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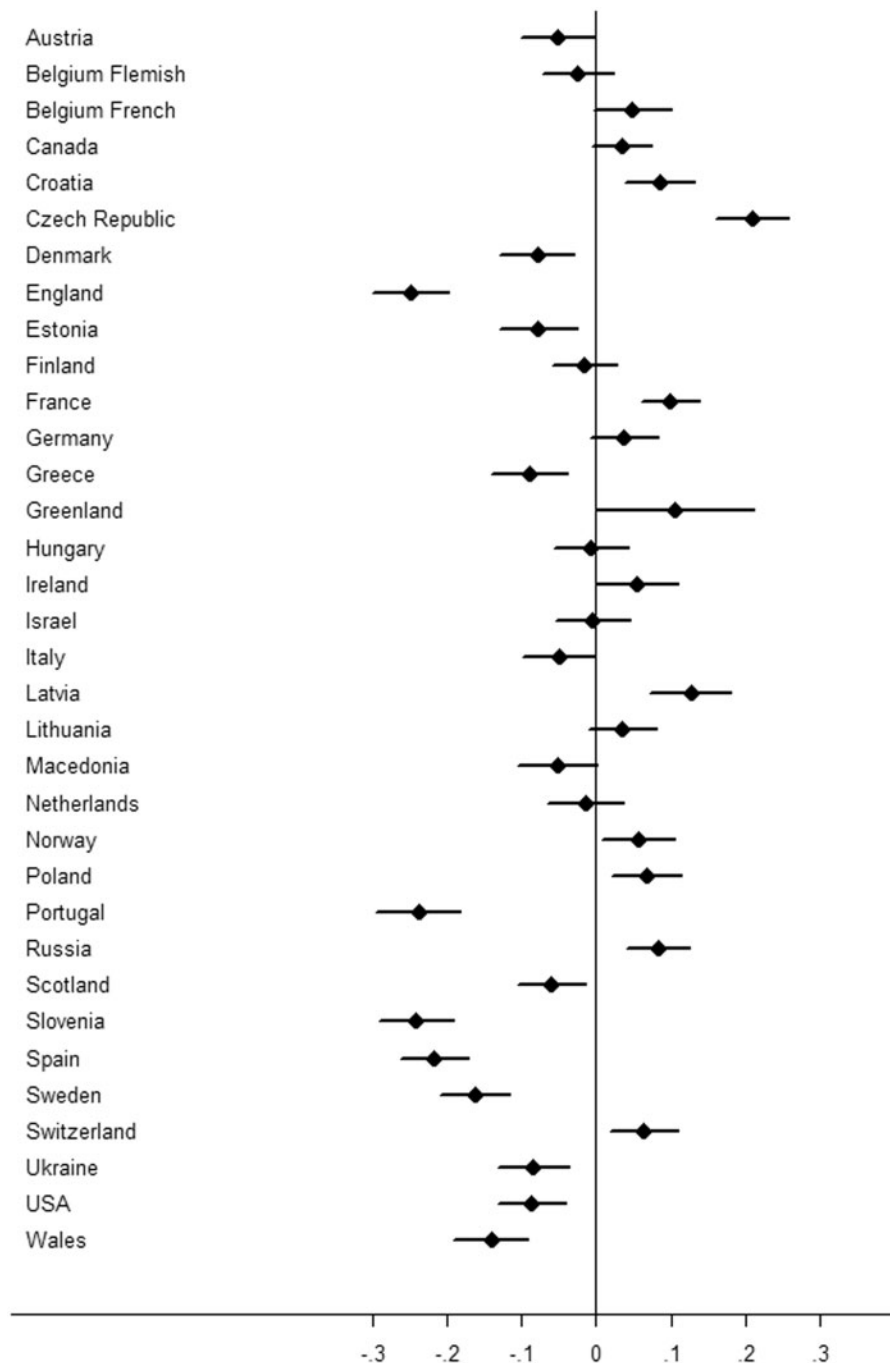
Figure 1 Random effects meta-analysis of the overall trend (2010 vs. 2002) in subjective health complaints in 34 countries

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 intraclass 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.

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.

References

1 Currie C, Zanotti C, Morgan A, et al. Social determinants of health and well-being among young people. Health Behaviour in School-aged Children (HBSC) study: international report from the 2009/2010 survey. Health Policy for Children and Adolescents. Copenhagen, Denmark: WHO Regional Office for Europe, 2012.

2 Olsson GI, von Knorring AL. Adolescent depression: prevalence in Swedish high-school students. *Acta Psychiatr Scand* 1999;99:324–31.

3 Garber J. Depression in children and adolescents: linking risk research and prevention. *Am J Prev Med* 2006;31(6 Suppl 1):104–25.

4 Petanidou D, Daskagianni E, Dimitrakaki C, et al. The role of perceived well-being in the family, school and peer context in adolescents' subjective health complaints: evidence from a Greek cross-sectional study. *Biopsychosoc Med* 2013;7:17.

5 Rhee H. Relationships between physical symptoms and pubertal development. *J Pediatr Health Care* 2005;19:95–103.

6 Hagquist C. Psychosomatic health problems among adolescents in Sweden—are the time trends gender related? *Eur J Public Health* 2009;19:331–36.

7 Botello-Harbaum M, Haynie DL, Murray KW, Iannotti RJ. Cigarette smoking status and recurrent subjective health complaints among US school-aged adolescents. *Child Care Health Dev* 2011;37:551–58.

8 Ottová-Jordan V, Smith ORF, Gobina I, et al. Trends in multiple recurrent health complaints in 15-year-olds in 35 countries in Europe, North America and Israel from 1994 to 2010. *Eur J Public Health* 2015;25(suppl 2):24–27.

9 Eccles JS, Lord S, Midgley C. What are we doing to early adolescents? The impact of educational contexts on early adolescents. *Am J Educ* 1991;99:521–42.

10 Due P, Damsgaard MT, Lund R, Holstein BE. Is bullying equally harmful for rich and poor children? : a study of bullying and depression from age 15 to 27. *Eur J Public Health* 2009;19:464–69.

11 Moreno C, Sánchez-Queija I, Muñoz-Tinoco V, et al. Cross-national associations between parent and peer communication and psychological complaints. *Int J Public Health* 2009;54:235–42.

12 Wiklund M, Malmgren-Olsson EM, Öhman A, et al. Subjective health complaints in older adolescentsare related to perceived stress, anxiety and Gender–a cross-sectional school study in Northern Sweden. *BMC Public Health* 2012;12:993–1006.

13 Gustafsson J-E, Allodi Westling M, Alin Åkerman B, et al. School, Learning and Mental Health. A Systematic Review 2010. Stockholm: The Royal Swedish Academy of Sciences, The Health Committee, 2010.

14 Pape H, Hammer T. Sober adolescence-Predictor of psychosocial maladjustment in young adulthood? *Scand J Psychol* 1996;37:362–77.

15 Janssen I, Katzmarzyk PT, Boyce WF, et al. The independent influence of physical inactivity and obesity on health complaints in 6th to 10th grade Canadian Youth. *J Phys Act Health* 2004;1:331–43.

16 Torsheim T, Eriksson L, Schnohr CW, et al. Screen- based activities and physical complaints among adolescents from the Nordic countries. *BMC Public Health* 2010;10:324.

17 Brunsborg GS, Mentzoni RA, Melevik OR, et al. Gaming addiction, gaming engagement, and psychological health complaints among Norwegian adolescents. *Media Psychol* 2013;16:115–28.

18 Muntaner C, Eaton WW, Miech R, O'Campo P. Socioeconomic position and major mental disorders. *Epidemiol Rev* 2004;26:53–62.

19 Bremberg S. Social health inequalities in Swedish children and adolescents – a systematic review, 2nd edn. Östersund: Swedish National Institute of Public Health 2011: 11.

20 Holstein BE, Currie C, Boyce W, et al. Socio-economic inequality in multiple health complaints among adolescents: international comparative study in 37 countries. *Int J Public Health* 2009;54:260–70.

21 Torsheim T, Currie C, Boyce W, Samdal O. Country material distribution and adolescents' perceived health: multilevel study of adolescents in 27 countries. *J Epidemiol Commun Health* 2006;60:156–61.

22 Ottova V, Erhart M, Vollebergh W, et al. The role of individual and macro-level social determinants on young adolescents' psychosomatic complaints. *J Early Adolesc* 2012;32:123–55.

23 Schnohr CW, Molcho M, Rasmussen M, et al. Trend analyses in the Health Behaviour in School-aged Children study: methodological considerations and recommendations. *Eur J Public Health* 2015;25(suppl 2):7–12.

24 Roberts C, Freeman J, Samdal O, et al. The Health Behaviour in School-aged Children (HBSC) study: methodological developments and current tensions. *Int J Public Health* 2009;54(Suppl 2):140–50.

25 Haugland S, Wold B, Stevenso J, et al. Subjective health complaints in adolescence. A cross-national comparison of prevalence and dimensionality. *Eur J Public Health* 2001;2:1.

26 Ravens-Sieberer U, Erhart M, Torsheim T, et al. An international scoring system for self-reported health complaints in adolescents. *Eur J Public Health* 2008;18:294–99.

27 Olweus D. Bullying at school: knowledge base and an effective intervention program. *Ann N Y Acad Sci* 1996;794:265–76.

28 Torsheim T, Wold B, Samdal O. The teacher and classmate support scale—factor structure, test-retest reliability and validity in samples of 13-and 15-year-old adolescents. *School Psychol Int* 2000;21:195–212.

29 Currie C, Molcho M, Boyce W, et al. Researching health inequalities in adolescents: The development of the Health Behaviour in School-Aged Children (HBSC) Family Affluence Scale. *Soc Sci Med* 2008;66:1429–36.

30 Prochaska JJ, Sallis JF, Long B. A physical activity screening measure for use with adolescents in primary care. *Arch Pediatr Adolesc Med* 2001;155:554–59.

31 Solt F. Standardizing the world income inequality database. *Soc Sci Quat* 2009;90):231–42.

32 The World Bank. USA: http://data.worldbank.org/indicator/NY.GDP.PCAP.CD.ref (26 March 2014, date last accessed).

33 Tymms P, Merrell C, Hernderson B. The first year at school: a quantitative investigation of the attainment and progress of pupils. *Edu Res Eval* 1997;2:101–18.

34 Torsheim T, Ravens-Sieberer U, Hetland J, et al. Cross-national variation of gender differences in adolescent subjective health in Europe and North America. *Soc Sci Med* 2006;62:815–27.

35 Richter M, Rathmann K, Nic Gabhainn S, et al. Welfare state regimes, health and health inequalities in adolescence: A comparative study in 32 countries. *Soc Health Ill* 2012;34:858–79.

36 Commission on Social Determinants of Health (CSDH). Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health (CSDH). Geneva: World Health Organization (WHO), 2008.

37 Karvonen S, Vikat A, Rimpelä M. The role of school context in the increase in young people's health complaints in Finland. *J Adolesc* 2005;28:1–16.

38 Haugland S, Wold B, Torsheim T. Relieving the pressure? The role of physical activity in the relationship between school-related stress and adolescent health complaints. *Res Q Exerc Sport* 2003;74:127–35.

39 Torsheim T, Currie C, Boyce W, et al. Material deprivation and self-rated health: a multi-level study of adolescents from 22 European and North American countries. *Soc Sci Med* 2004;59:1–12.

40 Steinhausen H-C, Winkler Metzke C. Continuity of functional-somatic symptoms from late childhood to young adulthood in a community sample. *J Child Psychol Psyc* 2007;48:508–13.

41 Rose G. Sick Individuals and sick populations. *Int J Epidemiol* 1985;14:32–8.