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Research article

Physical Activity and Sedentary Behavior in an Ethnically Diverse Group of South African School Children

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Abstract
Few studies have examined physical activity and inactivity levels in an urban South African setting across 12 years of formal schooling. This information is important for implementing strategies to curb increasing trends of physical inactivity and related negative consequences, especially in low to middle income countries facing multiple challenges on overburdened health care systems. We examined levels of physical activity and sedentary behaviour cross-sectionally over 12 school years from childhood to adolescence in Black, White and Indian boys and girls. The aim of our study was to describe gender and race related patterns of physical and sedentary activity levels in a sample of South African children and to determine whether there were associations between these variables and body mass status. Physical activity questionnaires, previously validated in a South African setting, were used to gather information about activity and sedentary behaviours among 767 Black, White and Indian children (5-18 years of age) across the 12 grades of formal schooling. Body mass and height were also measured. Time spent in moderate-vigorous physical activity declined over the school years for all race groups and was consistently lower for girls than boys ($p = 0.03$), while time spent in sedentary activity increased with increasing grade ($p < 0.001$) for boys and girls and across all race groups. Associations between physical activity and body mass were observed for White children ($r = -0.22$, $p < 0.001$), but not for Black and Indian children ($p > 0.05$) whereas time spent in sedentary activities was significantly and positively correlated with body mass across all race groups: Indian ($r = 0.25$, $p < 0.001$), White ($r = 0.22$, $p < 0.001$) and Black ($r = 0.37$, $p = 0.001$). The strength of the associations was similar for boys and girls. Black and Indian children were less physically active than their white peers ($p < 0.05$), and Black children also spent more time in sedentary activity ($p < 0.05$). Additionally, Black children had the highest proportion of overweight participants (30%), and Indian children the most number of underweight children (13%). Regardless of ethnicity, children who spent more than 4 hours per day in front of a screen were approximately twice as likely to be overweight (OR, 1.96 [95%CI: 1.06-3.64, $p = 0.03$]). Regardless of race, inactivity levels are related to body mass. Ethnic and gender disparities exist in physical activity and sedentary activity levels and this may echo a mix of biological and cultural reasons.

Key words: South African children, ethnicity, screen time, physical activity.

Introduction

The adoption of a sedentary lifestyle in low to middle income countries is an important problem needing to be addressed (Popkin, 2009). A country such as South Africa is already battling the double burden of communicable disease (tuberculosis and HIV epidemics), and this coupled with problems arising from diseases of lifestyle associated with poor physical activity levels may cripple an already overburdened health care system. A child who is overweight is more likely to be overweight or obese as an adult (Biro and Wien, 2010) and engaging in exercise has numerous benefits in terms of weight loss and general health.

Over one third of South African public high school pupils (Grades 8-12) do not engage in sufficient physical activity (Amosun et al., 2007). Mamabolo et al (2007), studied physical activity levels in a population of 14 year old South African adolescents from a rural high school and showed a reduction of physical activity levels with advancing pubertal status. In addition, the authors found that weekend physical activity levels were negatively correlated with Body Mass Index (BMI) (Mamabolo et al., 2007). More recently Pienaar et al (2012) have shown sustained increased levels of physical activity in boys (but not girls) after an exercise intervention. Of concern however, is the observed decline in physical activity levels in both boy and girl South African adolescents over a three year period (Pienaar et al., 2012). Other studies conducted in South African children report on older children (Engelbrecht et al., 2004; Lennox et al., 2008; Mciza et al., 2007) but none have examined physical activity levels in an urban South African setting across 12 years of formal schooling.

In 2001, the American Academy of Paediatrics recommended that children should view less than two hours of television each day (American Academy of Pediatrics, 2001). High income countries such as Australia and the USA have implemented these guidelines into national recommendations and other countries such as Norway have adopted other initiatives to decrease screen time (Øverby et al., 2013). No such national guidelines currently exist for South African children. The South African Youth Risk Behaviour Survey (SAYRBS) provided nationally representative information regarding time spent watching television and being physical active in South African high school children (Reddy et al., 2008). While the (SAYRBS) data are comprehensive and provide useful insight into physical activity behaviour, no data are provided on primary school aged children and relationships with body mass status have not been evaluated.

Ethnic disparities in physical activity levels have been reported in South African children (McVeigh et al.,

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2004). While lower levels of physical activity in Black children compared to White children may be related to socio economic differences (McVeigh et al., 2004; Kriska, 2000), there may also be different leisure time preferences between different ethnic groups. Little is known about how South African Indian children spend their leisure time and since this population forms a large part of the broader South African population, it is important that this group is not neglected in studies of physical activity and health especially in children. The association between physical activity, inactivity and body mass underpins the importance of understanding how youth use their leisure time. In addition, insight into after school behaviour has implications for policy development and caregivers (Olds et al., 2009).

Few studies conducted in low to middle income countries have used sedentary time and physical activity guidelines as "barometers" to assess whether inhabitants of those countries are meeting international recommendations. Narrow age ranges, not relating body mass across the school years to race, physical activity or sedentary behaviour data on Indian children remain limitations of current studies. In the present study, we aimed to examine the levels of physical activity over a period of change from childhood to adolescence in Black, White and Indian children. The aim of our study was to describe gender and race related patterns of physical and sedentary activity levels in a large sample of South African children aged between 5 and 18 years and to determine whether there were associations between these variables and body mass status.

Methods

Subjects and study design

We contacted 14 (primary and/or secondary) schools in the Johannesburg Metropolitan area. The schools included in the study offered physical education lessons as part of their curriculum as well as after school sports. Permission to conduct the study in the schools was granted by the principal, primary caregiver as well as the children themselves. In total, 10 schools agreed to participate in the project. Two thousand children from grade 1 (first year of primary school) to 12 (final year of secondary school) enrolled in the schools, were invited to take part in a physical activity and inactivity questionnaire survey. The municipality from which our participants were selected encompasses inhabitants of diverse ethnic backgrounds. We thus chose to collect data from "semi-private" schools within the greater Johannesburg region. The schools were matched for a similar fee structure and were able to offer the students at the schools similar access to opportunities for being physically active. The specific area from which we chose our schools was in a 30 km radius of Central Business District (CBD) of Johannesburg. The primary language of instruction at all schools we recruited was English. Questionnaires, consent forms and instructions were sent home with the children to the primary caregiver, who completed the questionnaire in conjunction with and on behalf of the child. Detailed instructions and examples on how to complete the questionnaire were provided. One week after distributing the questionnaires, we returned to the school to collect the questionnaire and to record the height and body mass of the individual. Only children who returned accurately completed, eligible questionnaires and who consented to anthropometric measures being made were included in the final analysis. The study was approved by the Human Research Ethics Committee of the University of the Witwatersrand (protocol number: M10828).

Physical Activity Questionnaire (PAQ)

We used a PAQ which has been previously validated with actigraphy in an ethnically diverse and similar cohort of South African children (McVeigh & Norris 2012). The questionnaire was used to gather information pertaining to the child's participation in physical (in)activity across six domains. These domains included 1) school physical education classes; 2) informal activities (e.g. playing with friends outside etc); 3) sedentary after school activities (television, computer, computer and video games); 4) transport to and from school; 5) extra mural/formal activities and 6) sleep. The PAQ was scored based on a rating of each activity's metabolic expenditure equivalent (MET) (Ainsworth et al. 2000). The MET physical activity score (METPA) was calculated by multiplying the intensity (multiples of basal metabolic rate (metabolic equivalents)) by the duration of the activity (hrs/wk). A total METPA score was calculated for each participant as the sum of all METPA scores for each activity. This total METPA score is a gross estimate of activity since we did not subtract the resting energy expenditure (one MET) from the gross cost of each activity. Additionally, we determined the total minutes spent in moderate to vigorous activities (activities with MET scores greater than three and six, respectively) during the week, in order to ascertain which children met the Centers for Disease Control and Prevention (CDC) guidelines of 60 minutes of moderate to vigorous activity, 5 days of the week (U.S. Department of Health and Human Services 2008). We used a two hour per day cut off for sedentary behaviour (television, computer and video game play) based on the recommendation of the American Academy of Paediatrics that children should view less than two hours of television each day (American Academy of Pediatrics 2001).

Demographics and anthropometric measures

Children were asked to self-indicate on the PAQ which race group they belonged to. The height of each child, recorded to the nearest millimetre, was measured using a stadiometer (Holtain, UK), and weight, recorded to the nearest 100 gram, was measured using a digital scale (Dismed, USA). Participants were measured with light clothing and no shoes. BMI percentile-for-age and gender was calculated using software available from the World Health Organization (WHO, http://www.who.int/childgrowth/software/en). Children were classified according to weight categories, i.e. underweight (≤5th percentile), overweight (≥85th percentile) and obesity (≥95th percentile).

Data analysis

Statistica v11.0 (Statsoft Inc, OK, USA) was used to analyse the data. Descriptive statistics were used to analyse participant demographics and anthropometry. All variables were assessed for normality using the Kolmogorov-Smirnov test and where appropriate, non-parametric analyses were performed for skewed data. A chi-squared test was used to detect differences in the proportion of participants who were classified as overweight or obese within gender and race groups. Spearman's correlation coefficients were used to determine relationships between non-normally distributed variables. We used the Mann-Whitney test to assess differences in physical activity and inactivity scores between primary and high school children as well as between boys and girls. A MANOVA (using log transformed METPA data) and sedentary time was used to assess differences between race and gender groups over time (grade). Independent t tests were used to assess body mass differences between participants in different categories of physical and sedentary activity. Multinomial logistic regression analysis (odds ratio; (OR)) was used to assess the relationship between time spent engaging in sedentary activity and BMI categories. In the analysis, moderate sedentary/screen time was used as the reference group (two-four hours per day). For the BMI categories, normal body mass was used as the reference group. Data are reported as median and interquartile (IQR) range for METPA scores and as mean (SD) for anthropometric data and sedentary activity data.

Results

A total of 767 participants who had completely filled out questionnaires and had completed anthropometric measurements were included in the final analysis. Grade 11 and 12 participants were combined due to only six participants in Grade 12 being eligible for inclusion. Participant numbers included in the final analysis per grade were as follows: Grade 1 (75); Grade 2 (105); Grade 3 (95); Grade 4 (87); Grade 5 (103); Grade 6 (104); Grade 7 (62); Grade 8 (18); Grade 9 (30); Grade 10 (41); Grade 11 & 12 (47). Participant characteristics are shown in Table 1.

Body mass status

The majority of children had a body mass that was within the normal range for their age and gender (75.6%, n = 580). Only 4.8% (n = 36) of children were underweight, and 12.1% (n = 93) and 7.4% (n = 58) were classified as overweight and obese, respectively. There was no difference in the proportion of boys and girls classified as being underweight, normal weight, overweight or obese ($\chi^2 = 2.92$, $p = 0.57$) as shown in the Table 2. The distribution of overweight and obese children was different across race groups ($\chi^2 = 45.86$, $p = 0.001$) as shown in Figure 1. Black children had the greatest proportion of participants classified as overweight or obese ($p < 0.001$) in comparison to the other two race groups. No Black children were classified as being underweight and Indian children had the highest proportion of underweight children ($p < 0.001$).

Physical activity trends between gender and race

There was a significant negative correlation between grade and METPA score ($r_s = -0.15$, $p < 0.001$). Overall, boys reported more physical activity (68540 (IQR: 40400-113520) METPA/yr) than girls (56836 (IQR: 29388-95328) METPA/yr, $p = 0.02$). White children (76420 (IQR: 48600-116680) METPA/yr) reported higher physical activity levels compared with Black (46427 (IQR: 26920-78260) METPA/yr, $p < 0.001$) and Indian children (29639 (IQR: 16000-59080) METPA/yr, $p < 0.001$). There was a significant main effect for grade as the number of minutes that participants reported per week engaging in moderate to vigorous physical activity declined significantly across school

Table 1. Participant characteristics by grade.

	Grade	1	2	3	4	5	6	7	8	9	10	11 & 12
Demographics, mean (± SD)	**Age (years)**	7.4 (1.5)	8.2 (1.7)	9.1 (1.4)	10.1 (.9)	10.7 (1.0)	11.7 (.9)	11.8 (2.0)	13.8 (1.2)	14.7 (.4)	16.0 (.3)	17.0 (1.7)
	Height (m)	1.27 (.09)	1.32 (.10)	1.37 (.10)	1.42 (.09)	1.45 (.09)	1.51 (.10)	1.54 (.14)	1.62 (.11)	1.64 (.14)	1.63 (.29)	1.67 (.16)
	Body Mass (kg)	24.2 (4.7)	27.5 (5.7)	31.4 (6.6)	36.9 (8.6)	39.5 (11.3)	44.9 (10.5)	52.0 (11.2)	56.7 (11.5)	59.2 (10.7)	61.7 (14.6)	62.6 (10.5)
	Boys	27	47	40	42	63	71	35	17	17	17	24
Ethnic group, n	**Black**	13	16	15	13	13	11	11	5	9	10	12
	White	40	63	61	52	68	74	43	7	11	21	24
	Indian	22	26	19	22	22	19	8	6	10	10	11
BMI distribution, n	**Underweight (BMI ≤5th %ile)***	5	6	3	6	7	3	1	1	0	2	2
	Normal (BMI >5th-<85th %ile)	51	82	79	63	76	80	47	11	22	27	42
	Overweight (BMI≥ 85th %ile)	10	11	8	13	13	12	8	5	5	6	2
	Obese (≥ 95th %ile)	9	6	5	5	7	9	6	1	3	6	1

* Terminology based on the study of Barlow et al. (2007).

Table 2. Participant characteristics by gender.

		Boys (n = 400)	Girls (n = 367)
Demographics, mean (±SD)	**Age (years)**	11.04 ± 2.77	10.91 ± 3.14
	Height (m)	1.43 ± 0.31	1.42 ± 0.23
	Body mass (kg)	42.2 ± 16.1	39.5 ± 13.6
Ethnic group, n (%)	**White**	244 (32%)	220 (29%)
	Black	61 (8%)	67 (8%)
	Indian	95 (13%)	80 (10%)
BMI distribution, n (%)	**Underweight (BMI ≤5th %ile)***	16 (4.1%)	21(5.7%)
	Normal (BMI >5th<85th %ile)	298 (74.4%)	282 (76.9%)
	Overweight (BMI ≥ 85th %ile)	54 (13.4%)	40 (10.8 %)
	Obese (≥ 95th %ile)	32 (8.1%)	24 (6.6%)
Grade, n (%)	**One**	33 (4.3%)	42 (5.5%)
	Two	52 (6.8%)	53 (6.9%)
	Three	47 (6.1%)	48 (6.3%)
	Four	45 (5.9%)	42 (5.5%)
	Five	64 (8.3%)	39 (5.1%)
	Six	71(9.3%)	33 (4.3%)
	Seven	35 (4.6%)	27 (3.5%)
	Eight	7 (0.9%)	11 (1.4%)
	Nine	10 (1.3%)	20 (2.6%)
	Ten	17 (2.2%)	24 (3.1%)
	Eleven & Twelve	27 (3.5%)	20 (2.6%)

* Terminology based on the study of Barlow et al. (2007).

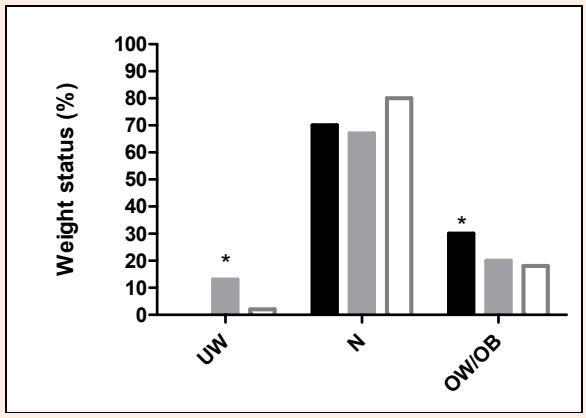

Figure 1. Body mass status of Black (black bars), Indian (grey bars) and White (white bars) children. * denotes differences in the proportions of children between races ($p < 0.05$). Indian children had the most number of participants classified as underweight and Black children had the most number of participants classified as overweight.

grades ($p = 0.03$) (Figure 2). Furthermore, there was a significant main effect for gender as girls consistently reported less number of minutes per week engaging in moderate to vigorous physical activity than boys ($p = 0.012$), but there was no interaction between grade and gender ($p = 0.70$). There was no main or interactive effect of race and grade ($p = 0.11$). Grade and body mass were positively correlated ($r = 0.79$, $p < 0.001$). Time spent in moderate to vigorous physical activities (MVPA) and body mass (after controlling for grade) were negatively correlated ($r = -0.14$, $p < 0.001$) across the whole group, but not for each race group. The strength of the associations was similar between boys ($r = - 0.15$, $p = 0.003$) and girls ($r = - 0.18$, $p = 0.001$). There was a significant negative correlation between MVPA and body mass for White children ($r = - 0.22$, $p < 0.001$), but not for Black ($r = -0.75$, $p = 0.49$) and Indian ($r = -0.31$, $p = 0.66$) children. Participants were then divided into two groups (those who met the recommended physical activity guideline and those that did not. There were significant body mass differences ($p < 0.001$) in participants who met the physical activity guidelines compared to those that did not as shown in Figure 3.

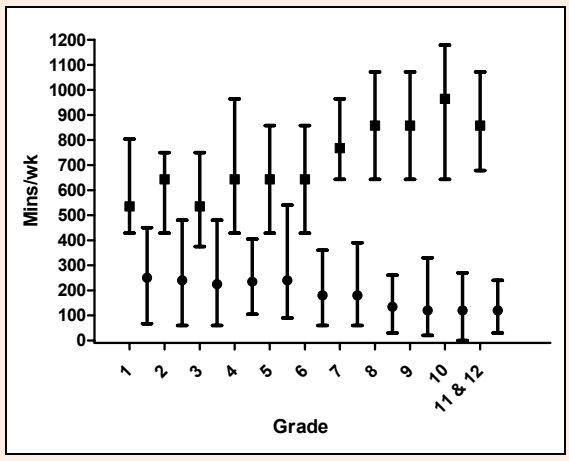

Figure 2. Median (range) minutes spent in moderate to vigorous physical activity (circles) and sedentary activity (squares) per week across 11 school grades.

Sedentary activity trends between gender and race

We assessed sedentary activity as a function of the number of hours that children spent per day in front of a screen (television, computer). There was a significant positive correlation between grade and time spent in sedentary activity ($r = 0.31$, $p < 0.001$). Overall, time spent in sedentary activities was higher in the high school (8-12) grades (3.2 ± 1.3 hrs/day) compared to the primary (1-7) school grades (2.2 ± 1.2 hrs/day, $p < 0.001$). Black chil-

dren (2.8 ± 1.4 hrs/day) spent the most amount of time engaged in sedentary activities compared to White (2.4 ± 1.1 hrs/day, p=0.04) and Indian (2.3 ± 1.2 hrs/day, p = 0.04) participants. There was a significant main effect for grade as the number of minutes that participants reported spending per week in sedentary activities increased significantly ($p < 0.001$) across school grades (Figure 2). There was no significant effect for gender ($p = 0.92$) or race ($p = 0.28$). Time spent in sedentary activities was significantly and positively correlated with body mass (after controlling for grade) across all race groups: Indian ($r = 0.25$, $p < 0.001$), White ($r = 0.22$, $p < 0.001$) and Black ($r = 0.37$, $p = 0.001$). The strength of the associations was similar between boys ($r = 0.20$, $p < 0.001$) and girls ($r = 0.364$, $p < 0.001$). Sedentary activity was divided into two groups (less than two hours/day, and more than two hours per day). There were significant body mass differences ($p < 0.001$) in participants who spent less than two, and more than four hours per day engaged in sedentary activities as shown in Figure 3.

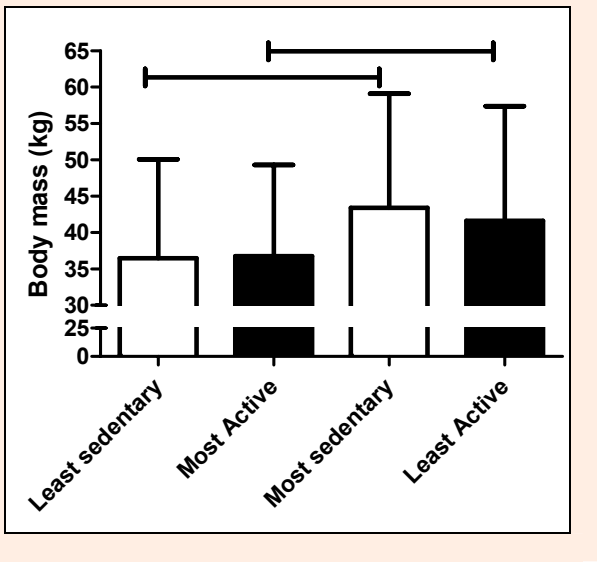

Figure 3. Participants with less than 2 hrs/day of sedentary activity (n = 316) weighed less than those who spent more than 2 hrs/day (n = 450) in sedentary behaviour ($p < 0.001$). Participants who met the prescribed physical activity guideline of 60 minutes (mod-vig activity) per day (n = 596) weighed less than those who did not (n = 170) meet the guideline ($p < 0.001$). Data are mean (SD). Body mass is adjusted for grade.

In Table 3, the results of the multinomial logistic regression analyses showed a strong and significant positive association between time spent in sedentary activity and BMI for the overweight participants who spent greater than four hours (OR, 1.96 [95%CI: 1.06-3.64, $p = 0.03$]) or less than two hours per day (OR, 0.47 [95%CI: 0.32-0.70], $p < 0.001$) in sedentary activity. The association between being underweight and spending less than 2 hours per day sedentary activity (OR, 1.40 [95%CI: 0.97-2.02]) was not significant ($p = 0.07$).

Sleep trends between gender and race

Participants reported a longer duration of sleep on the weekend (10.21 ± 2.65 hrs/night) in comparison to during the week (9.48 ± 1.02 hrs/night, $p < 0.001$). White children reported the most hours of sleep during the week (9.64 ± 0.98 hrs/night) compared to Black (9.11± 1.14 hrs/night, $p < 0.001$) and Indian children (9.28 ± 1.03 hrs/night, $p < 0.001$). There was no gender difference between number of hours of sleep during the week or on the weekend ($p = 0.96$). There was a negative correlation between the number of hours of sleep during the week and grade ($r = -0.68$, $p = 0.001$). There was a significant interaction between grade and race for number of hours sleep during the week ($p < 0.001$), with Black children consistently reporting less sleep than the other two race groups. The number of hours sleep that participants had in the week days was significantly and negatively correlated with their body mass ($r = -0.56$, $p < 0.0001$).

Table 3. Multinomial logistic regression analyses relating BMI categories and time spent in sedentary behaviour.

	OR	95% CI	P value
Underweight			
<2 hrs/day sedentary	1.397	0.968-2.017	0.07
>4 hrs/day sedentary	1.294	0.634-2.643	0.48
Overweight			
<2 hrs/day sedentary	0.469	0.317-0.695	<0.001
>4 hrs/day sedentary	1.963	1.060-3.638	0.03

Normal BMI and spending between two and four hours per day in sedentary activity were used as the reference categories.

Discussion

We have described physical activity and inactivity patterns (which we defined as time spent in front of a screen) in boys and girls across 12 years of formal schooling in an ethnically diverse group of South African children. Black children spent the most amount of time engaged in sedentary activities and the least amount of time in physical activity. In our study, we found similar prevalence's of overweight and obesity between boys and girls but a higher proportion of obesity in Black children and of underweight in Indian children. Boys tended to be more physically active than girls and girls spent more time engaged in sedentary behaviour. Children who spent the most time engaging in sedentary activity and least amount of time partaking in physical activity were also the heaviest.

Similar to other studies which have shown a decline in physical activity from adolescence into young adulthood (Olds et al., 2009; Kjønniksen et al., 2008), our data show that in South African children, self reported time spent in moderate to vigorous physical activities declines with increasing school year. This trend was consistent across all three race groups included in this study and girls consistently reported being less active than boys. Participation in moderate to vigorous intensity activity has been shown to lead to lower weight gain as much as after one year of follow up; irrespective of total physical activity or sedentary time (Fisher et al., 2011) emphasising the importance of including daily MVPA in one's routine. Indeed, by the time the school children in the present study reached high school, they were spending almost half as much time engaged in physical activity compared to the primary school years. Similar declines

have been reported in populations from high income countries such as Australia and Finland (Olds et al., 2009; Telama and Yang, 2000). Studies conducted in South African older children show a decrease in physical activity among adolescents (Kruger et al., 2006; Pienaar et al., 2012; Reddy et al., 2008), and we have shown that this trend occurs consistently over the school years in Indian, White and Black children. It may be argued that the school workload increases as one advances their school career, offsetting the amount of time (something that we were unable to measure) that one has available for participation in physical activity. However, considering that physical activity levels have been shown to decline further into adulthood (Dwyer et al., 2009), we are challenged to not only find ways of promoting physical activity in the high school years, but also to find encouraging methods of maintaining physical activity well into adulthood.

Low levels of physical activity are not uncommon in other African populations (Peltzer, 2010) and the negative association between physical activity and body mass observed in the present study echoes similar findings from global data (Jiménez-Pavón et al., 2010). The relationship between physical inactivity and body mass is an understudied area in children. A large study recently conducted on Mexican children showed that screen time is positively associated with increased adiposity in adolescent males (Lajous et al., 2009). Concomitant with the declining trend with age in moderate to vigorous physical activity levels, our participants spent more time in front of a screen in high school than they did in primary school. The two hour per day recommendation made by the American Academy of Paediatrics (American Academy of Pediatrics, 2001) was used as a categorical division in order to assess whether body mass differences were associated with increased screen time, irrespective of age. Indeed we found that spending more than two hours per day in front of a screen (after school) was associated with an approximate 7 kg difference in body mass. It is also possible that prolonged screen time may be associated with a greater consumption of energy dense foods (Pearson and Biddle, 2011), which may contribute to the higher body masses observed. Nonetheless, across all race groups there was a significantly association between increased screen time and a larger body mass. Children who spent more than four hours per day in sedentary behaviour were almost twice more likely to be obese than those children who spent less than two hours per day engaged in sedentary behaviour.

Across all race groups described in this study, we found a negative association with sleep and body mass. Although number of hours of sleep has been shown to decline as children get older (Olds et al., 2009), the relationship with body mass is important, especially since Stone and colleagues (2013) have recently shown (with the use of actigraphy), that children who attain nine hours or less of sleep per night are more overweight and partake in less physical activity than children who sleep for 10 hours or more per night (Stone et al., 2013).

Ethnic disparities in physical activity levels between Black and White children have been reported previously in South African (McVeigh et al., 2004). In addition, ethnic disparities in overweight and obese statuses have been reported in the US. Gordon-Larsen et al. (2002) reported that US Black children have lower levels of physical activity and black girls had the highest prevalence of overweight and obesity. Similar to these findings, we have shown that Black South African children remain the least physically active and the most sedentary of our participants. While numerous studies have considered the association between ethnicity, body mass and physical activity and inactivity in developed countries (Gordon-Larsen et al., 2002; Jiménez-Pavón et al., 2010; Kimm et al., 2002; Owen et al., 2010; Whitt-Glover et al., 2009) few have examined the trends in low to middle income countries. In our study, Black children had the greatest proportion of overweight participants and spent more time in front of a screen than Indian and White children. Black children also slept less than their Indian and White peers. European children from a high socio economic status have the highest levels of participation in physical activity (Jiménez-Pavón et al., 2010) while another study has shown only slight associations between socioeconomic status and physical activity (Pitel et al., 2013). As our sample came from schools which provided similar opportunities to be physical active, we cannot attribute these differences in physical (in)activity to the types of schools which the participants attended. More than twenty years after the end of a legislated segregation of race groups in South Africa, inequalities regarding physical activity remain between race groups. Herein lays the challenge for ethnically and culturally relevant targets for exercise and health promotion.

Our cross sectional design limits inferences of a longitudinal or casual nature. The majority of the children attending the chosen schools for this study were either of White, Black or Indian descent. Although, there were some mixed race children attending the school (n = 12), the numbers were not large enough to be meaningful, thus our findings cannot necessarily be extrapolated to other ethnicities, although we acknowledge that mixed race children do make up a significant proportion of the South African population. Furthermore, the numbers of boys and girls within each ethnic group limits the longitudinal inferences across grades which can be made. Additionally only schools with English as the language of instruction were chosen, and thus are results may not be applicable to children from schools where other languages are used to teach. Moreover, we did not assess the ability of the caregiver to understand the written instructions on the questionnaire. It is possible that given the focus on increasing activity levels and decreasing sedentary time that children and parents may have over reported physical activity and underreported sedentary activity. We did not ascertain dietary information from the participants and thus cannot exclude the possibility of many of the relationships that we describe here being confounded by dietary habits. Additionally, the limitations inherent to questionnaire data must be considered.

Conclusion

In conclusion, the present study shows that in an ethnically diverse urban group of South African school children who attend similarly funded schools, there exists an age related decline in physical activity and increase in time spent in front of a screen. There remain racial differences in activity and inactivity levels, but regardless of race, children who spend more than four hours per day in front of a screen are almost twice as likely to be overweight. Research studies which will help to understand why different ethnic and gender groups may prefer spending their leisure time in different ways, will aid in developing methods to promote healthier lifestyle choices.

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Key points

- Regardless of race, inactivity levels are related to body mass.
- In an ethnically diverse urban group of South African school children, there exists an age related decline in physical activity and increase in time spent in front of a screen.
- Ethnic and gender disparities exist in physical activity and sedentary activity levels and this may echo a mix of biological and cultural reasons.

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