○ | ○ | ○ |
| 10. The traffic makes it difficult or unpleasant for my child to walk. | ○ | ○ | ○ | ○ |
| 11. Streets have good lighting at night. | ○ | ○ | ○ | ○ |
| 12. There are crosswalks and robots (traffic lights) on busy streets. | ○ | ○ | ○ | ○ |
| 13. There are many places to go within easy walking distance of my home. | ○ | ○ | ○ | ○ |
| 14. I'm afraid of my child being taken or hurt by a stranger on local streets. | ○ | ○ | ○ | ○ |
| 15. I'm afraid of my child being taken or hurt by a stranger in my yard, driveway, or common area. | ○ | ○ | ○ | ○ |
| 16. I'm afraid of my child being taken or hurt by a stranger in a local park. | ○ | ○ | ○ | ○ |
| 17. I'm afraid of my child being taken or hurt by a known "bad" person (adult or child) in my neighbourhood. | ○ | ○ | ○ | ○ |

## L. DISTANCE TO LOCATIONS

**About how long would it take <u>you</u> to walk from your home to the nearest places listed below? Please select the time it would take you to walk to each place, regardless of whether you/your child go there.**

| | 1-5 min | 6-10 min | 11-20 min | 21-30 min | 31+ min | Don't know |
|---|---|---|---|---|---|---|
| 1. Convenience/corner store/small grocery store/spaza | ○ | ○ | ○ | ○ | ○ | ○ |
| 2. Supermarket | ○ | ○ | ○ | ○ | ○ | ○ |
| 3. Fast food restaurant | ○ | ○ | ○ | ○ | ○ | ○ |
| 4. Non-fast food restaurant | ○ | ○ | ○ | ○ | ○ | ○ |
| 5. Indoor recreation or exercise facility (public or private; e.g., Virgin Active, Planet Fitness, community centre) | ○ | ○ | ○ | ○ | ○ | ○ |
| 6. Beach, lake, river, or creek | ○ | ○ | ○ | ○ | ○ | ○ |
| 7. Bike/hiking/walking trails, paths | ○ | ○ | ○ | ○ | ○ | ○ |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8. Basketball or netball court (including half-court) | ○ | ○ | ○ | ○ | ○ | ○ |
| 9. Other playing fields/courts (like soccer, rugby, cricket, tennis, skate park, etc.) | ○ | ○ | ○ | ○ | ○ | ○ |
| 10. Small public park | ○ | ○ | ○ | ○ | ○ | ○ |
| 11. Large public park | ○ | ○ | ○ | ○ | ○ | ○ |
| 12. Public playground with equipment | ○ | ○ | ○ | ○ | ○ | ○ |
| 13. School with recreation facilities open to the public | ○ | ○ | ○ | ○ | ○ | ○ |

## M. FAMILY

**During a typical week, how often do you or another adult in the household:**

| | Never | 1-2 days | 3-4 days | 5-6 days | Every day |
|---|---|---|---|---|---|
| 1. Watch your child participate in physical activity or sports | ○ | ○ | ○ | ○ | ○ |
| 2. Encourage your child to do sports or physical activity | ○ | ○ | ○ | ○ | ○ |
| 3. Provide transport to a place where your child can do physical activity or play sports | ○ | ○ | ○ | ○ | ○ |
| 4. Do a physical activity or play sports with your child | ○ | ○ | ○ | ○ | ○ |