

The European Journal of Public Health

Trends in vigorous physical activity and TV watching of adolescents from 1986 to 2002 in seven European Countries

Oddrun Samdal, Jorma Tynjälä, Chris Roberts, James F. Sallis, Jari Villberg and Bente Wold

Eur J Public Health 17:242-248, 2007. First published 28 Oct 2006;

doi:10.1093/eurpub/ck1245

The full text of this article, along with updated information and services is available online at <http://eurpub.oxfordjournals.org/cgi/content/full/17/3/242>

References

This article cites 26 references, 5 of which can be accessed free at <http://eurpub.oxfordjournals.org/cgi/content/full/17/3/242#BIBL>

Cited by

This article has been cited by 2 articles at 5 June 2008 . View these citations at <http://eurpub.oxfordjournals.org/cgi/content/full/17/3/242#otherarticles>

Reprints

Reprints of this article can be ordered at http://www.oxfordjournals.org/corporate_services/reprints.html

Email and RSS alerting

Sign up for email alerts, and subscribe to this journal's RSS feeds at <http://eurpub.oxfordjournals.org>

PowerPoint® image downloads

Images from this journal can be downloaded with one click as a PowerPoint slide.

Journal information

Additional information about The European Journal of Public Health, including how to subscribe can be found at <http://eurpub.oxfordjournals.org>

Published on behalf of

Oxford University Press
<http://www.oxfordjournals.org/>

Adolescent Health

Trends in vigorous physical activity and TV watching of adolescents from 1986 to 2002 in seven European Countries

Oddrun Samdal¹, Jorma Tynjälä², Chris Roberts³, James F. Sallis⁴, Jari Villberg², Bente Wold¹

Background: The aim is to study trends in physical activity and TV viewing in seven European countries in the period 1985–2002. **Methods:** The data are collected through questionnaires in the survey 'Health Behaviour in School-aged Children. A WHO Cross-national study', using nationally representative samples of 11-, 13-, and 15-year-olds. Between 1985/86 and 2001/02, a standard set of items was used to measure vigorous physical activity and TV watching in the study. Austria, Finland, Hungary, Norway, Scotland, Sweden, and Wales used these measures in all surveys. **Results:** Between 1985/86 and 2001/02, there was a slight increase in Finland in the proportions reporting vigorous physical activity 4 or more times a week, whereas a pattern of stability was observed for the other countries. Across all surveys and countries boys were more likely to report regular vigorous physical activity than girls. No clear pattern emerges when examining trends over time in TV watching. Boys reported spending more time watching TV than girls in all countries. The correlation between the two behaviours at the 1986 and 1998 measurement points was non-significant. **Conclusion:** The finding that boys were more likely to report regular vigorous physical activity and TV watching confirms results of previous studies. The present study of seven European countries generally indicates stability or a small increase in physical activity of boys and girls aged 11–15 from the mid-1980s to the early 2000s.

Keywords: adolescents, Europe, physical activity, trends, TV watching

Introduction

It is well recognised that physically inactive lifestyles present a major health problem to the populations of developed and developing nations, contributing to chronic diseases and psychological distress.^{1–6} Physical activity in youth has been associated with risk factors for chronic diseases, overweight, skeletal health, and mental health.⁷ Time spent engaging in sedentary behaviours, particularly television viewing, is independent of physical activity, but consistently associated with risk of overweight in youth.^{8,9}

Although young people are more physically active than adults, the worldwide increase in overweight among youth¹⁰ has raised concerns about the adequacy of habitual activity levels in children and adolescents.¹ It has therefore been suggested that young people undertake at least an hour of physical activity of at least moderate intensity on most days of the week.^{11,12}

Societal changes such as increasing car ownership, unfriendly walking and cycling environments, and increasing choices in electronic entertainment combined with the concern about overweight have created a need to understand physical activity trends in youth. However, few studies have reported such trends, as it typically is impossible to compare prevalence rates across countries, due to differences in methodology.^{13–15} In the

United States, trends were documented for high school students between 1993 and 2003. Insignificant changes in prevalence of vigorous physical activity and inactivity were found.^{16,17} On the other hand there is evidence that television viewing is increasing among youth both in the United States⁸ and in Europe.¹⁸

Trends are likely to differ by country, and country-specific data are needed for public health planning. Thus, the purpose of the present study is to document trends in leisure time physical activity and television viewing of adolescents across several European countries, using standardised measures and protocols.

Methods

Health behaviour in school-aged children study

The data presented here are taken from the 'Health Behaviour in School-aged Children study; A WHO Cross-National Survey' (HBSC).¹⁹ The study was established in 1983/84 in four European countries (Austria, England, Finland, and Norway), growing to eleven countries in 1985/86. Since then, data have been collected every four years (1989/90, 1993/94, 1997/98), and in 2001/02, in 35 countries and regions across Europe and North America participated.

The survey aims to improve understanding of young people's health behaviours, lifestyle and perceptions of health, and their predictors. The data are collected through questionnaires from 11-, 13-, and 15-year-olds, following a standard protocol. Between 1985/86 and 2001/02, a standard set of items was used to measure vigorous physical activity and TV watching.

1 Department of Education and Health Promotion, Research Centre for Health Promotion, University of Bergen, Norway

2 Department of Health Sciences, University of Jyväskylä, Finland

3 Health Promotion Division, Welsh Assembly Government, Wales

4 Department of Psychology, San Diego State University, CA, USA

Correspondence: Oddrun Samdal, University of Bergen, Research

Centre for Health Promotion, Christiesg 13, N-5015 Bergen,

Norway, tel: +47 55 58 25 60, fax: +47 55 58 98 87,

e-mail: oddrun.samdal@psych.uib.no

Sample

This study focuses on those countries that have collected physical activity and TV watching data according to the HBSC protocol over the five surveys from 1985/86 to 2001/02. Of the eleven countries participating in 1985/86, seven countries met these criteria, namely Austria, Finland, Hungary, Norway, Scotland, Sweden, and Wales. Austria did not have comparable data for 2002, but was still included as it has trend data up to 1998. The seven countries represent four of the five major regions in Europe: the north (Norway, Finland, and Sweden), the west (Scotland and Wales), the central (Austria), and the east (Hungary). Southern Europe was not represented.

A standard cluster sampling procedure was followed by every country. Samples were designed to be nationally representative, the primary sampling unit being the school class, or the school where school class information was not available. A minimum sample size for each country of approximately 4500 was recommended, 1500 from each age-group. Actual sample sizes for the countries reported in this study ranged from 2992 (Austria in 1990) to 6724 (Wales in 1990). A further requirement for the sampling process was that 90% of the students should fall between half a year of the mean ages, 11.5, 13.5, and 15.5. The two main sources of non-response were school/class non-participation and pupils absent on the day the survey was carried out. Absent students were not followed up. Data were weighted for Austria and Scotland in 1986, and for Scotland in 1990; these weights have been accounted for in the analysis presented here. Full details of the methods used can be found in Currie, Samdal *et al.* 2001.¹⁹

Data collection

To produce mean ages of 11.5, 13.5, and 15.5 the timeline for survey administration depended on the time frame for admission to schools in each country. Whereas some countries followed the calendar year (January through December), other countries' school admission was based on the school year (e.g., September to August). Table 1 shows that the timetable for data collection was broadly consistent through time for each country, although there were some notable exceptions; Austria's data collection took place as early as March (1997/98) and as late as October (2001/02).

The physical activity variable was administered in all countries from 1986 to 1998, and in all countries, except Austria and Hungary in 2002. The TV variable was administered in all countries in 1986 to 1998, *except Sweden in 1998*.

Questionnaire

The questionnaires were developed through international consensus. All participating countries translated the final international version of the questionnaire into their native language(s) and piloted the national questionnaire before conducting the survey. To ensure that the translation gave the correct connotations and concepts, an independent re-translation back to English was carried out.

Vigorous physical activity was measured using the item 'OUTSIDE SCHOOL HOURS: How often do you usually exercise in your free time so much that you get out of breath or sweat?' with seven response categories: (1) Every day, (2) 4–6 times a week, (3) 2–3 times a week, (4) Once a week, (5) Once a month, (6) Less than once a month, and (7) Never. TV watching was measured by the item 'How many hours a day do you usually watch TV?' with six response options: (1) Not at all (2) Less than half an hour a day, (3) Half an hour to 1 hour, (4) 2 to 3 hours, (5) 4 hours, and (6) More than 4 hours.

Reliability

An Australian study investigating the HBSC items measuring vigorous physical activity concluded the items had acceptable reliability.²⁰ Based on the 1993/94 data, a test-retest study for the physical activity measure was conducted among Norwegian students. The Intraclass correlation coefficient (ICC) was 0.74, which is considered high.²¹ A similar test-retest in Finnish students in 2005 had ICC scores ranging between 0.6 and 0.8.²²

Data analysis

The data were analysed using SPSS for Windows, v12.0 (SPSS for Windows 2003). For the purpose of trend analyses, the two items were dichotomised. For vigorous activity, the cut-off point was set at four or more times per week, including the response options (1) Every day, (2) 4–6 times a week. This decision was based on international guidelines that children and adolescents should be at least moderately active at a minimum of 60 min per day on most days of the week.^{11–12} The cut-off point for TV watching was set at 4 h a day or more, because this amount of viewing has been linked with an increased risk of obesity for young people.^{8,23}

The younger age-groups reported to be more physically active than the older groups across all countries. Nevertheless, as trends followed the same pattern for all age-groups, and to reduce complexity of data presentation, the analyses are presented for the total sample of 11–15-year-olds, broken down by country and gender, with 95% confidence intervals calculated for gender subgroup estimates. Statistical tests were not computed for comparisons of interest, because the very large sample size would yield statistical significance when no practical significance was obtained. Interpretations are based on the confidence intervals and visual inspection of figures.

Finally, group level correlations of change scores from 1985/86 to 1997/98 for physical activity and TV watching were performed using each age and gender subgroup in each country as a case. As no Swedish data were available for TV watching, the total number of cases was 36, based on six countries and three age-groups by gender ($6 \times 3 \times 2$). Cross-sectional correlations at 1986 and 1998 between physical activity and TV watching were computed.

Results

Trends in vigorous physical activity

Some key findings emerge from the examination of trend data by country. In Finland alone there was evidence of a small but consistent increase for each survey in the proportions reporting regular vigorous physical activity between 1985/86 and 2001/02. In Scotland and Wales, an increase can be seen between 1985/86 and 1997/98, followed by a decline in 2001/02. In Austria, Hungary, Norway, and Sweden, the proportions remained stable across the 16-year-period. For all countries a similar pattern was observed for boys and girls.

Comparing prevalence rates of vigorous physical activity across countries, young people in Austria were most likely to report vigorous physical activity four or more times a week. On average 67% of the Austrian boys reported this level of activity across all surveys, whereas the number of boys reporting this level in the other countries averaged from 37% to 57%. For Austrian girls, the respective average proportion was 45%, whereas the average for girls elsewhere varied from 20% to 32%.

Trends in TV watching

Figure 2 shows that, overall, the proportions watching 4 h of TV daily changed little between 1985/86 and 1997/98. There

Table 1 Sample description by age, gender, year, and country

	11-year-olds		13-year-olds		15-year-olds		Total (n)
	Boys (n)	Girls (n)	Boys (n)	Girls (n)	Boys (n)	Girls (n)	
Austria							
1986	492	513	535	546	640	494	3220
1990	485	458	502	501	568	468	2982
1994	776	838	869	919	1128	687	5217
1998	729	693	747	771	610	766	4316
Finland							
1986	588	596	475	462	549	549	3219
1990	591	554	462	461	463	465	2996
1994	869	845	631	648	576	618	4187
1998	822	869	805	823	770	775	4864
2002	964	947	879	853	870	875	5388
Hungary							
1986	824	789	798	783	563	704	4461
1990	915	998	957	1016	1061	1551	6498
1994	1047	1025	900	1044	825	934	5775
1998	710	725	671	685	374	444	3609
Norway							
1986	720	642	612	690	667	624	3955
1990	864	892	836	797	801	847	5037
1994	798	816	868	833	837	800	4952
1998	873	860	826	797	848	822	5026
2002	874	786	880	859	800	824	5023
Scotland							
1986	662	647	965	889	822	755	4760
1990	596	641	576	629	590	687	3719
1994	995	1012	780	799	641	732	4959
1998	1070	1022	894	919	810	917	5632
2002	933	810	735	777	578	571	4404
Sweden							
1986	370	384	549	553	549	528	2933
1990	625	629	583	557	598	561	3553
1994	615	610	598	610	591	560	3584
1998	667	627	709	648	610	541	3802
2002	750	749	614	587	614	612	3926
Wales							
1986	1036	1072	1034	1127	956	113	6338
1990	1103	1122	1168	1146	990	1195	6724
1994	580	692	587	745	599	667	3870
1998	764	775	770	801	723	704	4537
2002	680	671	721	651	603	561	3887
Total (n)	25 391	25 313	24 538	24 928	23 228	23 973	47 201

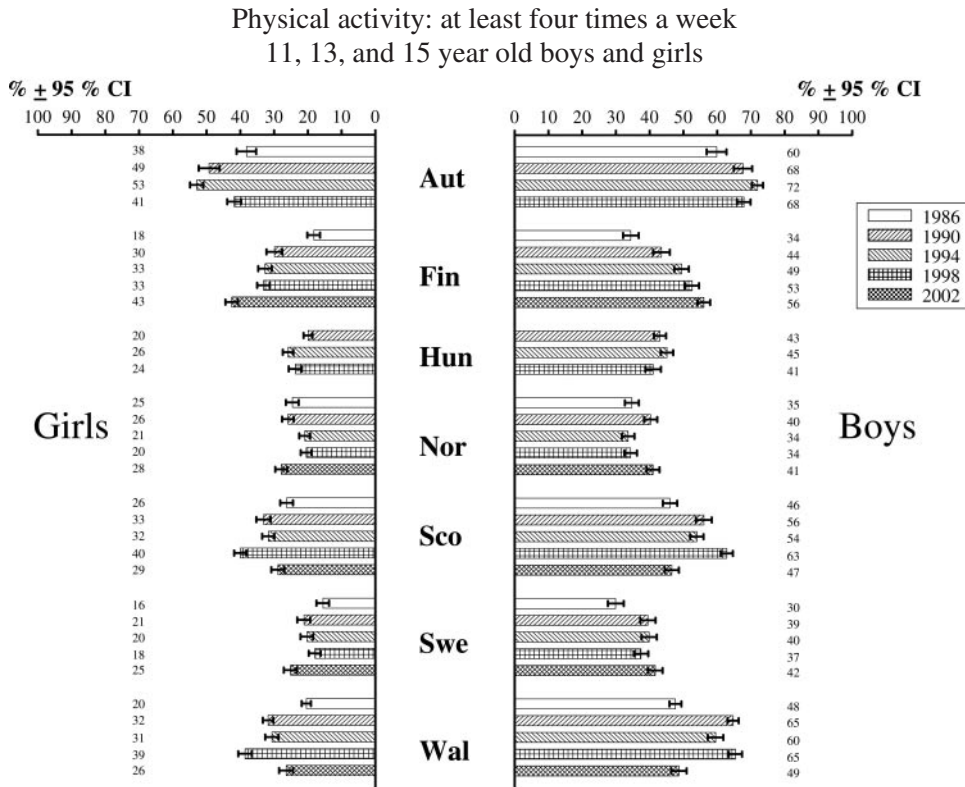


Figure 1 Percentage of 11, 13 and 15 year olds being vigorously physically active at least four times a week, by country, gender and year

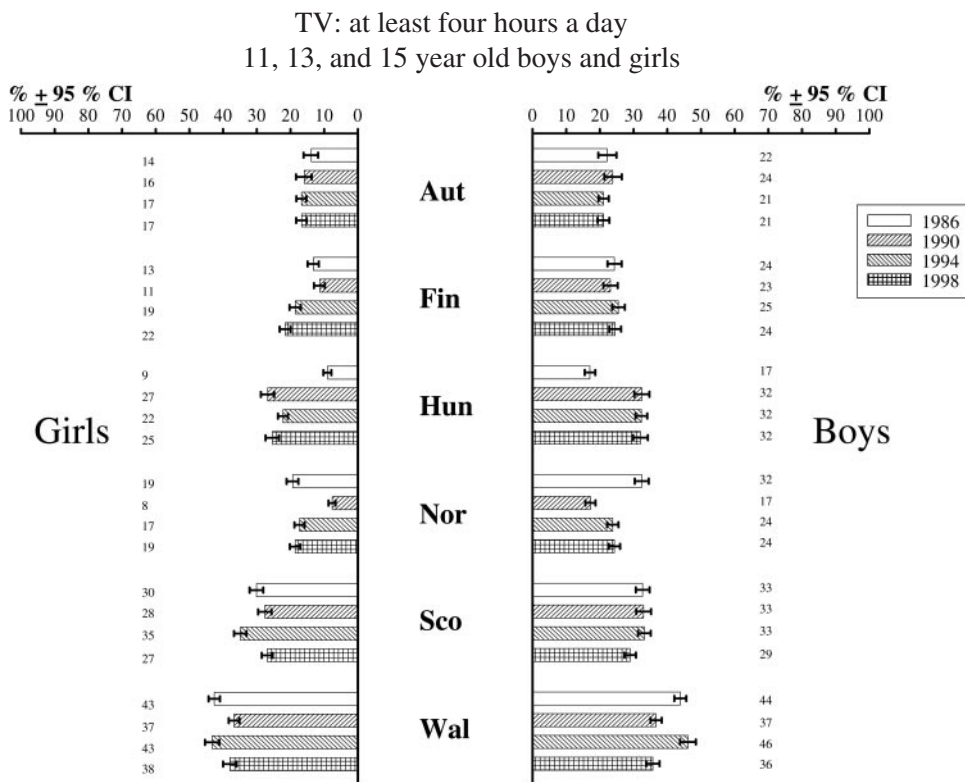


Figure 2 Percentage of 11, 13 and 15 year olds watching TV at least four times a week, by country, gender and year

were two main exceptions to this stable picture. In Hungary, rates were low in 1985/86 but rose in 1989/90 and were then stable until 1997/98. In Norway, rates were somewhat lower for boys in 1993/94 and 1997/98, compared with rates in

1985/86. Boys and girls in Wales were most likely to report high levels of TV watching across all four surveys. Boys reported spending more time watching TV than girls in all countries.

Table 2 Date of data collection for each survey by country

Date of administration					
Country	1985/86	1989/90	1993/94	1997/98	2001/02
Austria	June 1986	May 1990	May 1994	March–April 1998	Oct 2001
Finland	Jan–Feb 1986	March–May 1990	March–May 1994	March–May 1998	March–May 2002
Hungary	Feb 1986	May 1990	Oct–Nov 1993	Nov 1997	March 2002
Norway	Nov–Dec 1985	Nov–Dec 1989	Dec 1993	Dec 1997	Dec 2001
Scotland	Nov 1985	Feb–March 1990	Feb–June 1994	March–April 1998	Feb–March 2002
Sweden	Nov–Dec 1985	Nov–Dec 1989	Dec 1993	Nov–Dec 1997	Nov–Dec 2001
Wales	March–April 1986	March–April 1990	Jan 1994	Feb–March 1998	Feb–March 2002

Correlation of change in physical activity and TV from 1986 to 1998

The mean change score from 1986 to 1998 was calculated for vigorous physical activity and TV watching. Cases were mean changes for each age and gender group for each country. The correlation between these two measures was $r = 0.07$ and thus non-significant. The correlation between the two behaviours at the 1986 and 1998 measurement points was also non-significant.

Discussion

The HBSC study's long-term use of the same measures and research protocols allows a reasonably robust analysis of trends in a number of health behaviours, including physical activity and watching TV. The finding that boys and the younger age-group were more likely to report regular vigorous physical activity and TV watching confirms results of previous studies.^{16,17,23–25} It is now known that children and adolescents have health-enhancing effects not only from continuous forms of vigorous physical activity that the HBSC item was designed to assess.²⁶ Thus, guidelines have changed current recommendations are for young people to accumulate 60 min of at least moderate intensity activity most days of the week.^{1,11,27} Nevertheless, the vigorous physical activity item allows an assessment of trends over time that cannot be computed from any other multi-country study.

Because of the limitations of self-reported physical activity, absolute prevalence estimates should not be interpreted. However, the trends for vigorous physical activity were clear. Country-specific data revealed either stability or a small increase across time. Finland was the only country to show consistent and substantial increases in vigorous physical activity across the whole period in girls and boys. These trends indicating stability or small increases during most of the 1990s are surprising, because rates of overweight were generally increasing in European youth.¹⁰

The trends for TV watching suggested minimal change over the period 1985/86 to 1997/98, although there was some variation by country and gender groups. It is not possible to determine the reasons for different trends by subgroups, and additional research is needed to suggest factors that could account for the findings. During the study period, multiple new entertainment options were introduced that may be substituting other sedentary behaviours for TV time. Unfortunately only TV viewing was assessed across the time span. Overweight in children is related to watching TV 4 h or more per day,^{8,28–29} so it is worth noting that during a time of increasing obesity, there was no general increase in TV viewing. A Finnish time use study indicated that for 10–14-year-olds from the late 1980s till the late 1990s there was an increase in TV watching of 30 min

per day, confirming the small, but steady increase of TV watching across surveys observed in Finland.¹⁸

There is substantial interest in the association between physical activity and TV watching, based on the concern that adolescents who spend large amounts of time watching TV have limited time for physical activity.⁸ Most studies have shown very small associations between physical activity and TV watching, but few prospective studies have been conducted.^{30,31} An attempt was made in the present study to examine the correlation between change in physical activity and change in TV viewing. The analysis was limited by the lack of a cohort design and the need to treat population subgroups as cases. However, the lack of correlation between change scores or in cross-sectional analyses provides further confirmation that it is possible for adolescents to obtain sufficient physical activity and to spend time watching TV. The association between TV viewing and overweight in youth, usually, is found to relate to snacking during viewing time,³² and in many countries there are advertisements on TV to eat unhealthy foods which may contribute to increased energy intake in young people. It is therefore recommended that steps be taken to limit viewing time.

The present study has a number of limitations. First, there was a reliance on self-reported measures which do not provide accurate prevalence estimates. Second, moderate intensity activities were not assessed, so the physical activity measure did not reflect current international guidelines for youth physical activity.¹ Given growing international concern about the increase in overweight and obesity,¹⁰ it would have been useful to examine body mass index data alongside physical activity. However, such information is only available for the most recent survey, with self-reported height and weight added to the HBSC protocol in 2001/02. The measure of vigorous activity did not take seasonal variation into account. Some studies have found seasonal variation,³³ showing children are more active in summer than in winter, whereas other studies have not.³⁴ As seen in table 1, most countries in the present study collected their data in winter time. Two countries, Austria and Scotland, did, however, collect data during summer months in some of the surveys. Given the stability in vigorous physical activity across all surveys and countries (with the exception of Finland), increase of physical activity levels could have been expected for Austria and Scotland in the summer month surveys. This was not the case, and seasonal variation is therefore not considered to be a major problem in the data collection of this study.

Contrary to popular opinion that young people are becoming less physically active, the present study of seven European countries generally indicated stability or a small increase in vigorous physical activity of boys and girls aged 11 to 15 from the mid-1980s to the early 2000s. The results suggest that physical activity is still a popular leisure time activity

among young people. Confidence in these findings is increased by (i) the consistent use of the same survey items, sampling protocol, and administration methods; (ii) the large samples in each country; (iii) replication of findings across countries; and (iv) replication of findings across age and gender groups. The potential for further increases in physical activity among young people might particularly be related to transportation activities in terms of walking or biking to and from school and activities during the school day where young people spend a large part of their waking time.^{35–37}

There could be different influences on the youth physical activity trends in different countries. It is particularly difficult to identify causes of population-wide trends, so questions about causation may never be answered. These data may be more valuable for public health planning. It is important to continue to monitor these trends, so feedback on the possible outcomes of public health programmes can be obtained. It is also important to study the differences between countries and link them to incentives in the national policy to learn more about how physical activity can be increased in Europe. Finland is of particular interest to study more closely as they have been able to achieve a consistent increase over the 1980s and 1990s.

It is of great interest to determine trends in youth physical activity in other parts of the world, and across age-groups of younger and older adolescents using comparable measures and methods. The HBSC study has now expanded to over 40 countries on two continents, so the ability to monitor international trends for physical activity, TV watching, and other health behaviours is improving.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. The International Coordinator of the study is Dr Candace Currie, University of Edinburgh and the Data Bank Manager is Dr Oddrun Samdal, University of Bergen. For details, see <http://www.hbsc.org>. Funding to pay the Open Access publication charges for this article was provided by the Norwegian Research Council.

Key points

- This study provides unique data on physical activity and TV viewing behaviours of adolescents in multiple European countries at a time of increasing obesity rates.
- From the mid 1980s to the early 2000s there was a very small increase in the proportion of youths reporting vigorous physical activity and general stability in the amount of TV viewing.
- It does not appear that increasing obesity in European adolescents is explained by decreasing physical activity or increasing TV viewing.

References

- Strong WB, Malina RM, Blimkie CJ, et al. Evidence based physical activity for school-age youth. *J Pediatr* 2005;146:732–7.
- Lopez AD, Murray C. The global burden of disease, 1990–2020. *Nat Med* 1998;4:1241–3.
- Rejeski WJ, Shelton B, Miller M, et al. Mediators of increased physical activity and change in subjective well-being: results from the Activity Counseling Trial (ACT). *J Health Psychol* 2001;6:159–68.
- Aarnio M, Kujala UM, Kaprio J. Associations of health-related behaviors, school type and health status to physical activity patterns in 16 year old boys and girls. *Scand J Social Med* 1997;25:156–67.
- Skidmore PML, Yarnell JWG. The obesity epidemic: prospects for prevention. *Q J Med* 2004;97:817–25.
- WHO. *The World Health Report: Reducing Risks, Promoting Healthy Life*. Geneva: World Health Organization, 2002.
- Riddoch CJ. Relationships between physical activity and physical health in young people. In *Young and Active? Young people and health-enhancing physical activity—evidence and implications*. Biddle S, Sallis J, Cavill N, editors. Health Education Authority: London, 1998: 17–48.
- Andersen RE, Crespo CJ, Bartlett SJ, et al. Relationship of physical activity and television watching with body weight and level of fitness among children—Results from the Third National Health and Nutrition Examination Survey. *JAMA* 1998;279:938–42.
- Saelens BE, Sallis JF, Frank LD. Environmental correlates of walking and cycling: findings from the transportation, urban design, and planning literatures. *Ann Behav Med* 2003;25:80–91.
- WHO. *Obesity: preventing and managing the global epidemic*. Geneva: World Health Organization, 1998.
- Cavill N, Biddle S, Sallis JF. Health enhancing physical activity for young people: statement of the United Kingdom Expert Consensus Conference. *Pediatr Exercise Sci* 2001;13:12–25.
- Sallis JF and Patrick K. Physical activity guidelines for adolescents: consensus statement. *Pediatr Exercise Sci* 1994;6:302–14.
- Biddle S, Sallis J, Cavill N. Policy framework for young people and health-enhancing physical activity, in *Young and active? Young people and health-enhancing physical activity—Evidence and implications*. In: Biddle S, Sallis J, Cavill N editors. London: Health Education Authority, 1998.
- Roberts C, Tynjälä J, Komkov A. *Physical Activity, in Young people's health in context. Health Behaviour in School-aged Children (HBSC) study: international report from the 2001/2002 survey*. Health Policy for Children and Adolescents, No. 4, C.e.a.
- Booth M. Assessment of physical activity: an international perspective. *Res Q Exercise Sport* 2000;71:312.
- Pratt M, Macera CA, Blanton C. Levels of physical activity and inactivity in children and adults in the United States: current evidence and research issues. *Med Sci Sports Exercise* 1999;31:S526–33.
- Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. *Med Sci Sports Exercise*, 2000;32:963–75.
- Niemi I, Pääkkönen H. Time use changes in Finland through the 1990s. 2002, Helsinki: Statistics Finland.
- Currie C, Samdal O, Boyce W, et al. Health behaviour in school-aged children : a WHO cross-national study. Research protocol for the 2001/2002 survey. Edinburgh: Child and Adolescent Health Research Unit, University of Edinburgh, 2001.
- Booth ML, Okely AD, Chey T, et al. The reliability and validity of the physical activity questions in the WHO health behaviour in schoolchildren (HBSC) survey: a population study. *Br J Sports Med* 2001;35:263–7.
- Torsheim T, Wold B, Samdal O, et al. Test-retest reliability of survey indicators measuring adolescent health and health behaviour. Bergen: Research Centre for Health Promotion, University of Bergen, 1995.
- Vuori M. Reliability of physical activity items in the HBSC study. Pilot study among Finnish 11, 13 and 15-year -old school children. Jyväskylä: Research Centre for Health Promotion, University of Jyväskylä, 2005.
- Crespo C, Smit E, Troiano RP, et al. Television watching, energy intake, and obesity in US children : results from the third national health and nutrition examination survey, 1988–1994. *Arch Pediatr Adolescent Med* 2001;155:360–5.
- Riddoch CJ, Andersen LB, Wedderkopp N. Physical activity levels and patterns of 9- and 15-yr-old European children. *Med Sci Sports Exercise* 2004;36:86–92.
- Adams J. Trends in physical activity and inactivity among US 14-18 year olds by gender, school grade and race, 1993–2003: evidence from the youth risk behaviour survey. *BMC Public Health* 2006;6:57.
- Pate RR, Freedson PS, Sallis JF. Compliance with physical activity guidelines: prevalence in a population of children and youth. *Ann Epidemiol* 2002;12:303–8.
- Corbin BC, Pangrazi RP. *Physical activity guidelines: Appropriate physical activity for children*. Reston, VA: National Association for Sport and Physical Education, 1998.
- Andersen LF, Lillegaard IT, Øverby N, et al. Overweight and obesity among Norwegian schoolchildren: changes from 1993 to 2000. *Scand J Public Health* 2005;33:99–106.

- 29 Janssen I, Katzmarzyk PT, Boyce WF, et al. Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns. *Obesity Rev* 2005;6:123–32.
- 30 Marshall SJ, Biddle SJH, Sallis JF, et al. Clustering of sedentary behaviors and physical activity among youth: a cross-national study. *Pediatric Exercise Sci* 2002;14:401–17.
- 31 Robinson TN, Hammer LD, Wilson DM, et al. Does television viewing increase obesity and reduce physical-activity—cross-sectional and longitudinal analyses among adolescent girls. *Pediatrics* 1993;91:273–80.
- 32 Vereecken C, Todd J, Roberts C, et al. TV viewing behaviour and associations with food habits in different countries. *Public Health Nutr* 2006;9:244–50.
- 33 Loucaides CA, Chedzoy SM, Bennett N. Pedometer-assessed physical activity in Cypriot children. *Eur Phys Educ Rev* 2003;9:43–55.
- 34 Ridgers ND, Stratton G, Clark E, et al. Day-to-day and seasonal variability of physical activity during school recess. *Prevent Med* 2006; in press.
- 35 Morgan CF, McKenzie TL, Sallis JF, et al. Personal, social, and environmental correlates of physical activity in a bi-ethnic sample of adolescents. *Pediatric Exercise Sci* 2003;15:288–301.
- 36 Gordon-Larsen P, McMurray RG, Popkin BM. Determinants of adolescent physical activity and inactivity patterns. *Pediatrics* 2000;105:E83.
- 37 Sallis JF, Prochaska JJ, Taylor WC. A review of correlates of physical activity of children and adolescents. *Med Sci Sports Exercise* 2000;32:963–75.

Received 8 January 2006, accepted 7 September 2006