Trends in young people's health and social determinants

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Funded by
the Swiss National Science Foundation (Grant No. B-0010_160593),
the Swiss HBSC study (mainly funded by the Swiss Federal Office of Public Health, grant no. 09.000925) and the HBSC International Coordinating Center, St. Andrews, UK.

EUROPEAN JOURNAL OF
PUBLIC HEALTH

Volume 25 Supplement 2 April 2015

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European Journal of Public Health is published six times annually by Oxford University Press, Oxford, UK. Annual subscription price is £487.00/$971.00/€730.00. European Journal of Public Health is distributed by Air Business Ltd, c/o Worldnet Shipping Inc., 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Periodicals postage paid at Jamaica NY 11431.

US Postmaster: Send address changes to European Journal of Public Health, Air Business Ltd, c/o Worldnet Shipping Inc., 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA. Subscription records are maintained at Oxford University Press, Oxford, UK. Air Business Ltd is acting as our mailing agent.

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Typeset by Cenveo Publisher Services, Bangalore, India
Printed by Bell & Bain Ltd, UK

European Journal of Public Health, Vol. 25, Supplement 2, 2015, 1–3

doi:10.1093/eurpub/ckv009

Monitoring adolescent health behaviours and social determinants cross-nationally over more than a decade: introducing the Health Behaviour in School-aged Children (HBSC) study supplement on trends

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Young people are among the major driving forces of society's development. They are the capital on which tomorrow's world is built. It is not the young people *per se* that enhance tomorrow's quality of life but their ideas, creativity, motivation and energy to move things forward; these are all aspects that are closely intertwined with health and wellbeing. Young people's health and wellbeing is multi-faceted and several aspects contribute to it such as their physical condition, being overweight, injuries, physical activity, having a good relationship with their parents, not being bullied or stressed by school-related issues, safe sexual intercourse and—most of all—being free of physical or mental complaints and satisfied with life in general. It is one of this supplement's strengths to bring many of these aspects together in one volume.

But where are we standing in terms of adolescent health and wellbeing and related factors? What can possibly or realistically be achieved in the near future? These questions are crucial for policy makers in charge of improving young people's health and wellbeing. However, in a world in which most if not all conditions were found to be relative, it is impossible to answer these questions without a 'fixed point' or 'stand point' for comparison. In this respect, this supplement offers two valuable anchors. First, all contributions include multiple countries. This allows to see where a given country is standing in comparison to the neighbouring countries or to countries in different regions of Europe or even overseas. Second, all contributions include multiple survey years. This allows the comparison of a given age group, e.g. 15-year-olds, surveyed in 2010 with the same-aged peers living in the same country 4, 8, 12 or 16 years ago.

Moreover, both aspects contribute to the assessment of differences in changes of prevalence (differences in trends) of health behaviours and social determinants across different countries. While it is difficult to link a policy measure implemented in a given country at a certain time point or differences in a country-specific policy to observed differences in adolescent health behaviours or related factors, the results presented here nevertheless offer valuable insight on which evidence-based policy can and should be based.

What this supplement has to offer

General aim

As mentioned above, in addition to multiple countries and multiple survey years, the aim of this supplement was to provide evidence on various aspects of young people's health, wellbeing and related factors. To be able to do so, most contributions are in short report format. In this way, the reader can easily get an overview of prevalence changes across countries for selected outcomes, e.g. fruit and vegetable consumption, overweight, injury-related mortality and morbidity, physical activity, parental communication, bullying, early sexual intercourse and condom use, weekly alcohol consumption and the co-occurrence of tobacco and cannabis use, and life satisfaction, just to name a few of the outcomes included. Full-length papers offer examples of how time trends can be interpreted and explained when dealing with perceived school pressure and health complaints.

Results in a nutshell

Altogether, this supplement consists of 20 contributions. After a general introduction into the Health Behaviour in School-aged Children (HBSC) project by Currie and Alemán-Díaz[1] and its impact over time, Schnohr et al.[2] describe some historical aspects of the HBSC. Their paper also briefly reviews previously published trend papers that emerged from this collaboration. It also describes methodological considerations and analytical strategies on how to produce reliable trends based on an international study. In the paper by Cavallo et al.,[3] adolescents were asked to assess their current health condition. The results show that over the last decade an increasing proportion of adolescents rated their health as excellent. Analyses conducted by Vereecken et al.[4] reveal an increase in daily fruit and vegetable consumption between 2002 and 2010 in a majority of countries, with a decrease noted in only five countries. Honkala et al.[5] demonstrate that the prevalence of recommended tooth brushing (i.e. more than once a day) increased in all countries except in Scandinavia, where it was already high in 1994. This also means that differences between the countries diminished from 2004 to 2010.

Analyses conducted by Ottová-Jordan et al.[6] show that trend patterns in recurrent health complaints vary considerably across countries; i.e. nine countries showed no linear or quadratic trend, seven a linear decrease, five a linear increase, four a U-shape curve, six an inverted U-shape curve and four an unstable trend. Ahluwalia et al.[7] document an increase in overweight prevalence (including obesity) predominantly in Eastern Europe. In other countries, overweight rates remained stable albeit at high levels. Also noteworthy is that no decreases from 2002 to 2010 were found in any of the countries. The paper by Molcho et al.[8] reveals that in the same timespan injury-related mortality, but not morbidity, declined over time across all the included 30 countries. Interestingly, risky behaviours such as substance use, physical activity or fighting were

consistently and significantly associated with injury morbidity, but did not explain the observed temporal trends. Kalman et al.[9] demonstrate that despite a slight overall increase in physical activity from 2002 to 2010 across the 32 included countries nine showed a significant decrease.

Boniel-Nissim et al.[10] document an increase in electronic media communication from 2002 to 2010 in most of the 30 included countries. Electronic media communication was also linked with communicating easily with friends in general and with the opposite sex in particular. In the same vein, analyses conducted by Brooks et al.[11] show, in the majority of the 32 countries, an increase in the proportion of adolescents who find it easy to talk to their mother or father about the issues that are of importance to them, and this was mostly pronounced for the communication with the father. A decreasing trend was found only in France, Slovenia and Poland. The paper by Klinger et al.[12] reveals that the overall proportion of students who felt under pressure due to the amount of schoolwork they had did not change, with the levels reported in 1998 being similar to those reported in 2010 across all gender and age groups. Students in North America report the highest perceptions of school pressure, followed by Great Britain, Eastern Europe, Nordic countries and Germanic countries in a descending order. Analyses conducted by Moor et al.[13] show that, in the majority of countries, schoolchildren who perceived their family wealth as low reported significantly higher rates of multiple health complaints (1994: 12 out of 19 countries; 1998: 17 out of 25 countries, 2002: 26 out of 32 countries, 2006: 30 out of 37 countries, 2010: 32 out of 36 countries). In the majority of countries, there was no change in social inequalities in health complaints across the survey years.

The paper by Chester et al.[14] reveals a decrease in occasional and chronic bullying victimization between 2002 and 2010 in the majority of the 33 included countries. Although there was no linear trend across countries from 2002 to 2010, Ramiro et al.[15] demonstrate differences in sexual intercourse among adolescents in different European regions. There was a tendency of increased initiation among girls in eastern Europe and decreased very early initiation (i.e. younger than 13) among girls in northern Europe, along with a general increase in condom use in boys and most notably in girls. Analyses conducted by De Looze et al.[16] reveal that between 2002 and 2010 weekly alcohol use declined in 20 of the 28 European and North American countries included and in all geographical regions. The authors conclude that, although the declining trend was remarkably similar across countries, prevalence rates still differ considerably, from highest to lowest in eastern Europe (10.1%), southern Europe (9.9%), western Europe (7.8%), Anglo-Saxon countries (6.1%) and northern Europe (4.1%). Consistent with alcohol consumption, the paper by Hublet et al.[17] shows a decrease from 2002 to 2010 in concurrent use of tobacco and cannabis in all European and North American regions, a decrease in tobacco-only use in all European regions and a decrease in cannabis-only use in all regions except in eastern European countries. Holstein et al.[18] document that the prevalence of medicine use for headaches increased in twelve out of twenty countries, most notably in the Czech Republic, Poland, Russia, Sweden and Wales.

Concerning general life satisfaction, Cavallo et al.[19] found no consistent trends across all countries. Between 2002 and 2010, six relatively affluent western countries (Austria, Canada, Switzerland, Denmark, Finland and Greenland) and two eastern European countries (Hungary and Macedonia) decreased. In contrast, increasing life satisfaction was observed in six eastern European countries (Estonia, Croatia, Lithuania, Latvia, Russia and Ukraine), and in four western European countries (Spain, Norway, Portugal and Belgium). Finally, analyses by Ottová-Jordan et al.[20] reveal that individual factors, especially being a female, being bullied, experiencing school pressure and smoking, were more strongly associated with health complaints in the different survey years than country characteristics, such as national wealth or income inequality.

Conclusion: is there nothing to worry about anymore?

What emerges as a general picture of the 19 contributions included in this supplement is that, across countries, contemporary adolescents are better off than their counterparts were about a decade ago. In 2010, a higher proportion of adolescents ate healthily in terms of fruit and vegetable consumption, had a good dental hygiene, did not suffer from injury, were physically active on a daily basis, communicated with friends electronically, found it easy to talk to their mother or father about important personal issues, were not victimized in terms of occasional or chronic bullying, used a condom when having sex, did not drink alcohol on a weekly basis and lived tobacco and cannabis free. Consistently and as a kind of general summary, Cavallo et al.[3] report a higher proportion of adolescents who rated their health as excellent.

The overall optimistic picture seems surprising considering that many countries in Europe and North America faced a severe economic crisis in the last decade. At the same time, however, policies and actions to improve public health were implemented in many countries such as the ban of selling cigarettes to minors and smoking in public buildings including bars and restaurants or the policies aiming to increase physical activity and healthy eating in school children to counteract excess weight and obesity development. However, one has to bear in mind that such trends over time are never the result of a single measure but reflect changes in fashions, behavioural norms, societal values, etc., as well as the diversity of the policy actions that were taken. This is what makes it particularly difficult to come up with sound explanations for the observed trends.

While the overall picture indicates improvements in adolescent health and social determinants this was not the case for all the countries. For example, in Greenland, Norway, Poland and Denmark an increase in multiple recurrent health complaints was observed from 1994 to 2010.[6] In the Czech Republic, Denmark, Italy, Lithuania, Russia, Scotland, Slovenia, Switzerland and USA in 2010, there was a lower proportion of adolescents who were physically active on a daily basis compared to 8 years ago.[9] In the same time span, less adolescents found it easy to talk to their mother or father about important personal issues in France, Slovenia and Poland.[11] Also, in French-speaking Belgium and Finland, there were increasing trends of bullying victimization.[14] Thus, it is not only important to consider the evidence of single countries or groups of countries, but the multiple evidence presented in the various articles included in this supplement can help to better understand the development in a given country in the light of the others.

The fact that not all the examined variables developed positively across the years is something to be concerned about. Despite the results showing that a higher proportion of adolescents ate healthily in terms of fruit and vegetable consumption and were physically active on a daily basis, overweight prevalence including obesity increased from 2002 to 2010, predominantly in Eastern Europe, or remained stable in the best case.[7] Furthermore, although a higher proportion of adolescents did not suffer from any injuries, did not experience bullying victimization, did not drink alcohol on a weekly basis, lived tobacco and cannabis free, and rated their health as excellent, the prevalence of medicine use for headaches increased from 1986 to 2010 in 12 out of 20 countries.[18] More research is clearly needed to gain a better insight into these seemingly contradictory trends.

Another major concern is that many if not the majority of adolescents living in Europe and North America still do not meet the recommendations for healthy living despite the improvements described above. For example, large proportions of adolescents do

not meet the recommendations for physical activity (at least 60 min per day),[9] for time spent in front of electronic screens (no more than 2 h per day)[10] or for fruit and vegetable consumption (daily basis).[4] This demonstrates the need for continued advocacy, policy implementation, and a strengthening of efforts to motivate adolescents and their parents to behave in healthy ways. It is imperative to work with policymakers from various countries to implement health strategies for children and adolescents that take into account social determinants for health cross-nationally.

Acknowledgements

The Health Behaviour in School-aged Children (HBSC) study is an international study carried out in collaboration with the WHO/Europe. The international coordinator of the study was Candace Currie, University of St. Andrews, Scotland. The data bank manager of the study was Oddrun Samdal, University of Bergen, Norway. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The authors thank Dr. Kate Levin and Dr. Bjørn Holstein for their collaboration and contribution to the supplement and Lucie Chambeyron and Anna Katz for their editing work for all papers.

Funding

The data collection for each HBSC survey is funded at the national level. This supplement was funded by the Swiss National Science Foundation (B-0010_160593), the Swiss HBSC study (mainly funded by the Swiss Federal Office of Public Health, grant no. 09.000925) and the HBSC International Coordinating Center, St. Andrews, UK.

Conflicts of interest: None declared.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 4–6

doi:10.1093/eurpub/ckv017

Building knowledge on adolescent health: reflections on the contribution of the Health Behaviour in School-aged Children (HBSC) study

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Adolescence as a key stage in the life course has until quite recently been neglected by researchers and policymakers alike. Research on young people has largely focused on the early years of life, especially from pre-conception to age 5, with enormous investment in studying and intervening to improve wellbeing of young children. However, when 'around 1 in 6 persons in the world is an adolescent'[1] it is impossible to neglect this age group. Reports like 'The Lancet' series on adolescent health,[2–11] UNICEF's Progress for Children: a Report Card on Adolescents[12] and WHO's Health for the World's Adolescents report[13] shifted global attention and highlighted the importance of adolescence as a second critical period in development where investment and intervention is needed and valuable since it lays the foundation of good health in adulthood. McDaid et al.[14] have taken this argument a step further and provided the economic case for investment in adolescents. They demonstrate how available interventions during adolescence can generate substantial economic returns because they can mitigate the long-term adverse effects on health and other areas that result from poor wellbeing during childhood.

One study stands out as prescient in its focus on the adolescent years, the Health Behaviour in School-aged Children (HBSC) study, beginning its work 32 years ago to advance our understanding of young people entering the second decade of life. In the early eighties, HBSC researchers identified early through to middle adolescence as a critical period for the development of health and wellbeing, health behaviours and risk behaviours. They also understood, well before the concept became widely adopted, the need to consider these dimensions of health and behaviour as embedded within the fabric of the everyday lives of young people. The term used in the 1980s to describe this conceptual approach was 'lifestyle,' in the 90s 'social context' and in recent years, 'social determinants' has been adopted, but the underlying idea is the same. HBSC was 'ahead of its time' in formulating the perspective that adolescent health is both shaped and constrained by factors stemming from the social spheres of family, peers, school, and the wider economic conditions in which they are growing up.[15]

Since its inception, the HBSC has provided critical insight into the health and wellbeing of young people for a growing number of countries across Europe and North America. The cross-disciplinary nature of its conceptual and theoretical base, which has developed over time and continues to flourish today, has been a valuable source of research innovation in the field of adolescent health. In addition, the use of a common protocol has enabled the collection of comparative cross-national data amongst its participating countries; providing a platform for systematic data collection at the country level and a resource for national research capacity building. This has resulted in a coherent set of indicators that provide a valid representation of young people's health, well-being and risk behaviours; as well as their developmental and social determinants.[16] The long standing nature of this research collaboration has meant that, with successive surveys, trend data can be examined at the national and cross-national level as it is evident in this supplement enabling the identification of both emerging issues and continuing health challenges. Publications like this journal supplement underscore the value of the collected cross-national data in highlighting these issues. A further resource built over the last three decades is of human capital in the form of the HBSC network of researchers who through sustained collaboration have ensured the continuity and relevance of the study in advancing the health of the world's adolescents. As such, the potential for HBSC to impact the lives of the young people it surveys is at a point where it extends beyond Europe and North America for example through the development of HBSC linked projects[17] and sharing of indicators with other global initiatives.[18] It is our hope that the following papers can inform health promotion and health education policy, programmes and practice aimed at young people at both national and international levels.

Context

The HBSC study has grown exponentially over time both in absolute numbers of countries involved, scope of work, and impact. Initially, HBSC was a small collaboration of three countries and less than a dozen researchers. Today, 44 country teams form a research alliance and network of around 400 researchers across the European Region and North America. According to their expertise, network members align themselves to scientific and developmental groups within the study and this model has been successful in driving forward research innovation in the survey content. Each successive 4-year survey has included new topic areas, while at the same time maintaining core questions to enable tracking of trends in health and behaviour. National level data has been a critical resource for HBSC teams to use to draw attention to the particular health concerns among young people in their countries. This work has helped to build capacity for adolescent health at a country level, stimulating debate and discussion that can lead to strategic developments as well as channelling of funding towards further research. In turn, these processes have led to the building of a critical mass of researchers in the field of adolescent health.

Knowledge exchange

Early publications were largely limited to national reports and journal articles which were descriptive in approach. For example, initial papers were national and focused on national prevalence of behaviours such as smoking[19] followed by papers making cross-national comparisons[20,21] using HBSC data. When they were published, this work made an important contribution to

adolescent public health science since very little data had been previously collected or published on the health of this population group in countries across Europe. It was some years before papers began to examine associations between behaviours[22,23] or between social factors and health outcomes.[24] In the last decade or so, the analyses presented in papers and reports have become more sophisticated and using macro-level measures at country-level we have had the opportunity for multi-level modelling and answering more complex research questions.[25–28] For example, how features of the country, such as economic, cultural and policy factors[29–32] provide explanations for country differences and patterns of change across time in young people's health. In 2009, the first Supplement on the HBSC study was published and it provided a complete description of the study's origins, history, conceptual framework and methodology.[33]

While HBSC has had as a primary aim since its initiation to influence policy and practice, over time there has been increasing effort among researchers and greater sophistication in products and activities to achieve these goals. Again the language has also changed; now we talk of the need for research impact tracked through measureable change in discourse or practice among decision makers. In the early years of HBSC the goal was to find ways to disseminate information to end users without a great deal of concern about the outcome of this information sharing to ascertain its effectiveness in changing policy agendas. However, the need for academics to demonstrate their commitment to serve the public good is now widely accepted, and furthermore attached to research funding, which has increased the imperative to take this work seriously and to commit time and consideration to doing it effectively. This has been a driver for HBSC to develop new ways to share its research findings with wide and differentiated stakeholder groups. Working hand in hand with its partner, WHO, there has been an effort to create attractive and accessible designs for reports, briefings, fact sheets[16,34–37] and events such as the WHO-HBSC Forums[38–40] which provided an information exchange platform to discuss and learn about how scientific evidence can impact practice, programmes and policy to improve young people's health. A new WHO Collaborating Centre for International Child and Adolescent Health Policy has also recently been established at the University of St Andrews[41] and one of its aims is to assist HBSC in bridging the gap between research and policy, which will include developing novel approaches to engaging with stakeholder groups. New technology is also being used by HBSC through developing interactive data visualisations[42] to display our findings in more engaging ways and attract users to manipulate the data to create their own 'stories' to convince decision makers of the need for action.

The HBSC study has been instrumental in increasing the production of data on adolescents and making it available for researchers and policy makers, with a new data portal soon to be launched. The breadth of its topics and cross-national nature offer a convenient snapshot into the factors that contribute to creating the best conditions for young people to grow up in different country contexts and how they fare against others. But data alone will not create change, especially if it does not get into the hands of decision makers who determine funding levels and government priorities. Through a wide range of knowledge exchange activities, HBSC teams have engaged with stakeholders to help identify priorities for government action. One such example has been the work with organisations such as UNICEF using evidence from HBSC to raise awareness of specific issues such as the damaging effects of poverty and economic inequalities on children's health.[43–44] This supplement is another opportunity to make HBSC trend data and analysis accessible and informative to ensure that it can positively affect policies and programmes that aim to realise young people's potential for health, development and wellbeing.

Acknowledgements

The Health Behaviour in School-aged Children (HBSC) study is an international study carried out in collaboration with the WHO/Europe. The international coordinator of the study was Candace Currie, University of St. Andrews, Scotland. The data bank manager of the study was Oddrun Samdal, University of Bergen, Norway. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). Candace Currie has been HBSC International Coordinator since 1995; Aixa Y. Alemán-Díaz was Assistant International Network Coordinator 2011-2013. The authors would like to acknowledge the HBSC Study Network, the WHO Regional Office for Europe and HBSC funders as well as all the young people who have participated in HBSC over the years.

Funding

The data collection for each HBSC survey is funded at the national level. NHS Health Scotland funded the work of the HBSC International Coordinating Centre from 1995 to 2013. Additionally countries in the study network make a contribution to the international study through a subscription system.

Conflicts of Interest: None declared.

Key points

- HBSC researchers identified early through to middle adolescence as a critical period for the development of health and wellbeing, health behaviours and risk behaviours well before it was widely accepted.
- The use of a common protocol has enabled the collection of comparative cross-national data amongst its participating countries, providing a platform for systematic data collection at the country level.
- The long-standing collaboration has enabled a flourishing network of adolescent health experts and a rich resource for national research capacity building.
- HBSC has a primary aim to influence policy and practice; over time there has been increasing effort among researchers and greater sophistication in products and activities to achieve this goal.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 7–12

doi:10.1093/eurpub/ckv010

Trend analyses in the health behaviour in school-aged children study: methodological considerations and recommendations

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Background: This article presents the scope and development of the Health Behaviour in School-aged Children (HBSC) study, reviews trend papers published on international HBSC data up to 2012 and discusses the efforts made to produce reliable trend analyses. **Methods:** The major goal of this article is to present the statistical procedures and analytical strategies for upholding high data quality, as well as reflections from the authors of this article on how to produce reliable trends based on an international study of the magnitude of the HBSC study. HBSC is an international cross-sectional study collecting data from adolescents aged 11–15 years, on a broad variety of health determinants and health behaviours. **Results:** A number of methodological challenges have stemmed from the growth of the HBSC-study, in particular given that the study has a focus on monitoring trends. Some of those challenges are considered. When analysing trends, researchers must be able to assess whether a change in prevalence is an expression of an actual change in the observed outcome, whether it is a result of methodological artefacts, or whether it is due to changes in the conceptualization of the outcome by the respondents. **Conclusion:** The article present recommendations to take a number of the considerations into account. The considerations imply methodological challenges, which are core issues in undertaking trend analyses.

Introduction

Research into adolescents' health and health behaviours, as well as into the factors that influence them, is essential for the development of effective health education and health promotion policy, programs and practice targeted at young people. It is important that young people's health is considered in its broadest sense, encompassing physical, social and emotional well-being.[1] Further, and in accordance with the World Health Organization (WHO), health should be acknowledged as a resource for everyday living.[2,3] Thus, research into adolescents' health needs to investigate not only modifiable risk factors associated with ill-health, but also identify factors that promote young people's well-being.

History of HBSC

The WHO collaborative cross-sectional Health Behaviour in School-aged Children (HBSC) survey collects data on health and well-being, social environments and health behaviours from 11-, 13- and 15-year-old school going children every 4 years. The study was initiated in 1983 in 5 countries and developed into a large cross-national study including 43 countries and regions by the 8th data collection in 2009/2010 (see fig. 1).

This article takes on a methodological view of the 30-year-period since the inception of the HBSC study, in particular reflecting on methodological aspects in performing trend analyses. The article does so by presenting the challenges and considerations encountered in collecting data consecutively and analysing trends. More in-depth information on scientific rationale, partnerships and policy implications of the study has been published elsewhere. [1,4–7]

The initial idea to conduct a cross-cultural study was developed by researchers from Norway, Finland and England, who found a lack of comparability of smoking measures in existing surveys. This led to collaboration on the development of a cross-national survey using an internationally standardized protocol and questionnaire in each country, to ensure high comparability.[2,3] With the expansion of the HBSC study, there has been a natural increase in the number of HBSC network members, who brought a broad range of backgrounds and various professional views on methodological perspectives in setting the research agenda and in the development of specific items. This broad internal expertise forms the basis for achieving the original aim; to ensure high comparability in spite of the increased complexity due to the increasing numbers of participating countries and repeated survey rounds. The HBSC study Protocol is core in achieving this aim.

HBSC study protocol

Data are collected using a standard methodology outlined in the HBSC protocol created and agreed by all participating countries.[4,5] Each country uses random cluster sampling with classes or schools as the primary sampling unit, selecting approximately 1500 adolescents in each of the three age-groups (i.e. 11, 13 and 15 years), ensuring that the sample is representative of the target population. Data collection takes place in four-year intervals, and in the most recent survey, data were collected from approximately 200 000

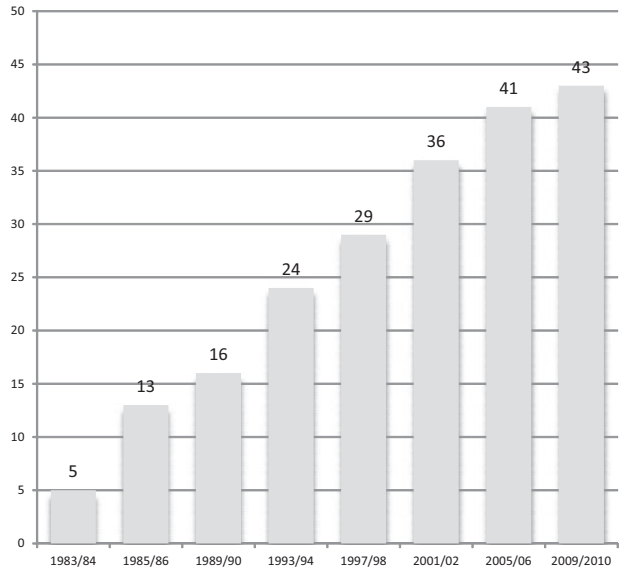

Figure 1 Participating regions in the HBSC

adolescents through a self-completion questionnaire, filled out during a school lesson. After data collection, national datasets are submitted to an international databank that checks the quality of the data collected, performs appropriate cleaning of the data and merges national data sets into an international data file.

Contributions of the HBSC study

The HBSC study has had an important lifelong partner in the WHO Regional Office for Europe, making use of HBSC data as a valuable source of knowledge on social and behavioural issues in Europe, supplementing existing data on morbidity and mortality indicators.[8] The value of HBSC as a database for the monitoring of child health is topical for trend analysis, particularly as the study now has been undertaken over numerous survey waves in many countries. Sixty-eight peer-reviewed papers were published between the initiation of the study in 1983 and 2002.[9] Since then between 20 and 30 papers have been published annually in peer-reviewed journals, including a total of 10 international and 30 national trend papers. The production of the aforementioned papers, and in particular the trend papers, has led to a number of methodological considerations and discussions within the HBSC network. Most of the papers produced are a result of the conclusions reached on how to optimize validity when working with international data spanning over time. A brief overview of these issues is presented here.

Methodological considerations

The objectives of trend analysis

Trend analysis serves several objectives. Importantly, describing trends in outcomes 'within countries' is a relevant question; e.g. did smoking increase in a given country between 1994 and 2010? Trend analysis can also be used to summarize trends between countries and examine the heterogeneity 'between countries'; e.g. has there been an overall increase in smoking across countries, and did some countries change more than others? In addition to these descriptive objectives, trend analysis may also examine causal 'mechanisms', and for example identify factors that moderate the magnitude of trend; to what extent did the magnitude of trend change in countries with smoke-free legislation, in comparison to countries without smoke-free legislation? Related to causal mechanisms, another objective of trend analysis can be the changing magnitude of 'associations'; if and how did social inequality in smoking change over time?

A review of international trend analysis papers

This article provides a brief review of some of the international trend papers published, to provide hands-on examples of some of the analytical approaches that were used. For the purpose of this article, international papers comparing two or more countries, over three or more cycles of data collection, are considered. Most of the HBSC trend papers to date have examined time trends in risk behaviours, such as drinking,[10,11] smoking[12,13] and fighting,[14] while others investigated time trends in bullying behaviours,[15,16] television viewing and physical activity.[17] In some papers, trends were determined based on graphical/visual differences backed by confidence intervals,[13,16,17] and in others more complex analyses were performed. Simons-Morton et al.[10] used Cochran-Mantel-Haenszel test for trends including time as a categorical variable, Pickett et al.[14] used Poisson regression including time as a covariate, and Zaborskis et al.[11] used multiple logistic regression with survey year as a covariate, an approach also used by de Looze et al.[12] Elgar et al.[15] aggregated all data at country level and used a Pooled-Time Series Analysis with country-years as the unit for analysis using linear regression to predict the outcome. This brief overview of different methods in reporting trends demonstrates the variety of possibilities in analysing trends. This variety in the approaches used reflects both emergence of new statistical tools and techniques to perform more advanced analyses, but also a general lack of clarity in the literature regarding a recommended, or even appropriate, trend analysis. To our knowledge, no consistent approach has been developed for trend analyses, which may depend both on the particular research question and the educational background and theoretical views of the research team of authors. This article includes examples of what are considered common methodological issues independent of the particular authors or research question.

Methodological considerations of trend analyses: and how the HBSC study has dealt with them

Different research areas and disciplines emphasize different theoretical and statistical approaches, as well as different methodological criteria. While challenging, meaningful agreement across disciplinary areas can be reached through establishment of a definition of common standards. While Heath and colleagues' focus was cross-country comparisons, issues relating to the handling of data are also relevant for time trend analyses.[18] Heath and colleagues suggest that methodological problems arise from either errors of non-observation or errors of observation. Encompassed in the latter is an error in the equivalence of meaning, which follows from changes in perceptions of the variables measured and not only from which and how many observations are included. Hence, methodological development can be led by an overall aim to achieve equivalence of meaning across time and country hereafter called 'functional equivalence'.

Errors of non-observation and response bias

Existing research around non-observation has explored general questions such as the relation between response rate, and response bias[19] and questions on whether data are representative. Variation in sampling methods, modes of data collection and response rates is likely to result in various non-response biases.[18] To illustrate, due to the existence of different ethical requirement across countries, countries can have different requirements for parental consent. In some countries, active (opt-in) consent is required, while in others passive (opt-out) consent suffices. Countries with active consent procedures are likely to have a lower response rate compared to those where passive consent is used. Even when steps in the design phase do not vary, it is necessary to check how far the observed

variation over time (and country) in the given outcome might be due to some standard (and investigable) sources of non-observation and/or observation error.[18] Taking the example of the consent process, there may—or may not—be differences in outcome, e.g. smoking, across countries that may be associated with who gives (active) consent and who does not. These variations are plausible and can often be investigated, and adhering to the HBSC protocol in practice, documenting data and being clear about the data cleaning process helps to minimize problems arising from such methodological challenges.

Errors of observation and functional equivalence

Functional equivalence is defined here as a methodological challenge associated with high levels of cultural, economic and historical diversity between regions constituting the HBSC study. This diversity is for obvious reasons complex to define, and existing research about compliance to questionnaires has explored general questions such as social acceptability bias or the different use of response categories depending on relevance in a national context.[15] The key concern is whether items have the same meaning across different contexts. These concerns can be tested through qualitative studies and following data collection, further statistical explorations to look for clues of bias due to compliance are recommended.[18] A thorough approach should include questioning whether the observed variations in the extent to which respondents over time and in each country subscribe to the conceptions in the given outcome, represents 'real' differences or whether one should treat some of the variation as essentially methodological artifacts.[18] With an overall aim to obtain functional equivalence it is beneficial to discuss and document (e.g. in a research protocol) which of those two interpretations are most likely or whether it is a combination.

Methodological recommendations

Statistical considerations of trend analyses

The consideration of analytical strategy is always an important part of a statistical study, but in a cross-national or trend analyses, this choice is critical, since it can potentially modify the findings.[20] This article suggests a number of preconditions, which are specifically proposed to be included as initial steps of trend analyses in order to increase validity in a broad sense, and should act as an aid in defending the modelling decisions made. The steps are divided into (i) preparation, (ii) analyses and (iii) interpretation.

Preparation of data

The following steps are recommended in order to assure sufficient data quality to do comparative and trend analyses. The importance or urgency of each step is dependent on the particular data used and research question posed, but the list may serve as a check-list for authors of trend papers in general.

The HBSC Data Management Centre performs a general check and cleaning of data before including a national sample in the international file, in which several of the steps listed in table 1 are included. However, as odd patterns can be seen in comparisons between groups, it is worthwhile to work through the steps to ensure sufficient data quality to perform each specific comparative and trend analyses.

Response rates and the variation within and between countries could be subject to a specific paper in itself. Within each country, there are particular challenges in the calculation of response rates; whether it is based on school level, class level, individual level or a combination of these. Within the HBSC, there is a special focus on developing consistency on this important methodological issue.

Table 2 illustrates the response rates for the participating countries in the past three survey rounds, and it illustrates substantial differences. The large variation is partly due to how data is oversampling in some countries. The lack of standardization of some of the sampling issues therefore makes it very difficult to compare responses across countries presently, as well as the challenge in collecting correct population data split by school and class level. This area is presently receiving a lot of attention within the network, to document the variation in responses within and between countries. As national data on population and sample size improve the quality of the response rate calculations increases.

Analysing data

With regression models as a starting point for trend analysis, variation in the dependent variable is a function of discrete or continuous time. In the 'discrete time' approach, each study year is represented by a separate model parameter, describing the difference with a reference time point, commonly the first time point in the series of data. A positive feature of modelling time as discrete is that it makes no assumptions of a continuous gradient between time points, allowing for any shape of relationship to be modelled.

In a 'continuous time' approach, the population trend is parameterized as a gradient or continuous slope of change per time unit. A positive feature of modelling time as continuous is that the pattern can be summarized through a single parameter: the slope of change over time. A negative feature is that the constant slope of change is biased when the true population trend is non-linear, e.g. if there is a steep change between time points. Nonlinear trends can be accommodated through quadratic and cubic terms, or through orthogonal polynomials.

When the analyses include several countries, the researchers must make a number of decisions, both in modelling the trend, and how to model cross-national differences in the trend. Three potential approaches ('the stratified approach', 'the fixed effect approach' and 'the random effect approach') modelling trends are outlined here using a prototypical example with use of the HBSC data from 35 countries across five study cycles.

'The stratified approach' implies running a series of regression analyses, with time as an independent variable in each country. The prototype example would require reporting 35 countries of 5 parameters. Notably, for the stratified approach, there is no statistical criterion for evaluating the overall trend or the heterogeneity, but inference about single countries can be made. Using this approach, only a narrative synthesis of the overall trend and the heterogeneity of trends can be made, as there are no statistics for the between country differences.

'The fixed effect approach suggests' model trends and heterogeneity of trends through specification of main and interactive effects of time and country. The overall main effect of time and the interaction effect of time by country can be tested in omnibus tests of model fit, such as the likelihood ratio test (LRT). Inference can be made when assessing the main effect of time, where a statistically significant estimate would imply an overall trend. A statistically significant interaction between time and country would indicate heterogeneity across the overall trend. As a supplement to an omnibus test, inference about single countries can be done through linear composites of the estimates.

'The random effects approach suggests': This approach suggests modelling an average trend with time as a fixed effect. Cross-national differences in such trends need to be parameterized through random components as functions of continuous or discrete time. Treating time as a nominal variable with five time points implies specification of five random variance components and ten covariances. If time is treated as continuous, the random effects approach requires specification of only three covariances; one for the random intercept, one for the random slope component, and one for the intercept–slope covariance. In the random effect model, the fixed average of trend could be tested using LRT. However, inference on

Table 1 Steps for checking the sufficiency of the data quality to do comparative and trend analyses

Response rates	Check reported response rates to assure that no country has an unusually high or low response rate, e.g. if the response rate is either 100% or close to zero. Also note whether response rates have varied substantially over time within the same country. Examine and document noteworthy results
Sampling procedures	Check that the countries included in the trend analyses have not made substantial changes to their sampling procedures or use of weights, particular for countries where earlier survey rounds were regional samples (and thereby no nationally representative sample). If this is the case, the early phase regional data cannot be included for comparison with later nationally representative samples
Wording	Check whether all countries have used identical questions and response-categories both across countries and survey years. Implications of different wordings or changes in response categories should be discussed in the article
Odd patterns	Check missing responses, look for and evaluate odd patterns in the answers both across countries and within countries for each survey year. If roof/ceiling-effects are observed between and/or within countries, they should be reported in the article as part of the description of the data set (methods section or discussion of strengths and weaknesses)
Odd patterns within items/categories	Check the consistency of related items, e.g. the two separate items on lifetime smoking and current smoking respectively, to make sure that no one has responded that they had never started smoking on one item, but reported current smoking to be daily. Inconsistencies are often dealt with during the standardized cleaning procedures. In the example above a conclusion of which response is more correct would be supported by a question on number of cigarettes smoked per day, week etc. If a number higher than 0 is given, the ''never'' answer can be considered wrong. If only two questions are available for evaluation of inconsistency a principle of the most extreme response either positive or negative as valid is often used to decide whether an inconsistency can be solved. In the example, ''Have you ever smoked?'' the response would be changed to yes, if the respondents later report to smoke. In cases where guidelines of most extreme response cannot be used, both variables need to be coded as missing
Use of weights	Examine the extent of weighting in the selected countries and survey years, and evaluate the consequences of use/no use of weights in comparisons done in the analyses. A rule of thumb is that weights need to be used for analyses of prevalence, whereas they are not required for analyses of associations
Clustering	Examine the extent of sample clustering and take account of observed clustering in the analyses
Basic demo graphics	Examine the prevalence of basic demographic variables (age, gender, urbanization etc.) in the population and differences in these demographic statistics over time

cross-national differences requires restricted maximum likelihood test for each added variance component, and a restricted LRT for nested models. Notably, this model does not provide separate estimates for each country, but single country estimates can be obtained through prediction of shrunken country-level random effects.

Interpreting data

When interpreting the findings from time trend analyses, in most cases it is important to include statements about the overall trend as well as the heterogeneity in trends. Often in trend papers, patterns are discussed and compared to parallel developments such as changes at a national level in legislation or other national level variables such as inequality measures like the Gini-coefficient. When interpreting changes in data from individual to a national and even international level, conclusions should be drawn with utmost caution. Ecological studies offer only limited evidence for causal relationships, and may be included as a support to known causal relationships.

The second issue relates to the scaling of the trends, and whether absolute and relative differences are found. It is important to differentiate between the two when measuring differences over time because interpretation of findings can vary when one or the other is used. An example may be where the prevalence of an outcome, has increased 3-fold (in relative terms) but in absolute terms the increase is from 0.03 to 0.09%, still a very small proportion. The importance of considering both absolute and relative changes is particularly pertinent when measuring differences between countries, over time or in any association studies. For example, in studies of socioeconomic health inequalities over time, absolute inequalities (the gap between rich and poor) may be reduced, while relative inequalities (a comparison of the ratio of change) may increase. Oliver et al.[21] provide examples where stand-alone statistics of relative or absolute inequalities result in ambiguous conclusions. In order to draw meaningful conclusions, analyses of time trends, and trend differences by country, SES or other groupings, should report both absolute and relative changes over time.

Discussion

The unique potential of the HBSC study to conduct trend analyses brings along a number of methodological challenges that need to be addressed before data can be used. This article has presented some of the challenges, alongside recommendations on how to deal with them. The HBSC network comprises of a large number of researchers from different disciplines; sociologists, psychologists, pedagogues, medical doctors and statisticians. The broad spectrum of experience and knowledge is combined and provides a true transdisciplinary approach to the field of adolescent public health both from a scientific and a methodological point of view.[18] Central to the HBSC study is a standardized protocol ensuring data are collected using a prescribed methodology, which allows comparison of data across countries and through time.

Apart from the challenges described by Heath and colleagues,[18] which are discussed here, repeated questionnaire studies must continuously improve and adapt the content of the questionnaire.[5] A key challenge here is the dilemma between leaving items unchanged in order to monitor trends vs. continuous improvement as new evidence of validity and reliability is produced, which may suggest that improvements are possible.[4] Such careful forethought and expertise in producing a research protocol enhances the status of a survey through meeting scientific and methodological standards, and ensuring robust comparisons between survey year and countries.

Over the 30 years of its existence, efforts to ensure that observed trends are not merely methodological artifacts, and that HBSC data have functional equivalence across countries and over time have been led by the pioneering work from the original researchers who initiated the study in 1983. By assuring a collaborative base using a common protocol and development of a data instrument with high

Table 2 Response rates (percentages based on school-, class- or individual level)

Country	2005/06	2009/10
Armenia	–	100
Austria	88	64
Belgium (French)	97	60
Belgium (Flemish)	–	29
Canada	92	44
Croatia	–	69
Czech Republic	100	87
Denmark	94	46
England	66	40
Estonia	100	87
Finland	89	70
France	79	77
Germany	47	86
Greece	96	87
Greenland	NA	45
Hungary	98	69
Iceland	–	89
Ireland	99	61
Israel	–	–
Italy	–	83
Latvia	98	80
Lithuania	100	89
Luxembourg	–	73
Malta	–	–
Macedonia	–	98
Netherlands	–	47
Norway	68	49
Poland	100	83
Portugal	100	85
Romania	–	83
Russian Federation	82	78
Scotland	66	65
Slovakia	–	78
Slovenia	–	84
Spain	–	58
Sweden	90	77
Switzerland	86	88
Turkey	–	79
Ukraine	–	81
USA	–	59
Wales	66	60

NA Not Applicable

comparability, these efforts continue to the current day. HBSC is a valuable international data source in the field of adolescent health research, and is a unique source of comparative research. This aim since the early development of the HBSC, has been maintained, and will continue in the future, as the HBSC consists of frontline researchers developing and adhering to high methodological standards.

Acknowledgements

The HBSC study is an international study carried out in collaboration with WHO Europe. The international coordinator was Professor Candace Currie from the University of St. Andrews, and the databank manager was Professor Oddrun Samdal from the University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The data collection for each HBSC survey is funded at the national level. The authors also wish to acknowledge the work of the principal investigators (PI's) in 43 regions, who hold personal responsibility of the conduction of the survey. The authors are grateful for the insightful and constructive comments of the reviewers.

Conflicts of interest: None declared.

Key points

The main messages in this article are:

- To describe challenges faced when working with large cross-national surveys
- To advise researchers working with comparative analyses, whether it be comparing between countries or over time
- To present basic statistical procedures forming reliable trend analyses
- To advise on providing reliable comparisons in large international studies, thereby providing more valid information to public health practice

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 13–15

doi:10.1093/eurpub/ckv011

Trends in self-rated health in European and North-American adolescents from 2002 to 2010 in 32 countries

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Background: Self-rated health (SRH) in adolescence is known to be associated with health outcomes in later life. We carried out a trend analysis on data coming from three waves of data collected in 32 countries (mostly European) from 2002 to 2010 coming from the Health Behaviour in School-Aged Children surveys. **Methods**: SRH in adolescents was assessed using a Likert scale (excellent, good, fair and poor). Responses were dichotomized into 'excellent' vs. 'rest'. Country, age and gender groups were compared based on the odds ratio of declaring excellent SRH in 2010 with respect to 2002 and 2006. **Results:** The trend for European adolescents indicates an improvement over the last decade, although, in the majority of countries, a higher proportion of adolescents rate their health as excellent during the period 2002–06 with respect to the second half of the decade (2006–10).Girls were found to constantly rate their health as poorer, compared to their male peers, in all countries. Age has also a very stable trend towards a decreasing rating of health with increasing age. **Conclusion**: Decreased rating of health in the period 2006–10 may be a signal of the socio-economic difficulties of Europe in the last part of this decade.

Introduction

Being in good physical and emotional health enables young people to deal with the challenges of adolescence and eases their transition to adulthood.[1]

Self-Rated Health (SRH) is a subjective indicator of general health. Young people's appraisal of their health is thought to be shaped by their overall sense of functioning, including physical and psychological health dimensions,[2,3] (emotional well-being, relationships with parents and peers, school acceptance) and is associated with a broad range of health indicators: medical, psychological, social and health behaviours.[3]

Background characteristics that are associated with poor SRH include a non-intact family structure, poor communication with parents[4] and low family affluence. Cultural and social status are also significant, together with migrant status, level of education, access to education and the level of health and social services.[5]

Cavallo et al.[6] reported a gender by age interaction in self-rated health, with girls reporting poorer health across ages 11–15.

Using the 1998 Health Behaviour in School-Aged Children (HBSC) material, Kelleher et al.[7] found psychosocial, demographic, and health-related correlates of SRH such as more health complaints, lower life satisfaction, less physical activity and more difficulties in making friends. In another study on the 1997/98data, Torsheim et al.[8] reported a strong relationship between material circumstances at individual, school and country level and poor SRH.

Also non-HBSC studies confirm that there are multiple independent correlates of adolescent SRH,[9] and that age-related increase in self-rated poor health can be observed during adolescence.[10]

SRH can be distinguished from more specific health constructs in that it captures an overall conception of health. The relevance of such general perceptions has been demonstrated in a number of empirical studies in which self-reported health has been an independent predictor of mortality, even after accounting for known demographic, social and medical risk factors.[11]

Few articles[12,13] have analyzed SRH trends across time, but mainly in single countries; whereas the HBSC dataset allows for a very wide comparison of trends among almost all European countries over a 10-year cycle, a period where many important changes have taken place in Europe as well as around the world. For this reason, the underlying assumption of our study is that change in adolescent SRH across the last decade might be, at least partially, influenced by macro socio-economic conditions during this period.

Methods

Data from the HBSC 2002, 2006 and 2010 surveys were analyzed.

The HBSC study has been collecting cross-sectional data on nationally representative samples of 11-, 13- and 15-year olds since 2001/02 in more than 30 countries in Europe and North America. Surveys are conducted every four years using standardized procedures for sampling (cluster sampling of classes in the selected schools) and data collection (a standardized questionnaire translated and back-translated from English in each national languages, anonymously filled-in by the children during school-class time).

Details on the general methodology of the HBSC survey have been published elsewhere.[14]

Among the 42 countries in the 2010 survey, only 32 participated in all three surveys (including Flemish and Francophone Belgium,

Table 1 ORs for excellent SRH (dichotomized in 'Excellent' vs. 'Good-Fair-Poor') for each country, adjusted for survey year, gender and age group

	$N_{surveyed}$ (% with data)	2006 vs. 2002	2010 vs. 2002	2010 vs. 2006	Female	13 years	15 years
Austria	13 930 (93.1)	1.348***	1.166**	0.865**	0.567***	0.708***	0.490***
Belgium (Flemish)	14 347 (97.1)	0.949	0.705***	0.742***	0.681***	0.672***	0.483***
Belgium (French)	11 955 (93.3)	0.828***	0.907	1.095	0.641***	0.761***	0.558***
Canada	25 367 (98.1)	1.164**	1.212***	1.041	0.635***	0.667***	0.513***
Croatia	15 521 (99.6)	1.534***	1.403***	0.915	0.612***	0.733***	0.445***
Czech Republic	13 957 (98.4)	0.825***	0.991	1.201**	0.546***	0.913	0.774***
Denmark	14 158 (98.9)	1.197***	0.996	0.832**	0.567***	0.679***	0.571***
England	13 986 (97.8)	1.072	1.492***	1.392***	0.522***	0.720***	0.640***
Estonia	12 642 (99.7)	1.842***	1.669***	0.906	0.741***	0.905	0.764***
Finland	16 824 (98.1)	0.824***	0.843***	1.023	0.630***	0.714***	0.673***
Germany	17 636 (99.0)	1.407***	1.587***	1.128**	0.567***	0.753***	0.701***
Greece	12 316 (99.4)	2.267***	1.998***	0.882*	0.729***	0.648***	0.511***
Greenland	13 264 (95.0)	0.637***	0.692***	1.086	0.623***	0.626***	0.363***
Hungary	12 171 (98.6)	0.708***	0.836**	1.181**	0.612***	0.839**	0.570***
Ireland	12 301 (98.9)	1.301***	1.255***	0.964	0.674***	0.784***	0.635***
Italy	12 986 (99.2)	1.243***	1.211***	0.974	0.542***	0.757***	0.556***
Latvia	11 832 (99.1)	1.222**	1.502***	1.229**	0.525***	0.709***	0.532***
Lithuania	16 488 (99.3)	1.376***	1.758***	1.278***	0.515***	0.729***	0.545***
Macedonia	13 142 (99.6)	1.587***	1.783***	1.124*	0.620***	0.658***	0.455***
The Netherlands	12 926 (99.3)	1.317***	1.294***	0.983	0.528***	0.782***	0.584***
Norway	13 881 (98.8)	1.345***	1.271***	0.945	0.608***	0.819***	0.646***
Poland[a]	15 996 (99.7)	1.001	0.467***	0.467***	0.591***	0.716***	0.441***
Portugal	10 781 (99.1)	1.606***	1.611***	1.003	0.568***	0.821**	0.584***
Russia	21 238 (99.1)	1.591***	2.124***	1.335***	0.484***	0.759***	0.506***
Scotland	17 173 (99.4)	1.158**	1.144*	0.988	0.557***	0.653***	0.465***
Slovenia	14 416 (99.7)	0.995	1.193***	1.199***	0.559***	0.690***	0.511***
Spain	19 599 (99.2)	1.146**	1.518***	1.325***	0.551***	0.778***	0.568***
Sweden	14 739 (98.7)	1.057	1.059	1.002	0.596***	0.704***	0.564***
Switzerland	15 496 (98.6)	1.056	1.221***	1.155**	0.689***	0.815***	0.674***
Ukraine	14 848 (98.7)	0.866*	1.182**	1.366***	0.413***	0.651***	0.443***
USA	14 972 (98.6)	0.791***	0.955	1.206**	0.642***	0.723***	0.594***
Wales	13 518 (98.7)	1.352***	1.764***	1.305***	0.485***	0.715***	0.660***

***$P<0.001$, **$P<0.01$, *$P<0.05$.

a: Translation of this item was changed in 2010 therefore results might not be comparable with previous ones.

Scotland, Wales and England as separate countries) and were included in the analyses.

The variable relative to children's SRH was analyzed for the three surveys in conjunction with age and gender of the children. The measure of SRH has four answer categories (poor, fair, good and excellent), which for the purpose of the analysis were dichotomized in 'excellent' vs. all the other three categories. The reason for this classification was that the term 'fair' and 'poor' are understood differently across countries. In order to avoid bias in either a positive or a negative direction, the decision was to classify the three lower categories in one class.

Comparisons between countries, age groups and gender were then based on the computation, separately for each country, of the odds ratio (OR) of declaring an excellent SRH in 2010 with respect to 2002, and for the two periods separately, 2006 vs. 2002 and 2010 vs. 2006.

Data were modelled by a multivariate logistic regression where SRH (dichotomized in 'excellent' vs. 'all others') was the dependent variable and survey year, gender (males taken as reference) and age (11-year old school-students taken as reference) the independent ones.

A *P*-value for each OR was computed, presenting significance at the traditional values of 0.05, 0.01 and 0.001.

All analyses were performed using STATA v12.1 (StataCorp, College Station, TX:StataCorp LP).

Results

By comparing the year 2010 with 2002, five countries (Belgium-Flemish, Finland, Greenland, Hungary and Poland) showed a significantly lower level of SRH in 2010, with the lowest ORs in Poland and Greenland (0.467 and 0.692, respectively). In USA, Czech Republic, Denmark and Francophone Belgium, the difference was not statistically significant. In all other countries adolescents reported a higher level of SRH in 2010, with the highest change in Russia and Greece (2.12 and 1.99, respectively, Table 1).

Analyzing the two periods separately (2006 vs. 2002 and 2010 vs. 2006), most countries demonstrate a consistent pattern over the total period (2002–10). An exception is represented by Finland, Greenland and Hungary, where the negative trend 2002–10 can probably be attributed to the negative score in the first period, as the second one seems to be stable around the value of 1.

Another one is Poland, where the situation is quite stable during the first period, while the second one brought about a sharp decrease, from an OR of 1 to the value of 0.467. Three other countries with no coherent trend within the two periods are Greece, with the sharpest change, going from a 2.27 in the 2002–06 period to a drop to 0.88 in the second one; Denmark and Austria, with a similar trend, even if the difference between first and second period is less marked (1.12 during 2002–06 vs. 0.83 during 2006–10 in Denmark and from 1.35 vs. 0.86 in Austria).

Two other countries show an opposite trend, Czech Republic and USA, which go from a significant decrease in the first period to a significant increase in the second one.

In general, in the majority of countries, a higher proportion of adolescents rate their health as excellent during the period 2002–06 with respect to the second half of the decade (2006–10).

In terms of gender, girls were found to consistently rate their health as poorer, compared with their male peers, in all countries, ranging from a minimum of 0.41 in Ukraine to a maximum of 0.74 in Estonia.

The impact of age also has a very stable trend towards a decreasing rating of the adolescents' health from 11 through 13 up to 15 years

of age. All decreasing ORs are highly significant ($P < 0.001$), except for 13-year olds in Estonia and Czech Republic.

Discussion

The strength of this study lies on the quantity and quality of data, collected in comparable ways and with similar protocols in all involved countries, allowing for the first time to obtain a cross-national view of a decennial trend in SRH in youth in Europe and North America.

The main limitation relates to the fact that comparison is based on relative changes, not on absolute levels. A country with a sharp decline from a high value may still end up having better life-satisfaction than a country which starts with a low value and shows a sharp increase. For the aim of the study this might not be a crucial drawback, as the focus is concerned with the analysis of changing trends within a country, with its possible relation with on-going macro socio-economic conditions, and on the different trends observed in different sets of countries behaving in a similar way.

Analysis by gender and age differences confirms known existing results,[6] that is lower SRH among girls and a decreasing rating with age; this finding underlines the reliability and consistency of our data.

Given these strengths and limitations, the HBSC data indicate a positive trend for European adolescents in the way they perceive their health over the last decade.

In comparing the first and second half of the decade, although the majority of countries (20 out of 32) demonstrate a significant improvement in SRH from 2002 to 2006, a lower number (13 countries) do so in the second period. This observation, combined with the decreased perception of health in some affluent countries (Austria, Denmark and Belgium) but most of all the dramatic decrease in Greece, may be interpreted as a signal of the impact of the economic crisis in Europe which started in 2007–08.

It is difficult to compare these data with similar ones, as there is a paucity of literature comparing trends in SRH among adolescents; few studies are concerned with the reliability of the measure of SRH along time, through adolescence[13] and from adolescence through to adulthood[12] and of its relationship with future health. Moreover some others try to relate it cross-sectionally with some background conditions, such as socioeconomic status.[15] Interpreting these trends should therefore be done with much caution and with the help of significant data on the countries condition during this decade.

Should this relationship be confirmed by the analysis of macro data on the different countries, the SRH indicator could be a powerful and sensitive tool for public health in terms of monitoring the effect of large scale socio-economic events in a given society on the well-being of adolescents and not only as a predictor of their health in the adult life.

Acknowledgements

The HBSC study is an international study carried out in collaboration with the WHO/Europe. The international coordinator of the study was Candace Currie, University of St. Andrews, Scotland. The data bank manager of the study was Oddrun Samdal, University of Bergen, Norway. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). We would like to thank all pupils, teachers and scientific co-workers who participated in the HBSC surveys.

Funding

The data collection for each HBSC survey is funded at the national level. Financial support is provided by various government ministries, research foundations and other funding bodies.

Conflicts of interest: None declared.

Key points

- This is the first cross-national study of a decennial trend in Self-Rated Health (SRH) of youth in Europe and North America.
- HBSC data indicate an overall positive trend for European adolescents in the way they perceive their health over the last decade.
- A remarkable number of countries show a significant decrease in SRH in the period 2006–10, among them some affluent countries (Austria, Denmark and Belgium) but mainly Greece.
- This observation may be interpreted as a signal of the impact of the economic crisis in Europe which started in 2007–08.
- SRH can be considered a sensitive tool for public health in terms of monitoring the effect of large scale socio-economic events and not only as a predictor of health in the adult life.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 16–19

doi:10.1093/eurpub/ckv012

Fruit and vegetable consumption trends among adolescents from 2002 to 2010 in 33 countries

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Background: Fruit and vegetable consumption is linked to many positive health outcomes, nevertheless many adolescents do not consume fruit and vegetables on a daily basis. **Methods**: Data of 488,951 adolescents, aged 11-, 13- and 15- years, from 33 mainly European and North American countries/regions participating in the cross-sectional Health Behaviour in School-aged Children surveys in 2002, 2006 and 2010, were used to investigate trends in daily fruit and vegetable consumption between 2002 and 2010. **Results**: Multilevel logistic regression analyses showed an increase in daily fruit and vegetable consumption between 2002 and 2010 in the majority of countries for both genders and all three age groups. A decrease in consumption was noticed in five countries for fruit and five countries for vegetables. **Conclusion**: Overall, a positive trend was noticed, however increases in daily fruit and vegetable consumption are still indicated.

Introduction

Adolescence is an important developmental life stage characterized by high nutrient requirements to meet rapid growth. Dietary habits established during adolescence may also persist into adulthood,[1] and thus much emphasis has been placed on improving dietary habits at a young age.

Fruit and vegetable consumption in particular has received much attention. Diets high in fruit and vegetables are associated with a lower risk of cancer,[2] coronary heart disease,[3] stroke[4] and other chronic diseases. Therefore, as well as promoting health during adolescence, meeting the recommendations for fruit and vegetable intake can have positive implications for long term health.

The World Health Organization (WHO) recommends at least 400 g of fruit and vegetables daily; and national recommendations are either close to or above this target.[5] To date, studies from Europe and North America indicate that the majority of children and adolescents fail to reach these recommendations.[5,6]

Many countries have implemented programmes, policies and strategies to increase fruit and vegetable intake, often with a focus on home-based (e.g., 5 a day campaigns), school (e.g., school fruit schemes, free school meals) or community settings.[7–9] It is thus appropriate to review whether changes over time have occurred and explore whether national efforts to increase fruit and vegetable consumption have been effective. So far, it appears that dietary trend analyses among children and adolescents have been focused on the country or regional levels, for example, the UK,[10,11] USA,[12–15] Norway,[1] Denmark[16] and Lithuania,[17] To our knowledge, no study has examined trends in fruit and vegetable intake cross-nationally in nationally representative samples of 11-, 13- and 15-year old boys and girls, using standardized questionnaires, and this is the aim of this study.

Methods

Data were obtained from the Health Behaviour in School-aged Children (HBSC) study collected in 2002, 2006 and 2010. Only data from countries who participated in all three surveys were included for the present paper: in total, 488 951 adolescents (11-, 13- and 15-year olds) from 33 countries or regions.

Children were asked to assess their frequency of consumption of fruit and vegetables by ticking one of seven responses: 'never', 'rarely/less than once a week', 'once a week', 'two to four times a week', 'five to six times a week', 'once a day, every day' and 'more than once a day, every day' for both items. Response options were recoded into dichotomous outcome variables (1 = daily, 0 = less than daily).

Analyses

As gender and age differences in fruit and vegetable consumption have previously been found, frequencies of daily fruit and vegetable consumption were standardized for age and gender by country (i.e., equal number of respondents per age*gender category). Multilevel logistic regression analyses were conducted for each country separately and pooled for the total sample. Additional analyses were run by gender and age. MLwin version 2.25 was used to perform the three-level analyses (adolescents nested within schools nested within countries). Age, gender and survey year were included in the models as dummy indicator variables, as compared with a reference category. P-values < 0.01 were considered significant.

Results

In figures 1 and 2, daily fruit and vegetable consumption is represented using spider charts. On each axis, the corresponding

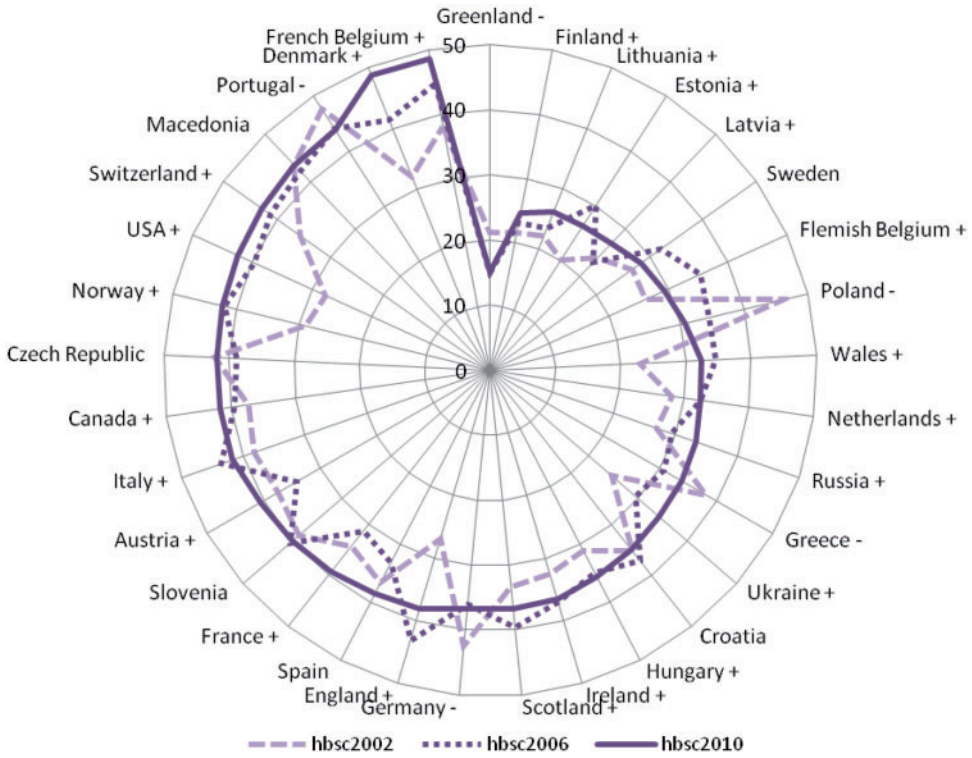

Figure 1 Prevalence (%) of daily fruit consumption by region (taking into account age category and gender). + significant increase ($P < 0.01$) from 2002 to 2010; – significant decrease ($P < 0.01$) from 2002 to 2010. *PS: not taking into account weighing factor in the file*

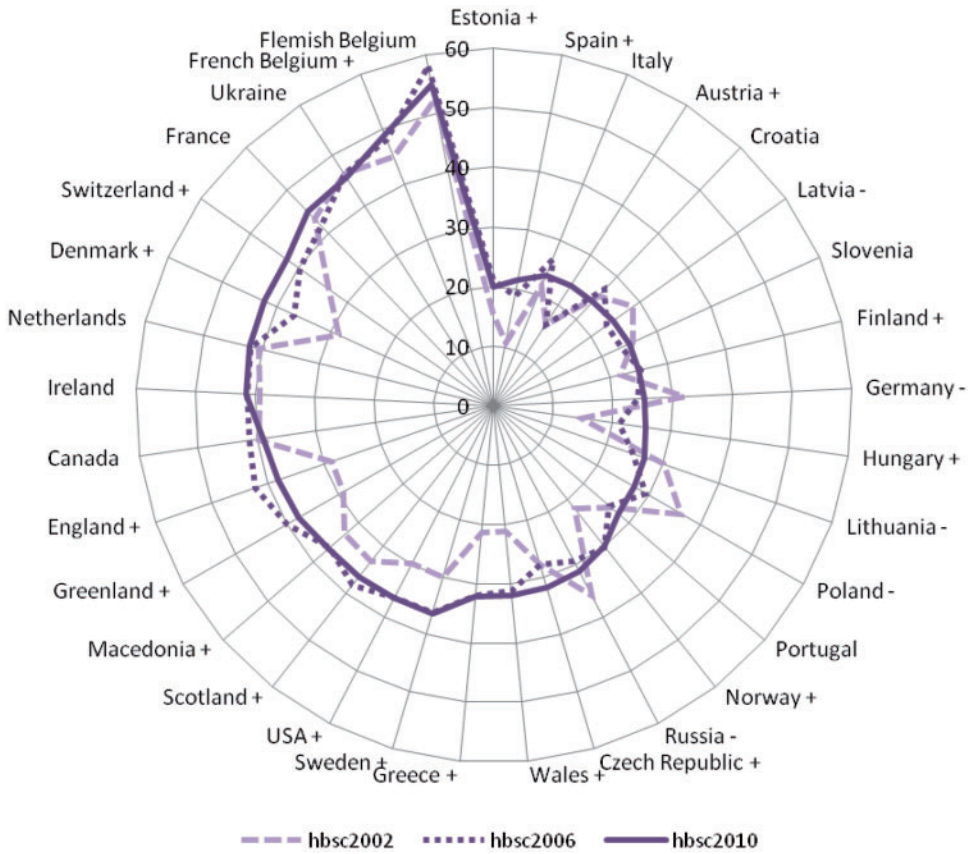

Figure 2 Prevalence (%) of daily vegetable consumption by region (taking into account age category and gender). + significant increase ($P < 0.01$) from 2002 to 2010; – significant decrease ($P < 0.01$) from 2002 to 2010

country's fruit and vegetable prevalence is displayed for each of the three time points, with countries organized by 2010 prevalence. In 2010, daily fruit consumption ranged from 15% in Greenland to 49% in Denmark and French Belgium, and daily vegetable consumption from 20% in Estonia to 55% in Flemish Belgium. Pooled analyses over all countries indicated a significant time trend of increase in daily fruit [OR = 1.22 (99% CI: 1.18–1.25)] and vegetable consumption [OR = 1.20 (1.17–1.22)], from 2002 to 2010. The increase was mainly observed between 2002 and 2006; OR for fruit and vegetable for 2002 to 2006 were 1.16 (1.13–1.18); and 1.16 (1.14–1.19), respectively. For 2006 to 2010 the OR were 1.06 (1.03–1.08); and 1.03 (1.01–1.05).

Separate analyses by country indicate significant increases from 2002 to 2010 in two-thirds of the countries and significant increases in vegetable consumption in 18 countries. The most pronounced increases in fruit consumption (OR > 1.6) were found in Denmark, England, Norway, Ukraine, USA and Wales. A significant decrease in fruit consumption was noted in five countries (Germany, Greenland, Greece, Poland and Portugal), while no significant differences were found in six countries (Czech Republic, Spain, Croatia, Macedonia, Sweden and Slovenia). The most pronounced increases in vegetable consumption were found in Spain, Denmark, Hungary, England, Wales, Greece and Austria (OR > 1.6). A significant decrease in vegetable consumption was found in five countries (Germany, Lithuania, Latvia, Poland and Russia). No significant differences were detected in 10 countries (Belgium-Flanders, Canada, France, Croatia, Ireland, Italy, the Netherlands, Portugal, Slovenia and Ukraine).

In general and across all countries, girls were more likely to consume fruit and vegetables than boys [OR^{fr} = 1.39 (99% CI: 1.37–1.41); OR^{veg} = 1.38 (1.36–1.41)]. In terms of trends according to age, 15-year olds were less likely to consume daily fruit and vegetables than 13-year olds [OR^{fr} = 0.79 (0.78–0.81); OR^{veg} = 0.92 (0.90–0.94)] who in turn were less likely to consume daily fruit and vegetables than 11-year olds [OR^{fr} = 0.78 (0.77–0.80); OR^{veg} = 0.86 (0.85–0.88)]. The increases in daily fruit and vegetable consumption from 2002 to 2010 were significant for boys [OR^{fr} = 1.18 (1.14–1.21); OR^{veg} = 1.15 (1.12–1.19)] as well as for girls [OR^{fr} = 1.25 (1.22–1.29); OR^{veg} = 1.23 (1.19–1.27)] and for each of the three age groups [OR^{fr11y}1.25 (1.20–1.29); $OR^{fr13y;}$ 1.22 (1.17–1.27); OR^{fr15y}1.19 (1.14–1.24); OR^{veg11y}1.20 (1.16–1.25); $OR^{veg13y;}$ 1.17 (1.13–1.22); OR^{veg15y}1.21 (1.15–1.26)].

Discussion

To our knowledge, this is the first report of trends in fruit and vegetable intake in youth across several countries examined using standardized methodology. This study found that overall a positive trend in fruit and vegetable consumption was observed between 2002 and 2010 mainly due to a significant increase between 2002 and 2006 and plateauing thereafter. The increase may reflect the success of national policies and initiatives implemented in the early 2000s including educational messages, subsidized fruit and vegetables and increased fruit and vegetables at schools. For example, in Denmark a nation-wide 6-a-day initiative has been conducted since 2001 to increase the intake of fruit and vegetables in the population.[16] In Norway, a subscription programme to increase fruit and vegetable intake was initiated in 1996 and made nationwide in 2003, and a free programme (without parental payment) was implemented nationwide in 2007.[18] However, analysis of national and local policies and programmes are needed to confirm any influence on trends in fruit and vegetable intake among adolescents.

Despite this general positive trend in fruit and vegetable consumption, a decrease was noticed in a few countries. Possible explanations include: a reduction in fruit and vegetable production due to unfavourable climate conditions resulting in a rise in prices, economic crises forcing families to reduce the intake of unnecessary items (such as fruit and vegetables), adolescents being more independent and busier leading to more reliance on convenience food.

A second major finding is that large proportions of adolescents do not eat fruit and vegetables on a daily basis. This highlights the importance of a continued focus on promotion of fruit and vegetable consumption as indicated by other studies. For example, in the Pro Children Project, the fruit and vegetable intake of 11-year-old children was far below the food-based dietary guidelines in the nine participating countries.[5] Similarly, a quarter of the Healthy Lifestyle in Europe by Nutrition in Adolescence adolescents, from 11- to 17-years old in eight European countries, did not consume any fruit during 2 recalled days[6]. In their study, boys reached the recommendations for fruit and vegetables by only about 40 and 30%, respectively, whereas for girls this was ~50 and 35%, respectively. In addition, in our study, girls' daily fruit and vegetable consumption was higher than boys'.

Finally, some strengths and limitations should be noted. Strengths of this study are the use of a large cross-national data set of adolescents across three different age groups, the use of standardized methods; and on-going validation of the included instruments.[19] Nonetheless, the validity of self-reported dietary methods among adolescents has been questioned.[19,20] In addition the food frequency questionnaire only includes frequency of intake, and no information is collected on amounts of fruit and vegetables consumed. Moreover, no definitions of fruit and/or vegetables are provided, so there may be differences in interpretation across countries. Seasonal bias may also influence cross-country comparisons, as time of data collection varied by country and access to fruit and vegetables may also vary by season.[16] Finally, we cannot exclude the possibility that the heightened focus on fruit and vegetables in many countries may have increased awareness[16] and/or social approval bias, although the questionnaires were completed anonymously and hence students had no reason to feel pressurised by peers and/or society.

In summary, between 2002 and 2010 a positive trend in daily fruit and vegetable consumption among adolescents across most countries was observed, but there is still room for improvement. A review of fruit and vegetable policies and initiatives across countries could help to explain the changes documented and help guide future strategies to increase fruit and vegetable intake among adolescents.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. The international coordinator was Professor Candace Currie, University of St. Andrews, and the databank manager was Professor Oddrun Samdal, University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The data collection for each HBSC survey is funded at the national level.

A paper entitled 'Cross-national trends in Fruit and Vegetable consumption' was presented as part of a symposium at the International Society for Behavioural Nutrition and Physical Activity conference in San Diego in May 2014.

Conflicts of interest: None declared.

Key points

- First study to examine trends in fruit and vegetable intake cross-nationally in nationally representative samples of 11-, 13- and 15-year-old boys and girls.
- A positive trend in daily fruit and vegetable consumption among adolescents across most countries was observed between 2002 and 2010.

- A few countries experienced a decline in fruit and vegetable consumption between 2002 and 2010.
- Further insight into fruit and vegetable policies and initiatives across countries could help to explain changes in intake and guide future strategies to increase fruit and vegetable intake among adolescents.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 20–23

doi:10.1093/eurpub/ckv013

Trends in toothbrushing in 20 countries/regions from 1994 to 2010

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Background: For maintaining good oral health, twice-a-day toothbrushing routine is recommended world-wide. As an association between oral diseases and the main non-communicable diseases is confirmed, the importance of brushing is rising. The aim of this article is to describe trends in more-than-once-a-day toothbrushing frequency in 20 countries/regions participating in five consecutive HBSC Surveys between 1994 and 2010. **Methods:** Eleven-, 13-, and 15-year-old children, who replied to the questionnaire in any of the five surveys, were included ($N = 474\,760$). Trends were analysed by logistic regression and multilevel logistic regression modelling. **Results:** Prevalence of recommended toothbrushing behaviour increased in all countries except in Scandinavia, which had already attained a very high level in 1994. The highest increase (more than + 16%) was observed in Estonia, Russia, Latvia, Finland and in Flemish Belgium. Girls had higher prevalence of toothbrushing than boys (OR = 2.06, 99% CI 2.03–2.10). However, the increasing trend was stronger among boys ($OR^{2010\ vs.\ 1994}$ for boys 1.60; for girls 1.48), and among the younger adolescents ($OR^{2010\ vs.\ 1994}$ for 11-year-olds 1.64; for 15-year-olds 1.45). **Conclusion:** Recommended toothbrushing frequency increased in most of the studied countries/regions and differences between the countries diminished during 2004–2010.

Introduction

Toothbrushing is the main self-care method to prevent the most prevalent non-communicable diseases, periodontal disease and dental caries. Consequently, twice-a-day toothbrushing frequency is a universally accepted recommendation for maintaining good dental and periodontal health.[1,2]

Poor oral hygiene has been shown to be associated with higher levels of cardiovascular diseases, diabetes mellitus, hypertension and metabolic syndrome.[3,4] The effectiveness of regular toothbrushing in preventing oral diseases has become even more important than before, as a strong association between oral diseases and the four main non-communicable diseases, i.e. diabetes, cancer, cardiovascular diseases and respiratory diseases, has been confirmed.[5]

Very few longitudinal studies have monitored toothbrushing habits over time in the same population.[6–8] They confirm that a constant toothbrushing habit is adopted quite early in the life and will not change easily later on. In Finland, health habits have been monitored in cross-sectional surveys of 12-, 14-, 16- and 18-year-olds with nationally representative samples every second year since 1977, and among 11-, 13- and 15-year-olds every fourth year since 1985.[9] They confirmed only slow improvement over two decades among younger age groups and boys, but a decline in prevalence of toothbrushing among girls in older age groups.

We hypothesize that higher proportions of adolescents have adopted a twice-a-day toothbrushing habit in 2010 compared with 1994. The aim of this article is to describe the trends in more-than-once-a-day toothbrushing frequency in different countries/regions participating in five consecutive Health Behaviour in School-aged Children (HBSC) Surveys between 1994 and 2010.

Methods

The HBSC mandatory question about toothbrushing 'How often do you brush your teeth?' focuses on the frequency of this habit. Response options given are from 'never' to 'more than once a day'. More-than-once-a-day toothbrushing frequency was selected as the cut-off point for analysis, while twice-a-day toothbrushing is a universally accepted recommendation.[1,2]

Toothbrushing frequency has been determined by this question, which has remained unchanged, since the first study of the HBSC survey.[10] This same question has been used since 1977 in the Finnish nation-wide research program, the Adolescents Health and Life-style Survey. The reliability and validity of the question have been tested several times and have been shown to be good.[11]

Analyses

Data were analysed using SPSS (version 18.0) and MLwiN (version 2.25). Studied variables included study year, country, gender and age. All countries/regions included participated in five consecutive cross-sectional HBSC surveys from 1994 onwards (1994, 1998, 2002, 2006 and 2010). These 20 countries/regions were: Austria, Flemish- and French-speaking Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greenland, Hungary, Latvia, Lithuania, Norway, Poland, Russia, Scotland, Sweden and Wales.

Prevalence (%) of more-than-once-a-day toothbrushing among 11-, 13- and 15-year-olds was presented as a total sample for each country/region for five consecutive HBSC surveys, for the trends between the individual surveys (4 years) and for the trends between the 1994 survey and the 2010 survey (16 years). This sample was weighted by age group and gender in analysis. Trends in more-than-once-a-day toothbrushing frequency in different countries/regions were analysed by logistic regression (SPSS), and for all countries together by multilevel logistic regression modelling (MLwiN) where children were clustered by country/region ($n = 474\,760$).

Results

Prevalence of more-than-once-a-day toothbrushing frequency increased between 1994 and 2010 in most of the countries and

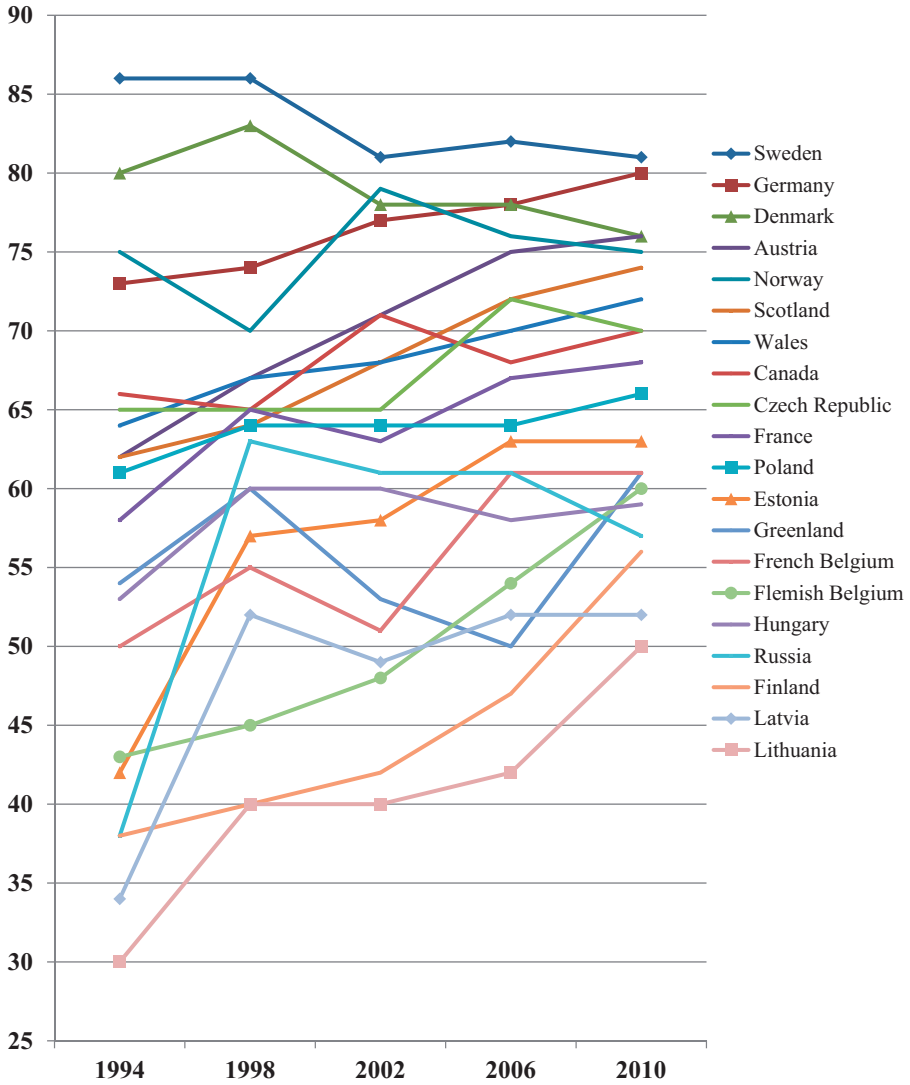

Figure 1 Prevalences (%) and trend of more-than-once-a-day toothbrushing among 11–15-year-old schoolchildren in 20 different countries/regions in five consecutive HBSC surveys, from the 1994 survey to the 2010 survey (16 years)

regions from 30–62% to 50–72% (fig. 1). The highest increase (more than +16%) was observed in Estonia, Russia, Latvia, Finland and in Flemish Belgium.

A slight decrease in recommended toothbrushing frequency was seen in countries with the highest prevalence in 1994 (75–86%), i.e. in Sweden (−5.4%), Denmark (−4.5%) and in Norway (−0.4%). However, the frequency in these countries still remained at a high level in the last follow-up year, between 75 and 81% (fig. 1).

Between 1994 and 1998, the improvement was over 10% in Russia, Latvia, Estonia and Lithuania (fig. 1). Between 1998 and 2002, the improvement was highest (+5.6%) in Canada and between 2002 and 2006, (over 5%) in French Belgium, Czech Republic, Flemish Belgium, Finland and Estonia. Between 2006 and 2010, the improvement was over 5% in Greenland, Finland and Flemish Belgium.

In all studied countries and regions between 1994 and 2010, girls had higher prevalence of more-than-once-a-day toothbrushing frequency than boys (OR = 2.06, 99% CI 2.03–2.10) (table 1). Adoption of recommended toothbrushing habits increased with age for girls (15-year-olds vs. 11-year-olds: OR = 1.50, 99% CI 1.46–1.55), but not for boys (0.95, 0.93–0.98).

The increasing trend from 1994 to 2010 was stronger among boys than girls ($OR^{2010\ vs.\ 1994}$ for boys 1.60; for girls 1.48) and among the younger adolescents ($OR^{2010\ vs.\ 1994}$ for 11-year-olds 1.64; for 15-year-olds 1.45).

Discussion

From a public health perspective, improvement of toothbrushing habits is important in preventing the most common dental diseases, but even more so in reducing common risk factors for the main non-communicable diseases. Furthermore, twice-a-day toothbrushing frequency is a good indicator of a healthy lifestyle in general.[4,12,13] Another positive aspect of good toothbrushing habits is that it has been shown to predict higher educational achievements for adolescents in later life.[14]

Trends found in our study were mostly positive. Relative and absolute improvement was greater among the younger age groups and boys, although these groups had more to improve upon in 1994, and continue to have lower prevalence in more-than-once-a-day toothbrushing in 2010. However, inequalities by country, gender and age group have decreased quite consistently during this time period, suggesting this to be a period of equalization overall. A similar positive trend was reported previously in Scotland.[15]

The small decline observed in toothbrushing prevalence in the Scandinavian countries, especially in Denmark and Sweden, might be attributed to different causes. The major reason is probably that the public health focus has, in most recent years and to some extent, drifted away from emphasising dental health. For example in Denmark, school dental clinics have closed and children have to

Table 1 Odds ratios (OR) and their 99% confidence intervals (99% CI) for more-than-once-a-day toothbrushing frequency among the total sample of the HBSC surveys in 1998, 2002, 2006 and 2010 compared with 1994, according to gender and age

	All		Gender				Age					
			Boys		Girls		11 years		13 years		15 years	
	OR	99% CI	OR	99% CI	OR	99% CI	OR	99% CI	OR	99% CI	OR	99% CI
Gender												
Boy (ref.)	1.00						1.00		1.00		1.00	
Girls	2.06	2.03–2.10					1.67	1.62–1.72	2.05	1.99–2.11	2.62	2.54–2.69
Age												
11 years (ref.)	1.00		1.00		1.00							
13 years	1.04	1.02–1.06	0.94	0.92–0.97	1.16	1.13–1.19						
15 years	1.18	1.16–1.20	0.95	0.93–0.98	1.50	1.46–1.55						
Study year												
1994 (ref.)	1.00		1.00		1.00		1.00		1.00		1.00	1.21–1.34
1998	1.26	1.23–1.29	1.25	1.21–1.30	1.27	1.22–1.32	1.24	1.18–1.30	1.27	1.21–1.33	1.28	1.24–1.36
2002	1.31	1.28–1.35	1.33	1.29–1.38	1.29	1.25–1.34	1.32	1.26–1.38	1.31	1.26–1.37	1.29	
2006	1.46	1.42–1.50	1.51	1.45–1.56	1.41	1.36–1.47	1.45	1.39–1.52	1.49	1.42–1.55	1.44	1.37–1.51
2010	1.54	1.50–1.58	1.60	1.55–1.66	1.48	1.43–1.53	1.64	1.57–1.71	1.54	1.48–1.61	1.45	1.38–1.52

go to private dental clinics. Although, dental care is still free for all children, attending services is not as easy as it was when the clinics were on school premises. This might have especially affected less privileged groups including the immigrant population. In general, toothbrushing frequency in the HBSC countries has been shown to be lower among the less privileged children.[15,16] Immigration has increased in Scandinavia; in 2010 almost one-fifth of the population in Sweden and one-tenth in Denmark were immigrants or their descendants from dozens of different countries.[17,18] Toothbrushing frequency has been shown to be lower and oral health poorer among the immigrant children than among the native.[19,20] Oral health and corresponding habits of immigrants can already be poorer (and established) when moving to a new country.[19] This reflects to the situation of their native country. The difference tends to remain even after settling into a new living environment.

Conclusions

Adoption of recommended toothbrushing frequency has increased in most of the studied countries or regions, except in the Scandinavian countries where the frequency was already high in 1994. This has resulted in an equalization of toothbrushing frequency cross-nationally.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO and involves a wide network of researchers from all participating countries and regions. The international coordinator was Prof. Candace Currie, University of St. Andrews, and the databank manager was Prof. Oddrun Samdal, University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The data collection in each country or region is funded at national level. We are grateful for the staff at the Norwegian Social Science Data Services, Bergen, for their work in preparing the international data file for all the surveys.

Funding

We are grateful for the financial support from the government ministries, research foundations and other funding bodies in the participating countries and regions. We particularly thank the Norwegian Directorate of Health, which contributed funding to the HBSC Data Management Centre.

Conflicts of interest: None declared.

Key points

- The article describes a positive trend in the toothbrushing frequency in a large number of countries.
- Cross-nationally, the article illustrates a declining difference in toothbrushing frequency.
- The article shows greater improvement among the younger age groups and boys, which have been target groups for oral health education for decades. However, these groups still lacks far behind the others and need to be continuously targeted.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 24–27

doi:10.1093/eurpub/ckv015

Trends in multiple recurrent health complaints in 15-year-olds in 35 countries in Europe, North America and Israel from 1994 to 2010

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Background: Health complaints are a good indicator of an individual's psychosocial health and well-being. Studies have shown that children and adolescents report health complaints which can cause significant individual burden. **Methods:** Using data from the international Health Behaviour in School-aged Children study, this article describes trends in multiple recurrent health complaints (MHC) in 35 countries among $N = 237\,136$ fifteen-year-olds from 1994 to 2010. MHC was defined as the presence of two or more health complaints at least once a week. Logistic regression analysis was performed to evaluate trends across the five survey cycles for each country. **Results:** Lowest prevalence throughout the period 1994–2010 was 16.9% in 1998 in Austria and highest in 2006 in Israel (54.7%). Overall, six different trend patterns could be identified: No linear or quadratic trend (9 countries), linear decrease (7 countries), linear increase (5 countries), U-shape (4 countries), inverted U-shape (6 countries) and unstable (4 countries). **Conclusion**: Trend analyses are valuable in providing hints about developments in populations as well as for benchmarking and evaluation purposes. The high variation in health complaints between the countries requires further investigation, but may also reflect the subjective nature of health complaints.

Introduction

Health complaints are an important indicator of an individual's psychosocial health and well-being.[1] The majority of children and adolescents do not have any serious diagnosable health problems; however, a growing number experience a variety of health complaints, such as pain, nervousness and sleeping difficulties. Subjective health complaints may indicate a more serious underlying health problem.[2] Clustering or co-occurrence of health complaints is common among adolescents.[3] Recurrent health complaints not only compromise the health of the individual, but also have negative consequences on their everyday functioning, e.g. school attendance.[4] Persisting symptoms can develop into chronic and more serious health problems later on in life[5], early identification is, therefore, essential. Girls and boys differ in terms of their risk for health complaints, with girls reporting psychosomatic symptoms more often than boys. Health complaints also increase with age.[6] One generally differentiates between somatic (pains) and psychological complaints (also referred to as mental health complaints[7]).

To date, no publication exists on international trends in health complaints in adolescents. Previous publications have looked at specific types of symptoms only and/or are limited to national samples.[7–10] The majority of these national trend papers showed an increasing trend in health complaints in children and adolescents,[1,7,10] with the exception of Dür et al.[8] who report a decreasing trend for Austria for 1994–2006. Ottova et al.[9] also found a slightly decreasing tendency in children and adolescents in Germany (between 2006 and 2010). This article will describe the trends in multiple health complaints (MHC) in 15-year-old adolescents in Europe, North America and Israel from 1994 to 2010.

Methods

Data were obtained from the international Health Behaviour in School-aged Children (HBSC) study, a cross-sectional survey in 11-, 13- and 15-year-old schoolchildren in Europe, North America and Israel. The survey is conducted every four years and all participating countries follow a standardized research protocol.[11] The present analyses are based on data from 1994, 1998, 2002, 2006 and 2010 from 35 countries/regions. Given the fact that the prevalence of health complaints increases with age,[12] we focused on 15-year-olds only as this group experiences the highest burden. The median sample size at country level was 1349, 1431, 1390, 1561 and

1648 for survey years 1994, 1998, 2002, 2006 and 2010, respectively. Time points where countries had less than half of the recommended sample size were excluded from the analysis (Belgium-French and Estonia, both 1998). This rule did not apply to Greenland due to their relatively small population size. The sample sizes ranged from 238 (Greenland, 2002) to 5441 (Canada, 2010). A full overview of sample sizes for 15-year-olds by country and survey year is provided in table 1.

Adolescents were asked to indicate how often they had experienced the following symptoms in the last 6 months: headache; stomach ache; feeling low; irritable or bad tempered; feeling nervous; difficulties in getting to sleep; and feeling dizzy. Response options ranged from 'about every day' to 'rarely or never'. The psychometric properties of the HBSC symptom checklist were previously tested using Confirmatory Factor Analysis and Differential Item Functioning. All items proved to be unidimensional.[12] Quantitative studies show an acceptable test–retest reliability of Pearson-$r = 0.79$ for the entire HBSC symptom scale and Pearson-$r = 0.61$–0.76 for the single symptoms.[13] We dichotomized the measure into two or more health complaints more than once a week (MHC) vs. less, based on HBSC recommendations and previous literature (e.g. Ravens-Sieberer et al.[14]).

Gender-adjusted prevalences of MHC were calculated for each country and each survey year using the entire study population as reference. Logistic regression analysis was used to evaluate gender adjusted temporal trends per 4 years of study in MHC within each country. Time was used as a covariate to model the shape of the observed trends of the included 35 countries in a parsimonious way. Linear time trends were examined for countries with 3 time points, whereas linear and quadratic time trends were tested for countries with 4 or 5 time points. Higher order terms were excluded because a maximum of five time points were available. The time variable was centred to avoid collinearity with its squared term. The significance of the quadratic term was evaluated by entering both values of the time variable and the square of the time variable. The quadratic term was dropped from the model if it was not significant (Wald-test), and the linear term was then tested. The difference between the maximum prevalence and the minimum prevalence across survey years was used as an absolute effect size measure (ES). Because of the clustered sample design, we adjusted the *P*-value to be more conservative using a design factor of 1.2 corresponding to an unadjusted *P*-value of 0.018 indicating statistical significance.

Table 1 Sample size (15-year-olds) by country and survey year

Country	1994	1998	2002	2006	2010
Austria	1815	1376	1277	1494	1820
Belgium-Flemish	1349	1559	2030	1616	1226
Belgium-French	1676		1381	1414	1341
Canada	2219	2403	1207	2289	5441
Croatia	–	–	1435	1630	2424
Czech Republic	–	1229	1660	1665	1522
Denmark	1314	1546	1369	1552	1226
England	–	1872	1764	1451	1118
Estonia	1179		1267	1587	1398
Finland	1194	1545	1741	1685	2110
France	1260	1245	2614	2222	1906
Germany	1050	1599	1741	2552	1640
Greece	–	1322	1324	1416	1648
Greenland	375	599	238	417	397
Hungary	1759	818	1310	1187	1733
Ireland	–	1457	919	1685	1695
Israel	1352	1385	1547	1997	1352
Italy	–	–	1220	1335	1546
Latvia	1263	1265	1112	1330	1375
Lithuania	1759	1435	1904	1861	1792
Macedonia	–	–	1399	1896	1536
Netherlands	–	–	1273	1363	1457
Norway	1637	1670	1622	1534	1339
Poland	1540	1636	2127	2287	1410
Portugal	–	1245	800	1383	1553
Russia	1354	1322	2574	2754	1847
Scotland	1373	1727	1149	2198	2567
Slovakia	934	843	–	1252	1914
Slovenia	–	–	1052	1561	1815
Spain	–	–	1756	3065	2003
Sweden	1151	1151	1218	1526	2090
Switzerland	–	1832	1501	1500	2246
Ukraine	–	–	1601	1829	1897
USA	–	1808	1625	1284	1892
Wales	1266	1427	1164	1350	1637
Total sample	28 819	37 316	49 921	59 167	61 913

Legend: '–' denotes no survey

Results

The prevalence of MHC varied considerably by country and survey cycle (table 2). In 2010, the prevalence of MHC varied from 19.5% in Slovenia to 52.3% in Italy, whereas in 2002, it ranged from 18.2% in Germany to 53.8% in Israel. The following patterns were observed: Seven countries displayed a linear decline (Croatia, Greece, Macedonia, Portugal, Slovenia, Spain and Ukraine), whereas five countries showed a linear increase (Belgium-Flemish, Denmark, Finland, Greenland and Norway). A U-shaped trend, or an initial decline followed by an increase at a later cycle, was observed in four countries (Austria, Canada, Czech Republic and Scotland). An inverted U-shape, or an initial increase followed by a decrease at a later cycle, was observed in six countries (England, Estonia, Lithuania, Poland, Slovakia, Sweden). Four countries (France, Latvia, Russia and USA) displayed unstable patterns with considerable fluctuations between survey years. The remaining nine countries did not display a clear linear or quadratic trend of MHC and were relatively stable over time. Most notable increases in MHC were found in Greenland (ES = 12.5), Norway (ES = 10.7), Poland (ES = 10.3) and Czech Republic (ES = 12.2). In contrast, USA (ES = 9.0), Portugal (ES = 8.6) and Spain (ES = 8.6) displayed rather sharp declines over time.

Discussion

The trends reported here are based on international HBSC data over a period of 16 years. We analysed the trends for MHC, which reflect the more burdensome end of the spectrum, i.e. accumulation of health symptoms that occur on a regular and frequent basis. Moreover, we focused on 15-year-olds, as they are known to have a higher prevalence of health complaints than younger age groups.[10,14] Age- and gender-specific differences are presented in another paper.

A majority of the countries showed either a rather stable pattern or a changing trend (U-shape or inverted U-shape). For most of these countries, the trends corresponded with the trends in life satisfaction.[15] A relatively small number of countries had a clear downward trend and high fluctuations emerged in only four countries. Interestingly, all four of these countries showed a uniform up–down–up–down pattern in 1994–2010. The fact that the countries are fairly evenly distributed across the six different 'trend types' raises the question why countries differ so much in health complaints. Individual circumstances, such as high expectations (from family, school, peers) and a certain lifestyle can be a source of stress which raises adolescents' vulnerability for health symptoms.[16] Typical stressors are school pressure, bullying and familial problems (e.g. divorce, financial problems), but also external and inner pressure and concerns about the future play a role. The current social and economic situation of a country may intensify this effect. Biological factors, such as early pubertal onset can also take effect. Although, unclear whether there is a secular trend in decreasing pubertal age, research on pubertal timing

Table 2 Gender adjusted temporal trends in multiple recurrent health complaints in 15-year-old adolescents (1994–2010)

	Prevalence (%)					*Linear Term*				*Quadratic Term*				*Trends*	
Country	**1994**	**1998**	**2002**	**2006**	**2010**	**B**	**SE**	***OR***	***P*-value**	**B**	**SE**	***OR***	***P*-value**	***ES***	***Trend type*[a]**
Austria	21.5	16.9	20.5	20.8	24.4	.013	.005	1.013	.008	.004	.001	1.004	.000	7.5	4
Belgium-Flemish	22.0	25.6	27.8	26.5	27.7	.015	.005	1.015	.002					5.8	3
Belgium-French	40.2		38.1	39.5	39.4	−.001	.005	.999	.772					2.1	1
Canada	39.4	33.0	34.6	34.5	37.5	−.003	.003	.997	.320	.004	.001	1.004	.000	6.4	4
Croatia	–	–	36.6	35.7	32.4	−.026	.009	.974	.003					4.2	2
Czech Republic	–	33.1	30.0	35.5	42.2	.037	.006	1.038	.000	.007	.002	1.007	.000	12.3	4
Denmark	18.1	22.8	21.2	24.7	24.7	.022	.005	1.022	.000					6.6	3
England	–	30.4	35.8	34.6	34.0	.012	.006	1.012	.065	−.004	.002	.996	.011	5.4	5
Estonia	32.1		38.8	34.6	32.8	−.008	.006	.992	.174	−.004	.001	.996	.000	6.7	5
Finland	26.0	26.5	27.6	30.7	28.8	.012	.004	1.012	.008					4.7	3
France	38.2	43.4	34.7	41.1	39.3	.002	.004	1.002	.688					8.7	6
Germany	21.3	22.9	18.2	23.5	21.8	.005	.005	1.005	.369					5.3	1
Greece	–	50.6	53.6	46.8	47.7	−.016	.006	.984	.009					6.8	2
Greenland	20.8	25.0	30.0	31.2	33.3	.039	.009	1.040	.000					12.4	3
Hungary	39.8	37.9	37.2	38.9	36.0	−.009	.004	.991	.031					3.8	1
Ireland	–	31.8	31.8	32.4	34.8	.009	.006	1.009	.154					3.0	1
Israel	52.6	53.6	53.8	54.7	49.8	−.004	.004	.996	.346					4.9	1
Italy	–	–	50.8	52.3	52.3	.009	.010	1.009	.384					1.6	1
Latvia	29.8	36.6	32.8	37.9	34.1	.012	.005	1.012	.014	−.003	.001	.997	.005	8.1	6
Lithuania	36.3	40.7	41.5	43.3	38.3	.008	.004	1.008	.047	−.003	.001	.997	.000	7.0	5
Macedonia	–	–	39.2	36.7	33.7	−.031	.010	.969	.002					5.5	2
Netherlands	–	–	23.2	24.4	22.4	−.007	.012	.993	.558					2.1	1
Norway	21.8	24.8	28.3	27.6	32.5	.031	.005	1.031	.000					10.7	3
Poland	29.0	39.3	39.0	37.8	39.3	.021	.004	1.021	.000	−.004	.001	.996	.000	10.3	5
Portugal	–	33.5	34.3	25.7	26.3	−.036	.007	.965	.000					8.6	2
Russia	33.8	39.3	32.1	36.6	36.0	.003	.004	1.003	.530					7.2	6
Scotland	30.6	30.9	30.8	28.8	34.4	.006	.004	1.006	.129	.002	.001	1.002	.008	5.6	4
Slovakia	32.0	37.2		42.9	37.5	.019	.005	1.019	.000	−.005	.001	.995	.000	10.9	5
Slovenia	–	–	26.5	21.7	19.5	−.049	.012	.952	.000					7.0	2
Spain	–	–	41.9	34.5	33.3	−.047	.009	.954	.000					8.6	2
Sweden	30.4	35.5	38.2	40.7	35.9	.018	.005	1.018	.000	−.004	.001	.996	.000	10.3	5
Switzerland	–	28.7	24.7	30.2	28.9	.006	.006	1.006	.275					5.5	1
Ukraine	–	–	45.0	43.3	40.0	−.028	.009	.973	.002					5.0	2
USA	–	45.7	38.7	45.9	36.9	−.022	.005	.978	.000					9.0	6
Wales	29.6	32.7	33.4	30.1	31.5	.001	.005	1.001	.912					3.9	1

a: Trend type: 1 = no linear or quadratic trend, 2 = linear decrease, 3 = linear increase, 4 = U-shape, 5 = inverted U-shape, 6 = unstable
Legend: '–' denotes no survey

indicates that children who experience early puberty are at a greater risk for psychosocial difficulties.[17] LeResche et al.[17] found that pubertal development status predicted pain and psychosomatic symptoms better than age, although the results differed for boys and girls.

The prevalence of MHC varied greatly between the survey years (>30% between countries) which can have several reasons. It is plausible that country-specific characteristics, such as the economic situation, high unemployment rates, rising social insecurity may account for some of these large country differences. National wealth and income inequality were investigated in Ottová-Jordan et al.[18], but the effects were small. Macro-level factors are more likely to function indirectly through mediating factors, such as the family's economic situation/affluence status, parental or individual employment status,[19] or through other social context factors. The association between individual social position and health has in fact not decreased over the past 16 years.[20]

Despite large differences in the prevalence between and within countries, health complaints are an internationally relevant public health issue. Trend analyses can deliver important hints on developments in the population, and provide an important basis for benchmarking/target goal planning, as well as for evaluation purposes. In Sweden for instance, data on deteriorating mental health in children and adolescents[21] has activated the national government to put mental health at the top of their priority agenda.

HBSC data facilitates the investigation of various research questions through a standardized data collection procedure and the assessment of a wide range of determinants and health outcomes. Although trend data cannot investigate causal relationships, they increase the information value of cross-sectional studies by facilitating an analysis of patterns across time and the monitoring of the health of different populations. The lack of information between the survey years and the fact that only marginal time points were considered, though, limit the generalizability of the results.

Acknowledgements

The Health Behaviour in School-aged Children (HBSC) study is an international study carried out in collaboration with the WHO/EURO. The international coordinator of the study was Candace Currie, Child and Adolescent Health Research Unit (CAHRU), University of St. Andrews, Scotland. The data bank manager of the study was Oddrun Samdal, University of Bergen, Norway. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). We would like to thank all pupils, teachers and scientific co-workers who participated in the HBSC surveys.

Funding

The data collection for each HBSC survey is funded at the national level. Financial support is provided by various government ministries, research foundations and other funding bodies.

Conflicts of interest: None declared.

Key points

- Multi-national perspective on the prevalence of health complaints in 35 countries in Europe, North America and Israel from 1994 to 2010.
- Despite generally rather stable patterns of health complaints across countries, great variation in prevalence rates between countries and survey years.
- Highest reported prevalence 54.7% in 2006 is more than three times as high as the lowest reported value in 1998 (16.9%).
- Trend data can deliver important insight on long-term developments in health and is useful for benchmarking and evaluation purposes.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 28–32

doi:10.1093/eurpub/ckv016

Trends in overweight prevalence among 11-, 13- and 15-year-olds in 25 countries in Europe, Canada and USA from 2002 to 2010

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Background: The purpose of this study was to assess recent changes in the prevalence of overweight (including obesity) among 11-, 13- and 15-year-olds in 33 countries from 2002 to 2010. **Methods:** Data from 25 countries from three consecutive survey cycles (2002, 2006 and 2010) that had at least 80% response rate for self-reported height, weight and age were analysed using logistic regression analysis. **Results**: Overweight prevalence increased among boys in 13 countries and among girls in 12 countries; in 10 countries, predominantly in Eastern Europe, an increase was observed for both boys and girls. Stabilization in overweight rates was noted in the remaining countries; none of the countries exhibited a decrease over the 8-year period examined. In the majority of countries (20/25) there were no age differences in trends in overweight prevalence. **Conclusion**: In over half of the countries examined overweight prevalence did not change during 2002–2010. However, increasing overweight prevalence was noted in many Eastern European countries over this time period. Overweight prevalence remained high in several countries in Europe and North America. These patterns call for continued research in youth overweight and highlight the need to understand cross-national differences by examining macro-level indicators. Such research should feed into developing sound translations and practices to prevent and reduce overweight in youth.

Introduction

Overweight and obesity in childhood and adolescence are associated with several short- and long-term adverse health consequences and high health-care costs.[1–3] These include increased risk of cardiovascular disease and related metabolic abnormalities such as dyslipidaemia and impaired glucose tolerance, other conditions such as sleep apnoea and orthopaedic problems, as well as several psychological and social repercussions.[1,3,4] Beyond tracking from adolescence into adulthood, adolescent overweight and obesity itself can have long-term adverse effects on adult health regardless of the weight status in adulthood.[5,6]

The prevalence of childhood overweight and obesity has been increasing globally during the past two decades. Studies often describe overweight in children including its more advanced form, i.e. obesity; in this article, we use the term overweight to include obesity (unless otherwise indicated). Childhood overweight (including obesity) prevalence ranged between 6 and 36% in European countries in early 2000s.[7] An increase in overweight by up to 1% annually was noted in some European countries in the early 2000s[8]; however, in recent years a stabilization in overweight prevalence has been suggested by cross-sectional surveys in several countries.[2,9] Nevertheless, some studies indicate that this overall plateau in overweight prevalence in the last decade in children and adolescents may mask an increase in certain groups related to income, gender or race-ethnicity.[2,9–11]

Few studies have examined cross-national trends in overweight prevalence using the same definitions for overweight/obesity status.[2] A recent report by Olds et al.[2] based on data from nine countries around the world using the International Obesity Task Force (IOTF)-2000 cut-offs to describe the trends in the prevalence of childhood overweight and obesity shows a slowing plateau effect or a declining trend in several countries.

The Health Behaviours in School-aged Children (HBSC) study uses a common measure of overweight across countries. It has been collecting cross-sectional self-reported data on height and weight from nationally representative samples of 11-, 13- and 15-year olds since 2002 in more than 30 countries in Europe and North America with surveys conducted every 4 years. The HBSC datasets from surveys in 2002, 2006 and 2010 enable systematic examination of cross-national trends in childhood overweight using comparable data collected over the same period using standardized procedures[12] thereby adding to the limited cross-national literature on this topic in this age-group. The objective of the current analysis is to examine trends in the prevalence of overweight (including obesity) in 11–15-year-olds in 33 countries in Europe and North America with data on three survey cycles of the HBSC (2002, 2006 and 2010) by gender.

Methods

Data for present analyses were collected in 33 countries participating in the three consecutive cycles of the WHO collaborative HBSC study (2002, 2006 and 2010), an international collaboration between research teams across Europe and North America with the aim of gaining insights into adolescents' health and health behaviours. The standardized international research protocol was followed in each country to ensure consistency in survey instruments, data collection and processing procedures.[12] Participation was voluntary, and anonymity and confidentiality were ensured. Questionnaires were administered in classrooms by trained personnel, teachers or school nurses. The time frame for filling the questionnaires was one school period. Each country followed ethical and legal requirements in their country for this type of survey.

Self-reported data on BMI-related variables (sex, age, height and weight) from 33 countries (including Flemish and Francophone Belgium, Scotland, Wales and England as separate countries) taking part in HBSC surveys in 2002, 2006 and 2010 were examined. However, only countries ($n = 25$) where there was <20% missing data on BMI were included for describing statistical findings and drawing conclusions, to be consistent with our previous publication.[13] Overweight (including obesity) status was assessed based on BMI using the IOTF-2000 cut-offs.[14] Age-standardized overweight prevalence rates were estimated, separately by survey cycle and gender, for each of the countries; the 2010 estimates were used as the standard. Overweight trends within each country were evaluated over time using logistic regression analyses considering overweight (dichotomized into yes vs. no) as the dependent variable and survey year (continuous) and age (categorized with 11-year-olds as reference) as independent variables. The significance of the trend was tested from the P-value of the slope coefficient β from the logistic fitting process. An interaction term between age and survey year was also included in the model to examine whether the trends were modified by age. All analyses were performed considering the effect of the survey design (including stratification, clustering and weighting) using STATA v12.1 (StataCorp., College Station, TX, USA: StataCorp LP); a statistical significance level of 5% was used.

Results

The description of statistical findings was limited to 25 countries with BMI data available on at least 80% of the surveyed population. Findings on the remaining eight countries (with >20% data missing on BMI) are also presented at the end of the tables, but are not considered in describing the results or drawing conclusions.

Tables 1 and 2 present the number of pupils surveyed and percentage of sample with BMI data by survey year for boys and girls, respectively. Age-standardized prevalence of overweight by survey year for each gender is also shown in tables 1 and 2. The prevalence of overweight was highest in USA (29–32.7% for boys; and 20–25.6% for girls) and lowest in Ukraine (6.8–13.0% for boys; and 4.6–7.3% for girls) during the study period (2002–2010).

For boys, overweight prevalence increased significantly in 13 out of the 25 countries, most (nine of 13) being in Eastern Europe (table 1), and remained stable in the remaining countries; no country showed a decreasing trend.

For girls, overweight prevalence increased significantly in 12 out of 25 countries, most (nine of 12) being in Eastern Europe (table 2) and, as for boys, overweight prevalence over the study period was relatively stable elsewhere; none of the countries exhibited a decreasing trend.

Despite the observation of increasing overweight prevalence in several Eastern European countries the prevalence levels in these countries generally did not exceed the levels observed in many Western European countries.

Increase in overweight prevalence was observed consistently in both genders in 10 out of 25 countries: Croatia, Czech Republic, Estonia, Greece, Latvia, Macedonia, Poland, Russia, Slovenia and Ukraine. With the exception of Greece, all other countries belong to the eastern part of Europe. In the other 15 countries examined, the prevalence of overweight increased only for girls in the USA and Germany, and only for boys in Austria, Sweden and Hungary (data not shown).

The interaction between wave of data collection and age was also examined separately for boys and girls (tables 1 and 2, respectively). A significant interaction with age for boys was noted only in Russia; increasing prevalence between 2002 and 2010 was greater for 11-year-olds (8–20%) than for 15-year-olds (7–10%). A similar significant interaction was also seen in girls in Russia even though absolute estimates were low in all ages and all surveys.

A similar interaction between age and wave of data collection was found among girls in Estonia and Poland, where 11- and 13-year-olds showed a marked increase in overweight between 2002 and 2010, while the 15-year-olds in these countries showed an increase in overweight prevalence only in 2006–2010. In contrast, Portugal exhibited a stable overweight prevalence in the two youngest cohorts and an increasing trend in the 15-year-olds. In the Netherlands, a marked decreasing trend in overweight prevalence was noted for the oldest age group (from 10.2 to 4.8% from 2006 to 2010 after a significant increase in the previous period from 8 to 10.2%) whereas overweight prevalence was stable in the younger age groups.

Discussion

This is the first cross-national report of trends in overweight (including obesity) in adolescents in Europe and North America using a standardized methodology.[12] In this study, over half of the countries examined demonstrated stabilization of overweight prevalence for both boys and girls, i.e. the prevalence of overweight in 10–15-year-olds did not change during the study period (2002–2010). These findings confirm the generally reported trend of an overall plateau in overweight and obesity prevalence in children and adolescents in several countries.[2,9,15] However, the current ecologic analysis finds that in several countries from Eastern Europe (with many in-transition economies) there is a clear and marked increase in overweight prevalence for both boys and girls. The change in overweight prevalence between 2002 and 2010 ranged from 4.5 (FYR Macedonia) to 10.5% (Poland) for boys, and from 2.3 (FYR Macedonia) to 7.2% (Estonia) for girls. This is consistent with the reported increase in overweight by up to 1% annually in some European countries.[8] Still, it should be noted that despite the observation of increasing prevalence in several Eastern European countries overweight prevalence in these countries did not generally exceed the levels observed in many Western European countries.

The analysis shows an increasing trend in overweight prevalence over an 8-year period examined in girls in Germany and in the USA, in boys in Sweden, Hungary and Austria, and in both girls and boys in Greece. This latter finding is consistent with the previously reported increase in overweight prevalence in 8–9-year-old children between 1997 and 2007 in Greece.[16] On the other hand, our findings are in contrast with the plateau or decrease in gender-specific overweight prevalence noted in previous studies (based on surveys other than HBSC) in Germany (overweight including obesity decreased in 12–16-year-old girls and 8–16-year-old boys),[17] Sweden (no change in prevalence of overweight including obesity in 10-year-old boys and significant decreased trend in prevalence of overweight including obesity for girls)[11] and in the USA (among 2–19-year-old girls no change in obesity prevalence; and for adolescent boys increasing trend in obesity).[10]

Table 1 Age-adjusted prevalence of overweight in boys from 2002 to 2010 by country

Country	*N* surveyed (% with BMI data)			Age-adjusted overweight%			Age-adjusted *P* value for trend
	2002	2006	2010	2002	2006	2010	
Austria	2164 (91.1)	2340 (94.4)	2456 (91.2)	13.67	15.37	17.35	0.005
Belgium (Flemish)	2996 (92.8)	2198 (92.0)	2086 (93.4)	10.98	10.01	11.30	0.818
Croatia	2158 (94.7)	2439 (94.8)	3012 (95.4)	15.52	18.41	21.88	<0.001
Czech Republic	2412 (99.5)	2411 (98.8)	2135 (97.1)	12.07	16.97	19.76	<0.001
Denmark	2211 (87.5)	2727 (83.8)	1914 (85.8)	11.67	10.49	10.25	0.217
Estonia	1982 (93.3)	2217 (93.4)	2022 (79.9)	8.95	12.52	17.31	<0.001
Finland	2692 (97.0)	2474 (95.8)	3179 (95.1)	16.19	18.50	18.22	0.051
France	4054 (93.1)	3551 (92.6)	3030 (87.6)	12.52	11.87	12.14	0.608
Germany	2777 (87.6)	3632 (92.3)	2406 (83.7)	15.14	14.41	15.76	0.347
Greece	1870 (93.9)	1746 (96.6)	2380 (96.0)	20.26	24.48	26.44	<0.001
Hungary	1779 (94.0)	1677 (91.7)	2257 (90.5)	15.10	19.12	19.21	0.003
Italy	2106 (93.9)	1974 (91.7)	2408 (89.9)	22.00	24.65	21.38	0.511
Latvia	1619 (88.3)	2034 (88.1)	2054 (91.6)	6.78	9.95	13.29	<0.001
Macedonia	1970 (91.4)	2625 (93.3)	1952 (87.5)	15.56	18.88	20.15	<0.001
Netherlands	2120 (90.2)	2114 (91.3)	2219 (83.7)	8.05	8.02	9.44	0.152
Norway	2550 (89.0)	2428 (80.1)	2171 (81.5)	14.33	12.3	14.36	0.900
Poland	3165 (93.8)	2649 (96.9)	2065 (95.9)	10.27	14.24	20.71	<0.001
Portugal	1413 (89.0)	1884 (90.9)	1878 (93.6)	19.63	21.63	21.34	0.334
Russia	3749 (92.7)	3892 (81.6)	2576 (89.0)	7.28	12.64	14.76	<0.001**
Slovenia	1966 (96.2)	2549 (94.7)	2761 (94.6)	17.09	19.83	21.57	0.002
Spain	2871 (75.7)	4368 (82.6)	2466 (91.8)	22.63	19.82	19.92	0.052
Sweden	1958 (89.7)	2179 (91.0)	3312 (82.4)	12.85	12.31	14.75	0.023
Switzerland	2223 (92.4)	2233 (94.5)	3320 (92.5)	9.83	11.02	11.15	0.156
USA	2322 (89.1)	1857 (91.1)	3260 (85.8)	29.05	32.71	31.7	0.068
Ukraine	1893 (89.0)	2388 (91.2)	2809 (90.6)	6.82	10.87	12.95	<0.001
Countries with >20% missing data on BMI							
Belgium (French)	2069 (71.3)	2313 (73.5)	1985 (71.4)	11.76	12.83	13.59	0.183
Canada	1996 (83.4)	2732 (84.5)	7711 (78.6)	22.96	25.04	23.54	0.868
England	2913 (60.8)	2308 (44.0)	1522 (46.7)	20.38	13.21	10.65	<0.001
Greenland	378 (68.5)	665 (71.3)	586 (57.5)	20.06	18.78	15.74	0.183
Ireland	1302 (41.6)	2451 (36.4)	2522 (35.0)	14.41	16.00	17.75	0.189
Lithuania	2886 (71.8)	2904 (65.6)	2740 (69.9)	5.6	10.41	14.06	<0.001
Scotland	2240 (50.4)	3032 (44.9)	3319 (40.3)	16.49	17.39	15.61	0.666
Wales	2003 (82.2)	2169 (70.0)	2746 (53.8)	22.72	19.46	20.49	0.136

**Significant interaction with age.

It is likely that the differences in methodology related to the use of measured vs. self-reported anthropometric measurements, the ages of samples examined, overweight/obesity definitions used, sample representativeness and participation rates could contribute to differential findings reported across the literature. The findings from this study involving several countries using the same methodology for data collection and analysis, indicating a general stabilization of overweight prevalence in several Western countries are therefore reassuring. However, our results highlight that in no country a decrease in overweight prevalence was noted in the 8-year study period, while an increasing trend in overweight prevalence was seen in several countries in economic transition in Eastern Europe. These findings suggest the continued need for programs and policies targeting child overweight via multifaceted approaches, including increased physical activity, reduced sedentary behaviours and improved nutrition habits[13] in countries demonstrating stabilization or no reduction in overweight prevalence. In the future, efforts to optimize such programs and policies may assist to further stabilize or reduce overweight prevalence. In addition, overweight prevention programs need to be increased particularly in Eastern European countries that showed a marked increase in overweight prevalence.

Age and sex effects on overweight trends

An overall plateau in the prevalence of overweight and obesity in children has been described in recent reviews[2,9] that was consistent across genders and ages. However, in this study we noted some differences in the trends in overweight prevalence across genders and ages. An interaction between time and age was observed only in a few countries, suggesting that the relationship did not differ between the age groups in general. However, studies including larger age-range indicate that time trends in overweight may differ by age. In a large German study a downward trend between 2004 and 2008 was observed in the youngest children, aged 4–7.99 years, whereas it stabilized in the older age groups.[17] However, a more marked stabilization in overweight (including obesity) among pre-school and primary school children as compared with older children has been shown in a recent review of findings from nine countries.[2] These results are in contrast to our finding of a significant trend towards increasing prevalence of overweight from 2002 to 2010 in 11–13-year-olds in Russia (for both genders) and in Poland and Estonia (for girls). In these countries, an increasing prevalence was also observed among 15-year-olds between 2006 and 2010. These results could relate to country-specific factors pertaining to an interaction of lifestyle habits and age in the context of the increased purchasing power in countries with in-transition economies.[9] Additional studies are needed to verify the differential age effects we noted in certain countries prior to identifying and addressing underlying factors that are involved in these trends.

Sex-specific trends in overweight and obesity have also been observed in other studies. For instance, trends for an increase in obesity prevalence among adolescent boys in the USA[10] and a decreasing prevalence of overweight (including obesity) among girls in Sweden[11] have been described. Although changes in overweight/obesity by gender differ from those observed in this study for these particular countries, taken together, these data highlight the need to recognize gender as a determinant of adolescent weight and health status and that interventions and

Table 2 Age-adjusted prevalence of overweight in girls from 2002 to 2010 by country

Country	*N* surveyed (% with BMI data)			Age-adjusted overweight%			Age-adjusted *P* value for trend
	2002	2006	2010	2002	2006	2010	
Austria	2202 (91.8)	2435 (94.1)	2547 (91.5)	10.35	8.01	11.09	0.422
Belgium (Flemish)	3293 (94.0)	2113 (91.9)	2094 (92.4)	8.58	8.50	10.29	0.123
Croatia	2208 (95.2)	2526 (95.2)	3240 (94.5)	7.32	11.44	12.1	<0.001
Czech Republic	2600 (99.7)	2364 (98.9)	2269 (96.0)	6.47	13.28	9.46	<0.001
Denmark	2373 (87.3)	2955 (82.8)	2132 (86.3)	9.53	9.10	8.23	0.182
Estonia	1994 (95.4)	2260 (94.4)	2002 (81.8)	4.41	6.76	11.58	<0.001**
Finland	2656 (97.7)	2719 (94.7)	3428 (94.2)	10.86	12.79	12.61	0.084
France	4131 (93.2)	3590 (92.5)	2990 (86.5)	9.34	8.95	7.99	0.077
Germany	2858 (85.6)	3592 (90.3)	2549 (82.0)	7.95	9.36	11.07	0.016
Greece	1937 (94.4)	1944 (96.2)	2519 (94.9)	10.84	13.10	15.18	<0.001
Hungary	2278 (95.4)	1821 (92.1)	2530 (90.8)	10.10	11.55	11.06	0.362
Italy	2251 (94.1)	1946 (89.3)	2403 (85.6)	11.16	11.87	13.07	0.067
Latvia	1836 (90.5)	2187 (91.7)	2210 (93.4)	4.33	5.44	8.29	<0.001
Macedonia	2060 (87.2)	2646 (93.5)	1945 (82.9)	8.68	9.95	10.97	0.029
Netherlands	2148 (90.7)	2114 (91.0)	2301 (84.3)	6.64	8.48	7.10	0.637**
Norway	2465 (87.0)	2269 (75.5)	2167 (78.1)	9.14	8.30	9.39	0.788
Poland	3145 (93.5)	2840 (96.9)	2176 (94.4)	5.38	7.93	13.48	<0.001**
Portugal	1515 (87.6)	2035 (91.7)	2158 (93.6)	13.54	15.94	15.87	0.098**
Russia	4283 (92.8)	4339 (83.5)	2598 (88.9)	3.86	7.03	8.17	<0.001**
Slovenia	1949 (96.4)	2570 (94.8)	2668 (93.9)	10.40	10.70	14.03	0.001
Spain	2952 (77.0)	4523 (82.7)	2574 (92.2)	13.00	13.38	13.72	0.407
Sweden	1938 (90.3)	2213 (89.8)	3333 (80.7)	7.94	8.61	8.62	0.407
Switzerland	2305 (92.6)	2346 (90.6)	3291 (91.5)	7.10	5.56	6.36	0.427
USA	2703 (88.0)	2035 (89.7)	3014 (82.2)	20.03	25.57	25.55	<0.001
Ukraine	2197 (88.8)	2681 (90.8)	3081 (91.5)	4.56	6.08	7.34	<0.001
Countries with >20% missing data on BMI							
Belgium (French)	2254 (70.6)	2163 (71.8)	2027 (67.9)	10.54	10.57	9.14	0.256
Canada	2365 (79.4)	3055 (80.5)	7999 (75.7)	14.83	17.41	16.41	0.245
England	3120 (58.7)	2460 (37.8)	1981 (43.4)	16.66	10.43	12.77	0.002
Greenland	495 (58.6)	693 (68.1)	619 (52.7)	19.25	18.71	15.80	0.121
Ireland	1573 (38.1)	2389 (29.0)	2202 (24.3)	10.41	11.84	13.45	0.649
Lithuania	2758 (76.9)	2728 (70.8)	2583 (74.0)	3.44	4.44	7.40	<0.001
Scotland	2155 (46.6)	3113 (39.2)	3419 (37.0)	13.32	13.96	10.98	0.064
Wales	1883 (80.9)	2227 (63.2)	2665 (42.3)	17.07	18.81	15.03	0.216

**Significant interaction with age.

prevention programs need to be gender-sensitive. While biological factors play a role in weight status, particularly among adolescents, social factors and gender norms related to food, body image and physical and sedentary behaviours may also be involved.

Strengths and limitations

The findings from the current trend analyses need to be considered in light of the methodology used. A standardized sampling frame, wording of items, data collection and data management are pre-requisites for conducting comparable trend studies across countries. In this study of trends in overweight prevalence between 2002 and 2010 these requirements were met with the use of the standardized HBSC study protocol.[12]

In the HBSC, BMI is used to define weight status. Although BMI, as an indirect indicator of body fat, may be biased by skeletal muscle mass, it is highly correlated with body fat mass and at the population level BMI is generally considered applicable for estimation of overweight prevalence.[18] In this study, BMI values were based on students' self-reports of height and weight. A solid body of literature documents that self-reported data generally lead to an underestimation of BMI especially among girls and among overweight and obese adolescents,[19] and we expect that the prevalence levels in this study are underestimated. The extent of underestimation may vary by country. However, this may not be a major methodological constraint in this study as the focus of this analysis was on trends in prevalence of overweight. There is no documented reason to believe that the reporting bias would change over time. However, because of the marked increase in overweight prevalence that many countries have experienced, changes in social norms related to overweight might have occurred resulting in changing patterns of social desirability towards reporting of weight (and height) status. The magnitude and directions of such changing patterns in misclassification over time among adolescents are unknown but this potential bias cannot be ruled out in this study. In the HBSC study students are assured of confidentiality and anonymity, which may have helped minimize information bias.

In this study we used the IOTF 2000 reference for defining overweight[14] in order to be consistent with our previous publication.[13] Several standards are available (e.g. the WHO growth references) which may not generate the exact prevalence estimate[20]; however, we believe that the use of other standards should not dramatically affect the findings on trends in overweight.

Eight countries had more than 20% missing data on BMI and were excluded from analyses. There was a considerable variation in proportion of missing BMI data, which could have compromised representativeness in some countries. The large proportion of missing BMI data observed in some countries points to the need for identifying reasons for students not to report height and/or weight and to identify ways of reducing missing data on BMI. Finally, time trends in overweight may depend on factors other than gender and age including socioeconomic status.[9] However, examining interactions between time and additional potential modifiers was beyond the scope of this report.

Conclusion

The current cross-national analysis of trends in overweight (including obesity) from 2002 to 2010 in 11–15-year-olds

demonstrates stabilization in overweight prevalence for both boys and girls in countries in the European region and in North America. However, our data indicate a marked increase in overweight prevalence in the majority of the countries in Eastern Europe examined in the current analyses. Overall rates of overweight in many countries remain high. Taken together, the observed patterns in overweight prevalence call for continued research on the epidemiology of youth overweight and point to the relevance of studying cross-national differences through macrolevel indicators. Targeting childhood overweight by maintaining existing prevention programs and policies in Western European and North American countries and increasingly building such programs in Eastern European countries are indicated to continue the combat against child and adolescent overweight.

Acknowledgements

The HBSC study is an international study that is carried out in collaboration with WHO Europe. The international coordinator was Professor Candace Currie from the University of St. Andrews, and the databank manager was Professor Oddrun Samdal from the University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org).

Funding

The data collection for each HBSC survey is funded at the national level. The Danish HBSC Trend Data File was financed by the Nordea Foundation (Grant number 02-2011-0122). The Flemish HBSC study was financed by the Flemish Government. HBSC Ireland was funded by the Department of Health, Government of Ireland. HBSC in Italy was part of the Project 'Sistema di indagini sui rischi comportamentali in età 6-17 anni' promoted and financed by the National Centre for Disease Prevention and Control, Ministry of Health, Italy. The Polish team acknowledges the Ministry of Science and Higher Education, Poland for funding HBSC study in Poland. The research for the USA HBSC study was funded in part by the intramural research program of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development. The Estonian HBSC study was funded through the National Health Plan 2009-2020 of Estonia. Some of the findings from this research were presented at the Annual Meeting in the International Society of Behavioural Nutrition and Physical Activity, San Diego, USA, May 21–24 2014.

Conflicts of interest: None declared.

Key points

- The prevalence of overweight (including obesity) among 11–15-year-olds remains high in several countries in Europe and North Americas.
- Overweight prevalence increased in about half the countries examined, and particularly in countries in Eastern Europe in both sexes. Rates of overweight remained unchanged in the remaining countries.
- None of the countries showed a decline in overweight prevalence over the 8-year study period.
- Continued efforts to monitor and reduce overweight prevalence in young children and adolescents are needed.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 33–36

doi:10.1093/eurpub/ckv026

Trend in injury-related mortality and morbidity among adolescents across 30 countries from 2002 to 2010

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Background: The aim was to examine temporal trends in injury mortality and morbidity across 30 countries in Europe and North America, and the impact of regional geography and adolescent risk behaviours (including substance use and physical fighting) on such trends. **Methods**: Data were obtained for 30 countries in 2002, 2006 and 2010. Mortality data were obtained from the World Health Organization's (WHO) Health for all database. Trends over time were described by WHO Regions using standardized rates comparisons and Poisson regression analyses. **Results**: Injury-related mortality, but not morbidity, declined over time across all countries (from 10 to 8 deaths per 100 000 between 2001 and 2010), with notable differences observed by Regions (e.g. from 48 to 39 deaths in Russia). Risk behaviours included in the models were consistently and significantly associated with injury morbidity, with substance increasing the risk for injury by 1.15 to 1.36 among girls, and physical fighting increasing the risk by 1.21 to 1.31 among boys across WHO Regions. Risk behaviours did not explain the observed temporal trends. **Conclusions**: Injury mortality and morbidity represent different health phenomena. Efforts that have been made to make societies safer for children have seemed to be successful in reducing injury morbidity.

Introduction

Injury is a leading public health problem in adolescents.[1] There is a clear need for effective, evidence-based, policy solutions to address this problem internationally. Analyses of trends in the occurrence of injury, as well as potential causes of such trends, can provide insight into potential interventions. Over the last three decades, declines in fatal childhood injury rates have been documented in some developed countries, attributable to advances in the field of injury prevention aimed at leading causes of mortality (road traffic crashes, drowning, burns, falls and poisonings).[1,2] Less is known about analogous trends in morbidity, and to our knowledge, models of potential explanations of international trends in adolescent injury have generally been descriptive.

In Europe, changes to the political landscape during the past decade undoubtedly had many impacts on adolescent health, including the occurrence of injury. There are many established individual risk factors for adolescent injury; common ones include substance misuse[3] violence,[4] time engaged in sport[5] and socioeconomic status.[6] The rapid political changes experienced in Europe may have impacted the prevalence and perhaps the impact of these leading risk factors. It would be informative for public health to know whether the effects of such etiological factors remained consistent in different Regions of Europe, and whether these factors can explain any observed temporal trends in the occurrence of adolescent injury in these regions.

In this article, we examine international trends in the occurrence of pediatric injury in 30, mainly European, countries. We profiled trends in the occurrence of fatal injury to children aged 1–19 years, then non-fatal injury to young adolescents, between 2002 and 2010. We examined relations between injury and the above risk factors in 12 370 715-year olds from the 30 countries. We expected to observe reductions in injury over time in most countries, as suggested by the literature,[2,3] and due to the recent emphasis on injury control and safety promotion internationally.[7] We also expected to observe variations in temporal trends and perhaps the impact of risk factors by WHO region, with more dramatic changes in new European Union (EU) entrants and the Commonwealth of Independent States (CIS). The article discusses the public health implications of the observed trends and patterns.

Methods

Study design and data sources

This article utilizes data from two sources. Estimates on 'injury mortality' of children aged 1–19 years were obtained from the WHO public registry HFA,[8] which provided data on rates of unintentional injury deaths. Self-report data from school children aged 11, 13 and 15 years in 30 countries were obtained using records of the three most recent cycles of the Health Behaviour in School-aged Children study (HBSC), with a total sample of 581 838 children. This article focuses only on 15-year olds ($n = 123\,707$).[9] Response rates varied by cycle and country and were more than 70% for almost all national surveys. Each country team obtained approval to conduct the survey from the ethics review board or equivalent regulatory body. Participation was voluntary, and consent was sought from school administrators, parents and children.

Measures

Injury

The core mortality indicator was age/gender-specific rates of 'unintentional fatal injuries to children aged 1–19 years'. These were calculated per country and year and used to analyse time trends. The core morbidity indicator was individual self-reports of two or more non-fatal injuries during the past 12 months; a standard indicator of repeated injury occurrence.[10] Rates were either obtained directly (mortality) or calculated (morbidity) for three recent study years (2002, 2006 and 2010).

Table 1 Trends in mortality and morbidity due to injury by WHO region and country, 2002–10

	Age/sex standardized rate of injury per year by country, and trends in rate over time											
	Mortality: Fatal injuries per 100 000 in ages 1–19 years[a]						Morbidity: Multiple injuries per 100 in ages 11–15 years[b]					
WHO Region Country	2001–02	2005–06	2009–10	Trend B	Se	P	2001–02	2005–06	2009–10	Trend B	se	P
Old European Union (pre-2004)												
Austria	13	11	9	−0.046	0.05	0.55	24	16	26	−0.010	0.006	0.10
Belgium	–	11	11	–	–	–	21	19	21	−0.003	0.004	0.47
Denmark	10	8	8	−0.029	0.06	0.72	23	27	25	0.010	0.005	0.08
Finland	13	12	9	−0.044	0.05	0.56	13	15	16	0.028	0.006	**<0.0001**
France	13	9	8	−0.063	0.06	0.47	27	20	19	−0.044	0.005	**<0.0001**
Germany	11	8	6	−0.076	0.06	0.44	29	23	26	0.012	0.005	**0.03**
Greece	13	11	10	−0.033	0.05	0.64	21	15	17	−0.025	0.006	**<0.0001**
Ireland	14	11	13	−0.010	0.05	0.88	21	16	15	−0.038	0.007	**<0.0001**
Italy	10	8	7	−0.045	0.06	0.60	21	21	19	−0.008	0.006	0.19
Netherlands	8	6	5	−0.060	0.07	0.56	14	17	19	0.043	0.007	**<0.0001**
Norway	11	9	8	−0.040	0.06	0.61	21	22	22	0.006	0.006	0.30
Portugal	16	–	8	–	–	–	21	18	16	−0.033	0.007	**<0.0001**
Spain	11	9	6	−0.073	0.06	0.44	29	29	34	0.017	0.005	**0.0002**
Sweden	8	7	6	−0.035	0.07	0.69	17	13	14	−0.025	0.007	**0.0002**
UK	9	8	6	−0.049	0.06	0.59	26	23	23	−0.016	0.003	**<0.0001**
New European Union (2004-)												
Croatia	14	12	10	−0.042	0.05	0.57	16	19	17	0.009	0.006	0.125
Czech Republic	14	12	9	−0.054	0.05	0.49	16	19	19	0.027	0.006	**<0.0001**
Estonia	31	24	14	−0.085	0.04	0.24	14	18	18	0.026	0.007	**0.0002**
Hungary	12	11	8	−0.049	0.06	0.54	13	18	13	0.0008	0.007	0.91
Latvia	37	24	17	−0.099	0.04	0.22	21	19	32	0.067	0.006	**<0.0001**
Lithuania	32	29	24	−0.035	0.03	0.48	21	26	23	0.010	0.005	0.05
Poland	15	14	13	−0.018	0.05	0.77	9	9	11	0.029	0.008	**0.0003**
Slovenia	14	12	9	−0.054	0.05	0.49	19	14	20	0.009	0.006	0.15
Commonwealth of independent states												
Russia	48	39	32	−0.051	0.05	0.32	19	18	21	0.007	0.005	0.19
Ukraine	32	28	21	−0.051	0.03	0.38	12	18	14	0.013	0.007	0.05
Other countries												
Canada	–	–	–	–	–	–	29	20	23	−0.036	0.004	**<0.0001**
Israel	15	9	5	−0.136	0.06	0.27	27	29	26	−0.005	0.005	0.30
Switzerland	11	09	8	−0.040	0.06	0.61	22	21	20	−0.013	0.006	**0.02**
TFYR-Macedonia	12	–	11	–	–	–	10	10	5	−0.088	0.010	**<0.0001**
USA	–	–	–	–	–	–	27	21	23	−0.019	0.005	**<0.0001**
All countries	**17**	**14**	**11**	**−0.054**	**0.009**	**<0.0001**	**21**	**20**	**20**	**−0.003**	**0.001**	**0.002**

a: Standardized to the standard European population.[14]
b: Standardized to the entire HBSC participant population for 2002–10.

Table 2 Trends in mortality and morbidity due to injury by WHO region and gender, 2002–10

	Age standardized rate of injury per year, and trends in rate over time											
	Mortality: Fatal injuries per 100 000 in ages 1–19 years[a]						Morbidity: Multiple injuries per 100 in ages 11–15 years[b]					
Region Gender	2002	2006	2010	Trend B	Se	P	2002	2006	2010	Trend B	se	P
Old European Union (pre-2004)												
Boys	15	13	11	−0.046	0.01	**0.0009**	28	25	25	−0.011	0.002	**<0.0001**
Girls	7	5	4	−0.042	0.02	**0.04**	18	17	17	−0.002	0.002	0.37
New European Union (2004-)												
Boys	21	19	16	−0.064	0.01	**<0.0001**	20	22	23	0.015	0.003	**<0.0001**
Girls	9	8	7	−0.051	0.02	**0.02**	12	14	15	0.033	0.003	**<0.0001**
Commonwealth of independent states												
Boys	56	46	36	−0.055	0.02	**0.04**	22	23	21	−0.0002	0.005	0.98
Girls	23	20	16	−0.047	0.03	0.18	12	14	13	0.023	0.007	**0.0005**
Other countries												
Boys	16	12	9	−0.052	0.03	0.08	28	24	24	−0.025	0.003	**<0.0001**
Girls	7	5	5	−0.051	0.04	0.21	19	16	18	−0.021	0.004	**<0.0001**
All countries												
Boys	**23**	**18**	**15**	**−0.056**	**0.01**	**<0.0001**	**25**	**24**	**24**	**−0.007**	**0.001**	**<0.0001**
Girls	**9**	**8**	**6**	**−0.048**	**0.01**	**<0.0001**	**16**	**16**	**17**	**0.003**	**0.002**	0.06

Note: Figures in bold represent significant results.
a: Standardized to the standard European population.[14]
b: Standardized to the entire HBSC participant population ages 11–15 year for 2002–10.

Table 3 Relations between survey cycle (time) and multiple injuries among 15-year olds within WHO Regions participating in the 2002–10 HBSC surveys, accounting for established individual risk factors for adolescent injury

Indicator	Relative risk (95% CI) for multiple injuries							
	EU Pre-2004		EU Post-2004		CIS		Other countries	
	Crude	Adjusted	Crude	Adjusted	Crude	Adjusted	Crude	Adjusted
Males								
N	31 715		14 072		3713		10 568	
Temporal trend—per 4 year cycle	0.96 (0.93–0.99)	**1.05 (1.01–1.09)**	1.03 (0.99–1.08)	1.01 (0.94–1.07)	1.02 (0.94–1.11)	1.06 (0.90–1.24)	0.92 (0.88–0.97)	0.96 (0.89–1.03)
Substance use (0–3 types lifetime)	**1.23 (1.21–1.26)**	**1.16 (1.14–1.19)**	**1.28 (1.23–1.32)**	**1.15 (1.11–1.20)**	**1.25 (1.17–1.33)**	**1.17 (1.08–1.28)**	**1.25 (1.21–1.30)**	**1.17 (1.12–1.22)**
Physical activity (1—'none' to 7 'daily')	**1.19 (1.17–1.21)**	**1.16 (1.14–1.18)**	**1.15 (1.12–1.18)**	**1.11 (1.08–1.15)**	**1.11 (1.06–1.17)**	**1.07 (1.02–1.14)**	**1.17 (1.13–1.20)**	**1.14 (1.10–1.18)**
Physical fighting (1–'none' to 5 '4+times')	**1.26 (1.24–1.27)**	**1.21 (1.19–1.23)**	**1.26 (1.23–1.29)**	**1.21 (1.18–1.25)**	**1.31 (1.26–1.37)**	**1.27 (1.20–1.34)**	**1.27 (1.24–1.30)**	**1.21 (1.17–1.25)**
Family affluence (0—'low' to 9 'high')	**1.05 (1.03–1.06)**	**1.04 (1.02–1.06)**	**1.10 (1.07–1.12)**	**1.08 (1.05–1.11)**	**1.11 (1.07–1.16)**	**1.07 (1.02–1.13)**	**1.06 (1.03–1.09)**	**1.04 (0.77–1.42)**
Females								
N	33 119		14 888		4349		11 283	
Temporal trend—per 4 year cycle	1.02 (0.99–1.05)	**1.11 (1.06–1.17)**	**1.13 (1.07–1.19)**	1.04 (0.96–1.12)	**1.15 (1.03–1.27)**	1.19 (0.97–1.46)	0.94 (0.89–0.99)	**1.00 (1.92–1.08)**
Substance use (0–3 types lifetime)	**1.26 (1.23–1.29)**	**1.20 (1.17–1.23)**	**1.36 (1.30–1.42)**	**1.26 (1.20–1.32)**	**1.22 (1.12–1.32)**	**1.13 (1.02–1.35)**	**1.19 (1.15–1.24)**	**1.16 (1.11–1.21)**
Physical activity (1—'none' to 7 'daily')	**1.17 (1.15–1.19)**	**1.17 (1.14–1.19)**	**1.15 (1.12–1.18)**	**1.14 (1.10–1.17)**	**1.10 (1.04–1.17)**	**1.08 (1.02–1.15)**	**1.18 (1.14–1.22)**	**1.17 (1.13–1.21)**
Physical fighting (1—'none' to 5 '4+times')	**1.32 (1.30–1.35)**	**1.28 (1.25–1.31)**	**1.34 (1.29–1.38)**	**1.29 (1.24–1.34)**	**1.34 (1.26–1.42)**	**1.31 (1.19–1.45)**	**1.29 (1.24–1.33)**	**1.24 (1.19–1.29)**
Family affluence (0—'low' to 9 'high')	**1.08 (1.06–1.10)**	**1.07 (1.05–1.09)**	**1.09 (1.07–1.12)**	**1.06 (1.02–1.09)**	**1.10 (1.04–1.16)**	**1.05 (0.98–1.13)**	**1.04 (1.01–1.08)**	**1.04 (1.01–1.08)**

Note: Figures in bold represent significant results.

Risk factors

Variables used in this analysis included time (survey cycle), gender, a composite substance use measure that considered lifetime smoking, drunkenness and cannabis use[11]; frequency of physical activity[9]; frequency of physical fighting[12] and individual family affluence (FAS).[13]

Analyses

Trends analyses by geographic region were conducted for both mortality and morbidity data. For these analyses, countries were divided into four WHO geographic Regions (EU prior to 2004, EU post-2004, CISs and other countries).

We first modelled temporal trends in the age/gender standardized rates of fatal injury by WHO region and over time using Poisson regression. Time was included here as a linear (continuous) term. Second, for the non-fatal injury outcome, age/gender standardized rates were estimated for adolescents (ages 11–15 years) by HBSC survey cycle for each country using the entire HBSC study population for those years as the standard. We then modelled temporal trends in individual reports of injury among all HBSC participants by country using Poisson regression analyses that modelled 'multiple injuries' as the dependent variable with age, gender and year of survey cycle (continuous) as the independent variables. Models accounted for the clustered nature of the sampling scheme, with individuals nested within schools, through incorporating a conservative design effect of 1.2 to account for the clustered sampling method. The analyses were weighted by sample sizes within each country.

Risk behaviour analysis

Poisson regression analyses were then conducted to predict the occurrence of 'multiple injuries' among 15-year-old HBSC participants. The focus here was on examining regional variations and also explaining any temporal trends observed within the four WHO Regions. Models were built to explore patterns in the individual risk factors for adolescent injury and whether they accounted for any observed trends. Countries and schools were included as random effects, as a way to compensate for the clustered nature of the sample. All analyses used SAS, V. 9.3.

Results

Mortality trends

There was a consistent decline in the rates of fatal injuries to children aged 1–19 years in all WHO regions. While the outcome was rare and the declines were modest enough that none achieved statistical significance within individual countries, this decline was statistically significant overall, and by gender in the analyses by WHO Region (Table 1).

Morbidity trends

Rates of injury were higher among males than females in all regions, and higher in old EU and 'other' countries. Observed temporal trends varied by WHO Region. Among old EU countries, self-reported injuries declined in six countries, increased in three countries and remained unchanged in six countries. Among the new EU countries, injuries increased in four countries and remained unchanged in four countries, in the CIS region no temporal trend was visible, and among the other countries injuries declined in four countries and remained unchanged in one (Table 2).

Risk factor analysis

In general, each of the risk factors for non-fatal injury included showed the hypothesized relationship, and this with remarkable consistency, in genders and within each WHO Region (Table 3). Confirmed risk factors were engagement in more types of psychoactive substances, more frequent physical activity,[5] more frequent reports of violence and higher levels of family affluence.[6] Unexpectedly, risk factors included in the study did not explain observed temporal trends, as time trends for most countries/

regions were not mitigated following simultaneous adjustment for these risk factors.

Discussion

The aim of this article was to examine temporal trends in injury mortality and morbidity. While injuries are one of the leading causes of death among young people globally, the mortality rates in the WHO European region are relatively low compared with other regions.[1,2] In most countries and regions, childhood mortality rates due to injury decreased since 2002, consistent with existing international reports from developed countries.[1,2] Such decreases may be the result of an investment in safety,[7] coupled with improved health services and trauma care.[1]

Unlike fatal injuries, no consistent trends were found in injury morbidity, both between and within WHO Regions. Supported by literature,[3,4] the findings demonstrated that physical fighting and substance use are the main predictors of injury across all regions and in both genders. Participation in physical activity was another risk factor, consistent with previous findings suggesting that the majority of self-reported injuries among young people occur during sport and physical activity.[5,6] Yet, these risk factors did not provide a consistent explanation for the temporal trends in self-reported injuries among 15-year olds.

Differences in temporal trends observed between the mortality and morbidity indicators are noteworthy. Our findings suggest that fatal and non-fatal injuries are different phenomena, with similar proportions of self-reported even where mortality rates are substantially higher, and with no consistency in the temporal trends for fatal and non-fatal injuries. The external causes of fatal and non-fatal injuries are very different, with most fatal injuries among young people are the result of road traffic injuries, drowning, burns, poisonings and falls.[1] Most self-reported injuries in HBSC are the result of physical activity. Hence, these differences in etiology may account for the divergence in observed patterns predicted by this theory. Another explanation could be found in the measure of self-reported injury that asks children to report medically treated injury. It is possible that the relative lower rates in CIS and New EU countries reflect the access to health care in the community thus biasing the injury reported towards more severe injuries,[5] resulting in under-reporting of less severe injuries.

Findings of our analysis have some policy implications. First, it is encouraging to see the observed declines in fatal injury across all regions. Clearly, efforts that were made to create a safer environment for children have been effective. Second, the consistency and universality of the risk factors as predictors of injury over and above temporal changes send a clear message to policy-makers in terms of areas for intervention for reduction of injury. For example, programmes that aim at reducing substance use, as well increasing safety in sport will, inevitably reduce the prevalence of injuries. Third, the findings suggest that there is a need to investigate children's access to health care and its effect on self-reported injuries. It is also of importance to continue the efforts to bring down level of injury mortality, in CIS countries in particular.

Acknowledgements

The HBSC study is an international survey conducted in collaboration with WHO/EURO. The International Coordinator of the study was Candace Currie, University of St Andrews, Scotland, and the data bank manager was Oddrun Samdal, University of Bergen, Norway. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The data collection in each country was funded at the national level. We are grateful for the financial support offered by the various government ministries, research foundations and other funding bodies in the participating countries and regions.

Funding

M.M. was a visiting scholar at Queen's University during the conduct of this analysis. Funding for this came from the Canadian Institutes of Health Research and the Heart and Stroke Foundation of Canada (Grants MOP 97961; PCR 101415).

Conflicts of interest: None declared.

Key points

- Injury-related mortality rates in WHO Region for Europe are declining, but no consistent trends were found in relation to injury morbidity.
- Engagement in risk behaviours increases the risk for injury, but does not provide a consistent explanation for temporal trends in injuries.
- Our findings suggest that injury mortality and injury morbidity represent different phenomena indicating that different prevention efforts are required for each phenomenon.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 37–40

doi:10.1093/eurpub/ckv024

Secular trends in moderate-to-vigorous physical activity in 32 countries from 2002 to 2010: a cross-national perspective

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Background: Sufficient levels of moderate to vigorous physical activity (MVPA) give substantial health benefits to adolescents. This article examines trends in physical activity (PA) from 2002 to 2010 across 32 countries from Europe and North America. **Methods:** Representative samples included 479 674 pupils (49% boys) aged 11 years ($n = 156\,383$), 13 years ($n = 163\,729$) and 15 years ($n = 159\,562$). The trends in meeting the recommendations for PA (at least 60 min daily) were evaluated using logistic regression. **Results:** There was a slight overall increase between 2002 and 2010 (17.0% and 18.6%, respectively). MVPA increased significantly ($P \leq 0.05$) among boys in 16 countries. Conversely, nine countries showed a significant decrease. Among girls, 10 countries showed a significant increase ($P \leq 0.05$). Eight countries showed a significant decrease. For all countries combined, girls were slightly less likely to show an increase in PA over time. **Conclusions:** The majority of adolescents do not meet current recommendations of PA. Further investment at national and international levels is therefore necessary to increase PA participation among children and adolescents and reduce the future health burden associated with inactivity.

Introduction

There are substantial health benefits of regular moderate-to-vigorous physical activity (MVPA) for adolescents.[1] International guidelines state that adolescents should participate in at least 60 min of MVPA daily[2] and many countries have developed national policies to promote physical activity (PA) among adolescents. Recent reviews on time trends in youth MVPA observe inconsistent findings with no clear declining or increasing patterns for overall PA as well as for specific PA domains.[3,4] However, four-fifths of adolescents do not reach the recommended levels of PA.[4] Boys are more likely to report at least 60 min of MVPA daily.[5] It is important to monitor secular trends in MVPA for public health surveillance purposes as well as to evaluate the effectiveness of national policies and interventions, and to inform future national and international priorities and policies. A cross-national perspective is especially important to shed further light into the overall time patterns of MVPA across different policy and cultural contexts.

This article examines country-specific trends in MVPA from 2002 to 2010 across 32 countries from Europe and North America using data from the Health Behaviour in School-aged Children (HBSC) Study. Since gender differences in PA are widely documented,[5] we analysed boys and girls separately.

Methods

HBSC is a self-report, school-based survey conducted every 4 years in many countries across Europe and North America according to the international research protocol.[6] This article presents data from the surveys in 2001/2002, 2005/2006 and 2009/2010 (2011 in Israel). Representative samples from 32 participating countries included 479 674 pupils (234 395 boys; 49%) aged 11 years ($n = 156\,383$), 13 years ($n = 163\,729$) and 15 years ($n = 159\,562$). Each country obtained approval to conduct the survey from an ethics review board or a country-specific equivalent regulatory body. Participation was voluntary and consent was sought from school administrators, parents and children as per national human subject requirements. Students' response rates were more than 70% in all years for almost all national surveys.

Measurement

Physical activity

Young people were asked: 'Over the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day?' with possible answers ranging from 0 to 7 days. The question was preceded by a definition of MVPA as 'any activity that increases your heart rate and makes you get out of breath for some time'. This measure was originally developed by Prochaska[7] and intends to give a picture of overall PA in compliance with recent PA guidelines. It thus aims to capture PA in a range of contexts including transportation, recreation and school. Previous studies have shown acceptable reliability and validity[8,9] and the measure has been recommended for brief surveillance purposes.[10]

Covariates

Age and the Family Affluence Scale (FAS) were included as covariates in our gender-specific analyses. Age was treated as categorical as only 11-, 13- and 15-year olds were included into HBSC. FAS is a measure of the material conditions of the household

and is used as a proxy indicator of the socioeconomic position.[11] It includes 4 items (i.e. own bedroom, family holidays, vehicle ownership and computer ownership). Responses to the individual items are weighted, summed up and subdivided into three categories for low (0–3), medium (4 and 5) and high (≥6) affluence.[11]

Statistical analysis

Data analyses were conducted using the IBM SPSS v. 19 two-step cluster analysis. Descriptive analyses were used to characterize the sample. We evaluated the trends in meeting the recommendations for PA using logistic regression. Meeting the PA recommendation (yes or no) was the dependent variable with survey year (2002, 2006 and 2010) as the independent variable. The significance of a trend was tested by treating the variable survey cycle as categorical in the logistic regression, with 2002 as the reference category. Resulting odds ratios express a change in MVPA per survey cycle. The results are presented separately for boys and girls. We controlled the analyses for age and FAS.

Results

Over all survey years taken together, 23.1% of boys and 14.0% of girls reported at least 60 min of MVPA daily (OR/95% CI: 0.546/0.537–0.554). Gender differences were significant in most countries across all age groups. A significantly higher frequency of daily MVPA was found among adolescents aged 11 years (23.2%) than those aged 15 years (14.0%; OR/CI: 0.534/0.524–0.544). In addition, we found that adolescents from high affluent families meet PA guidelines more often than adolescents from low affluent families (19.8% vs. 16.3%; OR/CI: 1.187/1.161–1.212).

Table 1 presents the proportions of school-aged children who achieved at least 1 h of MVPA per day by gender and by country. Across the whole sample, there was a slight overall increase between 2002 and 2010 (17.0% and 18.6%, respectively). The most significant increases in MVPA were reported in Finland (boys +11.9%, girls +5.7%). The most significant decreases were reported in Lithuania (boys −11.1%, girls −7.2%).

Among boys, the proportion meeting the current guidelines ranged from 10.7% in Italy to 37.6% in Ireland between 2002 and 2010. MVPA increased significantly among boys in 16 countries (Austria, Belgium, Croatia, Finland, France, Germany, Hungary, Israel, Latvia, Macedonia, Netherlands, Norway, Poland, Portugal, Spain and Ukraine). Conversely, nine countries showed a significant decrease (Czech Republic, Denmark, Italy, Lithuania, Russia, Scotland, Slovenia, Switzerland and USA). In the remaining seven countries the levels of MVPA remained stable.

Between 2002 and 2010, the proportion of girls achieving at least 60 min of MVPA a day ranged from 4.5% in France to 27.4% in

Table 1 Achievement of at least 1 h per day of moderate-to-vigorous intensity PA; HBSC study 2002–10 (controlled for age, FAS)

	Variable	Boys						Girls					
		2002	2006	2010	2010 vs. 2002		Trend	2002	2006	2010	2010 vs. 2002		Trend
		%[a]	%[a]	%[a]	OR	95% CI		%[a]	%	%	OR	95% CI	
1	Austria	27.4	23.2	30.5	1.258**	1.097–1.442	+	15.8	15.8	17.5	1.155	0.980–1.361	o
2	Belgium	14.8	23.3	20.9	1.489***	1.302–1.703	+	7.5	16.7	12.3	1.700***	1.437–2.012	+
3	Canada	26.9	30.5	28.0	1.050	0.936–1.178	o	17.5	17.0	17.2	1.012	0.893–1.148	o
4	Croatia	24.8	29.2	27.5	1.171*	1.026–1.336	+	14.4	16.9	13.6	0.870	0.740–1.024	o
5	Czech Republic	31.1	26.6	27.4	0.745***	0.650–0.854	–	22.3	17.0	18.6	0.724***	0.623–0.841	–
6	Denmark	19.2	25.1	14.3	0.667***	0.560–0.795	–	14.9	20.2	9.4	0.654***	0.464–0.685	–
7	UK	28.9	22.7	28.6	0.944	0.810–1.099	o	15.6	13.8	14.6	0.876	0.737–1.042	o
8	Estonia	13.6	21.3	16.6	1.149	0.958–1.378	o	9.5	14.4	12.3	1.208	0.983–1.485	o
9	Finland	17.8	28.9	29.7	1.897***	1.661–2.166	+	12.0	20.1	17.7	1.496***	1.282–1.745	+
10	France	13.2	19.4	17.5	1.328***	1.157–1.524	+	4.5	7.6	6.8	1.503***	1.215–1.860	+
11	Germany	15.1	19.9	20.0	1.444***	1.239–1.682	+	8.5	13.9	14.0	1.754***	1.465–2.100	+
12	Greenland	32.1	33.6	28.8	0.836	0.616–1.136	o	27.4	24.5	22.0	0.705*	0.522–0.951	–
13	Hungary	22.0	25.5	25.1	1.186*	1.018–1.382	+	10.8	14.1	13.5	1.200*	1.001–1.438	+
14	Ireland	35.4	37.6	34.3	1.033	0.889–1.201	o	21.7	24.3	20.3	0.922	0.779–1.091	o
15	Israel	21.2	23.9	23.6	1.179*	1.014–1.371	+	10.1	12.4	10.0	0.982	0.812–1.188	o
16	Italy	13.0	20.5	10.7	0.763**	0.632–0.922	–	8.3	9.8	5.4	0.567***	0.446–0.722	–
17	Latvia	18.9	27.6	24.5	1.275**	1.076–1.512	+	10.8	18.6	16.0	1.602***	1.312–1.955	+
18	Lithuania	30.8	22.7	19.7	0.502***	0.441–0.573	–	20.5	15.6	13.3	0.552***	0.472–0.645	–
19	Macedonia	19.6	26.7	26.6	1.446***	1.240–1.685	+	14.3	18.3	18.0	1.302**	1.093–1.550	+
20	Netherlands	18.0	24.2	22.3	1.204*	1.031–1.407	+	15.8	18.3	15.7	0.931	1.019–1.773	o
21	Norway	14.2	18.0	19.5	1.409***	1.201–1.654	+	8.5	12.5	11.2	1.213	0.990–1.487	o
22	Poland	20.8	22.2	25.3	1.224**	1.068–1.404	+	13.2	13.0	15.4	1.049	0.891–1.234	o
23	Portugal	16.0	22.0	18.4	1.228*	1.008–1.496	+	8.4	8.2	8.5	1.047	0.814–1.347	o
24	Russia	18.3	16.6	16.1	0.774***	0.671–0.892	–	11.4	9.6	9.1	0.656***	0.550–0.781	–
25	Scotland	25.2	28.5	18.3	0.710***	0.618–0.814	–	13.6	15.7	11.0	0.796*	0.668–0.949	–
26	Slovenia	29.0	21.9	25.5	0.772***	0.674–0.886	–	16.4	13.3	14.9	0.873	0.737–1.032	o
27	Spain	22.3	25.1	29.9	1.489***	1.310–1.694	+	11.7	17.4	15.1	1.376***	1.168–1.620	+
28	Sweden	16.0	18.2	15.6	0.971	0.826–1.142	o	9.8	14.7	12.2	1.228*	1.014–1.488	+
29	Switzerland	18.0	16.0	15.5	0.830*	0.717–0.962	–	12.1	10.0	8.5	0.660***	0.551–0.790	–
30	Ukraine	20.9	28.5	29.4	1.438***	1.243–1.664	+	12.4	16.0	16.9	1.194*	1.009–1.414	+
31	USA	35.2	34.1	32.6	0.869*	0.774–0.975	–	21.0	20.1	20.1	0.927	0.814–1.057	o
32	Wales	21.8	27.9	24.2	1.100	0.948–1.277	o	11.9	14.2	13.8	1.186	0.978–1.440	o
	All countries	21.4	24.3	23.4	1.105***	1.154–1.213	+	12.9	15.1	13.9	1.049**	1.018–1.080	+

Notes: OR, odds ratio based on logistic regression with year of survey (2010, 2006, 2002) as categorical variable, in table is displayed only contrast for 2010–02, with year 2002 as a reference group; +, significant positive trend; (increase MVPA); –, significant negative trend (decrease MVPA); o, no change.

a: Percentage of participants who met recommendation for PA; CI: 95% confidence interval.

***$P \leq 0.001$; **$P \leq 0.01$; *$P \leq 0.05$.

Greenland. Ten countries showed a significant increase (Belgium, Finland, France, Germany, Hungary, Latvia, Macedonia, Spain, Sweden and Ukraine). Eight countries showed a significant decrease (Czech Republic, Denmark, Greenland, Italy, Lithuania, Russia, Scotland and Switzerland). MVPA remained stable in the remaining 14 countries.

For all countries combined, a significant interaction between year and gender was observed whereby girls were slightly less likely to show an increase in MVPA over time (OR [ref:boys] = 0.949, 95% CI = 0.913–0.986, $P = 0.007$).

Discussion

This study of young people from 32 European and North American countries identified a small increase in the proportion of boys and girls aged 11–15 years who meet the current PA recommendations between 2002 and 2010. However, these positive trends were not evident in all countries. While many countries do report increasing ($n = 16$) or stable levels ($n = 7$) of PA, the proportion of adolescents achieving 60 min of MVPA daily has decreased in nine countries.

Our findings are similar to recent time trends in other studies of MVPA levels. The nationally representative Youth Risk Behavior Surveillance Surveys from the USA found stable patterns in adolescents for moderate intensity PA from 1999 up to 2005.[12] Another study in the USA found a slight increase in MVPA between 2002 and 2006 among children aged 9–13 years.[13] In contrast, a recent study in the Czech Republic observed declining steps by day measured by pedometers and declining amounts of moderate-intensity PA between 1998 and 2010.[14] Overall, however, there is little evidence of sharp declines over time. In light of increasing car ownership leading to decreases in active transportation[15] and increasing opportunities for sedentary leisure activities,[16] these trends may be considered encouraging. Despite this, the overall levels of PA among adolescents are still low and, in line with many previous studies, decrease with age. Similar concerns over current levels of inactivity among children and adolescents were highlighted by a recent international report on child PA in 15 countries which found that the majority of participating countries scored low on indicators for PA.[17] This highlights a need for continued investment in PA promotion among this age group with a focus on strategies which enable young people to make better use of available community and environmental resources.

In the majority of HBSC countries, similar trends are observed for boys and girls. However, in 11 countries, (Austria, Croatia, Greenland, Israel, Netherlands, Norway, Poland, Portugal, Slovenia, Sweden and USA) diverging gender trends were observed, with more positive trends among boys. Additional analyses for the whole sample showed a significant interaction between year and gender whereby girls were slightly less likely to show an increase in MVPA over time (data not shown).

Findings from our study also show a variation by socioeconomic status (SES), as measured by FAS. Across all countries combined, children with higher FAS scores were more likely to meet the PA recommendations than children with low FAS scores. Despite the inconsistent use of SES and PA measures, other studies have also shown an association between SES and PA among adolescents, with those from higher SES backgrounds more likely to be physically active than those with lower SES.[18,19]

The strengths of the HBSC study include the size and international nature of the sample. The study is one of the few international adolescent health surveys to employ common measures and survey procedures internationally, facilitating the conduct of robust trend analyses. The limitations of the HBSC study include a repeated cross-sectional design. This in turn limits causal inferences. Measures are self-reported and may be susceptible to recall bias. Finally, the HBSC sampling strategy excluded adolescents in non-classroom settings, which may impact upon the external validity of our findings.

Conclusions

Across Europe and North America, a majority of adolescents do not meet PA recommendations. Despite efforts to promote PA among this age group, we observed only a small increase in the proportion of adolescents aged 11–15 years meeting the recommendations, from 2002 to 2010. Further investment at national and international levels is therefore necessary to increase PA participation among children and adolescents and reduce future health burden associated with inactivity. Further investigation of those HBSC countries showing an increase in PA may help identify effective strategies for PA promotion.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. The International Coordinator of the 2001/2002, 2005/2006 and 2009/2010 surveys was Prof. Candace Currie, University of St Andrews and the Data Bank Manager was Prof. Oddrun Samdal, University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The data collection for each HBSC survey is funded at the national level.

Funding

This work was supported by the research grant of Czech Science Foundation 'Trends in Overweight and Obesity, Physical Activity and Sedentary Behaviour among Czech Schoolchildren: HBSC Study between 2002 and 2014', Reg. No. GA14-02804S and by the Czech Ministry of Education, Youth and Sports (MEYS) under Contracts No. LG14042 and No. LG 14043.

Conflicts of interest: None declared.

Key points

- Between 2002 and 2010, there was a small overall increase in the proportion of adolescents meeting current PA guidelines in 32 countries across Europe and North America.
- At country level, a positive trend was observed among boys in 16 countries and among girls in 10 countries.
- The majority of adolescents in Europe and North America did not meet current PA recommendations.
- More actions are needed on a local, national and international level to improve PA levels among the adolescent population.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 41–45

doi:10.1093/eurpub/ckv025

International trends in electronic media communication among 11- to 15-year-olds in 30 countries from 2002 to 2010: association with ease of communication with friends of the opposite sex

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Background: Electronic media has become a central part of the lives of adolescents. Therefore, this study examines trends in adolescent electronic media communication (EMC) and its relationship with ease of communication with friends of the opposite sex, from 2002 to 10 in 30 European and North American regions. **Methods:** Data from the HBSC study were collected using self-report questionnaires from 11-, 13- and 15-year-old participants ($N = 404\,523$). **Results:** EMC use has grown over the years in most of these regions and increases with age. Even though Internet usage is often blamed for its negative effects on teenagers' social interactions in the physical world, in this study EMC was found to predict ease of communication with friends. Especially, the more they use EMC, the easier they find it to talk with friends of the opposite sex. Although these findings suggest that EMC reinforces communication, the interaction between year (2002–2006–2010) and EMC usage was not significant. **Conclusion:** This finding contradicts research that suggests that EMC contributes to loneliness and isolation, and supports other studies that present electronic media as a powerful tool for helping to connect people.

Introduction

Electronic media has become a central part of the lives of adolescents. They are intensive users of new technology. Thirty-one per cent of American teenagers aged 14–17 have a smartphone, with texting being the dominant daily mode of communication.[1] More than half (55%) of American youths aged 12–17 use online social networking; 48% of teenagers use it daily.[2] Technology facilitates bonding; research shows that Electronic Media Communication (EMC) reinforces existing relationships rather than exacerbating loneliness and isolation.[3,4]

Social relations are important for teenagers' health and well-being. Most health indicators are socially patterned in adolescence and track into adulthood.[5–8] During adolescence, teenagers are engaged in establishing their position with their peers. They need their peer group to learn and practice social skills, share information and talk about things that bother them. Furthermore, within their peer group, teenagers tend to pay more attention and show more interest in friends of the opposite sex.[6,9]

EMC helps adolescents foster their interpersonal communication and widen their friendships.[4,10] Therefore, it is important to investigate whether EMC can help adolescents talk with friends of the opposite sex about things that really bother them. In the 1990s, several studies suggested that EMC damages social connectedness,[11] while recent studies tend to report the opposite effect.[12] Thus, it is essential to explore adolescents' EMC use and its association with ease of communication with friends of the opposite sex over the years. Furthermore, only few studies have looked at region and age differences.[9] Technological development, such as broadband, telecommunications technology and smartphones, has progressively made the use of electronic media easier. However, this development occurs at different rates in different ages and regions due to economic, cultural and social reasons.

Consequently, this study's aims are to describe trends of EMC use in a cross-regional sample of 11-, 13- and 15-year-old participants; to investigate the relationship between EMC and ease of communication with the opposite sex; and to investigate whether the relationship between EMC and ease of communication with the opposite sex has changed over the years.

Methods

This study reports data from 30 European and North American regions in the 2002, 2006 and 2010 Health Behaviour in School-aged Children (HBSC) surveys; a standardized, cross-national study carried out in collaboration with the World Health Organization (WHO) Region for Europe.[13] Data were collected through a school-based survey using classroom administered self-completion questionnaires. Each national study included students in the relevant age groups (11-, 13- and 15-year-old participants) from a random sample of schools or school classes (a detailed description of the sampling procedure can be found in the International Report of the survey[14]). Following data cleansing, the final international file used for the study contained 404 523 students (49% boys; 33% 11-year-olds, 34% 13-year-olds, 33% 15-year-olds).

Measures

EMC per week

Frequency of EMC was measured by asking how often one talks to friend(s) on the phone, sends them text messages or has contact through the Internet. Responses were measured on a 5-point scale (1 = *never or rarely* to 5 = *every day*). Following Kuntsche et al.,[15]

a dichotomized variable was created with responses indicating '<than 5 days a week' recoded as 0, and '5 days or more per week' as 1.

Sociodemographic information

Participants reported their gender.

Access to computers

Access to computers was measured by asking participants the number of computers in their home. The answers were dichotomized into 0 'none' or 1 'one or more'.

Number of close friends

Number of close friends was measured by asking: 'At present, how many close friends do you have?' with separate responses for male and female friends (response categories 1 = *none*; 2 = *one*; 3 = *two*; 4 = *three or more*). Responses were included in the model matching participants' opposite sex.

Ease of communication with friends of opposite sex

Ease of communication with friends of opposite sex was measured by the following item: 'How easy is it for you to talk to friends from the opposite sex about things that really bother you?'. Response categories were: '*very easy*', '*easy*', '*difficult*' and '*very difficult*'. For the analyses, responses were dichotomized with responses indicating 'very difficult or difficult' recoded as 0, and 'very easy or easy' as 1.

Statistical analyses

Chi-square analyses were used to examine EMC by region, year and age group. Secondly, hierarchical logistic regression analyses were carried out including all the control variables and EMC, and interaction EMC by year. Then, for each region, hierarchical logistic regression analyses were used to investigate the relationship between EMC use and ease of communication with the opposite sex and the change over time. The following control variables were included: Year of survey, gender, age, the presence of a computer at home and the number of close friends of the same and opposite sex. Data were entered in three blocks. In the first block, the control variables were added. In the second, EMC was added and in the third, EMC by year. Analyses were conducted using SPSS 20.

Results

In 2010, across regions, almost 42% of 11-year-olds, about 62% of 13-year-olds and almost 73% of 15-year-olds communicated with their friends using electronic media 5 days or more a week (table 1). From 2002 to 2010, EMC increased significantly in most of the participating regions. Notable increases can be observed in

Table 1 EMC (5 days or more per week) in the years 2002, 2006 and 2010 (in %) according to age group and region

	11				13				15			
	2002	2006	2010	χ^2	2002	2006	2010	χ^2	2002	2006	2010	χ^2
Israel	45.3	53.1	46.2	23.59**	57.8	63.9	62.5	16.18**	63.0	72.1	72.8	42.99**
North America												
Canada	48.8	43.3	41.6	24.76**	60.3	59.8	60.3	0.49	60.8	66.0	71.4	60.2**
USA	38.7	32.2	36.2	11.49**	49.9	46.6	56.2	37.73**	56.8	58.4	69.5	70.23**
North Europe												
Denmark	29.0	59.9	59.0	419.41**	53.4	76.7	73.5	240.44**	66.2	81.8	79.5	107.82**
England	37.1	45.5	50.0	199.45**	48.7	57.4	65.2	54.44**	61.0	72.2	79.4	83.57**
Estonia	30.1	46.9	43.8	88.42**	38.9	56.5	56.1	116.14**	43.1	65.6	67.2	199.45**
Finland	38.5	47.0	53.9	97.48**	51.5	61.8	67.8	104.92**	58.0	69.5	73.4	105.47**
Ireland	26.9	43.4	43.3	81.09**	44.9	58.7	67.6	129.94**	58.0	64.0	73.9	73.49**
Latvia	21.0	44.4	40.8	171.51**	28.3	59.7	60.9	336.71**	33.0	67.3	70.4	419.51**
Lithuania	12.8	61.1	60.1	1,115.63**	19.5	73.7	74.5	1,471.48**	26.7	83.7	81.7	1,680.85**
Scotland	35.9	45.6	46.6	50.54**	56.8	65.3	70.6	72.91**	66.2	71.0	79.1	79.51**
Sweden	27.3	43.3	48.6	169.98**	45.6	61.4	74.1	274.92**	57.5	71.9	82.5	242.27**
Wales	42.7	45.5	44.7	2.13	50.9	59.0	64.5	58.45**	57.3	65.5	75.6	102.69**
Central & Eastern Europe												
Croatia	40.0	46.0	47.2	18.39**	55.8	60.5	58.7	7.39*	62.9	64.5	68.5	14.36**
Czech Republic	19.1	28.3	34.4	92.40**	36.6	52.6	60.1	179.41**	54.2	61.4	73.6	128.06**
Macedonia	32.0	28.8	37.4	21.78**	44.5	39.2	52.9	55.38**	53.5	45.7	66.7	150.00**
Poland	18.5	40.6	46.7	355.13**	28.9	61.4	61.9	536.52**	36.2	71.8	72.3	710.20**
Russia	54.8	60.9	60.1	22.70**	58.7	67.3	63.3	45.10**	60.4	71.1	69.6	76.29**
Ukraine	27.7	36.9	45.5	111.28**	35.0	45.7	55.6	132.68**	33.0	57.5	68.1	408.83**
South Europe												
Italy	30.5	34.5	35.5	9.36**	53.5	56.7	62.4	27.1**	61.1	65.2	78.1	104.39**
Portugal	18.2	29.4	41.5	149.68**	40.6	54.4	65.2	134.22**	53.3	65.8	77.6	147.24**
West Europe												
Austria	17.5	22.9	37.1	156.01**	36.2	45.7	63.2	245.39**	52.4	59.6	74.7	172.01**
Belgium (FL)[a]	17.2	25.4	33.7	129.48**	39.7	48.9	66.8	235.26**	57.3	63.5	79.8	159.66**
Belgium (FR)[b]	13.7	25.3	30.2	111.98**	30.6	45.9	56.0	190.40**	45.9	54.9	69.0	146.43**
France	6.0	22.6	29.5	470.54**	17.4	45.4	52.0	746.52**	31.6	60.7	70.1	746.29**
Germany	25.0	26.6	27.0	2.07	43.8	50.0	51.0	22.51**	56.2	59.1	63.6	19.25**
The Netherlands	12.1	26.5	17.1	97.4**	34.3	50.6	49.4	100.26**	47.1	67.8	68.2	162.10**
Switzerland	17.3	17.9	20.8	7.66*	42.5	50.1	53.2	45.10**	56.5	65.1	67.0	44.91**
Total	29.0	39.5	41.8	2,312.39**	42.8	56.7	61.5	3,656.14**	51.7	65.9	72.8	4,412.05**

a: Flemish Speaking Belgium.
b: French Speaking Belgium.
*$P < 05$.
**$P < 01$.

Table 2 Hierarchical logistic regression model for easy talk to opposite sex by region

Region	Variable	OR	CI for OR	
			Lower	Upper
ALL	2002	–	–	–
	2006	0.96**	0.93	0.98
	2010	0.98	0.95	1.00
	Female	–	–	–
	Male	1.58**	1.56	1.61
	11-year-old	–	–	–
	13-year-old	1.34**	1.32	1.37
	15-year-old	2.24**	2.20	2.29
	No computers	–	–	–
	One or more computers	1.03**	1.01	1.06
	Number friends opposite sex	0.85**	0.84	0.86
	EMC[a]	1.68**	1.63	1.72
	EMC by 2002	–	–	–
	EMC by 2006	0.95**	0.92	0.99
	EMC by 2010	0.98	0.94	1.02
Israel	EMC	1.43**	1.25	1.64
	EMC by 2002	–	–	–
	EMC by 2006	1.07	0.88	1.30
	EMC by 2010	1.11	0.90	1.35
North America				
USA	EMC	1.88**	1.65	2.14
	EMC by 2002	–	–	–
	EMC by 2006	1.05	0.86	1.28
	EMC by 2010	0.93	0.78	1.11
Canada	EMC	1.77**	1.53	2.03
	EMC by 2002	–	–	–
	EMC by 2006	1.06	0.87	1.27
	EMC by 2010	1.00	0.85	1.18
North Europe				
Denmark	EMC	1.41**	1.22	1.63
	EMC by 2002	–	–	–
	EMC by 2006	1.31**	1.07	1.61
	EMC by 2010	1.11	0.89	1.38
England	EMC	1.82**	1.61	2.06
	EMC by 2002	–	–	–
	EMC by 2006	1.08	0.89	1.30
	EMC by 2010	1.05	0.85	1.29
Estonia	EMC	1.33**	1.15	1.54
	EMC by 2002	–	–	–
	EMC by 2006	1.12	0.92	1.37
	EMC by 2010	1.03	0.84	1.26
Finland	EMC	1.49**	1.30	1.71
	EMC by 2002	–	–	–
	EMC by 2006	0.90	0.74	1.09
	EMC by 2010	0.99	0.82	1.19
Ireland	EMC	1.65**	1.38	1.97
	EMC by 2002	–	–	–
	EMC by 2006	0.92	0.74	1.15
	EMC by 2010	1.17	0.93	1.48
Latvia	EMC	1.71**	1.42	2.07
	EMC by 2002	–	–	–
	EMC by 2006	1.05	0.83	1.34
	EMC by 2010	0.98	0.77	1.24
Lithuania	EMC	2.12**	1.83	2.46
	EMC by 2002	–	–	–
	EMC by 2006	0.63**	0.51	0.78
	EMC by 2010	0.64**	0.52	0.79
Scotland	EMC	1.89**	1.64	2.19
	EMC by 2002	–	–	–
	EMC by 2006	0.86	0.71	1.04
	EMC by 2010	0.99	0.81	1.20
Sweden	EMC	1.78**	1.53	2.07
	EMC by 2002	–	–	–
	EMC by 2006	0.85	0.69	1.05
	EMC by 2010	0.85	0.70	1.03
Wales	EMC	1.78**	1.54	2.06
	EMC by 2002	–	–	–
	EMC by 2006	0.89	0.73	1.09
	EMC by 2010	0.93	0.76	1.13
Central & Eastern Europe				
Croatia	EMC	1.33**	1.16	1.53
	EMC by 2002	–	–	–
	EMC by 2006	1.26*	1.04	1.52
	EMC by 2010	1.17*	0.98	1.40
Czech Republic	EMC	1.72**	1.50	1.98
	EMC by 2002	–	–	–
	EMC by 2006	0.89	0.74	1.08
	EMC by 2010	0.91	0.75	1.10
Macedonia	EMC	1.32**	1.14	1.53
	EMC by 2002	–	–	–
	EMC by 2006	1.23*	1.01	1.49
	EMC by 2010	1.32**	1.06	1.64
Poland	EMC	1.87**	1.62	2.15
	EMC by 2002	–	–	–
	EMC by 2006	0.86	0.71	1.04
	EMC by 2010	0.84	0.69	1.03
Russia	EMC	1.42**	1.28	1.57
	EMC by 2002	–	–	–
	EMC by 2006	0.96	0.82	1.11
	EMC by 2010	0.94	0.79	1.12
Ukraine	EMC	1.38**	1.18	1.63
	EMC by 2002	–	–	–
	EMC by 2006	1.18	0.96	1.47
	EMC by 2010	1.03	0.84	1.27
South Europe				
Italy	EMC	1.83**	1.59	2.10
	EMC by 2002	–	–	–
	EMC by 2006	0.93	0.77	1.14
	EMC by 2010	0.95	0.79	1.15
Portugal	EMC	1.72**	1.41	2.10
	EMC by 2002	–	–	–
	EMC by 2006	1.08	0.85	1.38
	EMC by 2010	1.16	0.91	1.49
West Europe				
Austria	EMC	2.14**	1.81	2.54
	EMC by 2002	–	–	–
	EMC by 2006	0.98	0.78	1.22
	EMC by 2010	0.87	0.70	1.09
Flemish-speaking Belgium (FL)	EMC	1.76**	1.56	1.99
	EMC by 2002	–	–	–
	EMC by 2006	1.04	0.86	1.25
	EMC by 2010	0.85	0.70	1.03
French-speaking Belgium (FR)	EMC	1.52**	1.29	1.78
	EMC by 2002	–	–	–
	EMC by 2006	1.04	0.83	1.29
	EMC by 2010	1.17	0.93	1.46
France	EMC	1.66**	1.44	1.92
	EMC by 2002	–	–	–
	EMC by 2006	0.99	0.83	1.19
	EMC by 2010	1.26**	1.05	1.51
Germany	EMC	1.83**	1.60	2.10
	EMC by 2002	–	–	–
	EMC by 2006	0.82*	0.69	0.98
	EMC by 2010	1.08	0.90	1.31
The Netherlands	EMC	1.5**	1.25	1.78
	EMC by 2002	–	–	–
	EMC by 2006	1.12	0.89	1.41
	EMC by 2010	1.12	0.88	1.41
Switzerland	EMC	2.25**	1.94	2.60
	EMC by 2002	–	–	–
	EMC by 2006	0.76**	0.63	0.93
	EMC by 2010	0.82*	0.68	0.99

a: EMC, electronic media communication.
b: First block introduced: year of survey, gender, age category, presence of computer at home, number of close friends of the same sex, number of close friends of the opposite sex (Nagelkerke R^2 ranged from 0.06 to 0.22). Second block introduced: EMC (Nagelkerke R^2 ranged from 0.07 to 0.23). Third block introduced: EMC by Year (Nagelkerke R^2 ranged from 0.07 to 0.23).
c: For ALL (all regions combined), the ORs for the full model have been presented, for individual regions only the ORs for the variable EMC and its interaction with survey year have been presented.
d: OR for the predictors varied differently between countries were year of survey ranged from 0.42 to 1.44, gender 0.96–1.97 age category 0.91–3.21, presence of computer at home 0.78–1.43, number of close friends of the same sex 0.76–1.17, number of close friends of the opposite sex 1.35–1.84.
e: Only the predictors of EMC and the interaction for EMC by year, under the third block as presented.
*$P < 0.05$.
**$P < 0.01$.

Western European regions between 2002, 06 and 10. Similar trends were reported in Southern Europe and in some Central and Eastern European regions. Some Northern European regions showed increase mostly between 2002 and 06.

In spite of the general growth of EMC within the regions, mixed trends were observed in some regions, for example, in Canada. No significant change across years and with age was found for Wales (at age 11), Germany (at age 11) and Canada (at age 13).

In the general model, hierarchical logistic regression analyses were carried out for all regions together, including all the control variables and EMC, and the EMC interaction by year (see table 2: ALL). With respect to the association between EMC and ease of communication with friends, across all regions, the higher the frequency of EMC, the easier the communication with friends of the opposite sex.

Communication with the opposite sex was shown to be significantly easier in 2006 compared with 2002, if you were: older, had a computer in the house, had more friends of the opposite sex and made use of EMC. Finally, although the predictor EMC by year overall was not found to be significant ($P = 0.06$); however, the interaction did show a significant OR (0.96) for 2006 compared with 2002.

Furthermore, the same model was applied for each region (table 2). While EMC is positively associated with ease of communication with friends of the opposite sex in all of the regions, in 23 regions (out of 30) the interaction with year was not significant. The only seven regions with significant interaction between EMC and year (compared with 2002) were Lithuania, Croatia, Macedonia, Switzerland, Denmark, Germany and France.

Discussion

The first aim of this study was to describe the trends of EMC in a cross-regional sample of 11-, 13- and 15-year-olds. Findings indicate that EMC is widely used among adolescents in European and North American regions. EMC is more frequently used among 15-year-olds than 11-year-olds. Growth in EMC between 2002 and 10 was observed in the majority of regions included in the study as can be seen in previous research.[16,17] With the appearance of smartphones and the growing popularity of social virtual networks,[18] it is understandable that the use of EMC is increased.

The second aim of the study was to investigate the relationship between EMC and ease of communication with friends of the opposite sex. It was found that the more teenagers use EMC, the easier it is for them to talk to friends of the opposite sex. This finding is supported by other studies showing that EMC helps teenagers to develop better social skills, which in turn helps them to expand and strengthen their peer group.[18] It has been suggested that the lack of eye contact and possible invisibility, that characterize EMC, help teenagers to communicate more freely about personal issues.[19]

The third aim of this study was to investigate whether the interaction between EMC and the ease of communication with the opposite sex had changed over the years (2002–10). The general model showed no influence of year on the interaction between EMC and ease of communication with friends of the opposite sex, except for the years 2002–06. The analysis that investigated each region suggested only seven regions (out of 30) with significant influence of year on the interaction between EMC and ease of communication. It is possible that the emergence of social networks during that period (e.g. Facebook in 2004) influenced the association between EMC and ease of communication with friends of the opposite sex.

Findings presented in this article must be considered in the context of the study's general strengths and limitations, which are discussed elsewhere in this supplement. A specific limitation of this study is that the EMC measure combines various forms of EMC hence the unique contribution of individual types of EMC cannot be explored. Further research should elaborate on the forms of EMC and test each one individually. Nevertheless, the results suggest no influence of year on the interaction between EMC and ease of communication with friends of the opposite sex. Meaning that, despite the growth in EMC, communication with friends appears to remain stable over the years with no apparent negative influence of EMC. This finding contradicts research that suggests that EMC contributes to loneliness and isolation[20] and supports other studies that present electronic media as a powerful tool for helping people to connect.[4,15]

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. The international coordinator of the study was Candace Currie, University of St Andrews, Scotland; and the data bank manager was Oddrun Samdal, University of Bergen, Norway. A complete list of participating countries can be found on the HBSC website (www.hbsc.org). The data collection for each HBSC survey is funded at the national level.

Conflicts of interest: None declared.

Key points

- Adolescent EMC has grown over the years and increases with age.
- Adolescent who use EMC more frequently finds it easier to talk with friends of the opposite sex.
- This study indicates that Electronic Media can be a powerful tool for helping adolescents to connect.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 46–50

doi:10.1093/eurpub/ckv034

Trends in adolescents' perceived parental communication across 32 countries in Europe and North America from 2002 to 2010

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Background: The quality of communication with parents is a determinant of health and well-being during adolescence, being predictive of self-esteem, self-rated health and the ability to navigate health risk behaviours. **Methods:** This article describes trends in adolescent's (aged 11, 13 and 15 years) perception of communication with mothers and fathers by gender across 32 European and North American countries from 2002 to 2010. Analyses were performed on 425 699 records employing a General Linear Model (MANOVA). **Results:** In most countries, significant increases in the prevalence of ease of communication with both mothers and fathers were observed, with the greatest positive changes over time in Estonia, Denmark and Wales. In some countries, the opposite trend was found with the greatest negative changes occurring in France, Slovenia and Poland. Across the pooled dataset, a significant positive trend was observed for ease of communication with father, for both boys and girls and for ease of communication with mother for boys only. **Conclusion:** The temporal trends demonstrated an increase in a positive health asset for many young people, that of family communication. Positive trends may be a feature of the economic boom over the past decade coupled with cultural changes in attitudes to parenting, especially fathering.

Introduction

Adolescence is often conceptualized as a developmental phase, whereby the young person transitions from the guardianship of parents towards independent adulthood. The quality of communication with parents during adolescence remains a strong determinant of health and well-being, being predictive of adolescents' self-esteem, well-being, self-rated health and ability to navigate health risk behaviours. Evidence from predominantly cross-sectional studies indicates that adolescents who report easy communication with their mothers are more likely to report excellent or high-rated health, and are less likely to be current smokers or frequent alcohol drinkers.[1,2] Moreover, finding it easy to talk with their mother or father about things that bother them, acts as a protective factor for adolescents' mental well-being and a strong predictor of resilience.[3,4]

European studies suggest that the quality of parent–adolescent relationships is determined by different factors: individual (such as age and gender) and external (cultural and socio-economic),[5,6] including at the national level differing social and family welfare policies.[6] Consideration of international trends in adolescents' communication with their parents offers an opportunity to begin to explore the relationship between changes in family lifestyle and socioeconomic contexts and other trends in adolescent health and well-being. An advantage of using the Health Behaviour in School-aged Children (HBSC) analyses is that the same instrument is used for measuring the quality of parent communication in all countries over three survey rounds.

The aim of the article is to describe trends in adolescent's perception of communication with mothers and fathers by gender among young people in early-to-mid adolescence across 32 European and North American countries for the first decade of the 21st century.

Methods

Data were drawn from the cross-national HBSC study, collected during the 2001–02, 2005–06 and 2009–10 school-years. A total of 425 699 young people, aged 11, 13 and 15 years, from 32 countries/regions reported on their perceptions of the quality of communication with both father and mother. The survey question explored young people's perceptions of how easy it was to talk to their mother or father about the issues that were of importance to them. Individual outcomes, reported quality of communication with father and mother were dichotomized into two categories: easy and difficult. The analyses were performed separately for boys and girls for the pooled dataset and separately for 32 countries, employing General Linear Model (a procedure MANOVA) from SPSS (version 21, 2012, IBM Corp., NY). Paired Bonferroni test was used to describe changes in quality of communication of Adolescents' with their parents from 2002 to 2010, controlling for age and family affluence. The pooled analyses used country weighting to control for the different size samples.

Results

Significant positive trends in prevalence of ease of communication with both parents were found in the vast majority of countries (figure 1), these consistent positive trends were identified across all ages (not reported in this article). However, significant differences

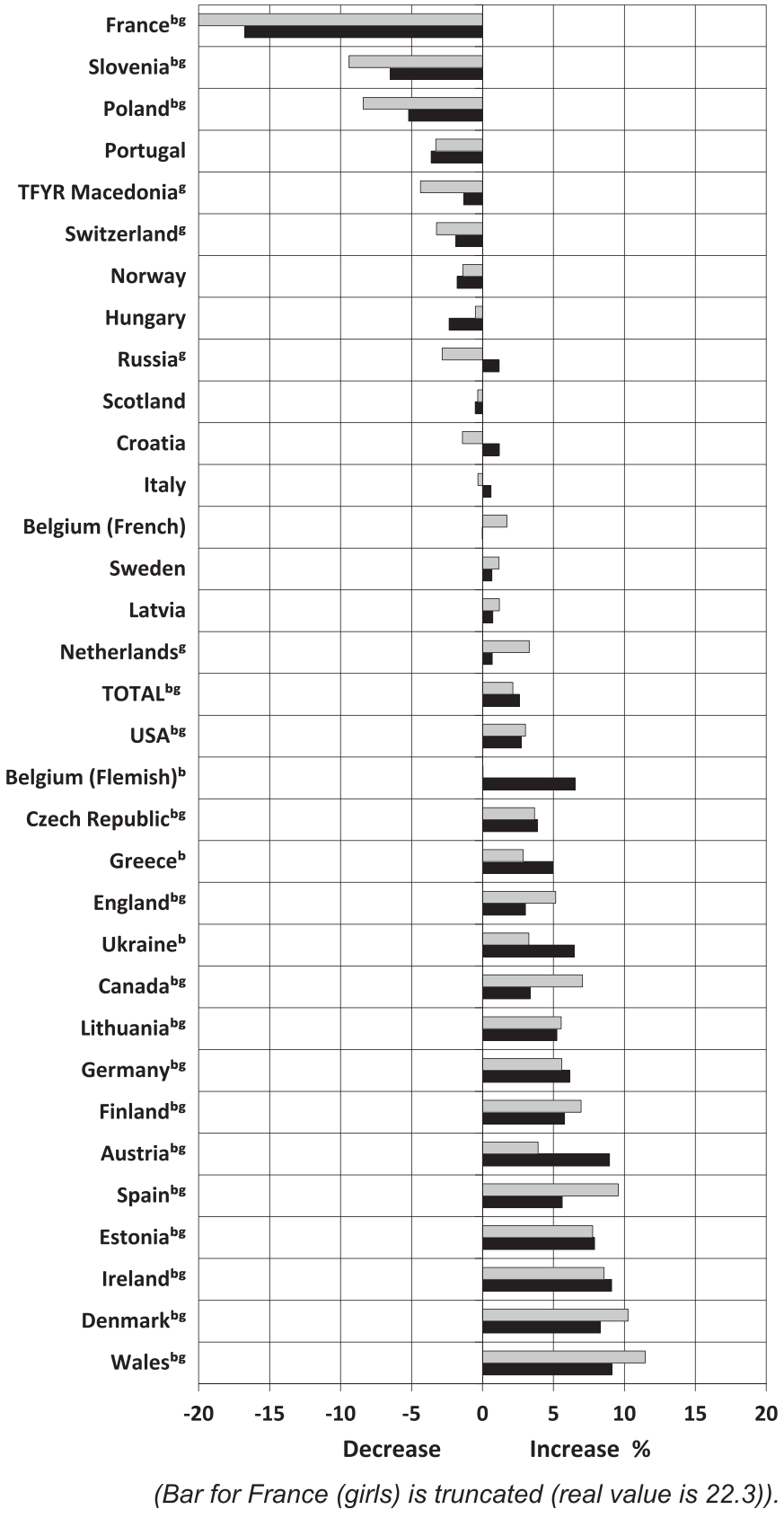

Figure 1 Change in the ease of communication between 2001–02 and 2009–10, by country

(continued)

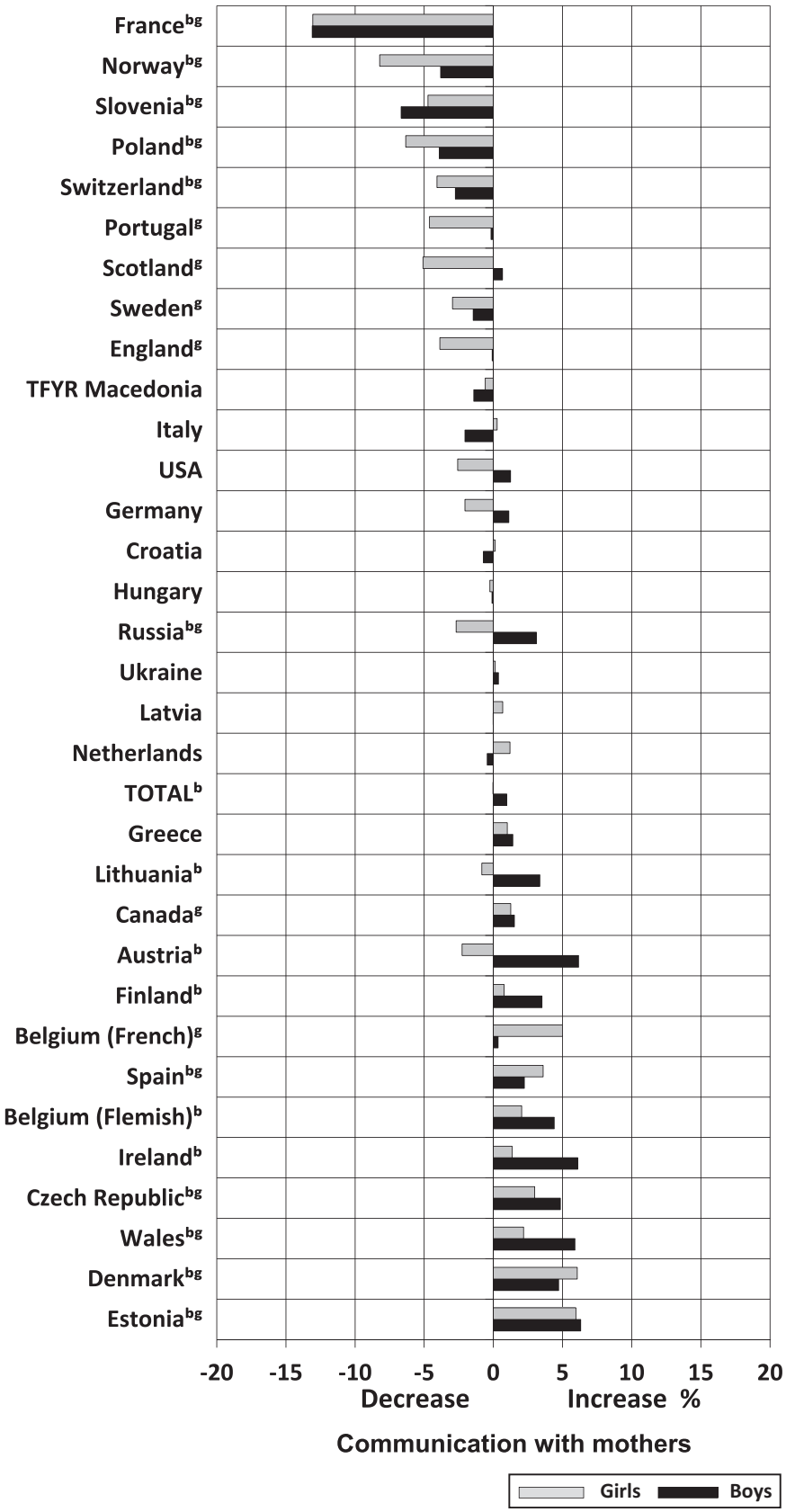

Figure 1 Continued

Table 1 Proportions and changes over time (% and CI) in quality of communication with parents for boys and girls[a]

	2001–02		2005–06		2009–10		Absolute change over study period[b]	
		(95% CI)		(95% CI)		(95% CI)		(95% CI) *P* value
Boys								
Easy to talk to father	72.10	(71.76 to 72.44)	73.82	(73.48 to 74.16)	74.71	(74.36 to 75.06)	2.61	(2.03 to 3.19) $P<0.001$
Easy to talk to mother	82.77	(82.49 to 83.06)	83.62	(83.34 to 83.91)	83.73	(83.43 to 84.03)	0.96	(0.47 to 1.45) $P<0.001$
Easy to talk to both parents	66.56	(66.20 to 66.91)	68.44	(68.08 to 68.79)	69.40	(69.03 to 69.77)	2.84	(2.23 to 3.46) $P<0.001$
Difficult to talk to mother only	5.54	(5.37 to 5.72)	5.38	(5.21 to 5.55)	5.31	(5.12 to 5.49)	−0.23	(−0.54 to 0.06) $P=0.176$
Difficult to talk to father only	16.21	(15.94 to 16.49)	15.18	(14.91 to 15.46)	14.33	(14.04 to 14.62)	−1.88	(−2.36 to −1.41) $P<0.001$
Difficult to talk to both parents	11.69	(11.44 to 11.93)	11.00	(10.75 to 11.24)	10.96	(10.71 to 11.22)	−0.73	(−1.14 to −0.31) $P<0.001$
Girls								
Easy to talk to father	55.44	(55.07 to 55.80)	56.93	(56.57 to 57.30)	57.58	(57.20 to 57.96)	2.15	(1.51 to 2.78) $P<0.001$
Easy to talk to mother	83.07	(82.79 to 83.34)	83.02	(82.74 to 83.30)	83.04	(82.75 to 83.33)	−0.03	(−0.52 to 0.46) $P=0.998$
Easy to talk to both parents	52.08	(51.71 to 52.45)	53.42	(53.05 to 53.79)	54.03	(53.65 to 54.41)	1.95	(1.31 to 2.59) $P<0.001$
Difficult to talk to mother only	3.36	(3.22 to 3.49)	3.51	(3.37 to 3.65)	3.55	(3.41 to 3.70)	0.19	(−0.04 to 0.44) $P=0.149$
Difficult to talk to father only	30.99	(30.65 to 31.33)	29.60	(29.26 to 29.94)	29.01	(28.65 to 29.36)	−1.98	(−2.57 to −1.39) $P<0.001$
Difficult to talk to both parents	13.58	(13.32 to 13.83)	13.46	(13.21 to 13.72)	13.41	(13.14 to 13.68)	−0.17	(−0.61 to 0.28) $P=0.998$

[a]Estimated marginal means using MANOVA procedure (adjusted by age and family affluence), pooled data of 32 countries, data weighted by countries.
[b]Based on estimated marginal means using Bonferroni test.

in adolescent–parent communication trends were found both between countries and genders. In most countries, significant increases in the prevalence of ease of communication with both mothers and fathers were observed, with the greatest positive changes over time in Estonia, Denmark and Wales. However in a minority of countries, the opposite trend was found with the greatest negative changes occurring in France, Slovenia and Poland.

Across the pooled dataset, a significant positive trend was observed for ease of communication with father, for both boys and girls and for ease of communication with mother for boys only. Communication difficulties between boys and their mothers reduced across surveys, but communication difficulties between girls and their mothers remained almost unchanged (table 1). In all surveys, the proportion of young people reporting ease of communication with their mother was higher than the proportion reporting ease of communication with their fathers and proportions reporting ease of communication with fathers was higher for boys than for girls.

Discussion

This study of young people in early-to-mid adolescence identified that across the majority of European countries and North America, there is a significant positive trend in terms of an increase in prevalence of ease of communication with parents over the past decade.

Positive family communication has been identified as an important protective health asset for young people, related to an increase of thriving behaviours and to a decrease in participation in health risk behaviours.[7] Consequently, the trends reported here may indicate an important contributory factor to positive improvements in the health and well-being of young people.

Generally, the identified increase in prevalence of ease of communication can be attributed to young people reporting a distinctive positive shift in the character of fathers' interaction with their adolescent offspring. This is a significant change as ease of communication with fathers has been suggested to have a particularly protective role on the health and well-being of young people in unique ways from mothers, and is associated with positive emotional well-being, less aggressive behaviour in boys and good body image among girls.[8–10]

Accounting for why such changes in reported experiences of communication with fathers has occurred is likely to be a reflection of complex interactions between shifts in domestic gender roles changes in the construction of masculine identities and social policies, including increased recognition of the importance of fathers' role in child development.[11] There is some evidence to support a shift in patterns of parent and child interaction away from gendered, stereotypical parental roles such as authoritarian decision-making roles for fathers and caregiving roles for mothers, towards shared care giving. Moreover, this shift in parenting values appears to foster democratic approaches to communication that develop autonomy and develop mutual respect between the child and parent rather than value obedience.[12]

There are notable differences remaining between countries in terms of the proportion of young people within countries reporting easy communication with their parents. The biggest positive changes were identified in Estonia, Denmark and Wales. The biggest decrease in perceived quality of communication, (with both parents) was reported by young people in Slovenia, France and Poland. The reconciliation of work and family life has been recognized as a key 'happiness' factor in determining what families have to say about their quality of their lives.[13,14] Those countries where individuals are purported to feel they have a good balance between work and family life[13,14] are also those countries identified in this study as having a more positive perception of parental communication (e.g. Denmark 24%; Estonia 31%). Moreover, those young people perceiving the lowest levels of ease of communication with their parents coincide with countries that have been identified as having a poorer self-reported perception of family life-work balance, for example, France 19% (workers personally satisfied with work life balance) and Slovenia 18%.[13,14]

In Poland, however citizens do tend to report a more positive perception of 'life–work balance' (27%). However one dimension of work–life balance that may relate to family interaction, *strain-based conflict* (proportion of workers having difficulties in fulfilling family responsibilities due to the intensity and time allocated to paid work) is in Poland well above the EU average (62 vs. 50%). A situation that has intensified over the past decade with large scale parental economic migration, resulting in the temporary separation of Polish families.[15] Overall, understanding the dimensions of work life balance that might be reflected in trends in family communication may aid in conceptualizing the impact work–life balance has on family life.

Further work is needed to account for the decline in ease of communication in France over the past decade, especially against trends towards increased ease in communication. There is some evidence to suggest that young people in France experience lower levels of

parental supervision and have weaker emotional bonds with their parents than is the norm for young people in other European and North American countries.[16] However, comparative analysis is required to identify how young people interpret their parenting experiences and if they have an awareness of cultural differences in family life.

Additional consideration is also needed to explain the gendered character of the trends described in this article, it is currently unclear why in contrast to the findings for fathers, positive increases in communication prevalence with mothers were found only for boys.

Conclusion

The temporal trends reported on in this article demonstrated an increase in a positive health asset for many young people, that of family communication. This was especially notable in relation to the quality of communication between adolescents' and their fathers suggesting that a qualitative change in the nature of fathering and interaction with their children during adolescence has occurred over the last decade.

Further work is needed to examine if economic conditions are a barometer for the quality of family communication and how they interact with socioeconomic and cultural changes, such as parental migration or changes in cultural attitudes concerning effective parenting.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. The international coordinator was Professor Candace Currie, University of St. Andrews, and the databank manager was Professor Oddrun Samdal, University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). We acknowledge and thank the following funders: The Department of Health, England, Ministry of Science and Higher Education, Poland, The Netherlands Institute for Social Research (SCP), The Ministry of Health, Social Policy and Equality, Spain, The Lithuanian University of Health Sciences. HBSC teams owe a great debt of thanks to the schools and young people who take part in the survey.

Funding

The data collection for each HBSC survey is funded at the national level.

Conflicts of interest: None declared.

Key points

- Over the past decade, across the majority of European countries and North America, there is a significant positive trend in terms of an increase in prevalence of ease of communication with parents.
- A distinctive positive shift in the character of fathers' interaction with their adolescent offspring was identified. Suggesting possible changes in the role of fathers in childrearing and potentially an increased understanding of the contribution of fathers to child development.
- The promotion of thriving behaviours is a key issue for public health policy across Europe. This article highlights the importance of considering the quality of family communication as a health asset that can contribute to thriving among young people.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 51–56

doi:10.1093/eurpub/ckv027

Cross-national trends in perceived school pressure by gender and age from 1994 to 2010

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Background: Pressure within school can be a critical component in understanding how the school experience influences young people's intellectual development, physical and mental health and future educational decisions. **Methods:** Data from five survey rounds (1993/1994, 1997/1998, 2001/2002, 2005/2006 and 2009/2010) were used to examine time-, age- and gender-related trends in the amounts of reported school pressure among 11-, 13- and 15-year-olds, in five different regions (North America, Great Britain, Eastern Europe, Nordic and Germanic countries). **Results:** Across the regions the reported perceptions of school pressure did not change between 1994 and 2010, despite a temporary increase in 2002 and 2006. With the exception of children at 11 years of age, girls reported higher levels of school pressure than boys (Cohen's *d* from 0.12 to 0.58) and school pressure was higher in older age groups. These findings were consistent across countries. Regionally, children in North America reported the highest levels of school pressure, and students in the Germanic countries the lowest. **Conclusion:** Factors associated with child development and differences in societal expectations and structures, along with the possible, albeit, differential impact of the Programme for International Student Assessment (PISA), may partially explain the differences and trends found in school pressure. School pressure increases alongside the onset of adolescence and the shift from elementary school to the higher demanding expectations of secondary education. Time-related increases in school pressure occurred in the years following the release of the PISA results, and were larger in those regions in which results were less positive.

Introduction

Children and youth spend a large portion of their waking time at school. As such, schools provide a 'critical context in shaping children's self-esteem, self-efficacy and sense of control over their lives' (p. 27).[1] Children's and adolescents' experiences at school influence their intellectual development, physical and mental health and future educational decisions.[2–5] Pressure within school can be a critical component in understanding how the school experience is related to these factors in young people's lives.

School pressure is a complicated but very real issue that affects many children in varying degrees and at different times throughout the course of their education.[6–8] Perceptions of school pressure are related to the current context in which it is experienced and to historical structures and events that help create the educational system children encounter. As children move through the educational system, they are subjected to greater academic demands and expectations. These rising expectations can result in increased pressure to succeed in school, with the potential to have either positive or negative impacts on young peoples' learning, health and emotional well-being.[6,9–11] Excessive pressure or stress may negatively impact students' academic performance and continued schooling, as well as their physical health, emotional well-being and health-related behaviours.[12–15]

From a historical perspective, economic shifts and trends have resulted in educational structures that are subjected to more competitive and pluralized post-secondary admissions processes with work opportunities for young people appearing to decline.[16] The past 20 years have also witnessed an increasing focus on accountability in public education, with a desire to demonstrate that current educational policies and practices are helping children develop the knowledge, skills and abilities to be productive members of rapidly changing societies. Initiatives such as the Programme for International Student Assessment (PISA), which was first administered in 2000, attempt to provide a 'global' method of comparison to determine which countries and regions appear to be best supporting the education of their children.[17–19] PISA results created significant debates across countries, especially those with relatively poor performance.[20–22] Educational accountability, already a topic of concern,[23] became a lightning rod, resulting in country shifts in educational policy and increased demands on teachers and schools to demonstrate that educators were making progress in their efforts to meet students' needs.[21,22] These internal country-wide accountability models, coupled with the international comparisons brought about by assessments such as PISA, might well result in increasing accountability demands and thus increase pressure by educators towards students in an attempt to make students perform better.

With heightened demands and expectations to perform well in school, school pressure is expected to be rising internationally across most, if not all, countries. The Health Behaviour in School-aged Children (HBSC) study provides an important mechanism to explore shifts in school pressure that children feel as they transition through adolescence. The repeated cross-sectional data collection across different ages of children and youth can be used to determine the extent to which students' perceptions of school pressure differ by age and gender, and if there exist systematic trends in perceived school pressure, both generally and differentiated across countries and regions. These differences can then be used to link our observations of children's perceptions about school pressure to either their personal (e.g., gender and age regardless of country)

or environmental contexts (e.g., school accountability, school structure), differentiated between the current educational environment (variance across countries) and historical educational structures (variance across time within and across countries). Our analyses were supported through a strategic selection of HBSC countries, covering five regions of Europe and North America, to understand those patterns in school pressure that we identified.

Two main research purposes guided our analyses of trends in students' perceptions of school pressure:

(i) To estimate the overall differences in the levels and trends of perceived school pressure experienced by boys and girls of different ages;
(ii) To describe trends in school pressure across countries and regions.

The results are interpreted through an ecological approach focusing on developmental issues at the personal level and on contextual differences across the included HBSC countries related to educational system, economic and political systems, geographical region and PISA performance. These structural national-level indicators may support our understanding of the observed differences and trends in perceived school pressure.

Methods

As a multinational survey of youth, the HBSC is used to obtain the perceptions, feelings and behaviours of adolescents at three critical ages, 11, 13 and 15. The surveys enable examination of the physical and mental health of children across adolescence. The HBSC provides a mechanism to explore relationships amongst children's health and their social, home and school contexts. Our primary data came from 18 countries participating in the previous five survey administrations. Our analyses focused on children's perceptions of school pressure. The 11-, 13- and 15-year-olds responded to the item: 'How pressured do you feel by the schoolwork you have to do?' Using one of four options (1 = not at all; 2 = a little; 3 = some; and 4 = a lot). Our analyses assumed these four options operated as an ordinal scale. We created a dichotomous scale (options 1 and 2 equalling zero; options 3 and 4 equalling one). The applied measure of student perceived school pressure is well functioning and has been qualitatively validated in several countries and included in other validated subscales measuring school pressure.[24]

Our analyses focused on differences and trends associated with age, gender and time. In addition to overall trends, we were interested in trends by regions characterized by countries with similarities in educational systems: North America (Canada, USA), Great Britain (England, Ireland, Scotland, Wales), Nordic countries (Denmark, Finland, Greenland, Norway, Sweden), Eastern European countries (Czech Republic, Estonia, Latvia, Poland, Russia) and Germanic countries (Germany, Austria) as well as by countries within regions. Countries were chosen based on having at least four HBSC cycles of continuous data on perceived school pressure. Countries within each region tend to have similar education systems. Of potential value to our analyses of school pressure trends, countries and regions have demonstrated differences in PISA rankings.[17–19]

Due to large samples for analyses and fluctuations in sampling, standard errors for each comparison group were used to calculate 99% CIs, and determine if proportions differed significantly across age, gender and region. Effect sizes were calculated (Cohen's d using pooled standard deviations) when significant differences were found.

Results

Trends in school pressure were examined in several ways to explore changes that occurred in adolescents' perceptions of school pressure related to their gender and age. Other than Greenland and Estonia (1998), each country had a minimum sample of 2500 students (mean yearly country sample size = 4700). Figure 1 uses the full sample of the HBSC data (non-weighted) to compare the trends for 11-, 13- and 15-year-old boys and girls at five time points. Since 1998, sample sizes were all above 11 000 for each of the six gender-age combinations (1998 sample was just under 10 000 per combination) with the mean sample size being 12 700. The y-axis represents the proportion of students who responded that they felt 'some' or 'a lot' of school pressure. There are consistent gender and age differences over time; 15-year-old girls reported greater levels of school pressure than their male peers ($P < 0.01$, Cohen's d from 0.12 to 0.18), with 15-year-old girls reporting the greatest school pressure of all groups ($P < 0.01$, Cohen's d from 0.12 to 0.58). In contrast,

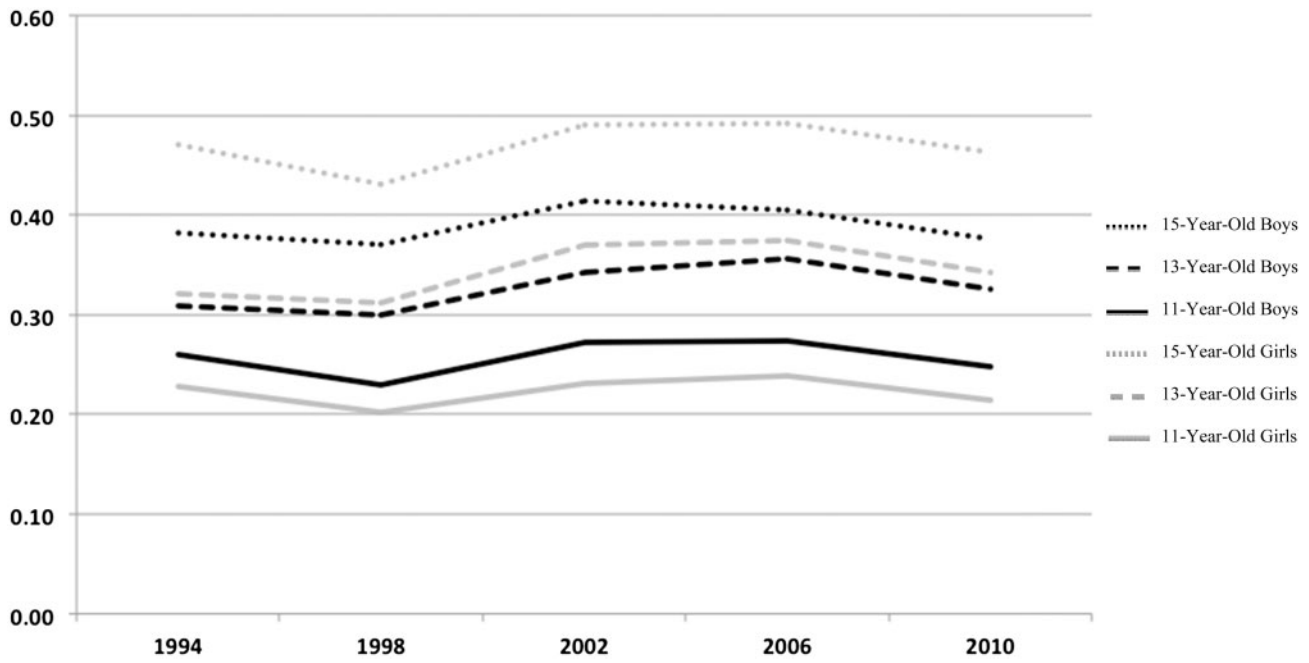

Figure 1 The proportion of 11-, 13- and 15-year old boys and girls reporting 'some' or 'a lot' of school pressure

11-year-old girls reported less school pressure than 11-year-old boys ($P < 0.01$), although effect sizes were small across years (Cohen's $d < 0.10$). Although differences existed with respect to the actual level of proportions by gender and age, the overall patterns in perceived school pressure over time were the same. Further, the overall proportion of students who reported feelings of school pressure did not change; the levels of perceived school pressure reported in 1998 were similar to those reported in 2010 across all gender and age groups (see figure 1). Nevertheless, the amount of school pressure has not been constant, as there was a significant ($P < 0.01$), albeit small, upward shift (Cohen's $d < 0.15$) in overall perceived school pressure in 2002 and 2006 for both genders across age groups.

Our next set of analyses focused on the five identified regions and countries within these regions (see table 1 and figure 2), combining gender and age for each region. For these analyses, the average proportion of students reporting 'some' or 'a lot' of school pressure was calculated across the countries within each region, with each country and age group contributing equally to the (non-weighted) average, preventing one country having more influence on the determination of the average proportion. With few exceptions, the differences between regions were significant (see figure 2). North American youth were consistently more likely to report higher levels of school pressure (with the highest prevalence level of 48% observed in 1998; $P < 0.01$ compared with all other regions, with the exception of Great Britain in 2002); effect sizes ranged from small (0.04) to moderately large (0.68). Similarly, students in Great Britain reported higher levels of school pressure compared with all the remaining regions (since 1998; $P < 0.01$, Cohen's d ranging from 0.04 to 0.44). In contrast, children in Germanic countries were least likely to report feelings of school pressure (with the lowest prevalence level of 18% observed in 1998; $P < 0.01$ compared with all other regions).

Table 1 Regional trends in the proportion of children reporting 'some' or 'a lot' of pressure over time

	1994	1998	2002	2006	2010
North America					
Canada	0.42	0.46	0.40	0.42	0.42
USA		0.49	0.44	0.48	0.40
Average	0.42	0.48	0.42	0.46	0.42
Great Britain					
England		0.38	0.47	0.51	0.43
Ireland		0.32	0.35	0.38	0.37
Scotland	0.30	0.31	0.37	0.29	0.34
Wales	0.33	0.34	0.47	0.45	0.38
Average	0.31	0.33	0.41	0.41	0.38
Eastern European countries					
Czech Republic	0.56	0.39	0.27	0.34	0.32
Estonia	0.41	0.41	0.48	0.39	0.35
Latvia	0.32	0.23	0.31	0.30	0.22
Poland	0.35	0.35	0.49	0.50	0.22
Russia	0.16	0.10	0.31	0.32	0.31
Average	0.36	0.30	0.37	0.38	0.28
Nordic countries					
Denmark	0.18	0.18	0.24	0.30	0.30
Finland	0.52	0.51	0.39	0.39	0.44
Greenland	0.33	0.27	0.23	0.18	0.18
Norway	0.22	0.22	0.31	0.33	0.32
Sweden	0.31	0.22	0.32	0.30	0.22
Average	0.31	0.28	0.30	0.30	0.29
Germanic countries					
Austria	0.27	0.22	0.20	0.18	0.19
Germany	0.15	0.14	0.25	0.24	0.24
Average	0.21	0.18	0.22	0.21	0.22

Note: SEs ranged from 0.003 to 0.006 across regions. SEs ranged from 0.006 to 0.01 across countries.

There were interesting similarities and differences amongst the countries within each region (see table 1). For example, the proportions were similar in Canada (range = 40–46%) and the USA (range = 40–49%). Of the 'countries' within Great Britain, youth in England were most likely to report perceptions of school pressure (range = 38–51%). In Eastern Europe, levels of school pressure increased over time for adolescents in Russia (16% in 1994, 31% in 2010, $P < 0.01$), while decreasing for those in the Czech Republic (56% in 1994, 32% in 2010, $P < 0.01$). In the Nordic countries, school pressure decreased in Greenland (33% in 1994, 18% in 2010, $P < 0.01$). The highest levels of school pressure were reported in Finland (52% in 1994), although proportions steadily decreased after 1998. In contrast, the proportions of reported school pressure jumped between 1998 and 2002 in Denmark and Norway. In both countries, approximately every fifth child reported feeling 'some' or 'a lot' of pressure by school during the first two survey rounds, increasing to approximately every third child after 2002. Lastly, proportions of school pressure jumped for German students from 1998 (14%) to 2002 (25%) ($P < 0.01$).

Figure 3 (see also table 2) provides a summary of the analyses focused on levels of perceived school pressure amongst regions across 11-, 13- and 15-year-old students, combining gender and survey administration. Each country and administration was equally weighted per region, while gender was weighted based on sample proportions. Consistent with our earlier findings, older students reported the highest levels of school pressure ($P < 0.01$) with the differences having a moderate effect size from ages 11 to 15. However, the shifts in perceived school pressure differed across regions. These shifts appeared to be generally linear for students in North America, Eastern European countries and Germanic countries. In contrast, there was a larger increase in the amount of school pressure between the ages of 13 and 15 for youth in Great Britain and Nordic countries. There were also distinctions across the countries within each region; 11-year-old children in Canada (31%) reported slightly less pressure than their American counterparts (37%) ($P < 0.01$, Cohen's $d = 0.12$), while 13- and 15-year-olds (53%) reported almost similar levels in both countries. Across Great Britain, adolescents in England reported the highest levels in school pressure, with a large jump between the ages of 13 (40%) and 15 (62%) ($P < 0.01$, Cohen's $d = 0.45$). A similar pattern was found for Wales with an even larger increase between ages 13 (32%) and 15 (62%) ($P < 0.01$, Cohen's $d = 0.63$), and Scotland (26 and 48%, respectively, $P < 0.01$, Cohen's $d = 0.45$), although the proportions were lower in Scotland. In Eastern Europe, the proportions and increases were the smallest for 11- (20%), 13- (25%) and 15-year-old (27%) Russians ($P < 0.01$, Cohen's $d = 0.17$). In Nordic countries, Finnish youth reported the highest levels of school pressure at each age group (31–57%). There was a sharp increase between youth ages 13 and 15 in Greenland (21–30%), Norway (25–43%) and Sweden (21–49%). In contrast, the shifts in pressure were similar between age groups in Denmark. Lastly, the youth in Germany reported the smallest shifts in reported levels of school pressure across age groups (19, 19 and 23%, respectively; $P < 0.01$, Cohen's $d = 0.09$), compared not only with Austrian students, but also to all countries sampled.

Discussion

Our results should be evaluated in light of potential limitations. First, the analyses were based on a single item measuring students' perceptions of school pressure. Despite being well-validated, we cannot rule out the risk of variations in these perceptions across countries due to cultural differences that might have implications for some of the observed country differences.

The HBSC data over the 18 countries included in this research clearly indicate country and regional differences in the level of school

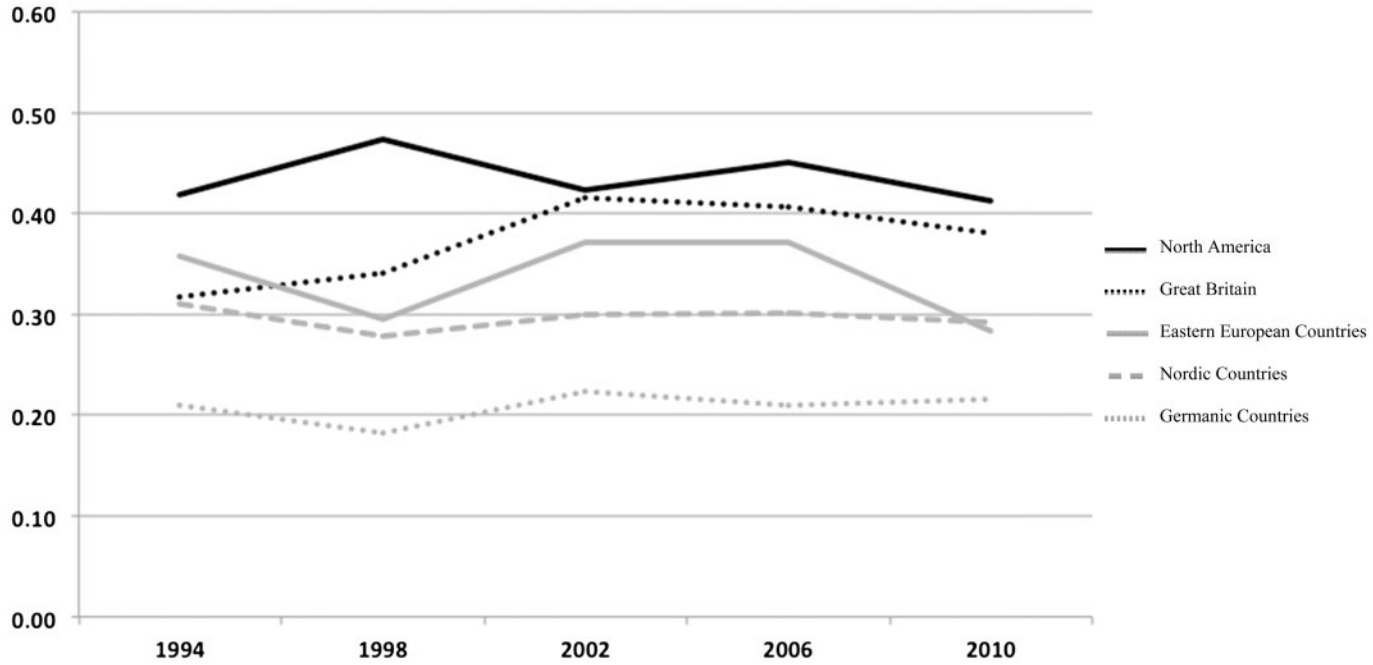

Figure 2 Regional comparisons of the proportion of children and youth reporting 'some' or 'a lot' of school pressure

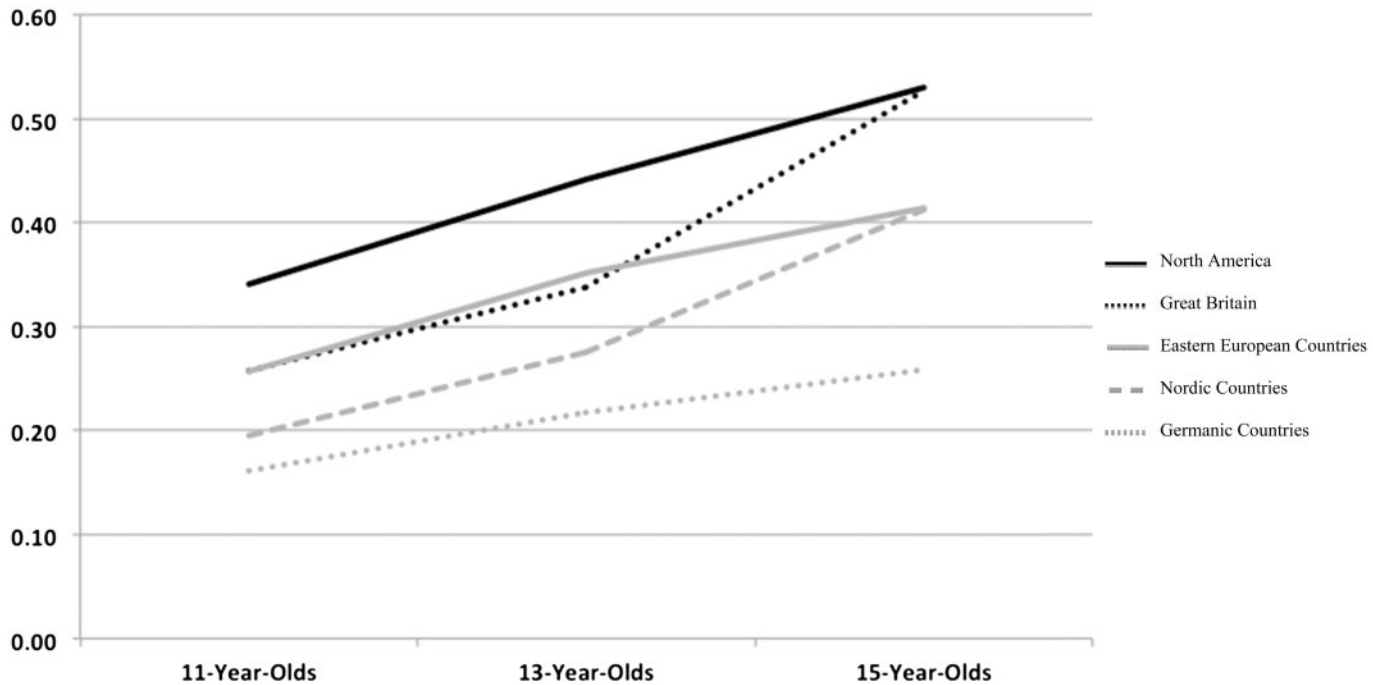

Figure 3 Regional comparisons of the proportion of 11-, 13- and 15-year-old children and youth reporting 'some' or 'a lot' of school pressure

pressure experienced by school-aged children. The highest level of school pressure is observed in North America followed in order by Great Britain, Eastern Europe, Nordic countries and Germanic countries. Despite some fluctuations over time, this pattern has generally remained stable across the years. These structural national-level indicators are of relevance to the present findings. The levels of school pressure vary across country, such that students in North America and 15-year-old students in Great Britain consistently report higher school pressure than students from other regions. In contrast, students from Germanic countries report the lowest levels of school pressure. These results suggest that children in regions with more conservative free market economies and more competitive selection methods to enter post-secondary education report the highest perceptions of school pressure.

Also, of importance for the current research, social and psychological characteristics of children and adolescence appear to have consistent relationships with perceptions of school pressure. Children, both boys and girls, feel increasing pressure at school as they become older, irrespective of survey cycle or country. In addition, the level of school pressure increases more so for girls

Table 2 Regional trends in the proportion of children reporting 'some' or 'a lot' of pressure across three age groups

	11-year-olds	13-year olds	15-year olds
North America			
Canada ($n = 45\,100$)	0.31	0.43	0.53
USA ($n = 20\,360$)	0.37	0.46	0.53
Average	0.34	0.44	0.53
Great Britain			
England ($n = 20\,761$)	0.33	0.40	0.62
Ireland ($n = 17\,128$)	0.23	0.35	0.48
Scotland ($n = 31\,675$)	0.23	0.26	0.48
Wales ($n = 28\,881$)	0.25	0.32	0.62
Average	0.26	0.33	0.55
Eastern European Countries			
Czech Republic ($n = 21\,507$)	0.30	0.39	0.43
Estonia ($n = 18\,112$)	0.29	0.42	0.51
Latvia ($n = 22\,611$)	0.22	0.27	0.34
Poland ($n = 30\,135$)	0.26	0.39	0.49
Russia ($n = 29\,440$)	0.20	0.25	0.27
Average	0.25	0.35	0.41
Nordic Countries			
Denmark ($n = 23\,721$)	0.19	0.24	0.29
Finland ($n = 29\,407$)	0.31	0.47	0.57
Greenland ($n = 6434$)	0.21	0.21	0.30
Norway ($n = 29\,091$)	0.16	0.25	0.43
Sweden ($n = 25\,998$)	0.12	0.21	0.49
Average	0.20	0.28	0.42
Germanic countries			
Austria ($n = 27\,012$)	0.12	0.23	0.29
Germany ($n = 25\,996$)	0.19	0.19	0.23
Average	0.16	0.21	0.26

Note: Sample sizes are calculated across age groups, and were generally similar across ages. Regional averages were based on equally weighted proportions from each country.

than for boys; at age 11, girls report experiencing less pressure than boys, while the reverse is true at age 15. As these findings hold across countries, these changes are likely attributable to personal characteristics of adolescents and to common characteristics of schooling across the different countries and regions.

With respect to gender differences, Benner and Graham[7] found students reported an increase in anxiety and loneliness after the transition from middle to high school, with this transition having a larger impact on girls than boys. With regard to age differences, as students get older, they are more frequently tested and tend to focus more on future academic and career options. This changed school focus comes at a time when, according to the stage-environment-fit-model, adolescents experience a growing need for close relationships, autonomy and competence, which can result in a mismatch between person and (school) environment.[9]

The results also suggest relationships attributable to the interactions between educational structures and the social and psychological characteristics of children. For example, a critical time for children occurs during the transition from elementary school to high school in North America and Great Britain (elementary schools typically have a format where one teacher is responsible for a class of 20–30 children). Although there may be specific-time constraints with respect to the use of specialized school facilities (e.g., the school gymnasium), the teacher has some control over the timing and duration of the daily schedule to best meet the educational needs of the children. In contrast, children in secondary school in North America and Great Britain typically move between classrooms with different teachers and classmates in each class. As a result, children experience changes in their relationships with teachers and peers.[9,25] These transitions occur much later in the Nordic or Eastern European countries and much earlier in the Germanic countries.[26] Furthermore, in many of the countries in these regions (e.g., the Nordic countries), students stay together across several years as a class group, often with the same teacher, which may explain lower levels of perceived stress across all ages.[27] Additionally, in countries such as Finland, less emphasis is placed on assessment than would be expected in North America and Great Britain.[27]

Although the average amount of perceived school pressure that children report has not changed across time when results from all countries are combined, there was a significant upward shift in perceived pressure in 2002 and 2006. This upward shift occurred during the same time period that PISA results were first released. We have hypothesized that the initial PISA results may have impacted educational policies and practices. Consistent with this hypothesis, the increasing levels of school pressure in 2002 and 2006 for some countries might be connected with the release of the first PISA survey results in 2001. Confronted with lower-than-expected results, there were intensive public debates in Germany, Denmark and Norway known as 'PISA shock', a shock that was not experienced in Finland and Canada where PISA results were comparatively strong. Especially in Germany, the impact of the PISA study was compared with the Sputnik shock in the USA.[22] The results of the first PISA wave fundamentally challenged Germany's self-perception as having one of the world's leading education systems.[17,22] Breakspear[22] provided evidence that the PISA findings had an impact on national educational policy in many countries (e.g., Austria, Hungary, Germany, Sweden, England, Denmark, Norway). Our analyses provide preliminary evidence that countries such as Canada and Finland did not witness the same relative increases in the proportions of children reporting school pressure as compared with lower performing countries such as Germany.

The question becomes the extent to which the increased perceptions of school pressure noted in 2002 and 2006 might be explained by the initial reactions and attention given to the PISA results. Of further interest, the prevalence of school pressure generally decreased from 2006 to 2010. One possible explanation for this decline may be that the intensive public discussions about the PISA findings in the early 2000s temporarily influenced the expectations and behaviours of teachers, parents and students. Over time, educators became less concerned with the PISA surveys as a driver for directing their own teaching, thereby slowly reducing the increased pressure put on teachers and students after the early phases of the PISA survey. Certainly, these shifts may be explained by other factors (sampling, economic pressures, etc.); however, our intention in analysing these trends is to illustrate a possible mechanism that aligns with the observed variations in children's and adolescents' perceived school pressure over time and regions. Subsequent research may provide alternative mechanisms and relationships that further explain these observed variations.

Together, our findings suggest that changes in children's and adolescents' perceived school pressure are associated with individual characteristics that hold across all countries surveyed, specifically, different gendered expectations as young people get older. School pressure differences across geographical regions might best be explained by the European model of schooling in contrast to that in Great Britain and North America. Historical changes could be attributable to country specific or more global phenomenon. The data also provide early support for the hypothesis that reactions to the PISA results in countries that performed relatively well or relatively poorly on PISA were associated with children's subsequent perceptions about school pressure. The resulting educational debates, policies and practices from the PISA assessment programs might have been a contributing factor to shifts in students' perceptions of school pressure in combination with a range of other possible factors. Additionally, current and historical country-level data on reactions to PISA results, other factors that may influence education policies and practices, specific school structure characteristics, and procedures for student evaluation should be collected for further in-depth analyses. Although we make no assumptions of causality in our findings, our approach is

valuable for exploring the potential associations amongst external factors and changes in students' perceptions of school pressure. Subsequent, more focused data collection and more advanced analytical model testing may provide stronger evidence for the associations indicated by our results, and the potential causes for these shifts in children's and adolescents' perceived levels of school pressure.

Acknowledgements

The HBSC study is an international study carried out in collaboration with WHO Europe. The international coordinator was Professor Candace Currie from the University of St. Andrews, and the databank manager was Professor Oddrun Samdal from the University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The data collection for each HBSC survey is funded at the national level.

The authors also acknowledge the principal investigators of each included country/region.

Conflicts of interest: None declared.

Key points

- Across all countries, perceived school pressure tends to increase with age and to be differentiated by gender, with older girls reporting the highest levels of school pressure.
- Students in North America report the highest perceptions of school pressure, followed in descending order by Great Britain, Eastern Europe, Nordic countries and Germanic countries.
- Differences in school systems across regions may partially explain regional differences.
- The overall levels of school pressure have not changed over the past 16 years; there was an increase in school pressure noted in 2002 and 2006. One possible link for this shift in pressure may be the renewed attention on schooling in countries with poor Programme for International Student Assessment results.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 57–60

doi:10.1093/eurpub/ckv028

Trends in social inequalities in adolescent health complaints from 1994 to 2010 in Europe, North America and Israel: The HBSC study

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Background: Studies have shown constant or increasing health inequalities in adulthood in the last decades, but less is known about trends in health inequalities among adolescents. The aim is to analyse changes in socioeconomic differences in subjective health complaints from 1994 to 2010 among 11- to 15-year-olds in Europe, North America and Israel. **Methods:** Data were obtained from the international 'Health Behaviour in School-aged Children' (HBSC) survey. Analyses were based on the HBSC surveys conducted in 1994 (19 countries), 1998 (25 countries), 2002 (32 countries), 2006 (37 countries) and 2010 (36 countries) covering a time period of up to 16 years. Log binomial regression models were used to assess inequalities in multiple health complaints. Socioeconomic position was measured using perceived family wealth. **Results:** Inequalities in multiple health complaints emerged in almost all countries, in particular since 2002 (RR 1.1–1.7). Trend analyses showed stable (29 countries), increased (5 countries), decreased (one country) and no social inequalities (2 countries) in adolescent health complaints. **Conclusion:** In almost all countries, social inequalities in health complaints remained constant over a period of up to 16 years. Our findings suggest a need to intensify efforts in social and health policy to tackle existing inequalities.

Introduction

Social inequalities are strongly linked to people's health and well-being.[1,2] In all European countries, people with a lower social position face an increased risk of morbidity and mortality. Several studies have revealed that even in adolescence social inequalities have a profound impact on health.[3] For instance, adolescents from socially disadvantaged groups have higher rates of poor subjective health,[4] low life satisfaction[5] and higher rates of multiple health complaints[6] across European countries.

Analysing trends in health inequalities is a prerequisite for investigating whether socioeconomic differences in health have changed and whether policy strategies have been successful in tackling health inequalities.[7,8] Studies in adult populations have shown that health inequalities have either remained relatively constant or increased over the last decades.[2,8–10] To date, few studies have examined trends in health inequalities in childhood and adolescence. National studies have indicated increasing inequalities in mental health or health complaints[11] and constant socioeconomic differences in self-rated health[12] over the last decades. However, evidence across European countries is still lacking with the exeption of one recently published study showing increasing inequalities in adolescent health across Europe.[13] As subjective health complaints are suitable indicators to describe young people's health,[14] our study analyses (i) the extent of social inequalities in adolescent health complaints between 1994 and 2010 in Europe, North America and Israel and (ii) how they have changed over time.

Methods

HBSC study

The 'Health Behaviour in School-aged Children' (HBSC) study is a World Health Organization (WHO) collaborative cross-sectional survey carried out every 4 years since 1982 in a growing number of countries. The aim of the study is to increase the understanding of adolescent health and health behaviours. HBSC is a school-based survey used to collect data from 11-, 13- and 15-year-old schoolchildren through self-completion questionnaires based on an internationally agreed protocol. A detailed description of the aims and theoretical framework of the study can be found elsewhere.[3] The HBSC survey provides data which allow trend analyses on the basis of several survey years. Analyses were based on the HBSC surveys conducted in 1994 (19 countries), 1998 (25 countries), 2002 (32 countries), 2006 (37 countries) and 2010 (36 countries) covering a time period of up to 16 years.

Instruments and variables

Subjective health complaints were measured using the HBSC Symptom Checklist (HBSC-SCL)[15] covering eight items on somatic and psychological complaints schoolchildren experienced in the last 6 months: headache, stomach ache, feeling low, irritable or bad tempered, feeling nervous, difficulty in getting to sleep and feeling dizzy. Response options ranged for each symptom from 'about every day' to 'rarely or never'. The analyses show multiple (two or more) subjective health complaints more than once a week.[3]

Perceived family wealth was measured by asking 'How well off do you think your family is?' The five response options were 'very well off (1)' 'quite well off (2)' 'average (3)' 'not so well off (4)' and 'not at all well off (5)' which were dichotomized into high family wealth (1–2) vs. low wealth (3–5).[16] This item was included in all survey years (since 1994) and has the advantage that it is easy to answer for adolescents, reflects dimensions of socioeconomic position and relates to almost all health and health behaviour outcomes in the HBSC study.[17] It was designed as a proxy for young people's

Table 1 Relative Risks (RR) for multiple health complaints by low family wealth (95% confidence interval CI), controlled for age and gender, ranked into four groups (A = increasing, B = constant, C = decreasing, D = no social inequalities in health complaints), HBSC survey 1994–2010

HBSC country	HBSC survey participation	1994			1998			2002			2006			2010			Changes
		RR	95% CI	*n*	RR	95% CI	*n*	RR	95% CI	*n*	RR	95% CI	*n*	RR	95% CI	*n*	
Austria	1994–2010	0.90	0.77–1.06	4707	0.89	0.74–1.07	4201	1.31**	1.16–1.48	4123	1.48**	1.30–1.68	4577	1.31**	1.18–1.46	4783	Group A
Canada	1994–2010	1.13**	1.06–1.21	6178	1.21**	1.13–1.31	6449	1.46**	1.33–1.60	4078	1.59**	1.48–1.72	5508	1.47**	1.40–1.54	14418	
France	1994–2010	0.78*	0.67–0.91	3307	1.04	0.95–1.14	3727	1.47**	1.38–1.56	7696	1.32**	1.24–1.40	6851	1.33**	1.25–1.42	5794	
Ireland	1998–2010				1.05	0.95–1.15	4272	1.24*	1.09–1.40	2744	1.32**	1.19–1.46	4476	1.30**	1.17–1.43	4026	
Lithuania	1994–2010	0.95	0.85–1.06	4582	1.14*	1.04–1.24	4361	1.19**	1.09–1.31	5494	1.29**	1.18–1.40	5391	1.18**	1.09–1.28	5181	
Belgium	1994–2010	1.01	0.94–1.09	8149	0.92*	0.85–0.99	6902	1.02	0.95–1.09	9841	1.06	0.99–1.14	7747	1.07	0.99–1.15	7227	Group B
Croatia	2002–2010							1.25**	1.14–1.37	4293	1.32**	1.22–1.44	4806	1.20**	1.11–1.29	6146	
Czech Republic	1998–2010				1.14*	1.01–1.28	3635	1.12	1.00–1.23	4870	1.07	0.97–1.17	4633	1.13*	1.04–1.23	4223	
Denmark	1994–2010	1.11	0.93–1.33	3492	1.05	0.91–1.21	4847	1.17*	1.01–1.36	4422	1.05	0.92–1.18	5414	0.96	0.83–1.11	3840	
Estonia	1994–2010	1.17*	1.02–1.34	3218	1.00	0.83–1.22	1845	0.92	0.82–1.03	3965	1.28**	1.18–1.40	4345	1.34**	1.23–1.47	4143	
Finland	1994–2010	1.44**	1.27–1.64	3715	1.36**	1.23–1.50	4542	1.36**	1.24–1.50	5179	1.29**	1.17–1.42	5071	1.74**	1.59–1.90	6461	
Germany	1994–2010	1.26*	1.10–1.45	2911	1.15*	1.04–1.27	4680	1.40**	1.25–1.57	5216	1.44**	1.31–1.57	6955	1.41**	1.26–1.57	4818	
Greece	1998–2010				1.17**	1.09–1.25	4225	1.13*	1.05–1.21	3579	1.23**	1.14–1.32	3590	1.20**	1.12–1.28	4665	
Hungary	1994–2010	1.12*	1.02–1.22	5332	1.13*	1.02–1.26	3513	1.19**	1.09–1.29	3970	1.04	0.95–1.15	3373	1.12*	1.02–1.22	4693	
Iceland	2006–2010										1.62**	1.53–1.72	9109	1.55**	1.46–1.64	10255	
Israel	1994–2010	1.22**	1.14–1.29	4019	1.13**	1.06–1.20	4865	1.22**	1.15–1.29	5133	1.16**	1.09–1.22	4699	1.20**	1.11–1.29	3793	
Italy	2002–2010							1.13**	1.06–1.21	4269	1.15**	1.07–1.23	3840	1.14**	1.08–1.22	4690	
Latvia	1994–2010	1.24**	1.12–1.38	3659	1.26**	1.15–1.38	3575	1.36**	1.23–1.51	3226	1.41**	1.30–1.53	4061	1.40**	1.28–1.52	4011	
Luxembourg	2006–2010										1.32**	1.22–1.44	4012	1.34**	1.22–1.47	3705	
Macedonia	2002–2010							1.21**	1.12–1.32	3816	1.20**	1.11–1.30	5069	1.23**	1.11–1.36	3492	
Malta	2002–2006							1.02	0.87–1.20	1727	1.16*	1.03–1.31	1267				
Netherlands	2002–2010							1.13*	1.01–1.26	4112	1.16*	1.01–1.33	4005	1.13*	1.01–1.26	4249	
Norway	1994–2010	1.24**	1.10–1.40	4320	1.20*	1.08–1.33	4636	1.32**	1.21–1.44	4804	1.36**	1.23–1.51	4322	1.45**	1.31–1.61	3688	
Poland	1994–2010	1.05	0.87–1.27	3674	1.15*	1.04–1.26	4795	1.14*	1.05–1.25	6186	1.17**	1.08–1.28	5415	1.18**	1.08–1.29	4112	
Portugal	1998–2010				1.35**	1.23–1.49	3619	1.41**	1.26–1.58	2801	1.44**	1.28–1.62	3795	1.48**	1.32–1.66	3926	
Romania	2006–2010										1.28**	1.19–1.36	4443	1.32**	1.24–1.41	4971	
Russia	1994–2010	1.17**	1.07–1.27	3930	1.23**	1.14–1.33	3997	1.23**	1.16–1.31	7925	1.27**	1.16–1.39	7780	1.23**	1.13–1.33	4834	
Slovakia	1994–98, 2006–10	1.15*	1.04–1.28	3161	1.16*	1.05–1.29	3593				1.24**	1.14–1.36	3555	1.31**	1.21–1.41	4874	
Slovenia	2002–2010							1.72**	1.52–1.94	3839	1.58**	1.41–1.77	4980	1.38**	1.22–1.56	5291	
Sweden	1994–2010	1.41**	1.26–1.58	3353	1.29**	1.17–1.43	3690	1.48**	1.36–1.62	3692	1.40**	1.27–1.54	4226	1.56**	1.44–1.69	6094	
Switzerland	1998–2010				1.14*	1.03–1.26	4846	1.18*	1.06–1.31	4450	1.12*	1.02–1.23	4340	1.18**	1.09–1.27	6310	
Turkey	2006–2010										1.16**	1.11–1.22	4919	1.13**	1.07–1.18	5272	
UK	1994–2010	1.12*	1.04–1.19	8181	1.04	1.00–1.08	18743	1.19**	1.13–1.25	13520	1.27**	1.21–1.34	14343	1.27**	1.20–1.33	14502	
USA	1998–2010				1.30**	1.22–1.38	4826	1.35**	1.25–1.45	4711	1.31**	1.21–1.42	3737	1.34**	1.25–1.45	5700	
Ukraine	2002–2010							1.23**	1.12–1.35	3927	1.06	0.99–1.14	4678	1.11*	1.03–1.19	5484	Group C
Greenland	1994–2010	0.91	0.70–1.20	853	0.99	0.82–1.19	1267	1.11	0.89–1.37	739	1.01	0.84–1.21	1079	0.84	0.68–1.04	918	Group D
Spain	2002–2010							0.94	0.86–1.02	5624	1.06	0.96–1.18	8535	0.96	0.84–1.08	4882	

*$P<0.05$, **$P<0.001$.

perceptions of their own family's socioeconomic circumstances and implicates a subjective socioeconomic status.

Statistical analyses

To analyse the association between perceived family wealth and subjective health complaints, we performed log binomial regression models for each country separately. Relative risks (RRs) in subjective health complaints for perceived family wealth with 95% confidence intervals were calculated. The high family wealth group served as the reference category. All analyses were controlled for age and gender. Trend analyses were performed by estimating the RRs for subjective health complaints per year and across years by using a time trend variable that encompasses all survey years (the first year of observation served as reference category). Cases with missing values in relevant variables (subjective health complaints, perceived family wealth, age and gender) were excluded from the analyses. Further, Bulgaria and Armenia were excluded as they participated in only one HBSC survey. In total, up to 37 countries were included in the analyses. The statistical analyses were conducted using the software STATA 12.1 (StataCorp, College Station, TX).

Results

Table 1 shows the RRs for two or more health complaints at least once per week by low family wealth stratified by HBSC survey year and country. In almost all countries, significant social inequalities in health complaints among 11- to 15-year-old adolescents were found for almost all survey years. In the majority of countries, schoolchildren who perceived their family wealth as low reported significantly higher rates of multiple health complaints (1994: 12 from 19 countries; 1998: 17 from 25 countries, 2002: 26 from 32 countries, 2006: 30 from 37 countries, 2010: 32 from 36 countries). However, the effect sizes across all countries were rather modest and ranged from RR 1.1 to 1.7.

Looking at trends in social inequalities for the period 1994 (1998/2002) to 2010 four groups of countries can be identified: countries with increasing (Group A), constant (Group B) or decreasing social inequalities in health complaints (Group C) and countries with no health inequalities (Group D). Group A consists of five countries (Austria, Canada, France, Ireland and Lithuania) where social inequalities in multiple health complaints significantly increased from 1994 (or 1998) through 2010. Most of the countries (29) are placed in Group B where social inequalities in health complaints remained relatively stable over time. Only in Ukraine (Group C) did inequalities in health complaints by family wealth significantly decrease from 2002 to 2010. No social inequalities in health complaints were found in Spain and Greenland (Group D) regarding all survey years.

Discussion

Our results show constant inequalities in health complaints for the large majority of the countries, and few countries with increasing health inequalities. The findings confirm previous studies on social inequalities in adolescent health and health complaints in different countries.[18,19] However, cross-national comparisons of trends in social inequalities in adolescent health are limited to a few analyses of national HBSC data. Similar to our results, stable inequalities were also identified in self-rated health among German adolescents between 2002 and 2010.[12] In contrast, increasing social inequalities emerged in Scotland for health complaints and for several indicators of mental health between 1994 and 2006 using the family affluence scale (FAS) as the indicator for social position.[11]

The strength of the HBSC study is that it offers an opportunity for cross-national and time trend analyses in adolescent health. Our study provides information from five HBSC survey waves covering a period of up to 16 years (1994–2010). Generally, interpretation of trends should be made carefully because there is no information available between the different survey waves and because of the cross-sectional design of the survey. We observed rather modest effect sizes in the extent of social inequalities in health complaints across all countries. Effect sizes might be underestimated due to the measurement of perceived family wealth as we included the category 'average' family wealth in the lower family wealth group.[16]

Comparing the two extreme categories would tend to lead to greater effect sizes. However, we do not assume a severe bias as similar trend findings on social inequalities in health were found independently of using the FAS as an indicator of social position or perceived family wealth.[12] Moreover, subjective SES indicators seem to provide comparable or even stronger results for identifying health inequalities, as other studies on subjective indicators in adolescent health have shown.[20,21]

Our study indicates that social inequalities in adolescent health exist in almost all European and North American countries and did not decrease over a period of up to 16 years. Thus, inequalities in adolescent health continue to pose a serious public health problem, suggesting that current strategies have not been able to tackle existing health inequalities and thereby revealing the need to intensify efforts in social and health policy.

Acknowledgements

The HBSC study is an international survey conducted in collaboration with the WHO Regional Office for Europe. The International Coordinator of the study was Candace Currie, CAHRU, University of St Andrews, Scotland. The data bank manager was Oddrun Samdal, University of Bergen, Norway. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). We would like to thank all schoolchildren, teachers and scientific co-workers who participated in the HBSC surveys.

Funding

The data collection in each country was funded at the national level. We are grateful for the financial support offered by the various government ministries, research foundations and other funding bodies in the participating countries and regions.

Conflicts of interest: None declared.

Key points

- Studies on health inequalities in adulthood revealed either relatively constant or increased inequalities over the last decades
- However, trends in social inequalities in adolescent health are limited to few national analyses, evidence across European countries is still lacking
- Taking up to 37 European and North American countries into account our results identified inequalities in multiple health complaints in almost all European countries among 11–15-year-old adolescents
- Between 1994 and 2010 our analyses showed constant inequalities in adolescent health complaints for the large majority of the countries and few countries with increasing health inequalities
- Our findings suggest a need to intensify efforts in social and health policy to tackle existing inequalities in adolescent health

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 61–64

doi:10.1093/eurpub/ckv029

Cross-national time trends in bullying victimization in 33 countries among children aged 11, 13 and 15 from 2002 to 2010

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Background: Bullying among children and adolescents is a public health concern; victimization is associated with psychological and physical health problems. The purpose of this study is to examine temporal trends in bullying victimization among school-aged children in Europe and North America. **Methods:** Data were obtained from cross-sectional self-report surveys collected as part of the Health Behaviour in School-aged Children (HBSC) study from nationally representative samples of 11-, 13- and 15-year-olds, from 33 countries and regions which participated in the 2001–02, 2005–06 and 2009–10 surveys. Responses from 581 838 children were included in the analyses. Binary logistic regression was used for the data analyses. **Results:** The binary logistic regression models showed significant decreasing trends in occasional and chronic victimization between 2001–02 and 2009–10 across both genders in a third of participating countries. One country reported significant increasing trends for both occasional and chronic victimization. Gender differences in trends were evident across many countries. **Conclusion:** Overall, while still common in many countries, bullying victimization is decreasing. The differences between countries highlight the need to further investigate measures undertaken in countries demonstrating a downward trend.

Introduction

Bullying is a worldwide health problem among children and adolescents; a subject which has demanded much attention due to its detrimental and enduring consequences.[1] Bullying is defined as intentional harmful behaviour, carried out repeatedly, against an individual who is unable to defend themselves.[2] Extensive research has demonstrated a number of negative outcomes associated with experiencing bullying, including psychological maladjustment,[3,4] psychosomatic health problems[4] and suicide.[5] Moreover, bullying perpetration and victimization were found to be associated with various risk behaviours such as drinking, illegal substance use and smoking.[6,7] Given the severe and universal nature,[8] it is imperative bullying be understood cross-nationally so that lessons may be learnt from countries successful at reducing bullying.

The Health Behaviour in School-aged Children (HBSC) study[9] provides a unique opportunity to compare bullying victimization, of varying extents, over time and across different countries. This study examines temporal trends in bullying victimization across 33 countries and regions from the last three cycles of the HBSC study. This article extends and compliments previous research examining temporal trends in bullying by including more countries in the analysis and extending the time frame.[10] This study aims to identify countries in which bullying victimization has increased or decreased over an 8-year period, serving as a basis for policy interpretation, particularly around social policies influencing bullying behaviours among school-aged children.

Methods

Sample

The HBSC study collects data every 4 years from nationally representative samples of 11-, 13- and 15-year-old children, using anonymous self-report questionnaires administered in school.[9] This article used HBSC data collected from 33 countries and regions in 2001–02, 2005–06 and 2009–10. The total sample size for this study was 581 838 children.

Measures

Victimization from bullying was assessed using the question 'How often have you been bullied at school in the past couple of months?'; with the response options 'I have not been bullied at school in the past couple of months', 'It has only happened once or twice', '2–3 times a month', 'About once a week' and 'Several times a week'. The measure was preceded by a preamble, developed by Olweus,[11] which defines the concept of bullying.

Victimization was divided into two levels: occasional victimization (once or more in the last couple of months) and chronic victimization (2–3 times a month or more). Binary outcomes were created based on the responses given to the questions where occasional was defined as 'once or more' vs. 'never', and chronic was defined as '2 or more times a month' vs. 'twice or less in the past couple of months'. Binary outcomes were created in line with an existing paper examining temporal trends in bullying[10] which this study builds on.

Statistical analyses

Data analyses were conducted using IBM SPSS Statistics Version 20. Socioeconomic status (SES) was measured using the HBSC Family Affluence Scale[12] and all three age categories were aggregated into a single age group. Binary logistic regressions models were used to indicate the significance of the observed trend. Models were run for each country and by gender controlling for age group and SES.

Results

Overall, occasional victimization has decreased from 33.5 in 2001–02 to 29.2% in 2009–10. Table 1 presents the percentage of occasional victimization by gender across countries and over time. In total, 11 out of 33 countries demonstrated statistically significant decreasing trends in occasional victimization for both genders; including Croatia, Denmark and Portugal. In addition, England, Norway and Spain reported lower rates of bullying victimization in 2009–10 compared with 2001–02 for both boys and girls; however, these countries did not show consistent downward trends across the three surveys. A number of countries only presented statistically significant decreasing trends for either boys or girls; Ukraine, for example, reported a statistically significant decrease of 6.8% for occasional victimization among boys, but a non-significant 2.8% decrease among girls. Of the 33 countries, French Belgium and Finland reported significant increasing trends in occasional victimization for both genders.

Decreases were also reported in chronic victimization for both genders from 12.7 in 2001–02 to 11.3% in 2009–10. Three out of the 33 countries—Denmark, Italy and the Netherlands—demonstrated decreasing trends in chronic victimization from 2001–02 to 2009–10 (table 2). Spain and Lithuania also reported lower rates of chronic bullying for both boys and girls in 2009–10 compared with 2001–02, but this was not a trend observed over the three surveys. As with occasional victimization, many countries only presented significant trends for either boys or girls. Among boys alone, chronic victimization decreased significantly in six countries (Croatia, England, Germany, Norway, Sweden and USA) and increased in four (Austria, France, Hungary and Scotland). Among girls alone, there was a significant decreasing trend in three countries (Greenland, Lithuania and Macedonia). Of the 33 countries only French Belgium reported a significant increasing trend in chronic victimization for both genders.

Statistically significant increases were noticeable for occasional and chronic victimizations for one country only (French Belgium) for both genders from 2001–02 to 2009–10. Overall, decreases were visible in occasional and chronic victimization across both genders in Denmark, Italy and the Netherlands only from 2001–02 to 2009–10.

In both occasional and chronic victimizations, the largest change was reported by Greece. Greece reported a 24.1% decrease (down from 51.7 in 2005–06 to 27.6% in 2009–10) for occasional victimization, and a 14.4% decrease for chronic victimization (down from 22.9 in 2005–06 to 8.5% in 2009–10). While a number of other countries presented a similar trend of increasing between 2001–02 and 2005–06 followed by a decrease in 2009–10, these changes were not as dramatic as in Greece.

Discussion

Bullying victimization remains a common occurrence in most countries that took part in this study, with just under a third of children in the sample reporting occasional victimization and approximately one in eight children reporting chronic victimization. Encouragingly, for both genders, there is a slight but significant decrease in occasional and chronic victimizations between 2001–02 and 2009–10 in a third of participating countries.

Table 1 Trends in prevalence of being bullied once or more at school in the past couple of months by gender, country and survey year[a]

Being bullied	Boys (%)				Girls (%)			
Country	2001–02	2005–06	2009–10	*P*	2001–02	2005–06	2009–10	*P*
Austria	47.7	45.7	45.0	ns	41.2	36.0	35.9	0.005
Belgium (Flemish)	32.8	25.1	31.2	ns	27.7	22.4	28.2	ns
Belgium (French)	50.5	56.2	59.7	0.000	33.6	39.0	42.5	0.000
Canada	38.4	35.6	36.4	ns	37.0	34.7	37.9	ns
Croatia	28.4	21.2	18.2	0.000	20.8	18.8	15.9	0.000
Czech Republic	17.2	17.0	16.0	ns	14.9	15.5	15.1	ns
Denmark	31.3	24.3	19.9	0.000	32.1	24.9	20.0	0.000
England	38.1	30.3	27.0	0.000	34.8	26.8	28.1	0.000
Estonia	46.5	48.2	43.6	ns	42.4	42.7	38.3	ns
Finland	27.1	27.4	32.6	0.000	21.0	22.0	28.6	0.000
France	34.3	33.3	34.1	ns	36.0	35.1	33.9	ns
Germany	39.5	35.7	31.5	0.000	33.8	32.9	28.5	0.000
Greece	26.4	51.8	29.3	0.019	22.5	51.7	25.9	0.003
Greenland	40.5	49.1	39.6	ns	45.9	52.4	36.0	0.010
Hungary	22.7	24.2	29.2	0.000	23.8	26.1	25.1	0.011
Ireland	28.8	26.7	28.4	ns	23.6	25.2	26.2	ns
Italy	31.0	26.2	13.8	0.000	25.4	18.3	8.4	0.000
Latvia	52.3	50.3	47.8	ns	44.8	46.5	45.5	ns
Lithuania	65.0	56.4	55.2	0.000	63.6	56.2	52.8	0.000
Macedonia	30.6	30.6	26.0	0.003	25.0	21.0	16.1	0.000
Netherlands	32.2	28.3	26.8	0.001	27.3	25.3	22.6	0.002
Norway	35.0	29.5	27.6	0.000	29.7	23.1	25.3	0.002
Poland	33.2	31.2	31.7	ns	27.3	21.3	21.3	0.000
Portugal	55.6	46.2	43.8	0.000	44.0	37.5	31.9	0.000
Russia	40.4	35.5	37.6	0.039	35.1	34.3	36.3	ns
Scotland	27.8	26.6	23.8	0.022	30.1	26.3	23.3	0.003
Slovenia	21.8	27.2	21.8	ns	23.0	22.3	19.0	ns
Spain	27.5	16.0	18.0	0.000	24.7	11.4	10.8	0.000
Sweden	15.2	15.7	12.4	0.009	14.7	13.6	12.4	ns
Switzerland	42.3	41.5	39.2	0.023	38.7	34.3	33.4	0.000
Ukraine	50.0	49.4	43.2	0.000	48.1	50.4	45.3	ns
USA	35.6	29.9	28.4	0.000	32.6	29.1	27.4	0.000
Wales	28.6	30.1	29.7	ns	30.6	31.7	26.7	0.015

ns = non-significant.

a: Controlled age and social class.

Despite the decreasing trend of bullying victimization in around a third of the countries, many other countries do not present consistent downward trends but instead fluctuate. Flemish Belgium, Canada, Finland, Poland, Spain and Switzerland reported significant decreases in chronic victimization for boys and girls between 2001–02 and 2005–06 but then demonstrated significant increases between 2005–06 and 2009–10. Alternatively, a number of countries show increases from 2001–02 to 2005–06 followed by decreases between 2005–06 and 2009–10; with Greece demonstrating this trend most prominently.

In contrast to previous findings,[10] in most countries where significant changes were reported in occasional or chronic victimization from 2005–06 to 2009–10, they were larger among boys than girls. Moreover, gender differences in temporal trends are prominent; a number of countries present significant trends in occasional or chronic victimization for only one of the genders. Speculatively, these may reflect on the cultural conceptualization of bullying, as well as social acceptability of gendered behaviours. For example, England reported a significant decreasing trend for both occasional and chronic victimizations among boys but not girls. Within England the term bullying is most strongly associated with severe physical aggression and fighting and least associated with social exclusion.[13] This cultural conceptualization of bullying based on predominantly male behaviour may impact upon the bullying behaviours addressed in school.[14]

This study utilized a large cross-national dataset which allows for unique examinations of temporal trends in bullying victimization; however, there are some limitations to this study. Translational issues are a limitation of cross-national data; the term bullying often cannot be readily translated into other languages and could be understood differently across cultures.[14] Such cultural variations in the conceptualization of bullying may explain country differences in prevalence of bullying.[13] The HBSC survey instruments however are subject to a rigorous translational process to minimize these potential discrepancies.[9] In the past decade cyberbullying, bullying through electronic devices such as mobile phones and computers, has become recognized as another form of bullying. It must be noted that the measure used in the HBSC surveys did not explicitly refer to cyberbullying; consequently the prevalence rates may reflect only traditional forms of bullying and not cyberbullying.

In conclusion, this article has demonstrated decreasing trends in bullying victimization among boys and girls across a third of participating countries; with few countries reporting increasing trends in bullying victimization. While these results are positive, it is important to acknowledge that victimization is still a fairly common harmful experience for a number of school-aged children and that continued effort should be made to further reduce bullying. Moreover, substantial variations still exist across countries and the inconsistency of country trends raises important implications for policy development and evaluation. Firstly the inconsistency in direction emphasizes the importance continuity in national policy to maintain consistent trajectories; implementing policy until declines are reported is inadequate, a continued effort is necessary to maintain the decreasing trend. Secondly, the gender differences in significant trends suggest gender-specific programmes may be a useful tool in addressing the gender differences presented in this

Table 2 Trends in prevalence of being bullied at least two or three times at school in the past couple of months by gender, country and survey year[a]

Being bullied	Boys (%)				Girls (%)			
Country	2001–02	2005–06	2009–10	*P*	2001–02	2005–06	2009–10	*P*
Austria	19.5	19.6	21.6	0.048	13.5	12.1	13.4	ns
Belgium (Flemish)	13.8	9.4	12.0	ns	10.1	8.3	10.5	ns
Belgium (French)	19.8	22.1	27.8	0.000	11.5	11.9	16.5	0.000
Canada	16.4	15.2	16	ns	14.4	13.1	14.9	ns
Croatia	11.7	9.4	7.5	0.001	6.9	7.4	6.2	ns
Czech Republic	6.8	6.3	5.4	ns	5.5	4.8	5.1	ns
Denmark	11.4	8.3	6.6	0.000	11.1	7.8	6.1	0.000
England	14.4	10.8	9	0.000	11.6	8.7	9.9	ns
Estonia	21.7	23.9	20.5	ns	15.7	19.2	16.1	ns
Finland	10.4	9.1	11.5	ns	8	6.9	10.2	0.002
France	13.4	13.9	14.8	0.023	12.9	13.3	13.2	ns
Germany	15.2	14.9	10.6	0.000	11.1	12.9	9.8	ns
Greece	9.3	23	9.4	ns	6.7	22.9	7.7	ns
Greenland	22.1	23	18.1	ns	26.5	24.9	13.9	0.000
Hungary	5.7	6.3	8.7	0.000	6.4	6.7	6.4	ns
Ireland	10.2	10.0	10.9	ns	6.5	7.3	6.9	ns
Italy	12.1	10.1	4.8	0.000	8.5	6.6	2.9	0.000
Latvia	23.7	23.4	20.5	ns	16.2	19.3	18.1	0.008
Lithuania	36.4	28	28.5	0.000	32.3	26.5	23.4	0.000
Macedonia	11.8	12.0	10.6	ns	9.5	6.5	5.3	0.000
Netherlands	11.3	9.7	8.4	0.010	8.7	7.3	6.8	0.046
Norway	12	9.7	9.5	0.020	9.9	6.9	8.2	0.030
Poland	12.5	11.4	13.2	ns	8	7.3	7.8	ns
Portugal	24.3	16.5	16.8	0.000	13.4	12.6	11.1	ns
Russia	18.5	17.2	17.8	ns	16.8	15.7	17.3	ns
Scotland	8.4	9.3	9.8	0.016	9.1	9.5	8.5	ns
Slovenia	7.4	11.1	8.2	0.030	6.8	7.5	6.1	ns
Spain	10.1	5.6	7.5	0.012	7.5	3.6	4.3	0.000
Sweden	5.4	4.6	3.9	0.021	4.1	3.5	4	ns
Switzerland	16.2	13.7	14.9	ns	11.7	10.5	11.7	ns
Ukraine	17.2	19.4	16.2	ns	17.8	20.2	16.9	ns
USA	14.8	11.9	11.3	0.000	10.4	10.9	10.7	ns
Wales	9.3	11.1	9.5	ns	9.7	11.6	8.2	ns

ns, non-significant.

a: Controlled age group and SES.

article. Thirdly, those countries which report consistent downward trends in bullying victimization can guide and inform other countries in their bid to decrease bullying further.

Acknowledgements

HBSC is an international study carried out in collaboration with the WHO/EURO. The international coordinator was Candace Currie from the University of St. Andrews, and the databank manager was Prof. Oddrun Samdal, University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The data collection for each HBSC survey is funded at the national level. We thank all the pupils, teachers and investigators who took part in the HBSC surveys.

Conflicts of interest: None declared.

Key points

- In the academic year 2009–10 a third of school children in Europe and North America reported they had been victims of bullying in the previous 2 months.
- There are large variations in bullying victimization across countries.
- Bullying victimization is declining in a third of countries involved in the analyses.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 65–68

doi:10.1093/eurpub/ckv030

Gendered trends in early and very early sex and condom use in 20 European countries from 2002 to 2010

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Background: Sexual activity is often initiated during the adolescent period, and previous research suggests that the age of first sexual intercourse and condom use are crucial determinants of later sexual health. This study examined trends in adolescent sexual behaviours from 2002 to 2010 in 20 countries across four geographical regions of Europe. **Methods:** Data were collected by self-report questionnaires from 15-year-olds in classrooms during 2002, 2006 and 2010. Linear time trends were determined through logistic regression models, stratified for gender. **Results:** No linear trend over time was documented for most countries for sexual intercourse at the age of 13 or younger. Increased initiation among girls in Eastern Europe and decreased very early initiation among girls in Northern Europe emerged, along with a general increase in condom use in boys and most notably in girls. **Conclusion:** Overall prevalence of early and very early sexual intercourse initiation was quite stable in Europe between 2002 and 2010, while condom use increased. More detailed research and policy attention to the antecedents of non-condom use among young people is warranted; and further study of the relationships between age of sexual initiation and condom or pill use would be particularly valuable.

Introduction

Sexual activity is commonly initiated during adolescence,[1,2] but while generally accepted as a normative part of the transition into adulthood, it can have negative consequences like sexually transmitted infections (STIs) and unwanted pregnancy. Youth are at a higher risk of negative outcomes than adults due to their relative physical, emotional and cognitive immaturity,[3] and tendency towards more frequent risky behaviours such as unprotected intercourse.[2] Recent data suggest that among adolescents in Western, Central and Eastern Europe[1] that have had intercourse, up to 40% had not used condoms during their last sexual intercourse. Thus, many sexually active adolescents remain at risk of infection by STIs. Although there has been a recent decline in HIV infection among adolescents in industrialized countries, rates of other STIs have increased.[1] Rates of adolescent pregnancy and abortion have decreased in Europe overall while in Eastern European countries rates remain moderate to high.[2]

Age of sexual intercourse initiation has decreased in several industrialized countries.[1,] According to recent data, most sexually active 15-year-olds reported having had their first sexual intercourse at 14 years or older.[4] The earlier the first sexual intercourse occurs the more risky it potentially is,[5,6] and early intercourse initiation, relative to individual country norms, is a negative indicator of sexual health.[3] Addressing sexual behaviour among young adolescents is therefore of significance to public health.[6] Although there are data on sexual behaviour among adolescents worldwide, relatively little is known about those who initiate sex at a very early age (13 or younger)[2] and trend data are scarce, particularly in Europe.

This article aimed to (1) describe trends in sexual intercourse, very early sexual intercourse initiation and condom use during the last intercourse among 15-year-olds from 2002 to 10 in 20 countries; and (2) describe variations in these trends over time by gender at country and European regional level.

Methods

Data presented are from the HBSC studies undertaken in 2002, 2006 and 2010. Countries that participated in all three studies and asked sexual behaviour questions were included. Regional allocation was according to the UN Statistical Classification.[7] Adopting politico-historical criteria, the Baltic countries were reallocated from the Northern to Eastern region as were Hungary and Ukraine, representing east European post-communist countries.

Details on the development of the questions and methods can be found elsewhere.[7]

The total sample was 91 297, 3628 (4.0%) were excluded for missing or inconsistent answers. The net dataset comprised 87 669 (51.8% girls, mean age = 15.60 years; SD = 0.34). In some countries weights were used to improve representativeness. To minimize the effects of sample size variation across countries/studies, samples were reweighted so that each country within a region had the same weight, the total weighted *n* being equal to its unweighted *n*, and country-level weights were recalibrated accordingly.

Measures

Sexual behaviours

Experience of sexual intercourse was assessed by the question 'Have you ever had sexual intercourse?' (Yes/No); age of sexual initiation 'How old were you when you had sexual intercourse for the first time?' (11 or younger/12/13/14/15/16/17 or older). Responses were dichotomized into '13 or younger' and '14 or older'. This dichotomy was adopted because 13 is the commencement of 'teenagehood', and provided sufficient numbers in each group for analyses. Condom use during last intercourse was assessed by combining answers to a question about contraceptive use during last intercourse that included condom as a choice, and a separate question: 'The last time you had sexual intercourse, did you or your partner use a

Table 1 Ever had sexual intercourse and first sexual intercourse at age 13 or younger among 15-year-olds, by gender, year of study and country

			Ever had sexual intercourse								Had first sexual intercourse at age 13 or younger							
			Boys				Girls				Boys				Girls			
	n_{boys}[c]	n_{girls}[c]	2002 (%)	2006 (%)	2010 (%)	Trend	2002 (%)	2006 (%)	2010 (%)	Trend	2002 (%)	2006 (%)	2010 (%)	Trend	2002 (%)	2006 (%)	2010 (%)	Trend
Estonia	1911	2005	19.1	25.6	21.4	→	14.5	23.0	22.6	→	4.1	5.8	2.80	→	0.7	1.9	3.1	↗ **
Hungary	1618	2147	26.0	24.3	35.7	↗**	17.2	20.5	23.8	↗*	4.3	4.6	9.8	↗**	2.2	1.9	2.8	→
Latvia	1565	1889	20.1	20.5	26.9	↗*	12.9	17.6	17.7	→	3.2	2.5	6.8	↗**	1.2	2.3	2.1	→
Lithuania	2694	2570	25.0	24.5	25.7	→	10.8	12.1	12.1	→	10.3	4.2	6.5	↘*	3.6	1.6	1.2	↘ **
Ukraine	2301	2761	46.8	40.0	39.0	→	23.5	18.3	17.3	→	7.0	9.1	6.4	→	1.3	1.1	0.6	→
E. Europe	*10089*	*11372*	*27.4*	*27.0*	*29.8*	→	*15.8*	*18.3*	*18.7*	↗*	*5.8*	*5.2*	*6.5*	→	*1.8*	*1.8*	*2.0*	→
Croatia	2453	2777	21.7	28.4	26.2	→	8.5	16.6	12.6	→	4.4	8.4	5.4	→	0.8	2.1	1.8	→
Greece	1918	2100	33.4	44.5	38.2	→	9.6	17.7	17.6	→	4.8	15.9	5.2	→	1.4	4.0	0.7	→
Macedonia[a]	2226	2235	36.7	32.8	28.4	↘*	3.4	4.4	2.7	→	10.7	8.2	6.2	↘*	0.1	0.3	0.2	→
Portugal	1527	1966	30.1	25.8	25.9	→	19.6	20.2	17.5	→	11.0	8.3	6.9	→	1.2	2.8	3.0	→
Slovenia	2072	2119	28.6	27.2	30.0	→	20.8	16.7	23.2	→	6.5	4.7	6.3	→	2.2	1.3	3.2	→
S. Europe	*10196*	*11197*	*30.1*	*31.8*	*29.8*	→	*12.4*	*15.1*	*14.7*	↗**	*7.5*	*9.1*	*6.0*	↘*	*1.1*	*2.1*	*1.8*	→
Austria	1372	1508	27.0	31.7	35.2	→	25.5	27.8	28.4	→	6.2	9.3	10.4	→	4.7	6.6	6.7	→
Belgium[b]	2354	2209	26.1	21.3	24.3	→	23.6	23.5	28.5	→	5.2	5.8	5.0	→	4.8	6.2	6.3	→
France	2741	2847	27.5	32.9	31.5	→	19.7	22.9	23.3	→	8.4	8.6	10.0	→	4.1	3.5	2.9	→
Netherlands	1898	1952	23.6	25.6	19.1	→	21.3	26.6	21.8	→	7.7	6.6	4.6	→	5.6	6.7	3.8	→
Switzerland	2276	2334	24.9	23.1	23.8	→	20.6	17.4	16.4	→	6.1	4.8	5.8	→	2.6	3.1	2.5	→
W. Europe	*10641*	*10850*	*25.8*	*26.9*	*26.8*	→	*22.2*	*23.6*	*23.7*	→	*6.7*	*7.0*	*7.1*	→	*4.3*	*5.2*	*4.4*	→
England	1873	2210	35.3	25.5	24.2	↘*	40.2	30.6	33.2	→	10.1	6.8	6.7	→	8.9	6.1	5.1	↘**
Finland	2495	2742	22.9	24.4	19.8	→	33.1	29.2	24.2	↘***	5.1	5.2	3.1	↘**	6.1	4.6	2.8	↘***
Scotland	2667	2751	32.7	29.4	26.6	↘*	34.6	33.6	35.3	→	7.6	6.2	8.6	→	10.1	8.3	7.4	→
Sweden	2287	2295	24.9	24.7	31.2	↗**	31.3	32.1	32.5	→	8.0	6.6	9.0	→	8.2	5.8	8.5	→
Wales	2036	1968	28.2	30.1	28.9	→	39.7	40.7	38.8	→	5.2	5.4	7.0	→	8.0	6.8	6.6	→
N. Europe	*11358*	*11966*	*28.8*	*26.8*	*26.1*	→	*35.8*	*33.2*	*32.8*	→	*7.2*	*6.1*	*6.9*	→	*8.3*	*6.3*	*6.1*	↘***

n, percentages and linear time trends between 2002 and 2010 (HBSC 2002, 2006 and 2010).
Note: [a]Former Yugoslav Republic of Macedonia; [b]Flemish Community only; [c]Total unweighted *n* across the three studies; → no significant linear in- or decrease between 2002 and 2010; ↗ increasing trend between 2002 and 2010; ↘ decreasing trend between 2002 and 2010; *$P \leq .05$; **$P \leq .01$; ***$P \leq .001$. Percentages for European regions were calculated as means of the included countries and the data were reweighted accordingly for testing linear time trends.

condom?' (Yes/No). Those who answered yes to *either* of these questions were coded as having used a condom during last intercourse.

Time

Time was operationalized in years beginning from 2002 (2002 = 0, 2006 = 4, 2010 = 8).

Statistical analyses

Descriptive analyses examined sexual behaviours by gender and year. Condom use data were only drawn from sexually initiated adolescents. Linear time trends were determined through logistic regression models, with age as a control variable, while adjusting for the design effects inherent in the clustered sample. Descriptive data analyses and calculation of weights were carried out in PASW/SPSS 18.0 and logistic regressions in STATA 12.0. As sexual behaviour is gender-specific, results are stratified by gender.

Results

Have had sex

The rates of 15-year-olds who reported having experienced sexual intercourse ranged from 2.7 in Macedonia (girls, 2010) to 46.8% in Ukraine (boys, 2002). In most countries, boys were more likely than girls to have had intercourse, with differences generally larger in Southern and Eastern Europe, compared with Western. In Northern European countries, this gender pattern was reversed (i.e., generally higher rates among girls). No significant linear trend over time 2002–06–10 was observed for most countries, apart from Hungary, Latvia and Sweden (increasing) and Macedonia, England, Scotland and Finland (decreasing). Regionally, there were no significant linear time trends for boys, but increasing trends for girls in Eastern and Southern European regions (see table 1).

Early sexual intercourse initiation

The rates of 15-year-olds who reported having had sexual intercourse for the first time before age 14 ranged from 0.1% in Macedonia (girls, 2002) to 15.9% in Greece (boys, 2006). In most countries, boys were more likely than girls to report very early first sexual intercourse, with gender differences tending to be larger in southern and eastern countries. In four northern countries this gender pattern was reversed in at least one year. No significant linear trend 2002–06–10 was found for most countries, but some decreasing trends were observed in countries of the Northern (Finland and England) and Southern regions (Macedonia), while in Eastern Europe both increasing (Hungary, Latvia and Estonia) and decreasing (Lithuania) trends were observed. Regionally, a linear decrease was found for boys in Southern and for girls in Northern Europe (table 1).

Condom use

Rates of condom use at last intercourse ranged from 49.5% in Sweden (girls, 2002) to 91.6% in Estonia (boys, 2010). Condom use was more frequently reported by boys, especially in Northern and Western regions. In three countries in the Southern region (Croatia, Portugal and Slovenia) reported condom use was higher

Table 2 Condom use at last sexual intercourse among sexually initiated 15-year-olds, by gender, year of study and country

	Boys					Girls				
	n[c]	2002 (%)	2006 (%)	2010 (%)	Trend	*n*[c]	2002 (%)	2006 (%)	2010 (%)	Trend
Estonia	429	75.7	88.7	91.6	↗**	412	72.2	81.3	90.7	↗***
Hungary	470	85.0	82.1	81.7	→	437	71.0	77.8	76.7	→
Latvia	356	78.2	88.6	79.4	→	306	77.6	80.7	83.6	→
Lithuania	676	79.6	85.2	78.3	→	300	65.6	76.6	84.5	↗***
Ukraine	969	83.5	88.4	83.6	→	539	57.6	75.9	78.9	↗***
E. Europe	*2900*	*80.4*	*86.6*	*82.9*	→	*1994*	*68.8*	*78.5*	*82.9*	↗***
Croatia	634	74.8	82.4	84.7	↗*	353	71.9	84.3	81.9	→
Greece	738	91.3	88.1	88.8	→	314	82.5	65.6	87.0	→
Macedonia[a]	721	85.0	83.5	82.8	→	80	(82.6)[d]	79.9	(83.3%)[d]	→
Portugal	411	68.8	85.4	80.9	→	372	77.8	84.4	84.7	→
Slovenia	595	78.1	77.1	87.9	↗*	431	68.6	85.6	86.1	↗**
S. Europe	*3099*	*79.6*	*83.3*	*85.0*	↗*	*1550*	*76.7*	*79.3*	*84.6*	↗**
Austria	450	80.7	86.3	86.2	→	419	75.5	76.8	77.6	→
Belgium[b]	568	79.5	78.3	77.6	→	545	59.7	66.7	68.8	→
France	845	86.2	87.6	89.4	→	627	70.3	79.9	81.5	↗*
Netherlands	431	81.0	85.5	77.0	→	456	71.6	73.6	77.9	→
Switzerland	545	77.2	88.5	85.0	↗*	419	83.3	77.9	81.0	→
W. Europe	*2839*	*80.9*	*85.3*	*83.1*	→	*2466*	*72.1*	*75.0*	*77.4*	↗*
England	540	69.2	87.4	78.5	→	749	70.6	82.7	73.5	→
Finland	553	71.4	81.5	76.6	→	782	58.7	64.3	63.5	→
Scotland	772	75.1	83.3	72.8	→	945	63.4	74.0	70.5	→
Sweden	631	62.9	68.2	69.2	→	736	49.5	62.2	57.3	→
Wales	592	74.7	82.0	83.9	→	781	63.6	72.0	78.0	↗**
N. Europe	*3088*	*70.7*	*80.5*	*76.2*	↗*	*3993*	*61.1*	*71.1*	*68.6*	↗***

n, percentages and linear time trends between 2002 and 10 (HBSC 2002, 2006 and 2010).
Note: [a]Former Yugoslav Republic of Macedonia; [b]Flemish Community only; [c]Total unweighted *n* across the three studies; [d]$n < 30$, thus statistical inference not possible; → no significant linear in- or decrease between 2002 and 2010; ↗ increasing trend between 2002 and 2010; ↘ decreasing trend between 2002 and 2010; *$P \leq .05$; **$P \leq .01$; ***$P \leq .001$. Percentages for European regions were calculated as means of the included countries and the data were reweighted accordingly for testing linear time trends.

among girls. A significant overall trend revealed an increase in condom use 2002–06–10, largely explained by an increase in the Southern and Northern regions for both boys and girls and an increase for girls in the Eastern and Western regions (table 2).

Discussion

No significant linear trend was documented for most countries for having experienced sexual intercourse by age 15 or for sexual initiation before age 14. Regionally, increasing trends in sexual intercourse emerged among Eastern and Southern European girls, regions where girls had a lower prevalence than boys in the same regions and than girls in the Western and Northern regions. The maintenance of these substantial differences between the rates of girls and boys reporting sexual initiation may reflect the preservation of traditional gender norms, that promote and allow more sexual permissiveness for boys than for girls.[8] The gender gap has narrowed somewhat in these regions, suggesting that traditional gender norms may be eroding. As for the prevalence of very early initiation (before age 14), a decrease was found for boys in Southern Europe-the region where the largest gender gap was found, and for girls in Northern Europe-the region with the highest prevalence for girls.

The highest prevalence of sexual intercourse initiation among 15-year-olds and very early initiation among those aged 13 or younger was found in Northern European countries. Traditionally, these countries have had extensive sexual education programmes, yet their sustainability has been jeopardized by reductions in commitment (e.g., at policy level, driven by both financial restraints, and in some cases by political and moral objections by interest groups).[9] It may also be that previous successes in reducing sexual risk behaviours has resulted in sex education now being of lower priority in some countries.[9]

There was an increase in condom use in all regions among girls, and in half of them for boys. The increase was notable among Eastern European girls, from <70% (2002) to >80% (2010). This may be due to wider contraceptive access since the transition from communist to market economies, but further investigation is warranted.

A significant minority of adolescents are involved in risky behaviours such as not using a condom during their last intercourse and having had sex before age 14, behaviours related to major negative outcomes individually and in terms of public health.[5] It is therefore crucial to understand why prevention initiatives have not been successful with these adolescents.

These findings must be considered in the light of the study's strengths and limitations. While the study samples are nationally representative and of sufficient size for analysis, the mode of data collection-in classrooms-may have influenced the responses of students. The HBSC questionnaire employed did not include questions on partner gender. Such data could help provide a better understanding of the way condom use behaviour evolves in individual terms. Analysing the relationship between condom use and early sexual intercourse initiation would be of particular interest for future research. While the data presented here have not been subject to external validity assessments, the guidelines on question presentation and translation across countries are very specific and refer only to vaginal intercourse with penile penetration. Country level results should be examined at a national level so that Sexual Health policy can meet the specific needs of the population.[10] Adolescent sexual behaviour is complex and culturally dependent and should consider factors that influence adolescent sexual behaviours at an individual (education, developmental stage), family (parenting, economic factors), school (school attachment and achievement) and community level (media exposure, access to services), as well as national policy and strategy.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. The International Coordinator of HBSC is Professor Candace Currie, University of St. Andrew's, and the databank manager is Professor Oddrun Samdal, University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The data collection for each HBSC survey is funded at the national level. We also acknowledge all the parents and children who consented and took part, as well as the management authorities, Principals and Teachers in all participating schools.

Funding

Authors of this paper have received grant support from the Ministry of Health and the Ministry of Science and Technology, Portugal; the Department of Health, and the Irish Research Council – Collaborative Research Grants with the Crisis Pregnancy Programme of the Health Services Executive, Ireland and the French Monitoring Centre for Drugs and Drug Addiction, the French interministerial mission against drugs and addiction, the Pfizer Foundation and the French National Institute for Prevention and Health Education.

Conflicts of interest: None declared.

Key points

- Early (at or before age 15) and very early (at or before age 13) sexual initiation was relatively stable in Europe between 2002 and 2010, especially for boys; though there was an increase in early initiation among girls in the Eastern region and a decrease in very early initiation among girls in Northern Europe.
- Condom use at last intercourse increased in both boys and girls across Europe between 2002 and 2010, especially for girls.
- Efforts to improve consistent condom use are essential, especially for the minority of children engaging in sexual intercourse who report non-condom use.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 69–72

doi:10.1093/eurpub/ckv031

Decreases in adolescent weekly alcohol use in Europe and North America: evidence from 28 countries from 2002 to 2010

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Background: This study examined trends in adolescent weekly alcohol use between 2002 and 2010 in 28 European and North American countries. **Methods:** Analyses were based on data from 11-, 13- and 15-year-old adolescents who participated in the Health Behaviour in School-Aged Children (HBSC) study in 2002, 2006 and 2010. **Results:** Weekly alcohol use declined in 20 of 28 countries and in all geographic regions, from 12.1 to 6.1% in Anglo-Saxon countries, 11.4 to 7.8% in Western Europe, 9.3 to 4.1% in Northern Europe and 16.3 to 9.9% in Southern Europe. Even in Eastern Europe, where a stable trend was observed between 2002 and 2006, weekly alcohol use declined between 2006 and 2010 from 12.3 to 10.1%. The decline was evident in all gender and age subgroups. **Conclusions:** These consistent trends may be attributable to increased awareness of the harmful effects of alcohol for adolescent development and the implementation of associated prevention efforts, or changes in social norms and conditions. Although the declining trend was remarkably similar across countries, prevalence rates still differed considerably across countries.

Introduction

In recent decades, frequent alcohol use was common among adolescents in North American and Northern and Western European countries.[1,2] However, between 1998 and 2006 alcohol use started to decline (see: Monitoring the Future reports (US), the European School Survey Project on Alcohol and other Drugs (Europe) and the Health Behaviour in School-Aged Children (HBSC) study (North America and Europe).[3–6] These trends may be attributable to an increased understanding of negative effects of alcohol on adolescent development and, consequently, the implementation of public health programs targeting adolescent alcohol use.[7]

However, during this same period substantial increases in adolescent alcohol use were reported for several Eastern European countries.[3,4] Explanations for these increases include the (rapid) increase in wealth and availability of alcohol in Eastern Europe after its transition from communist to market economies in the late 1980s.[8]

As adolescent alcohol use has also gained more attention in public health domains in Eastern European countries,[2] increasing trends may have ceased after 2006, or even begun to decline, emulating the trends observed in other regions. The present study aimed to test this hypothesis.

We describe (i) trends in weekly alcohol use from 2002 to 2010 in 28 countries; and (ii) variations in these trends by gender, age and geographical region. The variations by gender and age are relevant as boys and older adolescents are generally more likely to drink alcohol on a weekly basis compared with girls and younger adolescents.[9] Recent research has suggested that the gender gap in adolescent alcohol use has become more narrow between 1998 and 2006;[3,4] this study also sheds light on the potential continuation of this reduction.

Methods

We used data from the three most recent cycles of HBSC study. Anonymous surveys were conducted in the classrooms of 11-, 13- and 15-year-olds for academic years ending in 2002, 2006 and 2010, according to a common research protocol.[9] A clustered sampling design was used, where the initial sampling unit was either the class or the school. Schools were selected to ensure that samples were representative by regional geography and other demographic characteristics, with variations in sampling criteria permitted to fit country-level circumstances. In some countries (i.e. Germany, Greece, Hungary, the Netherlands, Ukraine and UK), data were weighted to ensure representativeness. Sample sizes can be found online (see Supplementary Table X).

Each of the 28 participating countries obtained approval to conduct the survey from their ethics review board or equivalent regulatory institution. Responses were treated as confidential and

anonymous. School and student response rates were above 70% in most countries. Further information about survey procedures can be found elsewhere.[9,10]

Measures

Weekly alcohol use

Students were asked how often that they drank beer, wine and liquor/spirits. For each type, response options were '1 = never', '2 = rarely', '3 = every month', '4 = every week' and '5 = every day'. This variable was dichotomized by combining options 1 through 3 (indicating less than weekly alcoholic use, coded as '0') and 4 to 5 (indicating weekly alcohol use, coded as '1').

Time

Time was included as a categorical variable based on the academic year (ending in 2002, 2006, 2010). To test our hypothesis that trends in Eastern Europe were stabilizing or declining; a curvilinear time variable (time squared) was also included in the model.

Demographic predictors

Socio-demographic variables included gender, country of residence and age group. Although alcohol use is rare among 11-year olds, this group was included because alcohol misuse is a risky behaviour particularly during early adolescence.

Statistical analyses

To account for potential differences in sample composition across survey years, prevalence estimates for each country and survey year were standardized by age and gender, using the overall study population (all 28 countries combined) for 2010 as the standard. Regression analyses were conducted with Mplus (version 6.12).[11] Trends were calculated by means of multiple group logistic regression analyses (with country as a grouping variable) in which both linear and curvilinear time variables were regressed on weekly drinking. To examine whether trends were different across geographical regions, this analysis was repeated with geographic region as a grouping variable. Group membership was based on geographical location (Northern, Western, Southern, Eastern Europe and Anglo-Saxon countries). Finally, to test whether the trends within countries and regions differed across age and gender, we conducted a multiple group analysis with six groups (3 age groups × 2 genders).

Percentages of missing values ranged from 0 (several countries) to a maximum of 2.9 (for Danish respondents). Missing values were model estimated in Mplus.

Results

Table 1 presents the prevalence of weekly alcohol use for boys and girls per country, categorized by geographic region. In 2010, the average of weekly alcohol use ranged from 2.4% in Finland to 19.6% in the Czech Republic.

In gender and age adjusted analyses, a trend towards decreasing weekly alcohol use was observed in 20 out of 28 countries. In some countries, this decrease was linear (e.g. Canada). In other countries, the decrease was steepest between 2002 and 2006 (e.g. France) or between 2006 and 2010 (Russia). Exceptions to this decline were found in eight countries. These countries showed an increase in weekly alcohol use (Croatia), no trend (Austria, Latvia, Portugal, Slovenia) or a fluctuating trend (Czech Republic, Macedonia, Ukraine).

Table 1 and figure 1 also present time trends by geographical region. In all regions, weekly alcohol use decreased over time. The decrease was strongest in Northern European, Southern European and Anglo-Saxon countries, followed by Western European countries. This trend was equally strong across time periods in Anglo-Saxon countries, but especially strong between 2002 and 2006 in the other regions. In Eastern European countries, adolescent alcohol use increased slightly between 2002 and 2006, but decreased substantially thereafter.

Figure 1 further presents the results of the multiple group regression analysis by age group and gender. Overall, weekly drinking was most prevalent among boys and older age groups. The multiple group analysis revealed that weekly alcohol use decreased to a similar degree in all gender and age subgroups (i.e. regression coefficients did not significantly differ; data available from first author).

Discussion

This study of adolescents from 28 European and North American countries (2002–10) identified a decline in weekly alcohol use in Anglo-Saxon and Northern, Western and Southern European countries. In Eastern European countries, alcohol use (slightly) increased between 2002 and 2006, but declined considerably between 2006 and 2010. Across countries and regions, weekly drinking declined to a similar degree among boys and girls of all age groups.

A variety of factors may have affected the general decrease in adolescent weekly drinking, including income, marketing, prevention approaches, changes in adult prevalence and shifts in teen culture.[4] Policies are in place in all Western countries to limit underage access and restrict use among those of all ages,[12] and stricter prevention policies are emerging in many countries.[2,13] In addition to the potential effects of these restrictions, changes in social norms, i.e. more societal disapproval of adolescent drinking, may account for the observed trends.

The general decline in weekly drinking is consistent with a general decline in adolescent tobacco and cannabis use,[14] sexual risk behaviours[15] and fighting[16] in the beginning of the twenty-first century in Europe and North America, reflecting a robust pattern of decrease in risk behaviours among adolescents.

Exceptions to the generally observed decline in adolescent alcohol use were observed in eight countries. Six of these were in Eastern Europe. The lack of a decline in these countries may be explained by rapid increases in wealth in these countries and adolescents' subsequent opportunity to be more financially independent and to consume goods that were previously unavailable, including alcohol.[17] However, other Eastern European countries have followed the more general tendency towards declines in alcohol use, with awareness, policies and social norms helping to curb alcohol consumption among adolescents. Hence, overall, alcohol use appeared to decrease in the Eastern region as of 2006.

Our finding that weekly alcohol use decreased to a similar extent among boys and girls and among adolescents from different age groups is inconsistent with earlier findings suggesting a closure of the gender gap in adolescent alcohol use in Europe.[3,4] It appears that gender convergence is more visible for more extreme drinking behaviours (i.e. drunkenness) in contrast to more regular drinking behaviours, such as weekly alcohol use, or that gender convergence has diminished in recent years.

Strengths of this study include our use of large, nationally representative datasets, inclusion of many countries, and uniformity of the protocol across countries and time. Limitations include (i) the study's reliance on self-reports, which may have caused some adolescents to provide dishonest or inaccurate answers (although anonymity was stressed); and (ii) our time frame, limited to the 8-year period between 2001/02 and 2009/10, so caution should be exercised in extending these conclusions to periods after this period. Finally, it is important to recognize that our outcome measure was (at least) weekly drinking of beer, wine and spirits. This measure did not include the consumption of other alcoholic drinks, such as alcopops and national alcoholic drinks. We did not include alcopops because we wanted to base our trend analysis on similar items across time, and alcopops were not included in the 2002 HBSC

Table 1 Trends in adolescent weekly alcohol use by country and region

		Age/gender-standardized rate per 100 children			Age/gender-adjusted linear time trend (per year of study)			Age/gender-adjusted curvilinear time trend (per year of study)		
Region	**Country**	**2002**	**2006**	**2010**	***B***	**SE**	***P***	***B***	**SE**	***P***
Anglo-Saxon countries		12.1	8.6	6.1	−0.263[ab]	0.026	<0.001	0.001[a]	0.013	0.932
	Canada	11.6	7.3	5.5	−0.278	0.066	<0.001	0.039	0.031	0.215
	Ireland	5.5	6.4	4.1	0.191	0.088	0.029	−0.141	0.040	<0.001
	UK	23.5	15.3	10.2	−0.332	0.033	<0.001	0.024	0.016	0.139
	USA	7.6	5.4	4.7	−0.224	0.081	0.006	0.053	0.039	0.182
Western Europe		11.4	9.3	7.8	−0.178[a]	0.025	<0.001	0.028[a]	0.012	0.025
	Austria	10.5	12.2	10.8	−0.072	0.072	0.318	−0.028	0.034	0.417
	Belgium	13.0	11.2	8.2	−0.058	0.047	0.220	−0.045	0.024	0.057
	France	7.2	7.0	6.6	−0.227	0.061	<0.001	0.069	0.030	0.022
	Germany	13.3	7.0	6.5	−0.454	0.063	<0.001	0.120	0.032	<0.001
	Netherlands	14.1	11.0	6.5	−0.098	0.074	0.186	−0.079	0.037	0.032
	Switzerland	10.2	7.3	8.1	−0.197	0.075	0.009	0.093	0.036	0.009
Eastern Europe		12.2	12.3	10.1	0.055[c]	0.019	0.003	−0.062[b]	0.009	<0.001
	Croatia	13.6	17.0	15.6	0.227	0.060	<0.001	−0.088	0.028	0.002
	Czech Rep	19.4	17.8	19.6	−0.125	0.056	0.025	0.063	0.027	0.020
	Estonia	9.8	7.8	6.0	−0.353	0.077	<0.001	0.070	0.037	0.062
	Hungary	15.7	11.4	10.4	−0.292	0.073	<0.001	0.074	0.035	0.037
	Latvia	8.1	9.4	7.2	0.049	0.077	0.530	−0.050	0.037	0.172
	Lithuania	9.8	6.1	6.9	−0.473	0.069	<0.001	0.175	0.034	<0.001
	Poland	7.3	5.2	6.0	−0.348	0.071	<0.001	0.141	0.036	<0.001
	Russia	14.5	11.4	5.5	0.004	0.049	0.928	−0.130	0.025	<0.001
	Slovenia	12.1	10.9	11.1	−0.024	0.069	0.724	0.007	0.032	0.818
	Ukraine	17.4	29.2	16.4	1.064	0.057	<0.001	−0.543	0.028	<0.001
	Macedonia	6.6	8.8	6.5	0.364	0.073	<0.001	−0.178	0.035	<0.001
Northern Europe		9.3	5.3	4.1	−0.390[b]	0.041	<0.001	0.073[a]	0.020	<0.001
	Denmark	18.6	11.1	8.5	−0.519	0.069	<0.001	0.134	0.034	<0.001
	Finland	5.1	3.7	2.4	−0.160	0.087	0.068	−0.004	0.043	0.935
	Norway	6.5	3.3	3.1	−0.456	0.094	<0.001	0.162	0.047	0.001
	Sweden	7.0	3.0	2.5	−0.533	0.099	<0.001	0.185	0.048	<0.001
Southern Europe		16.3	12.7	9.9	−0.238[ab]	0.042	<0.001	0.045[a]	0.020	0.025
	Greece	15.9	13.3	14.1	−0.601	0.079	<0.001	0.216	0.036	<0.001
	Italy	24.1	19.4	12.1	−0.140	0.060	0.020	−0.040	0.029	0.171
	Portugal	8.9	5.4	3.5	−0.096	0.091	0.291	−0.026	0.044	0.558

Notes: Due to the rising popularity of alcopops, in 2006 and 2010, an item 'alcopops' was included in the list of alcoholic drinks. Sensitivity analyses were conducted to check whether the inclusion of alcopops would influence the trends. No substantial differences in the outcomes of the trend analyses were found (results available on request).
Within columns, at the regional level, different subscripts refer to statistically significant differences at $P < 0.01$. For instance, the linear time trend in Anglo-saxon countries[ab] does not differ from the linear time trend in Western[a], Northern[b] or Southern[ab] Europe, but it does differ from the linear time trend in Eastern Europe[c].

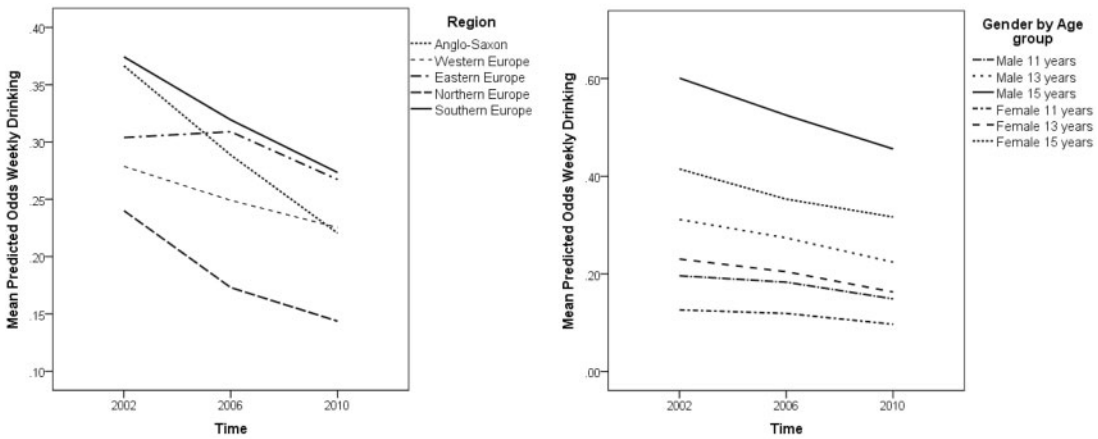

Figure 1 Trends in adolescent weekly alcohol use by region and by demographic group

questionnaire. Furthermore, a decrease in weekly alcohol use does not necessarily imply a decrease in the quantity of alcohol consumed. Future research may examine whether trends in different drinking behaviours, such as drunkenness, are also reflective of such decreases.

Our study confirms the need for an understanding of adolescent alcohol use trends in different populations that can facilitate establishing effective policies and programs to prevent the problematic consequences of these behaviours. Although observed trends in adolescent weekly drinking were remarkably similar across

countries and demographic subgroups, absolute prevalence rates in weekly drinking still differed substantially across countries. Future research may examine the role of national factors, such as wealth, alcohol control policies, preventive measures, the general availability of alcohol, adult drinking patterns and social norms, in further explaining these cross-national differences.

Supplementary data

Supplementary data are available at *EURPUB* online.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. The international coordinator was Prof. Candace Currie, University of St. Andrews, and the databank manager was Prof. Oddrun Samdal, University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). We thank Robert Smith (Norway) for his careful assembly of the international HBSC trends data file.

Funding

The data collection for each HBSC survey is funded at the national level.

Conflicts of interest: None declared.

Key points

- A substantial decline in adolescent alcohol use in the period from 2002 to 2010 was observed in North America and across Europe.
- The general decrease in alcohol use was not equally present in all Eastern European countries; however, after 2006 most of Eastern Europe seems to follow the declining trend established in the rest of Europe and North America.
- Adolescent boys still drink more than adolescent girls and the closing of the gender gap in alcohol use seems to have come to a halt.
- The general decline in alcohol use fits into a pattern of overall decrease in risk behaviours (smoking, drug use, sexual risk behaviour, fighting), characteristic of the early twenty-first century in western countries
- Results of cross-national monitoring studies can lead to higher awareness of the frequency of early adolescent alcohol use and its negative effects across a wide geographical area. Therefore cross-national monitoring studies are a crucial first step in the development of alcohol prevention and reduction programs among adolescents.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 73–75

doi:10.1093/eurpub/ckv032

Trends in the co-occurrence of tobacco and cannabis use in 15-year-olds from 2002 to 2010 in 28 countries of Europe and North America

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Background: Cannabis and tobacco use frequently co-occur. Adolescents who consume both substances experience more respiratory distress and psychosocial problems and are less likely to stop compared with those who use either tobacco or cannabis alone. This study examined time trends in tobacco and cannabis use among 15-year-olds in Europe and North America between 2002 and 2010. **Methods:** Twenty-eight countries were included and merged into six regions based on their welfare systems. Adolescents ($n = 142\,796$) were divided in four 'user groups': 'no-users', 'tobacco and cannabis users', 'tobacco-only users' and 'cannabis-only users'. Prevalence rates are reported by study-wave and region. Logistic regressions with study wave as independent variable were used to study trends in the user groups and regions. Interaction effects between time and gender were considered. **Results:** Overall, tobacco use, and concurrent tobacco and cannabis use decreased by 3 and 3.7%, respectively, but prevalence rates varied by region. Only in North America, an interaction effect between time and gender was found in tobacco and cannabis users. **Conclusions:** Although this study demonstrates a decrease in tobacco and cannabis use in most regions, it also shows that the use of both substances is related. Therefore, studying the co-occurring use of tobacco and cannabis is necessary.

Introduction

Despite legislation and prevention initiatives, substantial groups of adolescents smoke tobacco and/or use cannabis. Across Europe and North America, 18% of 15-year-olds smoke tobacco weekly or more frequently, and 13% use cannabis regularly (Health Behaviour in School-aged Children (HBSC) 2009/2010).[1] Adolescents are often motivated by the desire to experience the mood enhancing effects of these substances, to project a 'cool' adult-like image, or to adjust to peer norms.[2] However, tobacco use remains a leading cause of preventable death[3] and frequently inhaling cannabis smoke's high concentration of tar, can lead to increased heart rate and blood pressure, and impaired respiratory function.[4] Moreover, people using both substances have an elevated risk of respiratory distress, psychosocial problems and poorer cessation outcomes than users of each substance separately.[5,6]

Several mechanisms can explain the co-occurrence of tobacco and cannabis use.[7] First, the use of cigarettes may serve as a gateway for cannabis use (gateway hypothesis) or cannabis use can increase the risk of using tobacco (reverse gateway hypothesis). Second, tobacco and cannabis users may share a common vulnerability, which can be either genetically based (directly or indirectly, through a predisposition to externalizing problems) or environmentally based (low parental monitoring or support, negative peer influences, high availability of substances, media exposure). Third, smoking either substance may function as a trigger to use the other as the same set of behaviours is involved: lighting, inhaling, disposing of the end of the cigarette/joint. Last, cannabis and tobacco are in fact often used in concert, as most youth use cannabis by smoking 'joints' containing tobacco.[8]

In most studies,[1,9,10] trends in tobacco use and cannabis use are studied separately. Studying the joint use of these substances is necessary to capture the whole picture of tobacco and cannabis use. This study sets out to explore time trends in concurrent tobacco and cannabis use among 15-year-olds in Europe and North America over the school-years 2001/2002, 2005/2006 and 2009/2010, further referred to as 2002, 2006 and 2010.

Methods

Sample

This report contains data on 15-year-old boys and girls. Only countries that have data on the use of both tobacco and cannabis from the HBSC survey years 2002, 2006 and 2010 were included in the analyses. The countries were collated into six regional groups based on their current welfare system as described by Richter et al.[11]: Northern European countries (social-democratic: Denmark, Finland, Greenland), 'Bismarckian' countries (conservative: Austria, Belgium, France, Germany, the Netherlands, Switzerland), Anglo-Saxon countries (liberal: Ireland, UK), Southern countries ('southern' system: Greece, Italy, Portugal, Spain, Former Yugoslav Republic of Macedonia), Eastern European countries (countries in transition: Croatia, Czech Republic, Estonia, Hungary, Latvia,

Lithuania, Poland, Russia, Ukraine, Slovenia) and North America (Canada, and the USA).

Measures

Current smoking: 'How often do you smoke at present?' Response options: 'Every day', 'At least once a week but not every day', 'Less than once a week', 'I do not smoke'. Respondents indicating that they smoked at least once a week were recoded as 'tobacco users'.

Cannabis use: 'Have you ever taken cannabis in the last 12 months?' Response categories: 'never' to '40 times or more'. Respondents who indicated they used cannabis in the last 12 months were recoded as 'cannabis users'. 'Last year use of cannabis' was used as an indicator because in 15-year-olds regular cannabis use (i.e. weekly) is rare and occasional cannabis use has been shown to be a risk behaviour.[12]

Respondents with missing data on one or both questions were recoded as missing ($n = 9\,814$; 6.4% of the dataset). Four 'user groups' were identified: those neither using tobacco nor cannabis ('no-users'), those consuming both tobacco and cannabis ('tobacco and cannabis users'), those using tobacco but not cannabis ('tobacco-only users') and those consuming cannabis but not tobacco ('cannabis-only users').

Statistics

Prevalence rates are reported by study-wave and region. Trends in the prevalence of the four user groups were examined for each region separately, by using logistic regression by user group with study-wave as independent variable, and controlling for gender. Sequential binary logistic regressions were employed to test each user group against the others. Interaction effects between time and gender were considered.

Results

In total, 143 796 fifteen-year-olds were included in the analyses (2002: 43 734, 2006: 48 953, 2010: 51 109). Table 1 reports the prevalence rates by region and by user group in the three study-waves, along with odds ratios (ORs) comparing the user groups between the study-waves.

Prevalence and change by region

'Anglo-Saxon countries'—a region with high proportions of cannabis only (7.5%), and tobacco and cannabis users (8.4%), as compared with tobacco-only users (4.3%)—experienced a large increase in the no-use group between 2002 and 2010. The 'Bismarckian' countries—equal distribution between the three user groups in 2010—showed significant decreases over time in the tobacco and cannabis and the tobacco-only user groups. 'Northern European countries'—higher proportion of tobacco-only users (14.0%) compared with tobacco and cannabis users (6.5%) and cannabis-only (3.2%) in 2010—showed a substantial decrease only in the tobacco and cannabis user group. In 'Southern European countries', the largest decrease was among tobacco and cannabis users. In 'Eastern European countries', the observed decrease was limited to tobacco-only and tobacco and cannabis user groups. Finally, in 'North America'—high proportion of cannabis-only users in 2010 (19.1%), compared with tobacco and cannabis (7.7%) and tobacco-only users (1.8%)—decreases were found among cannabis-only and tobacco and cannabis user groups.

Prevalence and change by user group

The proportion of (weekly) 'tobacco-only users' ranged from 1.8% (North America) to 14.1% (Eastern Europe) in 2010. With the exception of North America, where there was no change, a decrease is observed in the proportion of tobacco-only users between 2002 and 2010, most notably in the 'Bismarckian', Anglo-Saxon countries and in Eastern Europe. No interaction between gender and time was found.

'Cannabis-only users (last year)' ranged from 3.2% (Northern Europe) to 19.1% (North America) in 2010. Across all regions, no significant decrease was observed between 2002 and 2010. Within regions, the proportion of cannabis-only users decreased significantly in the Anglo-Saxon countries and North America. In the other regions, no or marginal ($0.01 < P < 0.05$) changes were observed. No interaction between gender and time was found.

The proportion of 'tobacco and cannabis users', ranged between 6.5% (Northern Europe) and 9.3% (Bismarckian countries) in 2010. Significant decreases between 2002 and 2010 (all $P < 0.001$) were observed in all regions ranging from 1% in Eastern European countries (from 9.2 to 8.0%) to 6% in Anglo-Saxon countries (from 14.6 to 8.4%). In North America, an interaction effect was found between gender and time. In boys, a sharp decrease between 2002 and 2006 from 14.1 to 5.4% ($P < 0.001$) was followed by an increase to 7.6% in 2010 ($P = 0.003$). In girls, a decrease was found between 2002 and 2006 from 10.3 to 7.6% ($P = 0.007$), followed by a stabilization in 2010 (7.8%, $P = 0.820$).

Table 1 Smoking and cannabis use in school year 2002, 2006 and 2010 by region

	Northern European countries ($n = 9\,759$)			Bismarckian countries ($n = 33\,862$)			Anglo-Saxon countries ($n = 17\,611$)			Southern European countries ($n = 22\,032$)			Eastern European countries ($n = 47\,736$)			North America ($n = 12\,796$)			All ($n = 143\,796$)		
	2002	2006	2010	2002	2006	2010	2002	2006	2010	2002	2006	2010	2002	2006	2010	2002	2006	2010	2002	2006	2010
No use %	68.4	76.7	76.3	65.3	74.3	74.6	65	72.9	79.8	74.7	78.8	80.9	70	73.3	73.1	63	71.5	71.4	68.4	74.6	75.4
OR[a]	1	1.52	1.48	1	1.53	1.56	1	1.45	2.12	1	1.26	1.44	1	1.18	1.17	1	1.48	1.47	1	1.36	1.42
Tobacco use only (weekly use) %	16.9	14.2	14	11	8.7	8.7	6.4	6.1	4.3	9.4	8.3	7.7	16.3	13.7	14.1	2.3	1.4	1.8	12.1	9.8	9.1
OR[a]	1	0.81**	0.80**	1	0.77	0.77	1	0.98^{ns}	0.67	1	0.87*	0.81**	1	0.81	0.84	1	0.59**	0.81^{ns}	1	0.79	0.73
Cannabis use only (last year use) %	4.4	3	3.2	8.6	7.1	7.4	13.9	9.9	7.5	5.3	5.2	4.5	4.5	4.9	4.8	22.7	20.6	19.1	7.7	7.1	7.5
OR[a]	1	0.68**	0.73*	1	0.81	0.85**	1	0.66	0.49	1	0.99^{ns}	0.83*	1	1.09^{ns}	1.07^{ns}	1	0.87*	0.8	1	0.9	0.95^{ns}
Cannabis and tobacco use %	10.3	6	6.5	15.1	9.9	9.3	14.6	11	8.4	10.6	7.7	6.9	9.2	8.1	8	12	6.5	7.7	11.7	8.6	8
OR[a]	1	0.56	0.61	1	0.62	0.58	1	0.73	0.54	1	0.7	0.63	1	0.86	0.85	1	0.51	0.61	1	0.7	0.66

a: OR from logistic regression by user group and region separately, controlling for gender, with 2001/2002 as reference year. All ORs are significant at $P < 0.001$ except: ^{ns}, $P > 0.05$; *, $P < 0.05$ and **, $P < 0.01$

Discussion

Tobacco and cannabis use among 15-year-olds decreased significantly in most regions between 2002 and 2010. The extent of this change varies by user group and by region. Exceptions to these overall reductions are North America and the Eastern European countries, where no significant changes were observed in the proportions of tobacco-only and cannabis-only users. The concurrent use of tobacco and cannabis in 15-year-olds decreased dramatically within the study period.

Different factors may have accounted for the observed decrease in tobacco and cannabis use in the different regions. Economic and policy factors are likely to have played an important role, most notably the increase in tobacco price, which may have made these substances less accessible to adolescents.[7] In addition, social factors can be important. Kuntsche et al.[13] found that in most countries adolescents went out less frequently with their friends in 2006 compared with 2002, and demonstrated that cannabis use decreased accordingly.

The lack of decline in cannabis use in Eastern Europe can be partially explained by three important factors occurring in post-communist transition countries: (i) their previous relative isolation led to a delay in the development of cannabis distribution networks; the subsequent growth of these networks may have counteracted any otherwise downward trend (ii) dramatic social and economic changes, including increases in wealth and leisure opportunities, which have driven to substance use and (iii) unpreparedness of public health authorities and decision makers in terms of legislation, policy and education.[14]

One study limitation is that self-reports of smoking and cannabis use may raise validity and reliability issues. Adolescents typically view tobacco use as unnatural, harmful to health, addictive and unethical, and cannabis use as natural and harmless to their health.[15] It could therefore be that adolescents who are using tobacco only, or tobacco together with cannabis under-report their tobacco smoking but not their cannabis use. In addition, because cannabis is often smoked with a small amount of tobacco, we cannot rule out a degree of error in group classifications. A second limitation is that the study only focuses on 15-year-olds and current substance use. Use of cannabis and other illicit drugs is more typical in late adolescence. Our results cannot be generalized to that group. Finally, the data were not weighted by country population. Therefore, a small country in a region has the same influence on the prevalence as a larger country. This has to be taken into account when interpreting the results.

Overall the findings are encouraging, demonstrating declining tobacco and cannabis use in most regions. However, there are considerable regional variations, which should be studied more thoroughly in future research. Our study provides support for the notion that changes in the use of the two substances are related. Though the legal status of tobacco and cannabis is vastly different in most countries, it is valid to study not only tobacco and cannabis use separately, but also as a co-occurring activity.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. We thank International Coordinator of the study Prof. Candace Currie, University of Edinburgh, Scotland and the data bank manager, Prof. Oddrun Samdal, University of Bergen, Norway. A complete list of the participating countries and researchers can be found on the HBSC website (http://www.hbsc.org).

Funding

Data collection were funded separately by each of the participating countries and regions. In Slovakia, the HBSC fieldwork and processing of data were supported by the Slovak Research and Development Agency under the contract No. APVV-0032-11.

Conflicts of interest: None declared.

Key points

- Tobacco-only use decreased in all European regions between 2002 and 2010; while cannabis-only use decreased in all regions except in Eastern European countries.
- Moreover, the concurrent use of tobacco and cannabis decreased in all regions between 2002 and 2010.
- Regional variations in prevalence rates are considerable and should be studied further.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 76–79

doi:10.1093/eurpub/ckv035

Adolescents' medicine use for headache: secular trends in 20 countries from 1986 to 2010

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Background: This study reports secular trends in medicine use for headache among adolescents in 20 countries from 1986 to 2010. **Methods**: The international Health Behaviour in School-aged Children (HBSC) survey includes self-reported data about medicine use for headaches among nationally representative samples of 11-, 13- and 15-year-olds. We included 20 countries with data from at least three data collection waves, with a total of 380 129 participants. **Results**: The prevalence of medicine use for headaches varied from 16.5% among Hungarian boys in 1994 to 62.9% among girls in Wales in 1998. The prevalence was higher among girls than boys in every country and data collection year. The prevalence of medicine use for headaches increased in 12 of 20 countries, most notably in the Czech Republic, Poland, Russia, Sweden and Wales. **Conclusion**: The prevalence of medicine use for headaches among adolescents is high and increasing in many countries. As some medicines are toxic this may constitute a public health problem.

Introduction

Medicine use for headaches is common among adolescents.[1–3] Unsupervised medicine use for headaches in adolescents can be problematic: Some adolescents misuse prescription drugs as they know little about medicines for headaches[4,5] and they may use headache medicines inappropriately, e.g. to treat general discomfort.[6,7] A qualitative study based on interviews with parents of children under 5 years old suggests that due to time pressures in modern families, medicines are often readily given to children by their parents in order to quickly mitigate pain-related discomfort.[8] Use of common over-the-counter (OTC) pain killers are often reported by children and adolescents attempting suicide.[9] Medicine use for aches in adolescence is predictive of medicine use in young adulthood, i.e. inappropriate medicine use may continue or increase over the life course.[10] It seems necessary to promote appropriate use of medicines among adolescents. Therefore, it is important to know the prevalence, demographic patterns and secular trends of medicine use.

It is difficult to get appropriate data since sales statistics do not indicate user characteristics and prescription studies do not include OTC medicines. Self-reported use is potentially the most appropriate data source for analysis of prevalence and trends in medicine use for headache.[11–13]

There are few studies about time trends in adolescents' medicine use for headaches. Reports from Spain and Denmark showed increasing use of painkillers over the past two decades.[13,14] Data from the USA showed no major changes over time in the use of painkillers.[11] The Spanish study[13] focused on the age group 0–15 and included data from parents about their children's use of specific drugs. The Danish study[14] used data from 11- to 15-year-olds about medicine use for headache. The American study[11] focused on 0- to 12-year-olds and collected data from parents about use of specific drugs. These few available studies are difficult to compare because of differences in study population, data collection and measurements. Many factors such as need for medication, increased marketing, increased availability, and changing norms about medicine use may result in increasing trends in medicine use. Allotey et al.[7] suggest that there is an increasing propensity to turn to medication as a possible way of improving lifestyle. They interpret the findings as a progressive medicalization of present day society. We have not been able to find systematic information about these issues and are hesitant to formulate specific hypotheses about time trends in adolescents' medicine use for headache.

The objective of this article is descriptive: to present international secular trends in adolescent boys' and girls' self-reported medicine use for headaches over an extended period from 1986 to 2010. The study is about medicine use behaviour, not specific drugs or active ingredients. The international Health Behaviour in School-aged Children (HBSC) study provides a unique opportunity to study secular trends in adolescents' self-reported use of medicine for headache.

Methods

The HBSC study comprises cross-sectional surveys carried out every 4 years in the participating countries.[15] HBSC uses a standardized protocol for sampling students in three age groups (11-, 13- and 15-year-olds) in nationally representative samples of schools. The data file includes data about medicine use for headaches in at least

three waves of data collection in 20 countries (see table 1, $n = 380\,129$), among 13- and 15-year-old girls and boys. The response rate varied by country but was generally high, over 70%.

Students answered the internationally standardized HBSC questionnaire during a class period. The participants received oral and written information about the study and were informed that participation was voluntary and anonymous. In each country, the study complied with national research ethical and data protection regulations.[16]

Medicine use was measured by the following survey item: 'Within the past month, did you take any pills or medicine for headache?' In the first two waves of data collection 1987–88 and 1993–94, the response categories were 'yes' and 'no'. In the last three waves of data collection 1997–98, 2005–06 and 2009–10, the response categories were 'no', 'yes once' and 'yes several times', probably in order to study adolescents with frequent medicine use. The item was not included in 2001–02. There is little available information about the validity of adolescents' self-reported medicine use. One study asked both adolescents and their parents about medicine use for headache in the past month. The agreement between the two parties was fairly high, gamma correlation = 0.67, Kappa coefficient = 0.41.[17]

We dichotomized the responses into no and yes. The proportion of missing responses was less than 4.5% in all countries and all data collection waves with only two exceptions where the proportion of missing was 7.7 and 8.8%. We included missing in the no category to avoid inflated prevalence rates. Three countries have data from six data collection waves, four countries from five waves, four countries from four waves and nine countries from three waves of data collection (table 1).

Statistical procedures included contingency tables and the Cochran–Armitage test for trend.[18] This test is based on the regression coefficient for a weighted linear regression of a binomial proportion of a variable (here: prevalence of medicine use for headache) on an explanatory variable (here: year of data collection). Tests for trends only included years of data collection with data about medicine use. All tests were stratified by gender and age group

Results

Table 2 shows that the prevalence of medicine use for headache varied substantially across country, gender and data collection wave. For instance, in the 2009–10 waves of data collection, the lowest prevalence was among boys in Austria (25.6%) and the highest prevalence was among girls in France (55.8%). The prevalence was higher for girls than boys in every country and wave of data collection all P values from Chi-square tests were under 0.01 with two exceptions: Germany in 2001 ($P = 0.0919$) and Greenland in 1998 ($P = 0.1666$).

There was an increase in medicine use over time in 12 countries: Austria, Czech Republic, Denmark, Finland (for boys but not girls), France, Hungary, Latvia, Poland, Russia, Scotland, Sweden and Wales. The increase was substantial—more than double among girls in the Czech Republic and boys and girls in Hungary. In three countries, Finland, Scotland and Sweden, the trend was not linear but fluctuated over time. There was a decrease over time among girls but not boys in Germany and among boys but not girls in Greece. There was no clear increasing or decreasing trend in eight countries: Canada, Finland (girls), Germany (boys), Greece (girls), Ireland, Norway or Switzerland, and Flemish- and French-speaking parts of Belgium. Secular trends were fairly similar for the three age groups (data not shown).

Discussion

In 12 of the 20 countries, there was an increasing trend in the prevalence of medicine use for headaches. In the remaining countries, the prevalence was stable or characterized by increasing and decreasing fluctuations. There was a more consistent increasing pattern for girls than for boys. This comparative study confirms prior studies which show different secular trends in use of medicine for headache.[11,13,14] There are no apparent geographic patterns, nor specific time periods with more consistent increasing patterns.

We have not been able to identify publications which provide a sound explanation for the general increasing trend in adolescents'

Table 1 Study population by country and year of data collection

Country	Year of data collection[a]						Total
	1985–86	1989–90	1993–94	1997–98	2005–6	2009–10	
Austria	–	2982	5349	4316	4848	5033	22 528
Belgium (Flemish)	–	–	4506	4824	–	4180	13 510
Belgium (French)	3575	–	5196	2505	4476	4012	19 764
Canada	–	5565	6758	6567	–	–	18 890
Czech Republic	–	–	3585	3703	–	4425	11 713
Denmark	–	–	3912	5066	5741	4330	19 049
Finland	3216	2996	4187	4864	3410[b]	6723	25 396
France	–	–	4023	4133	7155	6160	21 471
Germany	–	–	3275	4792	7274	–	15 341
Greece	–	–	–	4299	3715	4944	12 958
Hungary	4461	6498	5775	3609	–	4864	25 207
Ireland	–	–	–	4394	4894	4965	14 253
Latvia	–	3008	3818	3775	4245	4284	19 130
Norway	3955	5037	4952	5025	–	–	18 969
Poland	–	4613	4527	4861	–	–	14 001
Russia	–	–	4001	3997	–	5174	13 172
Scotland	4760	3719	4959	5632	6190	6771	32 031
Sweden	2933	3553	3584	3802	4415	6718	15 005
Switzerland	4973	–	–	–	4621	6678	16 272
Wales	6338	6724	3870	4537	–	–	21 469
Total	34 211	44 695	76 277	84 701	60 984	79 261	380 129

a: Items about medicine use were mandatory in the three first waves. The HBSC data collection in 2001–02 did not include medicine use. The items about medicine use were optional in 2005–06 and 2009–10.
b: The data from Finland 2005–06 includes 13- and 15-year-olds but not 11-year-olds.

Table 2 Prevalence (%) of 11-, 13- and 15-year-old boys and girls who used medicine for headache during the past month, including test for trend

Country	Sex	Year of data collection[a]						Cochran-Armitage test[b]	Difference between first and last observation
		1985–6	1989–90	1993–4	1997–8	2005–6	2009–10		
Austria	Boys	–	18.9	20.5	26.8	27.0	25.6	*	Up 6.7%
	Girls	–	27.8	27.9	31.4	33.9	32.7	*	Up 4.7%
Belgium Flemish	Boys	–	–	31.2	31.7	–	29.7		Down 1.5%
	Girls	–	–	41.9	43.4	–	40.4		Down 1.5%
Belgium, French	Boys	37.2	–	36.1	37.9	31.2	34.8		Down 2.4%
	Girls	51.8	–	51.4	52.2	43.2	52.6		Up 0.8%
Canada	Boys	–	43.2	42.9	44.7	–	–		Up 1.5%
	Girls	–	58.1	57.8	58.0	–	–		Down 0.1%
Czech Republic	Boys	–	–	15.4	22.6	–	27.8	*	Up 12.4%
	Girls	–	–	21.1	30.7	–	43.3	*	Up 22.2%
Denmark	Boys	–	–	28.7	34.1	35.3	35.1	*	Up 6.4%
	Girls	–	–	40.8	45.8	47.5	46.8	*	Up 6.0%
Finland	Boys	29.7	33.1	31.4	44.8	33.3[c]	32.9	*	Up 3.2%
	Girls	36.1	44.9	43.4	52.6	41.2[c]	42.3		Up 6.1%
France	Boys	–	–	34.1	36.6	41.9	41.6	*	Up 7.5%
	Girls	–	–	48.4	51.8	53.6	55.8	*	Up 7.4%
Germany	Boys	–	–	20.5	24.1	19.5	–		Down 1.0%
	Girls	–	–	28.5	33.1	25.5	–	*	Down 3.0%
Greece	Boys	–	–	–	38.3	31.2	33.2	*	Down 5.1%
	Girls	–	–	–	47.2	46.5	45.6		Down 1.6%
Hungary	Boys	17.9	18.2	16.5	33.7	–	40.3	*	Up 22.4%
	Girls	25.1	26.9	27.6	42.7	–	50.3	*	Up 25.2%
Ireland	Boys	–	–	–	42.7	38.3	40.3		Down 2.4%
	Girls	–	–	–	49.1	45.6	48.1		Down 1.0%
Latvia	Boys	–	24.6	21.8	29.2	34.9	39.0	*	Up 14.4%
	Girls	–	36.5	34.2	39.2	50.1	49.6	*	Up 13.1%
Norway	Boys	22.7	24.0	25.3	24.7	–	–		Up 2.0%
	Girls	35.2	34.2	35.0	34.6	–	–		Down 0.6%
Poland	Boys	–	18.8	17.5	29.1	–	–	*	Up 10.3%
	Girls	–	26.3	28.5	42.4	–	–	*	Up 16.1%
Russia	Boys	–	–	18.2	30.1	–	35.4	*	Up 17.2%
	Girls	–	–	36.4	39.7	–	43.5	*	Up 7.1%
Scotland	Boys	34.0	37.3	35.2	48.7	37.9	38.5	*	Up 4.5%
	Girls	44.1	53.0	49.5	60.7	50.2	52.4	*	Up 8.3%
Sweden	Boys	28.1	32.1	36.1	33.8	35.2	39.7	*	Up 11.6%
	Girls	39.2	39.8	49.6	47.3	48.3	54.6	*	Up 15.4%
Switzerland	Boys	29.0	–	–	–	25.2	30.0		Up 1.0%
	Girls	39.3	–	–	–	32.9	38.6		Down 0.7%
Wales	Boys	34.9	40.7	42.5	45.6	–	–	*	Up 10.7%
	Girls	48.9	55.7	55.3	62.9	–	–	*	Up 14.0%

a: The HBSC data collection in 2001–02 did not include medicine use.
b: Inclusion of data collection waves with data about medicine use.
c: The data from Finland 2005–06 includes 13- and 15-year-olds but not 11-year-olds.
Level of significance $*P < 0.01$.

use of medicine for headache. The findings correspond with the studies which suggest that increase in perceived stress,[6] time pressure in the families,[7,8] and a general medicalization of the society[7] result in increasing medicine use. Other factors may contribute to the increase in medicine use, e.g. a more aggressive marketing of painkillers, higher availability, and changing norms about medicine use. From a drug safety point of view, the results of this study may be worrying. The findings may reflect an increasing need for medication, but also changes in social norms and availability resulting in an increase in medicine use. Further research is needed to understand why medicine use for headaches has increased.

The main merit of this study is the large sample and representative study population and the use of standardized and comparable data. There are important limitations as well. The study does not include information about specific drugs or active ingredients. Recent studies suggest that the medicines used for headaches among adolescents are mainly common OTC medicines such as acetaminophen/paracetamol, ibuprofen and acetylsalicylic acid.[6,13,19] While selection bias due to non-participating schools and pupils may be a limiting factor, we have no means to carry out rigorous non-participation analyses. It may be a limitation that the item about medicine use for headache had two response categories until 1993–94 and three response categories from 1997–98 onwards. In most of the countries with data from 1993–94 to 1997–98 there was an increase in the prevalence of medicine use for headache, i.e. the change of response categories may influence the findings. The unknown validity of the medicine use measurement is an important limitation of the study. The measurement includes OTC medicine and may provide a more realistic representation of medicine use in the general population than register-based studies which only include prescription medicine.

Given the possible medicine use beyond indication, the potential side effects and the modest knowledge among adolescents about medicines,[4] there is a need to promote appropriate medicine use. In their comprehensive literature review, Hämeen-Anttila and Bush concluded that children of the same age in different cultures appear similar in their attitudes, beliefs and behaviour related to medicines and they wish to learn about medicines.[4] They proposed that health educators and health care professionals should take a more active role in educating children about rational medicine use.[4]

Both health education and sales restrictions are potential components of future efforts to promote rational medicine use.[20]

Parents, health educators, health professionals, health authorities and the pharmaceutical industry are potential stakeholders of future health promotion and control policies.[20] From a research point of view, we need better data about young people's medicine use and attitudes towards medicines. We also need insight into individual, social and cultural forces that influence medicine use.

To conclude, this is the first study which reports systematic data about time trends in adolescents' use of medicine for headache in a large number of countries. There was an increasing trend in 12 countries and inconsistent changes over time in 8 countries. There was a more consistent increasing pattern for girls than boys.

Acknowledgements

HBSC is an international study carried out in collaboration with WHO/EURO. The international coordinator was Prof. Candace Currie, University of St. Andrews, and the databank manager was Prof. Oddrun Samdal, University of Bergen. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). The data collection for each HBSC survey is funded at the national level.

Funding

The authors thank the Nordea Foundation (02-2011-0122) for financial support.

Conflicts of interest: None declared.

Key points

- This is the first report about time trends in adolescents' use of medicine for headache in a large number of countries.
- There was an increasing trend in 12 countries and inconsistent changes over time in 8 countries.
- There was a more consistent increasing pattern for girls than boys.
- There is a need to promote rational medicine use, e.g. by means of health education and control policies such as sales restrictions

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 80–82

doi:10.1093/eurpub/ckv014

Trends in life satisfaction in European and North-American adolescents from 2002 to 2010 in over 30 countries

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Background: Life satisfaction (LS) is an indicator which is widely used for assessing the perception of a child's feeling about his life. **Methods**: LS is assessed in Health Behaviour in School-aged Children via the Cantril ladder with 10 steps indicating the worst and best possible life. This range of values (0–10) was dichotomized into 'low' (0–5) vs. 'high' (6–10). Countries, age groups and genders were compared based on the odds ratio (OR) of declaring a higher LS in 2010 with respect to 2002. **Results**: Analyzing the difference between 2002 and 2010, six countries from Western Europe show decreasing LS: Austria, Canada, Switzerland, Denmark, Finland and Greenland. In contrast, a group of Eastern European Countries, that is, Estonia, Croatia, Lithuania, Latvia, Russia and Ukraine, show a significant increase in LS. Data on gender and age differences confirm the lower rating of LS in girls and a decreasing rating with age. **Conclusion**: The LS scale appears to be a tool capable of discriminating the level of wellbeing of adolescent population among countries.

Introduction

Life satisfaction (LS), as an evaluation of an individual's quality of life is an important aspect of well-being[1] and one that is closely linked to subjective health.[2]Well-being in childhood is associated with social competence and good coping skills that lead to more positive outcomes in adulthood.[3]

LS in young people is strongly influenced by a dynamic interaction between their environment, which includes physical environment, housing quality, socio-economic condition and the quality of their social and familial relationships. Key protective factors for good LS include a sense of parent/family connectedness, with social support being supplied by at least one caring adult, good family communication[4] and supportive peers, who can help to adjust to new situations and face stressful life events.[5]

Determinants of adolescent LS were not studied until early 1990s.[6] LS is a global assessment of one's life and is thought to be relatively stable over time, compared with spontaneous feelings related to one's immediate experiences.[7] Among adults it is inversely associated with depression, anxiety, suicide, work disability, fatal accidents and all-cause mortality.[8–11] Studies of LS have found that during adolescence, LS is strongly influenced by life experiences and relationships, particularly within the context of the family.[12,13]

The aim of our study was therefore to examine trends of LS from 2002 to 2010 in the countries covered by Health Behaviour in School-aged Children (HBSC), to generate hypothesis concerning positive and negative trends observed and identifying possible 'clusters' of countries following the same pathway.

In this study, the underlying assumption is that change in adolescent LS across the last decade might be, at least partially, influenced by macro socio-economic conditions during this period.

Methods

Data from the HBSC 2002, 2006 and 2010 surveys have been used for trends analysis with the aim to explore differences and commonalities among different groups of countries.

The HBSC study has been collecting cross-sectional data on nationally representative samples of 11-, 13- and 15-year olds since 2001/02 in more than 30 countries in Europe and North America.

Details on the general methodology of the HBSC survey have been published elsewhere.[14]

Among the 42 countries in the 2010 survey, only 31 (including Flemish Belgium examined independently, and Scotland, Wales and England as separate countries) participated in all three surveys and were included in the analyses.

The variable relative to adolescents' LS was represented by a ladder[15] with steps going from 0, the lowest, to 10, the highest. Participants were asked to evaluate their LS using this visual analogue scale by indicating the step on the ladder that corresponded to their satisfaction with their life. Data were analyzed for the three surveys, in conjunction with age and gender of the adolescents. For the analyses, the range of possible values (0–10) was dichotomized into 'low' (0–5) vs. 'high' (6–10).

The comparison among countries and among age and gender groups was based on the computation, separately for each country, of the age and gender standardized prevalence and of the odds ratio (OR) of reporting a higher LS in 2010 with respect to 2002, and for the two periods separately, 2006 vs. 2002 and 2010 vs. 2006 (table 1)

Data were modelled using a multivariable logistic regression where LS (dichotomized into 'low' and 'high') was the dependent variable and survey year, gender (males taken as reference) and age

Table 1 Age and gender standardized prevalence[a] and ORs for life satisfaction (dichotomized in 'low' vs. 'high') for each country

	Age and gender standardized Rate[a] (per 100 children)			ORs (adjusted for survey year, gender and age group)					
	2002	2006	2010	2010 vs. 2002	2006 vs. 2002	2010 vs. 2006	Female vs. male	13 vs. 11 years	15 vs. 11 years
Austria	88.0	88.0	85.9	0.834**	0.998	0.836**	0.650***	0.636***	0.564***
Belgium (Flemish)	87.7	90.3	90.1	1.265**	1.301***	0.972	0.784***	0.745***	0.606***
Canada	86.3	85.6	83.7	0.807***	0.944	0.855**	0.644***	0.945	0.942
Croatia	81.2	80.5	85.3	1.371***	0.963	1.424***	0.751***	0.730***	0.508***
Czech Republic	83.3	81.2	84.9	1.121	0.864*	1.298***	0.724***	0.883	0.883
Denmark	87.6	90.3	85.9	0.862*	1.343***	0.641***	0.560***	0.811**	0.856*
England	83.4	85.2	85.6	1.180*	1.154*	1.022	0.626***	0.867*	0.762***
Estonia	76.6	85.9	87.3	2.114***	1.877***	1.126	0.878***	0.743***	0.542***
Finland	91.6	91.5	89.9	0.813**	0.989	0.822**	0.690***	0.757***	0.610***
France	85.0	84.1	85.6	1.046	0.928	1.128*	0.706***	0.833***	0.669***
Germany	82.8	82.0	84.1	1.099	0.949	1.159**	0.711***	0.698***	0.704***
Greenland	91.4	82.2	84.2	0.563***	0.490***	1.149	0.596***	0.710*	0.535***
Hungary	84.5	81.2	82.7	0.882	0.800**	1.102	0.842***	0.927	0.590***
Ireland	86.4	87.4	86.6	1.033	1.106	0.934	0.714***	0.750***	0.474***
Italy	85.3	84.5	85.7	1.042	0.943	1.105	0.754***	0.924	0.617***
Latvia	76.9	79.1	84.6	1.662***	1.145*	1.452***	0.896*	0.909	0.802**
Lithuania	75.1	78.7	81.1	1.440***	1.225***	1.176**	0.794***	0.856**	0.715***
Macedonia	90.5	88.4	86.6	0.692***	0.798**	0.867	0.965	0.631***	0.473***
Netherlands	94.2	93.0	94.0	0.962	0.815*	1.181***	0.491***	0.727**	0.505***
Norway	82.8	88.0	87.9	1.524***	1.534***	0.993	0.669***	0.814***	0.586***
Poland	80.0	82.0	79.8	0.993	1.162**	0.855**	0.744***	0.686***	0.498***
Portugal	80.4	82.3	84.6	1.344***	1.123	1.196**	0.756***	0.776***	0.592***
Russia	76.1	79.5	82.3	1.474***	1.215***	1.213***	0.791***	0.885*	0.824***
Scotland	85.9	84.4	87.5	1.157*	0.898	1.288***	0.601***	0.729***	0.619***
Slovenia	85.6	85.7	86.8	1.090	0.998	1.092	0.677***	0.661***	0.570***
Spain	87.8	91.0	89.6	1.211**	1.446***	0.837*	0.732***	0.594***	0.459***
Sweden	85.9	87.4	86.8	1.078	1.140*	0.946	0.587***	0.547***	0.394***
Switzerland	89.1	88.2	87.4	0.846**	0.924	0.916	0.613***	0.722***	0.699***
Ukraine	74.6	81.0	79.2	1.301***	1.453***	0.895	0.910	0.962	0.661***
USA	83.0	84.1	84.2	1.077	1.075	1.002	0.760***	0.850*	0.793***
Wales	83.7	81.1	82.5	0.919	0.827**	1.110	0.556***	0.716***	0.645***

a: The reference population was the HBSC 2010 total population.
*$P<0.05$ ** $P<0.01$ *** $P<0.001$.

(11-year-old school-students taken as reference) the independent ones. As the computed ORs are just relative measures of difference between one period and the other, nothing can be said about absolute differences between the two periods, or about absolute differences among countries.

A *P*-value for each OR was computed, presenting significance at the traditional values of 0.05, 0.01 and 0.001.

All analyses were performed using STATA v12.1 (StataCorp, College Station, TX).

Results

Observed trends for LS are presented and further discussed in terms of the relative change between one period and the other within countries, and of the observed differences among countries; absolute values were not taken into consideration, as the focus of the article is on comparing trends within countries and among them.

Analyzing the overall difference between 2002 and 2010, LS decreased for a group of six relatively affluent Western countries (Austria, Canada, Switzerland, Denmark, Finland and Greenland) and two belonging to the former Eastern European Countries (Hungary and Macedonia). In contrast, increasing LS was observed in a group of Eastern European Countries, that is, Estonia, Croatia, Lithuania, Latvia, Russia and Ukraine, and in four Western European countries (Spain, Norway, Portugal and Belgium).

Analyzing the two periods separately (2002–2006 and 2006–2010) revealed that for Greenland and Hungary the decreasing trend was mainly determined by the first period, while for the other decreasing countries the significant reduction occurred between 2006 and 2010. There was only a steady decrease in reported LS across all three time points in Macedonia (ORs: 0.798 and 0.867, respectively) and Switzerland (ORs: 0.924 and 0.916, respectively).

As for the 'high satisfaction countries' belonging to the Western European cluster, the exception occurred among Spanish adolescents, with a drop in ORs from 1.446 in the first period to 0.837 in the second.

In the Czech Republic, which has been classified as seeing no change overall, the opposite has occurred, with a decrease between 2002 and 2006 (OR = 0.864), followed by an increase between 2006 and 2010 (OR = 1.298).

In terms of gender differences, females have, with a few exceptions (Latvia, Macedonia and Ukraine), a general and significant tendency to a lower level of LS in all countries.

LS also decreases with increasing age, even if this pattern has many exceptions in the surveyed countries. The sharp decrease occurs in most countries at 15 years, with the only exception of Canada and Czech Republic, where the rating of LS remains unchanged across age. At 13 years, the decrease in rating is less marked, and 6 countries (Canada, Czech Republic, Hungary, Italy, Latvia and Ukraine) do not show significant differences with respect to their fellow mates of 11 years.

Discussion

The strength of this study lies on the quantity and quality of data, collected in comparable ways and with similar protocols in all involved countries, allowing, for the first time, to have a cross-national view of a decennial trend in LS of youth in Europe and North America.

The main limitation results from the fact that the comparison between countries is based on relative changes, not on absolute levels. A country with a sharp decline from a high value may still end up having higher LS than a country which starts with a low value and shows a sharp increase. For the aim of the study, this might not be a crucial drawback, as the focus is pointed on the analysis of changing trends within a country, and on the different trends observed in different sets of countries behaving in a similar way, with a view of the possible relation with on-going macro socio-economic conditions.

Trends in LS across Europe and North America show a quite scattered picture. In fact, increasing, decreasing and stable situations are split in a similar way (12 countries with increasing values of LS, 7 with decreasing values and 12 with stable ones).

It is interesting to note a 'Northern European' cluster of countries characterized by decreasing LS between 2002 and 2010, and an 'East European' cluster with increasing LS. Spain seems to be the only country with a decrease in LS that appears to follow the general economic crisis.

Some similarities with the trend in self-rated health[16] can be pointed out as, for example, the similar trend in Hungary and Greenland (worst rating in the period 2002–2006), the marked trend of the Check Republic towards increasing values in the period 2006–2010 and that of Spain and Denmark in the opposite direction in the same time interval.

Data on gender and age differences confirm what has already been evidenced in the recent literature, namely that girls report a lower LS than boys do and that LS decreases with increasing age.[17] In addition, the trend towards decreasing satisfaction with increasing age is consistent across all countries and across age.

The crucial transition towards lower LS seems to take place between 13 and 15 years, as if the onset of adolescence were the crucial event, rather than the physiological change taking place, especially in girls, usually at an earlier age.

As for the geographical cluster, no clear pattern seems to emerge. A more detailed analysis of their characteristics, including socio-economic data and cultural features at the national level, would be necessary to gain a deeper insight into the variability of this phenomenon.

In conclusion, the LS scale appears to be a tool that is not only capable of discriminating the level of wellbeing among countries, but also of catching the qualities of emotional well-being that are different from those captured by measuring self-rated health. Using these two indicators together is therefore likely to be of value for public health practitioners for the overall assessment of the health of the adolescent population.

Key points

- This is the first cross-national study of a decennial trend in Life Satisfaction (LS) of youth in Europe and North America.
- A 'Northern European' cluster of countries characterized by decreasing LS between 2002 and 2010, and an 'East European' cluster with increasing LS can be noted.
- Girls report a lower LS than boys and all adolescents show adecreasing LS with increasing age, across all countries and across age.
- The LS index is likely to be of value for public health practitioners for the overall assessment of the health of the adolescent population.

Acknowledgements

The HBSC study is an international study carried out in collaboration with the WHO/EURO. The international coordinator of the study was Candace Currie, University of St. Andrews, Scotland. The data bank manager of the study was Oddrun Samdal, University of Bergen, Norway. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). We thank all pupils, teachers and scientific co-workers who participated in the HBSC surveys.

Funding

The data collection for each HBSC survey is funded at the national level. Financial support is provided by various government ministries, research foundations and other funding bodies.

Conflicts of interest: None declared.

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European Journal of Public Health, Vol. 25, Supplement 2, 2015, 83–89

doi:10.1093/eurpub/ckv033

Trends in health complaints from 2002 to 2010 in 34 countries and their association with health behaviours and social context factors at individual and macro-level

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Background: This article describes trends and stability over time in health complaints in adolescents from 2002 to 2010 and investigates associations between health complaints, behavioural and social contextual factors at individual level and economic factors at macro-level. **Methods:** Comprising N = 510 876 11-, 13- and 15-year-old children and adolescents in Europe, North America and Israel, data came from three survey cycles of the international Health Behaviour in School-aged Children (HBSC) study. Age- and gender-adjusted trends in health complaints were examined in each country by means of linear regression. By using the country as the random effects variable, we tested to what extent individual and contextual variables were associated with health complaints. **Results:** Significant associations are stronger for individual level determinants (e.g. being bullied, smoking) than for determinants at macro-level (e.g. GDP, Gini), as can be seen by the small effect sizes (less than 5% for different trends). Health complaints are fairly stable over time in most countries, and no clear international trend in health complaints can be observed between 2002 and 2010. The most prominent stable determinants were being female, being bullied, school pressure and smoking. **Conclusion:** Factors associated with health complaints are more related to the proximal environment than to distal macro-level factors. This points towards intensifying targeted interventions, (e.g. for bullying) and also targeting specific risk groups. The comparably small effect size at country-level indicates that country-level factors have an impact on health and should not be ignored.

Introduction

Data on subjective health and health determinants among adolescents are crucial for increasing awareness considering that traditional indicators of morbidity and mortality only capture a very limited scope of common health problems in this age group. Subjective health complaints refer to a variety of complaints experienced by the individual which may range from occasional to clinical manifestations and impair everyday functioning. Mild psychological complaints, such as anxiety, headaches, stomach pain and dizziness are remarkably common[1] while clinical diagnoses are rare: only ~6% of teenagers are diagnosed with depression.[2] Mild psychosomatic symptoms may increase the risk of developing a more serious mental illness later in life;[3] and can negatively influence adolescents' well-being.[4]

Adolescents undergo extensive developmental changes which increase their risk for experiencing health complaints.[5] Overall, 32–44% of girls and 26% of boys[1] in Europe and North America report health complaints, although the prevalence varies greatly by country. Trends show that while prevalence rates have increased in some countries, for example, in Sweden,[6] elsewhere they have dropped.[7] Different prevalence rates across the countries and different patterns in health complaints across time[8] suggest that they are a complex public health issue requiring more in-depth investigation of determinants at national and individual levels.

Studies suggest that behavioural and social context factors may foster the development of health complaints. Various psychosocial developmental processes during adolescence such as autonomy demand, peer orientation and self-consciousness affect relationships with adults and peers.[9] Peer bullying[10] and communication issues with peers and parents[11] are associated with more health complaints. Health complaints are also brought in association with school-related stress.[1,12] A systematic review revealed in fact that the relationship between school failure and mental health is bidirectional.[13] Longitudinal studies indicate a similar relationship between depressive symptoms and alcohol abuse.[14]

Literature suggests that unhealthy lifestyles, especially higher weight, a lower level of physical activity, a higher rate of screen-based activities, smoking, regular alcohol consumption, gaming engagement and addiction, increase the likelihood of health complaints.[9,15,16,17]

Aside from lifestyle factors, individual social context plays an important role as well. Adverse living conditions, such as high inequality or an adverse economic situation, are risk factors for poor health.[18] The prevalence of health complaints is higher in young people from socioeconomically disadvantaged families[19] which suggests a social gradient in health complaints.[20] Torsheim and colleagues found an association between high levels of material inequality as well as low household income, and poor subjective health.[21]

The Health Behaviour in School-aged Children (HBSC) study provides a unique opportunity for trend analysis in multiple countries, as well as for investigation of associations between proximate factors (e.g. health behaviours, social context) and more distal (i.e. macro-level) factors and the subjective health of young people. Indicators were selected based on the underlying assumption that young people growing up in poorer societies with high income inequality are at higher risk for health complaints than children in wealthier and more prosperous countries. Given the strong evidence for the association between behavioural and social contextual factors and young people's health, we set out to investigate the strength of this link and its stability over time in an international sample of children and adolescents. To test the stability of the impact of various factors on health complaints over time, we included interaction effects for sociodemographic factors (age, gender, affluence status) as well as for other factors which proved to be strongly associated with health complaints in a previous publication on this topic.[22]

Objective

This article has the following research aims:

(1) To describe the trend(s) in health complaints in 34 countries in Europe, North America and Israel in 2002–10 for 11–15-year-olds.
(2) To investigate the impact of behavioural and social contextual factors at individual and macro levels on health complaints in these 34 countries.
(3) To analyse the stability of the impact of behavioural and social contextual factors on health complaints across time.

Individual level factors were selected from the familial, school and peer context. Macro-level factors included national wealth (gross domestic product, GDP) and income inequality (Gini).

Methods

Study population

Data came from the 2001/02, 2005/06 and 2009/10 HBSC international survey. Trend data was available for 34 countries and included N = 510 876 children and adolescents aged 11, 13 and 15 years. More details on the study and the participants can be found elsewhere.[23,24] The following measures were used in all three waves presented in this article.

Measures

Psychosomatic health complaints

Health complaints were assessed using the HBSC symptom checklist (HBSC-SCL).[25] The HBSC-SCL is a reliable and valid instrument[26] which measures eight symptoms (headache, stomach ache, back ache, feeling low, irritability or bad temper, feeling nervous, difficulties in falling asleep and feeling dizzy) over the past 6 months (five-point scale). Although previous research has suggested a two-factor solution, the scale can also be conceived as measuring a uni-dimensional latent trait of psychosomatic complaints.[26] A sum score was calculated for each participant based on seven items (28 = high level of health complaints; 0 = absence of health complaints) whereby the 'sleeping difficulties' item was excluded from the analysis due to differential item functioning across countries.[26]

Familial context

The family context included items developed within HBSC on communication with parents and family structure. Communication was assessed separately for individual parents and responses were dichotomized into two dummy variables 'very easy/easy' vs. 'difficult/very difficult' and 'don't have or see this person' vs. 'difficult/very difficult'. Family structure was assessed by indication of whether respondents lived with both parents, one parent or another caretaker. In the analysis, we differentiated between families with 'both parents', 'single parent' or 'other'.

Peer relations

Social relationships were assessed by asking about the average number of close friends (male and female friends combined) and experiences around bullying. Bullying was assessed using an adapted version of Olweus.[27] Responses were dichotomized into '2 or 3 times a month/about once a week/several times a week' vs. 'it has only happened once or twice/I have not been bullied at school in the past couple of months.'

School environment

School environment included items developed within HBSC: class climate, academic achievement and school pressure. Class climate comprised three items on student relations ('students like being together'; 'students are kind and helpful'; and 'students accept me') which function well as a subscale of a valid measurement model on support.[28] The Class Climate Index was calculated by averaging the scores on the five-point scale with high scores indicating a good class climate.

Academic achievement was assessed by asking respondents to indicate what they think their teacher thinks about their school performance compared with their classmates. Answers were dichotomized as 'very good/good' vs. 'average/below average.' School pressure was assessed by the question 'How pressured do you feel by the schoolwork you have to do?'; answers were dichotomized as 'not at all/a little' vs. 'some'/'a lot.'

Family affluence

The socioeconomic status of the respondents was based on four items representing the Family Affluence Scale (FAS): 'Does your family own a car, van or truck?', 'Do you have your own bedroom for yourself?', 'During the past 12 months, how many times did you travel away on holiday (vacation) with your family?' and 'How many computers does your family own?'. Based on the sum score (range 0–7), individuals were categorized into high (6–7), medium (4–5) and low (0–3) FAS. The FAS has been validated within HBSC and can be used as 'an indicator of child material affluence'.[29]

Behavioural factors

Behavioural factors comprised physical activity, sedentary behaviour, smoking and alcohol consumption. Physical activity was assessed using a valid and reliable measure from Prochaska et al.[30] Respondents were asked on how many days they were physically active for a total of at least 60 min over the past 7 days. Sedentary behaviour was measured by asking about the frequency of engaging in activities such as watching TV (DVDs or videos) and/or using a

computer on weekdays and on weekends. A weighted index (Sedentary Behaviour Index) was calculated by averaging the responses for TV watching and computer use (weekdays and weekend). Smoking and alcohol consumption was assessed by asking participants about smoking frequency and consumption of alcohol drinks. The analyses reflect smoking at least once a week and drinking any alcoholic drink at least every week.

Table 1 Description of study sample

Variable	n (%)
N	510 876
Number of countries/regions	34
Year	
2002	160 325 (31.4%)
2006	171 548 (33.3%)
2010	179 003 (35.0%)
Sex	
Boys	250 156 (49.0%)
Girls	260 720 (51.0%)
Age group	
11	166 159 (32.8%)
13	172 828 (34.1%)
15	167 835 (33.1%)
Psychosomatic complaints (Mean (SD))	6.82 (5.66)
GDP per capita in 1000 USD (Mean (SD))	27.80 (17.20)
GINI (Mean (SD))	30.22 (5.01)

Macro-level factors

The Gini coefficient was used to measure income inequality across countries. Estimates were obtained from the Standardized World Income Inequality Database.[31] The estimates ranged from 21.90 for Sweden indicating low income inequality to 45.20 for Russia indicating high income inequality. Absolute wealth in countries was measured by using the gross domestic product per capita (GDP) in USD. Estimates were obtained from the World Bank[32] and ranged from 879 USD for the Ukraine indicating a low income country to 85 443 USD for Norway indicating a high income country.

Statistical analyses

Descriptive statistics were used to present the sample characteristics. Individual and macro-level determinants were selected for the analyses based on previous literature. To adjust for differences in age- and gender profiles across countries and survey years, age- and gender-adjusted means of health complaints were calculated for each country and each survey year using the entire study population as reference. Age- and gender-adjusted trends by country were examined through linear regression analyses. Backward difference coding of the survey year variable was adopted to compare 2006 vs. 2002 and 2010 vs. 2006. Cohen's *d* was calculated as a measure of effect size (ES). Overall, trends in terms of ES were examined in each country by comparing health complaints levels in 2010 to 2002. To test for an international trend, a random effects meta-analysis was performed treating the results from each country as an individual study. Finally, multilevel

Table 2 Age- and gender adjusted mean levels and trends of subjective health complaints

Country	Age- and gender-adjusted means			Age- and gender-adjusted trend					
	2002	2006	2010	2006 vs. 2002			2010 vs. 2006		
				β[a]	*P* value	ES[b]	β[a]	*P* value	ES[b]
Austria	5.22	4.54	4.95	−0.062	<0.001	−0.135	0.039	<0.001	0.100
Belgium Flemish	5.57	5.26	5.45	−0.029	0.002	−0.104	0.013	0.178	0.027
Belgium French	6.74	7.23	7.04	0.039	<0.001	−0.243	−0.016	0.116	0.048
Canada	6.84	7.02	7.04	0.013	0.084	−0.061	0.001	0.909	0.003
Croatia	6.26	6.91	6.71	0.052	<0.001	0.083	−0.022	0.017	−0.021
Czech Republic	7.16	7.88	8.24	0.066	<0.001	0.032	0.033	<0.001	−0.019
Denmark	5.76	5.48	5.40	−0.034	<0.001	0.101	−0.006	0.505	−0.029
England	8.35	6.98	6.90	−0.122	<0.001	0.145	−0.003	0.775	0.076
Estonia	7.33	6.73	6.88	−0.051	<0.001	0.092	0.013	0.182	-0.054
Finland	7.43	7.40	7.36	−0.003	0.753	−0.061	−0.003	0.739	0.002
France	6.86	7.61	7.39	0.066	<0.001	−0.243	−0.018	0.022	0.009
Germany	5.51	5.96	5.69	0.041	<0.001	−0.007	−0.024	0.004	−0.012
Greece	7.82	7.31	7.30	−0.041	<0.001	0.140	−0.004	0.072	−0.037
Greenland	5.16	4.82	5.82	−0.031	0.112	−0.061	0.078	<0.001	0.174
Hungary	7.59	8.01	7.56	0.030	0.004	−0.090	−0.038	<0.001	-0.038
Ireland	6.04	5.92	6.34	−0.014	0.141	0.121	0.035	<0.001	−0.021
Israel	9.66	10.72	9.64	0.072	<0.001	0.074	−0.071	<0.001	−0.066
Italy	9.38	9.31	9.09	−0.009	0.367	−0.024	−0.019	0.061	0.061
Latvia	6.43	7.60	7.16	0.091	<0.001	0.154	−0.037	<0.001	−0.170
Lithuania	7.10	7.23	7.32	0.010	0.256	−0.012	0.007	0.388	−0.038
Macedonia	5.71	5.80	5.42	0.006	0.511	0.021	−0.034	<0.001	0.015
Netherlands	5.21	4.44	5.14	−0.075	<0.001	0.210	0.069	<0.001	−0.078
Norway	6.35	6.16	6.64	−0.018	0.055	0.017	0.041	<0.001	−0.051
Poland	7.13	7.22	7.52	0.006	0.471	−0.160	0.023	0.008	0.146
Portugal	5.84	4.60	4.63	−0.106	<0.001	−0.037	0.004	0.714	0.088
Russia	6.17	7.23	6.68	0.084	<0.001	0.015	−0.039	<0.001	0.030
Scotland	6.67	5.87	6.34	−0.073	<0.001	−0.248	0.047	<0.001	0.023
Slovenia	5.49	4.94	4.34	−0.047	<0.001	0.175	−0.062	<0.001	−0.098
Spain	7.42	6.01	6.13	−0.112	<0.001	−0.153	0.011	0.130	0.095
Sweden	8.37	7.39	7.49	−0.079	<0.001	−0.177	0.007	0.463	0.009
Switzerland	6.59	7.09	6.91	0.044	<0.001	−0.114	−0.015	0.101	−0.123
Ukraine	8.69	8.99	8.21	0.022	0.017	0.052	−0.063	<0.001	−0.140
USA	7.70	7.58	7.19	−0.009	0.362	−0.020	−0.034	0.001	−0.090
Wales	7.06	6.67	6.29	−0.032	0.001	−0.072	−0.037	<0.001	−0.082

a: β, standardized regression coefficient; b: ES, Cohen's *d*.

linear regression analyses were conducted with country as the random effects variable on the pooled international sample to test to what extent individual and contextual level variables explain variance in health complaints. ES were calculated the following way:[33] ES of a dichotomous variable was calculated as the regression coefficient divided by the country level adjusted outcome standard deviation (SD). For continuous variables, ES was calculated as the regression coefficient multiplied by two times the variables SD divided by the country level adjusted outcome SD. The latter ES describes the change on health complaints produced by a change of ± one SD on the continuous determinant variable standardized by the pupil level SD. Because of the clustered sample design (school/class effect) and the large sample, we adjusted the *P* value to be more conservative to a *P* value of 0.001 indicating statistical significance. Analyses were performed in Stata/IC version 11.1 for Windows and SPSS version 20.

Results

Summary statistics are presented in table 1. The mean level of subjective health complaints in the total sample was 6.82 (SD = 5.66).

Based on a scale from 0 to 28, this value indicates that the average 11–15-year-old child reported rather low levels of health complaints. Split by age group, the average scores were 5.87 (SD = 5.50) for 11-year-olds, 6.84 (SD = 5.60) for 13-year-olds and 7.70 (SD = 5.71) for 15-year-olds. In addition, girls (Mean = 7.76; SD = 5.83) reported higher mean levels of health complaints than boys (Mean = 5.83; SD = 5.30). This gender effect was significant and was observed across all countries and age groups.

Health complaints levels varied across countries with means ranging from 4.34 in Slovenia to 9.64 in Israel in 2010 (table 2).

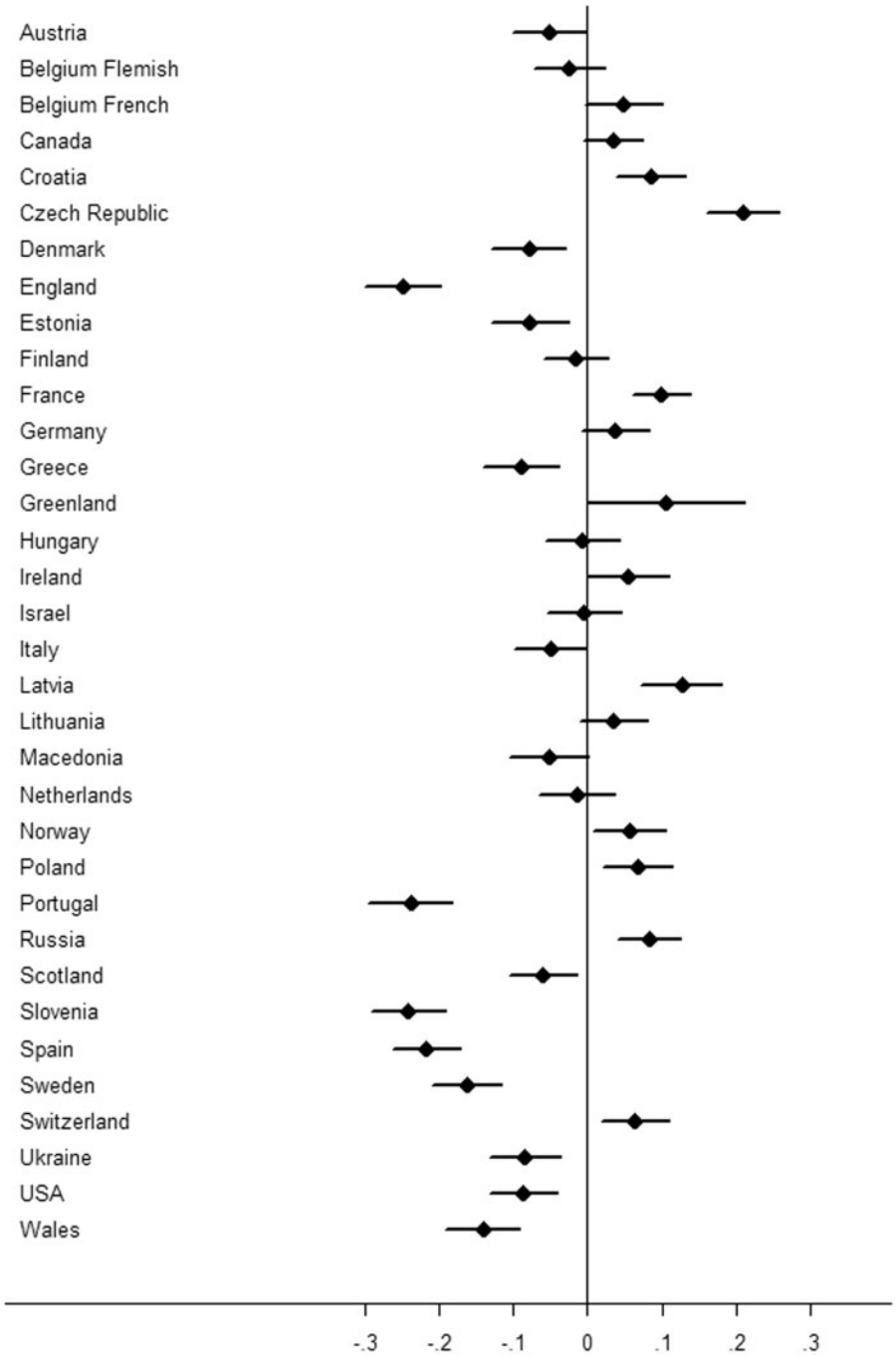

Figure 1 Random effects meta-analysis of the overall trend (2010 vs. 2002) in subjective health complaints in 34 countries

Twenty out of 34 countries reported statistically significant differences between 2006 and 2002 at the $P < 0.001$ level. Eleven countries reported lower levels in 2006 whereas 9 countries reported higher levels in 2006 as compared with 2002. ES were small and inferior to 0.3 in all countries. When comparing 2010 with 2006, 15 out of 34 countries reported statistically significant differences at the $P < 0.001$ level. Eight countries reported lower levels in 2010 and seven countries reported higher levels in 2010 as compared with 2006. In all cases, ES were small.

The overall trend from 2002 to 2010 is displayed in figure 1 expressed as ES. There was no clear overall increasing or decreasing international trend. The average ES extracted from the random effects meta-analysis was −0.025 ($z = 1.31$, $P = 0.19$) and not significant suggesting that there is no international trend in a particular direction.

Table 3 presents the results from the pooled analysis that explored the associations of individual and country level factors. The intra-class correlation was calculated to be 0.046, suggesting that 4.6% of the variance in health complaints was explained by the country. The bivariate model identified significant associations with medium ES ($d \approx 0.5$) between subjective health complaints and communication with parents, being bullied, weekly smoking and school pressure. Low ES ($0.2 < d < 0.3$) emerged for gender, age, weekly alcohol use, class climate and academic achievement. Country-level factors (GINI, GDP) were found to be significantly associated with health complaints but ES were very low (0.078 and −0.037, respectively).

Table 3 Adjusted main effects regression model with individual level determinants

Indicator[a]	Bivariate				Adjusted model main effects only				Adjusted model with interaction effects			
	b	SE	*P* value	ES	*b*	SE	*P* value	ES	*b*	SE	*P* value	ES
Country level												
GINI	0.043	0.004	0.000	0.078	0.025	0.005	0.000	0.052	0.025	0.005	0.000	0.052
GDP per capita (in USD)	−0.006	0.001	0.000	−0.037	−0.007	0.002	0.003	−0.048	−0.004	0.002	0.068	−0.031
Time level												
2010	−0.097	0.019	0.000	−0.018	0.243	0.039	0.000	0.050	0.131	0.068	0.053	0.027
2006	−0.013	0.019	0.489	−0.002	0.231	0.031	0.000	0.048	0.204	0.063	0.001	0.042
Individual level												
Girl	1.913	0.015	0.000	0.345	1.893	0.017	0.000	0.390	2.029	0.031	0.000	0.418
15 years old	−1.813	0.019	0.000	−0.327	−0.435	0.022	0.000	−0.090	−0.237	0.039	0.000	−0.049
13 years old	−0.852	0.019	0.000	−0.154	−0.220	0.021	0.000	−0.045	−0.151	0.037	0.000	−0.031
Low FAS	0.927	0.023	0.000	0.167	0.214	0.026	0.000	0.044	0.101	0.043	0.019	0.021
Medium FAS	0.273	0.018	0.000	0.049	−0.015	0.019	0.442	−0.003	−0.122	0.037	0.001	−0.025
Difficult to talk with father	2.630	0.017	0.000	0.475	1.182	0.020	0.000	0.244	1.152	0.035	0.000	0.237
Don't have/see father	2.051	0.031	0.000	0.370	0.521	0.038	0.000	0.107	0.521	0.038	0.000	0.107
Difficult to talk with mother	2.565	0.021	0.000	0.463	1.096	0.024	0.000	0.226	0.921	0.043	0.000	0.190
Don't have/see mother	1.319	0.053	0.000	0.238	0.430	0.058	0.000	0.089	0.427	0.058	0.000	0.088
Other parent	0.982	0.044	0.000	0.177	0.612	0.053	0.000	0.126	0.605	0.053	0.000	0.125
Single parent	1.008	0.020	0.000	0.182	0.376	0.023	0.000	0.077	0.371	0.023	0.000	0.076
Smoking (weekly)	2.979	0.027	0.000	0.538	1.613	0.031	0.000	0.332	1.622	0.031	0.000	0.334
Alcohol use (weekly)	1.893	0.032	0.000	0.342	0.883	0.034	0.000	0.182	0.889	0.034	0.000	0.183
Experiencing school pressure	2.695	0.016	0.000	0.486	1.903	0.018	0.000	0.392	1.782	0.033	0.000	0.322
Being bullied	2.873	0.024	0.000	0.519	2.091	0.027	0.000	0.431	1.816	0.047	0.000	0.374
Sedentary Behaviour Index	0.054	0.006	0.000	0.026	0.380	0.007	0.000	0.205	0.379	0.007	0.000	0.205
Physical activity (days)	−0.258	0.003	0.000	−0.194	−0.043	0.004	0.000	−0.037	−0.043	0.004	0.000	−0.037
Average number close friends	−0.125	0.005	0.000	−0.069	−0.023	0.006	0.000	−0.014	−0.023	0.006	0.000	−0.014
Positive class climate (index)	−1.389	0.010	0.000	−0.396	−0.718	0.012	0.000	−0.234	−0.717	0.012	0.000	−0.233
Poor academic achievement	1.573	0.016	0.000	0.284	0.654	0.018	0.000	0.135	0.652	0.018	0.000	0.134
Interaction effects												
15 years old × 2010									−0.302	0.053	0.000	−0.054
15 years old × 2006									−0.264	0.052	0.000	−0.048
13 years old × 2010									−0.091	0.050	0.068	−0.016
13 years old × 2006									−0.094	0.050	0.058	−0.017
Girl × 2010									−0.217	0.042	0.000	−0.039
Girl × 2006									−0.174	0.042	0.000	−0.031
Low FAS × 2010									0.149	0.064	0.020	0.027
Medium FAS × 2010									0.162	0.048	0.001	0.029
Low FAS × 2006									0.159	0.057	0.005	0.029
Medium FAS × 2006									0.120	0.048	0.013	0.022
School stress × 2010									0.210	0.045	0.000	0.038
School stress × 2006									0.142	0.044	0.001	0.026
Being bullied × 2010									0.528	0.065	0.000	0.095
Being bullied × 2006									0.294	0.063	0.000	0.053
Difficult talk father × 2010									0.103	0.048	0.031	0.019
Difficult talk father × 2006									−0.013	0.047	0.791	−0.002
Difficult talk mother × 2010									0.280	0.058	0.000	0.050
Difficult talk mother × 2006									0.208	0.058	0.000	0.038
Residual variance estimates												
Pupils	30.693				23.567				23.551			
Country	1.482				1.230				1.224			

a: The reference group was defined as 11-year-old boys assessed in 2002 living with their two original parents, reporting easy communication with their parents, not having been bullied more than one or two times in the past couple of months, with high FAS, not smoking weekly, not drinking alcohol weekly, good to very good academic achievement, not at all to little school pressure and with a mean value for physical activity, the sedentary behaviour index, average number of friends and the positive class climate index.

The adjusted model with main effects only revealed that being female, being bullied (at least 2–3 times per month), being a weekly smoker and experiencing school pressure were key determinants of higher levels of health complaints based on their significance level ($P < 0.001$) and ES ($d > 0.02$). The determinants listed in table 3 explained 22.6% of the pupil variance in health complaints.

Using a hierarchical regression approach, interaction effects of time * gender, time * age group, time * bullying, time * talk to father/mother and time * school pressure were tested against the main effects model of table 3 but did not yield meaningful effects as indicated by very low ES.

Discussion

The aim of the article was to describe trends in health complaints in young people in 34 countries between 2002 and 2010 and to investigate the effect of individual and macro-level factors on health complaints over time.

Generally, trends in health complaints were fairly stable in most countries. Statistically significant upward and downward trends were observed in some countries, but ES were generally small. No clear international trend in health complaints was observed for 2002–2010. Country-level factors explained less than five per cent of the variance in health complaints suggesting that the variation in health complaints is mostly explained for by individual factors. In line with other studies,[22,34] health complaints were more prevalent in girls and older adolescents. Although, proximal factors seem to have a larger effect than distal factors, such as GDP and Gini, the small ES might indicate that there is some macro-level impact on young people's health. Previous studies on macro-level determinants of young people's health and health inequalities have shown that country-level indicators are less strongly related to health in terms of ES.[35] Nevertheless, incorporating macro-level determinants in analyses enriches our understanding of the possible impact of the context in which young people live and grow up in on health and health inequalities[36] and enables us to provide recommendations for policy makers, public health researchers and health practitioners.

We found several significant associations with behavioural and social context factors; however, ES were generally small, ranging below $d = 0.42$. Factors, such as being a girl, having been bullied at least 2–3 times a month, smoking on a weekly basis and experiencing school pressure had the strongest effects. This is in line with other studies, which also showed clear associations between health complaints and gender, school-related pressure,[12,28,37] and smoking.[7]

While the psychosocial consequences of school-related stressors on health may be intuitive, the associations between various risk behaviours, such as smoking and sedentariness and health complaints may be less clear. However, we found significant associations for smoking and sedentariness also after taking into account school-related stressors. This is in line with Karvonen et al.[37] who also found an association between smoking and health complaints. Supporting evidence also comes from Haugland et al.[38] who found a mediating effect of physical activity on the relationship between school-related stress and health complaints. The authors suggest that young people who are less physically active—and likely engaging in more sedentary behaviour—are at greater risk for health complaints.

The strength of the association between national level factors and health complaints was negligibly small in our analyses, thus putting limitations on wider interpretations. Previous studies on these types of associations have come to discrepant conclusions.[20,22,39] While more such analyses would be necessary, it is safe to say that individual level factors play a more decisive role when it comes to individual, subjective health and that the strength of the effect also depends on the outcome evaluated. Present results show that at least in terms of health complaints, familial affluence has a stronger effect than the economic situation at national level.

To test the stability of the impact of individual level determinants on health complaints across time, we explored interaction effects between selected individual determinants and survey year. Although most of the interaction effects were statistically significant in the model, ES were negligible and these differences have therefore little practical relevance.

Limitations

The major strengths of HBSC are its large sample size, the cross-national nature of the sample and the standardized approach in the study design and questionnaire enabling direct comparisons between countries. Due to the cross-sectional nature of the data, however, causal interpretations are not possible. The analyses are based on the period of 8 years which may be too short in order to be able to observe the effects of societal changes. Specific health complaints were not investigated, as we only focused on health complaints in general. Our findings are based on self-reported data from the children and adolescents themselves. The discrepant trends in health complaints in the countries may be a reflection of true changes in the occurrence of health complaints in society, but may also reflect changes in the subjectivity over time and how children perceive and report health complaints. Lastly, we found that alcohol use had no effect on health complaints although numerous studies indicate a relationship between alcohol consumption and depressive symptoms.[14] One explanation may be that we used the frequency of alcohol consumption, rather than the amount of alcohol consumed—which may have led to a different result.

Conclusions

Although health complaints are subjective, they are associated with a great burden and have lasting effects on individual health that are likely to persist into adulthood.[40] Health complaints have been fairly stable in most countries and although ES at country-level were rather small, a country's increase in wealth might actually increase health in a larger population than targeted interventions might do.[41] Further investigations on the effects of the financial crisis in recent years on health complaints are needed. In terms of health promotion, our study suggests that there is a need to address the wider social determinants of health and health inequalities by focusing on the macro-level characteristics as determinants of health and health inequalities.

Acknowledgements

The Health Behaviour in School-aged Children (HBSC) study is an international study carried out in collaboration with the WHO/EURO. The international coordinator of the study was Candace Currie, Child and Adolescent Health Research Unit (CAHRU), University of St. Andrews, Scotland. The data bank manager of the study was Oddrun Samdal, University of Bergen, Norway. A complete list of participating countries and researchers is available on the HBSC website (http://www.hbsc.org). We would like to thank all pupils, teachers and scientific co-workers who participated in the HBSC surveys.

Funding

The data collection for each HBSC survey is funded at the national level. Financial support is provided by various government ministries, research foundations and other funding bodies.

Conflicts of interest: None declared.

Key points

- HBSC provides the opportunity to observe and compare trends over longer time periods and for multiple countries.
- Health complaints levels have remained fairly stable for most of the 34 countries between 2002 and 2010.
- Being female, being bullied, experiencing school pressure and smoking, were more strongly associated with health complaints over time than country characteristics.
- For health promoting policies, wider social determinants of health beyond individual factors need to be addressed.

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