

Title: Associations between physical activity in adolescence and health behaviours, well being, family and social relations

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Abstract

Across Europe and North America, few young people meet the recommended levels of physical activity of one hour of moderate to vigorous physical activity per day. However, the lives of young people cannot simply be polarised as either completely sedentary or active.

Drawing on findings from the World Health Organization Health Behaviour in School-aged Children cross sectional international study (HBSC), this paper examines the domains of adolescent life associated with young people's participation in overall physical activity, including health behaviours, social relationships and family activities. Consideration is also given to gender differences.

Information in England was collected from 4,404 students aged 11, 13 and 15 years, using anonymised self-completed questionnaires. Physical aspects of lifestyle were determined using internationally validated items for measuring Physical Activity (PA) that met international guidelines for activity and the frequency and duration of Vigorous Exercise undertaken during leisure activities (VEL). Separate analyses were conducted for boys and girls. Levels of physical activity and vigorous exercise were compared using the chi-squared test for trend.

The findings draw attention to the value for the health and well-being of young people participating in some form of physical activity, even if they do not meet the recommended levels. Medium levels of physical activity appear to be associated with high levels of life satisfaction, self-rated health and an improved sense of body image. Significant health gains are likely to be made for adolescents in encouraging sedentary young people to undertake some form of physical activity.

Key words Physical activity, adolescent health, well-being, health promoting behaviours.

Introduction

Consideration of adolescent health and well-being has tended to prioritise reducing behaviours that pose a risk to the health and well-being of young people. Over the past decade, many countries in Europe and North America have experienced a decline in the prevalence of health risk behaviours among adolescents (Currie et al. 2012). In England, since 2002, a downward trend in health risk behaviours can be identified in smoking prevalence, regular alcohol consumption, physical fighting and early sexual initiation (Brooks et al. 2011).

The decline in the prevalence of health risk behaviours has, however, not been matched by an equivalent increase in the adoption of health promoting behaviours that encompass good nutrition and physical activity (Brooks 2013). In relation to physical activity, a slight decline in prevalence has occurred despite evidence linking benefits of physical activity to long term health (Janssen and LeBlanc 2010) and health related quality of life (Gopinath et al. 2012) psychological and social well-being (Parfitt and Eston 2005) and achievement for young people (Busch et al. 2014). Moreover, sedentary behaviour is associated with negative health impacts including overweight, obesity and poor mental health (Biddle and Asare 2011).

Across Europe and North America, few young people meet the recommended levels of physical activity of one hour of moderate to vigorous physical activity per day (Currie et al. 2012). Recent international figures from the World Health Organization (WHO) Health Behaviour in School Aged Children study (HBSC) indicate that even in countries with the highest reported levels of physical activity such as Finland, Austria or the USA only a minority meet the recommended levels. In the USA for example, only 33% of 15 year old boys and 17% of girls report at least one hour of moderate to vigorous physical activity per day. In countries with the lowest physical activity rates such as France, Italy and Switzerland, the proportions for 15 year old girls and boys are between 5-6% and 12-14% respectively. There is also notable diversity among the UK constituent countries. The highest levels of 15 year old adolescents meeting the guidelines are in England (12% girls and 25% boys) while for Scotland the figures drop to 8% for girls and 13% for boys (Currie et al. 2012). Moreover, reported trends in risk behaviours have been associated with absolute affluence and Gross Domestic Product (GDP), as well as geographically defined cultural differences (Pickett et al. 2013). In contrast, there appear to be no clear geographical patterns that act as determinants of physical activity levels. There are marked differences for example, between levels in Mediterranean countries such as Spain and Italy, as well as distinctly different patterns among countries with similar high GDP such as Canada, Norway and Finland (Currie et al. 2012). These variables suggest that there are significant inequalities in the way that individual countries are addressing physical activity promotion. However the exact determinants of the variability between countries warrant further examination.

Public health policy and actions may, however, be influential in determining prevalence levels. In Finland, for example, official levels for moderate to vigorous physical activity exceed the recommended guidelines, while Italy has experienced education reform that has reduced the number of teachers with a physical education qualification (Currie et al. 2012). Policies and interventions designed to enhance physical activity levels among young people may therefore offer an arena for highly successful public health actions. Consequently, it is important to understand the impacts of physical activity on adolescents and the wide range of determinants that construct their activity levels.

Although it is clear that the majority of young people both nationally and internationally do not meet the guidelines for physical activity, this does not mean that the lives of young people can be polarised as being either completely sedentary or active. Less is known about the impact on young people of undertaking some level of physical activity or at what levels young people subjectively experience benefits from participation therein. Moreover, understanding the factors and determinants that enable young people to undertake activity per se may also provide valuable insights into how to encourage the sedentary to become more ~~the~~ active.

Low levels of physical activity among adolescents have sometimes assumed to be caused by new lifestyle choices that increase sedentary behaviours such as higher levels of television watching and or electronic media and computer use which become subject to less adult surveillance as the young person transitions out of childhood (Gentile et al. 2012). Evidence from the USA indicates that appropriate use of leisure time has significant implications for health and well-being (Nelson and Gordon-Larsen 2006). Those who have any external interests (including either sporting and/or sedentary pastimes) have been found to be less involved in health damaging behaviours, have better mental health and higher levels of school attainment (Nelson and Gordon-Larsen 2006). This positive impact of external interests also includes those who participate in community activities with their parents (Nelson and Gordon-Larsen 2006). However it is unclear as to how young people incorporate physical activity into their leisure and whether specific sedentary activities are associated with higher or lower levels of physical activity. Furthermore, although participation in physical activity may be associated with reductions in certain health risk behaviours (Nelson and Gordon-Larsen 2006), less attention has been given as to how participation in physical activity during adolescence might be associated with other beneficial lifestyle choices, such as healthy eating.

Interventions to promote and enhance participation in sports and general levels of physical activity among children and young people have often been developed within educational settings, and there is now a strong body of evidence relating to the development of effective school based interventions. Other significant domains in the adolescent's life including social networks and family life may also potentially influence health promoting behaviours including physical activity (Simpkins

et al. 2013). Exploration of the influence of these domains may offer insight into how to refine physical activity interventions.

Given that during adolescence individual autonomy increases, it is also important to consider the role of adolescent choices and their relationship to domains of authority, such as schools and parents. Consideration of the relationship between the domains of authority in the adolescent's life and how they influence and accommodate the agency and preferences of the young person may also offer strategies for improving physical activity interventions.

Drawing on recent findings from the HBSC study for England, this paper aims to examine the proportions of young people who engage in differing levels of physical activity and to explore the domains of adolescent life associated with young people's participation in physical activity, including peers and family. This paper also seeks to investigate potential differences between overall levels of moderate to vigorous physical activity and engagement with physical activity by adolescents during their leisure time. In addition consideration will be given to gender differences.

Methodology

The Health Behaviour in School-aged Children (HBSC) study is a cross sectional international World Health Organization collaborative study that seeks to gain insights from young people concerning the determinants of their health and well-being, and health behaviours. Information is collected from school students using anonymised self-completed questionnaires.

The involvement of England in the HBSC study commenced in 1997, and the third ~~cycle~~ **questionnaire survey** was conducted in 2010. A random sample of all secondary schools in England (state and independent) resulted in a sample of 4,404 students, from 197 classes after data cleaning. A response rate at the student level of over 90% was obtained. The questionnaire was targeted at three groups of adolescents, with planned mean ages of around 11.5, 13.5, and 15.5 years (in England school years 7, 9, and 11 respectively). Almost all of the survey questions were scored either as binary (e.g. gender) or as a Likert scale (e.g. strongly disagree, disagree, neither agree nor disagree, agree, strongly agree).

Physical aspects of lifestyle were determined using ~~two~~ internationally validated items that measured Physical Activity (PA) ~~that met international guidelines for activity~~ and the frequency and duration of Vigorous Exercise undertaken during Leisure Activities, in their free time, outside of school (VEL). The PA question is a measure of weekly moderate to vigorous physical activity, used to identify those

who meet the current international guidelines for physical activity of one hour or more of moderate intensity (increases heart rate and generates a feeling of being out of breath for some of the time). The question used to assess PA was “*Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per **day?***” (Prochaska, Sallis and Long 2001). Young people are provided with examples of activities to include such as sports, school activities, playing with friends or walking to school. VEL was measured using the HBSC question: “*Outside school hours, how often do you normally exercise in your free time so much that you get out of breath or **sweat?***” Responses for PA were categorised into Low (0-2 days), Medium (3-6 day), and High (7 days). Responses for VEL were divided into Low (once a week or less), Medium (a few times per week), and High (every day).

For the purpose of these analyses, the explanatory variables under study were life satisfaction (scored as a whole number from 0 to 10), self-rated health, perception of body size, computer gaming during the week and at weekends, number of same sex friends, experience of bullying in the previous two months, and participation in sport with family members. In addition lifestyle variables were also included, namely, frequency of eating breakfast, eating fruits and vegetables, smoking cigarettes, and having been drunk (a temporary state in which physical and mental faculties are impaired by an excess of alcoholic drink).

Responses on these variables were categorised according to the HBSC international protocol for each question item and where relevant (for comparative purposes) conformed to the presentation of the variables for the WHO international report (Currie et al. 2012). Life satisfaction was rated as “higher” for a score of 6 or greater v. 0-5. Self-rated health was divided into good or excellent v. other categories, and body size was based on whether or not the participant viewed their body as too fat. Computer gaming was divided into two groups (for both weekdays and days during weekends), with higher usage being more than 2 hours per day. The number of same sex friends was divided into 0-2 v. 3 or more. Significant bullying was regarded as occurring at least 2-3 times in the previous two months. Regular participation in family sport was regarded as at least weekly. The frequency of eating breakfast during the week was divided on the basis of every day v. 4 days or fewer, and a higher level of fruit and vegetable consumption was defined as 2 or more days per week. Smoking was defined on the basis of at least once per week (regular smoker) v. less frequent or not at all. Participants were divided into those who had been drunk on a single occasion at most v. at least twice.

As the effect of gender on various aspects of physical lifestyle behaviour is of great interest, separate analyses were conducted for boys and girls. Levels of physical activity and vigorous

exercise were compared using the chi-squared test for trend. The analyses were performed using SPSS version 20.

Ethics and consent

The study gained ethics approval via the University Ethics Committee for Health and Human Sciences (NMSCC/07/09/19/A). Once permission was gained from schools, consent and information letters were sent to all students in the classes. Letters to parents were passed on by interested students, enabling students to make the initial decision on participation. A ~~young persons~~² reference group of ~~young people~~ also worked with the team to enhance ethical sensitivity.

Results

~~Although only~~ Only a minority of the young people met ~~meet~~ the recommended activity levels. ~~However, most of the participants engaged had at least a medium level of engagement in physical activity and vigorous exercise at least a few times a week (physical activity (PA) 1 hour a day at least a few times a week: (85% boys, 80% girls for PA and vigorous exercise (VEL) outside of school at least a few times per week: 77% boys, 63% girls for VEL).~~ Findings for Physical Activity are given in detail in Table 1 (boys) and Table 2 (girls). Results for Vigorous Exercise during leisure times are displayed in Table 3 (boys) and Table 4 (girls).

Life satisfaction

~~For both boys and girls~~ There was a positive association between level of PA and life satisfaction (boys $P=0.005$, girls $P=0.001$). A higher score was significantly more likely to be reported in the medium and high PA groups. Similar findings were found for levels of VEL (boys $P=0.019$, girls $P=0.001$).

Self-rated health

Individuals with medium or high PA were more likely to rate their health as either good or excellent, with a difference between high and low PA of 22% for boys and 16% for girls (both groups $P<0.001$). A similar striking contrast was found for VEL, with differences between high and low VEL of 20% and 16% for boys and girls respectively (both groups $P<0.001$)

Perception of body size

Both boys and girls were less likely to regard their size as too fat if they were involved in at least medium PA; ~~the~~ The same was true for VEL ($P<0.005$ throughout).

Playing computer games

For prolonged weekday gaming, overall participation was around 55% for boys and 20% for girls. No significant differences were found with regard to levels of PA and VEL, although for girls a slight negative association with PA level was found (22% low PA, 20% medium PA, 16% high PA). Both boys and girls were more likely to engage in prolonged computer gaming at the weekend (around 70% of boys and 30% of girls). However, no significant associations were found between weekend prolonged playing of computer games and level of exercise (for both PA and VEL).

Television viewing

For both PA and VEL there was a negative relationship between prolonged television viewing and level of exercise. This is true for both boys and girls. In fact, the largest differences are for girls on weekdays (PA 70% v. 63% v. 56%, $P<0.001$; VE 67% v. 62% v. 57%, $P=0.002$).

Number of same sex friends

Both boys and girls engaging in high PA were more likely to have several same sex friends compared to those undertaking only low PA (boys $P=0.008$, girls $P=0.011$). For VEL, however, although a similar trend was seen, differences between levels of exercise were much smaller.

Experience of bullying

Around 10% of both boys and girls experienced more than occasional bullying (at least 2-3 times in the past month). Overall, for boys the likelihood of being bullied was greater for low levels of PA and VEL, whereas for girls there was an association in the opposite direction. This was particularly the case with those who undertook a high level of PA, at 17% ($P=0.017$).

Engagement in sport with family

Boys were more likely to participate frequently in sport with family compared to girls. **For both boys and girls, Both** PA and VEL levels were **strongly** linked to engagement in sport with family members ($P<0.001$ throughout).

Eating habits

There was a consistent positive trend between level of PA and the likelihood of eating breakfast every weekday for both boys ($P<0.001$) and girls ($P=0.005$). However, for VEL this relationship existed only for girls ($P=0.001$).

For both boys and girls, regular ~~Regular~~ consumption of fruit was significantly more common in the medium and high level **PA and VEL** groups ($P<0.001$ throughout). ~~for both PA and VEL for~~

boys, as it was with girls. Girls also showed this association for the eating of vegetables ($P<0.001$). However, for boys the association between greater consumption of vegetables and level of engagement was much weaker for both PA and VEL.

Health Risk Behaviours

Regular self-reporting of smoking cigarettes was uncommon with both boys (5%) and girls (7%). For boys, smoking at least once per week was unrelated to levels of both PA and VEL. However, girls with a high level of PA were less likely to smoke ($P=0.004$) and those with a low level of VEL were more likely to smoke ($P<0.001$).

Having been drunk at least twice was unrelated to level of PA in boys. For girls, however, those with low PA were more likely to have been drunk on at least two occasions ($P=0.009$). For level of VEL, contrasting findings emerged. Boys with a high level of VEL were most likely to have been drunk more than once ($P=0.040$). Overall, for girls the association was in the opposite direction, with girls engaging in higher VEL being less likely to report having been drunk at least twice. ($P<0.001$).. However, by 15 years of age there was a positive association between the level of VEL and having been drunk at least twice for both boys (low VEL 28%, high VEL 43%) and girls (low VEL 49%, high VEL 59%).

Discussion

Although only a minority of all young people undertake the recommended levels of physical activity, the majority of adolescents do ~~however~~ report undertaking some form of activity a few times a week (medium PA and medium VEL). Importantly, medium levels of physical activity appear to be associated with high levels of life satisfaction, self-rated health and an improved sense of body **image**, which in adolescence can be an important contributor to positive self-esteem (Frost and McKelvie 2004). Participation in medium and high levels of physical activity were also associated with overall healthier lifestyles when compared to those with low levels of activity. Those who are physically active for at least a few times a week are also likely to engage in other health promoting dietary behaviours **such as greater consumption of fruit**; the beneficial relationship to breakfast eating among girls is noteworthy given the proportions of girls regularly consuming breakfast has declined over the past decade (Brooks et al. 2011). Lower participation in behaviours that pose a risk to health such as smoking and drinking to excess was also found among physically active young people when compared to low physically active peers. The notable exception is the positive association with repeated drunkenness among boys who have high levels of ~~physical activity~~ **vigorous exercise** during their leisure time. **Closer examination of the data also showed that this relationship strengthens with age for boys and becomes apparent at age 15 years for girls.** It is possible that this may be related to a

masculinised culture of drinking linked to team sports (Garry and Morrissey 2000), which may also be increasingly adopted by girls who play team sports (Volk and Lagzdins 2009). Strategies to address this culture within community based sports programmes are likely to warrant attention especially in relation to how adolescents are socialised into drinking cultures.

The value of constructive use of leisure time for young people has been previously identified (Barber, Eccles and Stone 2001). The findings here also indicate that activity during leisure time outside of schools constituted an important component of physical activity participation for both boys and girls. One of the most striking findings of this study was the positive contribution of the family to sporting activities during adolescence, was a notable finding and represents a somewhat under-researched area. Adolescence is often depicted as a time when the influence of parents as a determinant of behaviour is displaced by an increased influence of peers. However recent work on the family has identified the significant and consistent role of family functioning to adolescent well-being (Brooks et al. 2012b, Moreno et al. 2009), including influence over participation in health risk behaviours and the maintenance of aspects of well-being, such as positive body image (Fenton et al. 2010, Brooks et al. 2012a). The findings presented in this paper also add to the understanding of the significance of the maintenance of family based activities throughout childhood and adolescence. Moreover the findings indicate that the promotion of family based community activities could offer important benefits in terms of addressing sedentary lifestyles, especially if interventions focussed on challenging normative expectations relating to girls participation by girls. In recent years, intensive attention has been given to physical education and the value of school based interventions for both student well-being and academic attainment (Brooks and Magnusson 2010, Trudeau and Shephard 2008, Clea et al. 2002). The findings presented here provide additional evidence to highlight that even for adolescents their families also have an important role to play in the adoption of health promoting behaviours. Acknowledgement of the role of the family could be usefully embedded into interventions designed to promote physical activity. These could encompass both family based leisure provision and the formulation of policies that increase family leisure time and consideration of how parental time poverty can be addressed.

The findings also highlight an interesting distinction between types of sedentary leisure activities and their potential relationship to physical activity levels. Television viewing appears to be influential in structuring leisure activities for both boys and girls. The high levels of television watching among more sedentary girls is interesting as boys overall have been found to be more likely than girls to spend two or more hours every week watching television (Currie et al. 2012). However, even high levels of video gaming do not seem to have a similar effect. Boys in particular appear to be able to find time to accommodate both physical activity and sedentary pursuits. Thereby providing evidence of a more nuanced relationship between; Biddle et al. (2009) identified different temporal patterns for

sedentary behaviours and physical activity. The findings relating to gender distinctions in leisure time appear to demonstrate that sedentary activities have a greater negative impact on physical activity for girls, compared to boys. This gender inequality indicates that interventions aimed at enhancing physical activity among adolescent girls need to take account of the specific underlying determinants that construct their sedentary behaviours.

Overall, the findings clearly reinforce the evidence relating to the existence of gender divisions in physical activity levels. Boys were much more likely than girls to undertake high levels of PA or VEL, and girls were much more likely to undertake little or no PA or VEL and therefore be highly sedentary. Lower rates of participation among adolescent girls both in school and as part of leisure activities are well known (Slater and Tiggemann 2011, Brooks and Magnusson 2007). **Studies** that have explored girls experiences of PA and **sports** tend to indicate that gender stereotyping reinforces lower participation by girls via multiple domains and mechanisms such as psychological and social or peer groups influences (Cockburn and Clarke 2002, Coleman, Cox and Rocker 2008) and the way school programmes are organised (Brooks and Magnusson 2006). **Studies** that have explored girls experiences of PA and **sports** tend to indicate that gender stereotyping reinforces lower participation by girls via multiple domains and mechanisms such as psychological and social or peer groups influences (Cockburn and Clarke 2002, Coleman et al. 2008) and the way school programmes are organised (Brooks and Magnusson 2006). The findings relating to bullying illustrate further the significance of gendered normative expectations concerning sporting prowess and **physicality**, and how challenging such norms can be problematic for the adoption of some health promoting behaviours (O'Neill, Calder and Allen 2013, Volk and Lagzdins 2009). **Engaging in gender atypical behaviour has been associated with victimisation (Young and Sweeting 2004); for example, female athletes were up to three times more likely to be both a victim or perpetrator of bullying in comparison with a national representative sample of females (Volk and Lagzdins 2009). Girls who are physically active may be seen to be opposing "girl culture" (Simmons 2002) and consequently are more likely to experience rejection from their peers making them vulnerable to victimisation.** The increased prevalence of **bullying** reported by physically active girls suggests that this could be valuably addressed by anti-bullying strategies in schools. The findings from the HBSC study presented here indicate that further consideration of the way that girls **who** undertake physical activity especially during their leisure time could offer a means to enhance current understanding of how to construct PA/VEL promoting interventions targeted for girls.

Conclusion

The findings presented in this paper have drawn attention to the value for the health and well-being of young people undertaking some form of physical activity, even if they do not meet the recommended

levels of participation in physical activity. Overall significant health gains are likely to be made for adolescents by encouraging sedentary young people to undertake some form of physical activity.

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References

- Barber, B. L., J. Eccles & M. Stone (2001) What ever happened to the Jock, the brain and the princess? Young adult pathways linked to adolescent activity and social identity. *Journal of Adolescent Research*, 16, 429-455.
- Biddle, S. J. H. & M. Asare (2011) Physical activity and mental health in children and adolescents: a review of reviews. *British Journal of Sports Medicine*, 45, 886-895.
- Brooks, F. 2013. Chapter 7 : Life stage: School Years. In *Chief Medical Officer's annual report 2012: Our Children Deserve Better: Prevention Pays*, ed. Professor Dame Sally C Davies. London: Department of Health.
- Brooks, F. & J. Magnusson (2006) Taking part counts: Adolescents experiences of the transition from inactivity to active participation in school based physical education. *Health Education Research*, Available on line May 2006.
- (2007) Physical activity as leisure: The meaning of physical activity for the health and well-being of adolescent women. *Health Care For Women International: Special Edition, Health and Leisure.*, 28, 69-87.
- . 2010. Physical activity programmes in high schools. In *Childhood Obesity Prevention International Research, Controversies, and Interventions*, eds. J. O'Dea & M. Eriksen. Oxford: Oxford University Press.
- Brooks, F., J. Magnusson, E. Klemra, N. Spencer & A. Morgan. 2011. England National Report 2010 : Health Behaviour in school-aged children (HBSC): World Health Organisation Collaborative Cross National Study. Hatfield: University of Hertfordshire.
- Brooks, F., J. Magnusson, N. Spencer & A. Morgan (2012a) Adolescent multiple risk behaviour: An assets approach to the role of family, school and community *Journal of Public Health.*, 34 48-56.
- Brooks, F., A. Zaborskis, A. Orkenyi, I. Tabak, M. d. C. Granado Alcón, I. Borup, I. Camacho & E. Klemra. (2012b). Social Context: Communciation with mother, communciation with father. In *Social determinants of health and well-being among young people: Health Behaviour in School-aged Children Study (HBSC): International Report from the 2009/2010 Survey*, eds. C. Currie, C. Zanotti, A. Morgan, M. de Looze, C. Roberts, O. Samdal, O. Smith & V. Barnekow. Copenhagen Denmark: The World Health Organisation (WHO).
- Busch, V., A. Loyen, M. Lodder & A. J. P. Schrijvers (2014) The Effects of Adolescent Health-Related Behavior on Academic Performance
A Systematic Review of the Longitudinal Evidence. *Review of Educational Research*, Published online before print January 7, (2014), doi: 10.3102/0034654313518441.
- Clea, A., J. M. McNeely, J. Nonnemaker & R. W. Blum (2002) Promoting School Connectedness: Evidence from the national longitudinal study of adolescent health. *Journal of School Health*, 72 :138-146.
- Cockburn, C. & G. Clarke (2002) Everybody's looking at you!: Girls negotiating the femininity deficit they incur in physical education. *Women's Studies International Forum*, 25, 651-665.
- Coleman, L., L. Cox & D. Roker (2008) Girls and young women's participation in physical activity:psychological and social influences. *Health Education Research*, 23, 633-647.
- Currie, C., C. Zanotti, A. Morgan, M. de Looze, C. Roberts, O. Samdal, O. Smith & V. Barnekow. 2012. Social determinants of health and well-being among young people: Health Behaviour in School-aged Children Study (HBSC): International Report from the 2009/2010 Survey. Copenhagen Denmark:: The World Health Organisation (WHO).
- Fenton, C., F. Brooks, N. Spencer & A. Morgan (2010) Sustaining a positive body image in adolescence: an assets-based analysis. *Health and Social Care in the Community*, 18, 189-198.
- Frost, J. & S. McKelvie (2004) Self-esteem and body satisfaction in male and female elementary school, high school, and university students. *Sex Roles*, 51, 45-54.
- Garry, J. P. & S. L. Morrissey (2000) Team Sports Participation and Risk-Taking Behaviors Among a Biracial Middle School Population. *Clinical Journal of Sport Medicine*, 10, 185-190.
- Gentile, D. A., A. I. Nathanson, E. E. Rasmussen, R. A. Reimer & D. A. Walsh (2012) Do you see what I see? Parent and Child Reports of Parental Monitoring of Media. . *Family Relations*, 61, 470-487.
- Gopinath, B., L. L. Hardy, L. A. Baur, G. Burlutsky & P. Mitchell (2012) Physical Activity and Sedentary Behaviors and Health-Related Quality of Life in Adolescents. *Pediatrics*, 130, e167-e164.
- Janssen, I. & A. G. LeBlanc (2010) Systematic review of the health benefits of physical activity and fitness in school aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, 7.
- Moreno, C., I. Sanchez-Queija, V. Munoz-Tinoco, M. G. de Matos, L. Dallago, T. Ter Bogt, I. Camacho & F. Rivera (2009) Cross-national associations between parent and peer communication and psychological complaints. *International Journal of Public Health.*, 54 (suppl 2), 235-242.

- Nelson, M. C. & P. Gordon-Larsen (2006) Physical Activity and Sedentary Behavior Patterns Are Associated With Selected Adolescent Health Risk Behaviors. *Pediatrics*, 117, 1281-1290.
- O'Neill, M., A. Calder & B. Allen (2013) Tall poppies: bullying behaviors faced by Australian high performance school-age athletes. *Journal of School Violence* onlinefirst DOI 10.1080/15388220.2013.846223.
- Parfitt, G. & R. G. Eston (2005) The relationship between children's habitual activity level and psychological well-being. *Acta Paediatrica*, 94, 1791-1797.
- Pickett, W., M. Michal, F. Elgar, F. Brooks, K. Rathmann, T. Ter Bogt, S. Nic Gabhainn, D. Sigmundova, M. Gaspar de Matos, W. Craig, S. Walsh, Y. Harel-Fisch & C. Currie (2013) Trends and socio-economic correlates of adolescent physical fighting in 30 countries. *Pediatrics*, 131, 1-9.
- Prochaska, J., J. F. Sallis & B. Long (2001) A physical activity screening measure for use with adolescents in primary care. *Archives of Pediatrics and Adolescent Medicine*, 155: 554-559
- Simmons, R. 2002. *Odd girl out: The hidden culture of aggression in girls*. . New York: Harcourt Press.
- Simpkins, S. D., D. R. Schaefer, C. D. Price & A. E. Vest (2013) Adolescent friendships, BMI, and physical activity: Untangling selection and influence through longitudinal social network analysis. *Journal of Research on Adolescence*, 23, 537-549.
- Slater, A. & M. Tiggemann (2011) Gender differences in adolescent sport participation, teasing, self-objectification and body image concerns. *Journal of Adolescence* 34 455-463.
- Trudeau, F. & R. Shephard (2008) Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioral Nutrition and Physical Activity*, 5, <http://www.ijbnpa.org/content/5/1/10>.
- Volk, A. A. & L. Lagzdins (2009) Bullying and victimization among adolescent girl athletes. *Athletic Insight*, Spring, 13-31.
- Young, R. & H. Sweeting (2004) Adolescent bullying, relationships, psychological well-being, and gender-atypical behavior: A gender diagnosticity approach. *Sex Roles*, 50, 525-537.

Table 1: Boys (Physical Activity)

	Low PA	Medium PA	High PA	P-value
Life satisfaction score at least 6 out of 10	230/284 (81%)	1011/1130 (89%)	483/542 (89%)	0.005
Good or excellent self-rated health	195/287 (68%)	980/1139 (86%)	492/548 (90%)	< 0.001
Perceived size (too fat)	92/285 (32%)	261/1134 (23%)	89/545 (16%)	< 0.001
Computer gaming for more than 2 hours per day				
(weekday)	146/268 (54%)	574/1058 (54%)	271/494 (55%)	0.886
(weekend)	169/261 (65%)	744/1053 (71%)	332/488 (68%)	0.619
TV viewing for more than 2 hours per day				
(weekday)	190/271 (70%)	747/1054 (71%)	320/487 (66%)	0.112
(weekend)	226/266 (85%)	896/1050 (85%)	377/490 (77%)	0.001
Three or more same sex friends	226/272 (83%)	947/1070 (89%)	463/514 (90%)	0.008
Been bullied at least 2-3 times in last two months	38/280 (14%)	101/1123 (9%)	53/537 (10%)	0.212
Sport with family at least weekly	57/270 (21%)	397/1080 (37%)	230/515 (45%)	< 0.001
Eating breakfast every weekday	177/282 (63%)	745/1132 (66%)	386/540 (71%)	< 0.001
Eating fruits at least 2 days per week	193/286 (67%)	915/1132 (81%)	454/549 (82%)	< 0.001
Eating vegetables at least 2 days per week	211/283 (75%)	930/1129 (82%)	452/548 (82%)	0.020
Smoking at least once per week	14/292 (5%)	46/1152 (4%)	25/555 (5%)	0.975
Drunk at least twice in life	51/282 (18%)	212/1107 (19%)	112/542 (21%)	0.344

Table 2: Girls (Physical Activity)

	Low PA	Medium PA	High PA	<i>P</i> -value
Life satisfaction score at least 6 out of 10	308/413 (75%)	1172/1374 (85%)	251/303 (83%)	0.001
Good or excellent self-rated health	292/418 (70%)	1182/1381 (86%)	260/304 (86%)	< 0.001
Perceived size (too fat)	174/411 (42%)	549/1359 (40%)	93/299 (31%)	0.004
Computer gaming for more than 2 hours per day				
(weekday)	86/393 (22%)	267/1311 (20%)	45/274 (16%)	0.098
(weekend)	118/391 (30%)	371/1299 (29%)	78/270 (29%)	0.667
TV viewing for more than 2 hours per day				
(weekday)	277/396 (70%)	837/1322 (63%)	157/280 (56%)	< 0.001
(weekend)	316/394 (80%)	1046/1323 (79%)	199/279 (71%)	0.011
Three or more same sex friends	347/397 (87%)	1232/1346 (92%)	266/287 (93%)	0.011
Been bullied at least 2-3 times in last two months	44/417 (11%)	127/1371 (9%)	51/299 (17%)	0.017
Sport with family at least weekly	68/399 (17%)	386/1344 (29%)	104/287 (36%)	< 0.001
Eating breakfast every weekday	201/415 (48%)	774/1374 (56%)	177/303 (58%)	0.005
Eating fruits at least 2 days per week	296/419 (71%)	1201/1386 (87%)	269/304 (88%)	< 0.001
Eating vegetables at least 2 days per week	327/419 (78%)	1233/1384 (89%)	263/302 (87%)	< 0.001
Smoking at least once per week	47/421 (11%)	73/1381 (5%)	20/307 (7%)	0.004
Drunk at least twice in life	110/419 (26%)	273/1381 (20%)	57/301 (19%)	0.009

Table 3: Boys (Vigorous Exercise)

	Low VEL	Medium VEL	High VEL	P-value
Life satisfaction score at least 6 out of 10	357/426 (84%)	887/985 (90%)	421/473 (89%)	0.019
Good or excellent self-rated health	297/420 (71%)	860/985 (87%)	432/476 (91%)	< 0.001
Perceived size (too fat)	121/427 (28%)	211/981 (22%)	91/479 (19%)	0.001
Computer gaming for more than 2 hours per day				
(weekday)	236/423 (56%)	523/972 (54%)	259/474 (55%)	0.749
(weekend)	297/418 (71%)	671/972 (69%)	318/463 (69%)	0.483
TV viewing for more than 2 hours per day				
(weekday)	312/415 (75%)	655/968 (68%)	309/459 (67%)	0.014
(weekend)	368/413 (89%)	797/964 (83%)	363/462 (79%)	< 0.001
Three or more same sex friends	355/415 (86%)	868/977 (89%)	420/470 (89%)	0.086
Been bullied at least 2-3 times in last two months	61/425 (14%)	71/972 (7%)	47/471 (10%)	0.037
Sport with family at least weekly	103/414 (25%)	354/981 (36%)	230/473 (49%)	< 0.001
Eating breakfast every weekday	263/417 (63%)	679/972 (70%)	313/469 (67%)	0.286
Eating fruits at least 2 days per week	280/417 (67%)	810/979 (83%)	395/471 (84%)	< 0.001
Eating vegetables at least 2 days per week	317/411 (77%)	828/977 (85%)	379/470 (81%)	0.232
Smoking at least once per week	23/423 (5%)	38/986 (4%)	23/476 (5%)	0.702
Drunk at least twice in life	64/412 (16%)	203/956 (21%)	98/461 (21%)	0.040

Table 4: Girls (Vigorous Exercise)

	Low VEL	Medium VEL	High VEL	P-value
Life satisfaction score at least 6 out of 10	598/764 (78%)	852/988 (86%)	245/293 (84%)	0.001
Good or excellent self-rated health	563/768 (73%)	869/997 (87%)	263/296 (89%)	< 0.001
Perceived size (too fat)	332/769 (43%)	384/981 (39%)	93/291 (32%)	0.001
Computer gaming for more than 2 hours/ day				
(weekday)	149/764 (20%)	200/989 (20%)	61/290 (21%)	0.563
(weekend)	204/759 (27%)	303/981 (31%)	77/285 (27%)	0.483
TV viewing for more than 2 hours per day				
(weekday)	513/767 (67%)	618/995 (62%)	168/293 (57%)	0.002
(weekend)	604/766 (79%)	798/996 (80%)	208/291 (72%)	0.064
Three or more same sex friends	680/765 (89%)	921/996 (92%)	263/288 (91%)	0.054
Been bullied at least 2-3 times in last two months	69/767 (9%)	108/997 (11%)	37/296 (13%)	0.073
Sport with family at least weekly	121/761 (16%)	314/997 (31%)	136/289 (47%)	< 0.001
Eating breakfast every weekday	370/760 (49%)	578/999 (58%)	175/288 (61%)	< 0.001
Eating fruits at least 2 days per week	589/772 (76%)	893/1002 (89%)	258/292 (88%)	< 0.001
Eating vegetables at least 2 days per week	633/770 (82%)	899/999 (90%)	261/292 (88%)	< 0.001
Smoking at least once per week	73/766 (10%)	50/1006 (5%)	14/296 (5%)	< 0.001
Drunk at least twice in life	204/768 (27%)	169/995 (17%)	58/290 (20%)	< 0.001