# Deterioration Is Not the Only Prospect for Adolescents' Health: Improvement in Self-reported Health Status Among Boys and Girls From Age 15 to Age 19

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**Aim** To assess changes in the mental and physical health of adolescents between the ages of 15 and 19.

**Methods** The study included a four-year follow-up of 844 students from 31 secondary schools located in Košice, Slovakia (response rate 45.6%). The 36-item short form (SF-36) scales were used to assess vitality and mental health, self-rated health, long-term well-being, long-standing illness, and the number of perceived health complaints at the age of 15 and four years later.

**Results** Both boys and girls reported significant deterioration in vitality (mean difference boys 5.3; girls 3.3; $P = 0.001$) and mental health (mean difference boys 7.7; girls 5.7; $P = 0.001$), while only boys reported deterioration in self-rated health ($P = 0.047$). The proportion of boys who reported an improvement ranged from 8%-40%, while the proportion of girls who reported an improvement ranged from 8%-45%. Significantly more girls than boys reported an improvement in mental health (27% of boys vs 34% of girls) and vitality (32% of boys vs 39% of girls), while more boys than girls reported a deterioration in vitality(55% of boys vs 48% of girls)). These differences were trivial according to the effect size (Cohen's H<0.20).

**Conclusion** Although significant deterioration in mental health and vitality was detected among both genders, with boys deteriorating more substantially in self-rated health than girls, the differences between the proportion of those with improved and those with deteriorated status were trivial in size.

It is of interest to study change in health during the period of adolescence because it has a psychological and physical impact on adolescents' further development. In general, health status of subjects during this period is assumed to deteriorate (1-3). Several studies have shown that girls reported worse health than boys (4-7). These gender differences remain stable over time, as was shown in a longitudinal study of Finnish adults (4).

The fact that physical and psychological health deteriorates in the period preceding adulthood is shown in many studies (1,8-11). Most of these results were found by cross-sectional studies. Both in the cross-sectional study by Wade et al (10) among Americans and Canadians aged from 11 to 21 years, and the longitudinal study by Mechanic (12) among Americans aged 12 to 17, no change in self-reported health was found. A cross-sectional study by Waters et al (13) on Australians aged from 11 to 18 found different effects of age on self-reported health. However, the cross-sectional studies by Hidalgo (2) on the Spanish respondents aged from 14 to 20 and by Simeoni (14) on French adolescents aged 11 to 17 reported worsening of psychological well-being. Furthermore, Currie et al (8) reported worsening of self-reported health with advancing age in a study that investigated the health status of children and adolescents aged 11, 13, and 15 years in 35 countries and regions of the United States and Europe. Wade et al (15) in a longitudinal study reported a substantial worsening of self-reported health and depressive symptoms in children from age 11 to age 15, followed by a plateau (stable period) from age 15 to age 19 and an improvement in health after the 19th year. However, in contrast with these outcomes, the results of Hankin et al (16) on clinical depression showed a plateau in children from age 11 to age 15, worsening between age 15 and age 18 year, and again a plateau from age

18 to age 21. Furthermore, Wight et al (11) found that the prevalence of depressive symptoms increased from the age 12 to 20, with a plateau between the age of 15 and 17. Thus, the results of both cross-sectional and longitudinal studies on changes in health status are consistent, since there was, on average, no improvement between the ages of 11 and 19. The results of these studies on perceived health status among adolescents suggest that health seems to be set to deteriorate or remain stable during certain phases. This may lead to a bias that distracts public health researchers and professionals from the hypothesis that in a given population it is also relevant to detect those who improved, even though the majority deteriorates or remains stable. Therefore, the current longitudinal study was performed to contribute to the clarification of the direction and magnitude of changes in health status in a cohort of 15-year-old adolescents who were followed-up to the age of 19.

**Participants and methods**

*Participants*

The sample was stratified according to the type of secondary school. After leaving elementary school (9 years of attendance), Slovak adolescents aged around 15 enter one of the following four types of secondary schools: 1) four-year general secondary school providing brode education and preparation for university study; 2) four-year specialized secondary school providing usually technical education, after which it is also possible to study at university; 3) four-year apprentice school providing education for manual occupations; 4) three or two-year apprentice school providing only basic education for manual occupations. A computer program generating random numbers was used to randomly select numbered schools per stratum. After inclusion, no school dropped out.

The sample consisted of 1850 first grade students from 31 secondary schools (7 general secondary schools, 13 specialized schools, 11 apprentice schools 4 four-year, and 7 three-year apprentice schools) located in Košice, Slovakia. Based on official statistical data from the Institute of Information and Prognosis of Education, Bratislava, we ensured by means of quota sampling that the proportions of male and female students and their educational levels represented their proportions in Slovakia. Participants completed the baseline questionnaire in their classrooms, under the guidance of field workers. Four years later, respondents received a self-administered questionnaire by mail together with a stamped return envelope. A single reminder was sent to those who did not reply. We received 844 questionnaires that served the purpose of analysis, representing the response rate of 45.6%.

### Outcome measures

According to Hammarström and Janlert (17), the most common way of examining health problems among young people is through self-reported symptoms. Six subjective health indicators assessing the health status of respondents were used in this study.

Self-rated health is widely used in health studies because it is generally accepted as a good predictor of mortality and morbidity (18). Respondents assessed their health using the five-point Likert scale from "excellent" to "bad." For this analysis, excellent and very good health ratings were considered as one group; while good, fairly good, and bad ratings were, according to the findings of Geckova (19), considered as a second group.

Vitality and mental health are two scales in the 36-item RAND questionnaire (20). The vitality scale consists of four items focusing on energy and fatigue. Mental health scale is a five-item scale focusing on psychological distress and well-being. For both indica-

tors, respondents were asked to evaluate their feelings during the previous four weeks using five-point Likert scales. Sum scores were then transformed into scales with a possible range from 0 (worst) to 100 (best).

Prevalence of a long-standing illness was assessed by the following question: "Do you have any long-standing illness (lasting for more than three months)?" with the response options "yes" and "no" (21).

Long-term well-being was measured on a seven-point scale consisting of stylized faces, with "1" representing the highest degree of well-being and "7" the lowest. Respondents rated their feelings about their life over the past year. The scale was used to assess socio-emotional health, in addition to global and physical health measured by other indicators. This simple scale provides a better representation of respondent's feelings than similar verbal scales, with a sufficient test-retest reliability and a median validity coefficient of 0.82 (22).

Information on self-reported health complaints was collected by the Netherlands Health Interview Survey (VOEG) (23-25). It comprises thirteen dichotomous questions on complaints related to general fatigue, the stomach, musculoskeletal system, and cardiovascular system. Internal scale reliability proved to be good (Cronbach's $\alpha = 0.86$) and test-retest reliability was satisfactory (Pearson $r = 0.76$) (26). Possible scores on the VOEG scale ranged from 0 to 13, with a higher score indicating more health complaints.

### Estimation of longitudinal changes

Outcomes of statistical testing for average difference scores between independent samples or paired observations may result in a mean difference score, indicating deterioration due to the fact that a majority of these difference scores indicate deterioration after subtraction of two mean scores. However, this does not mean that positive (improvement)

or zero scores (remaining stable) do not exist in the distribution. Using the respondents as their own "controls" allows for comparisons between those who improve, remain stable, or deteriorate in health. Detection of those who reported an improvement, remained stable, or reported deterioration was performed in two steps. In the first step, we differentiated a change found by sample fluctuation from a significant change in perceived health between the ages of 15 and 19 and estimated the magnitude of the difference with Cohen's effect size "d" (27) for continuous scales when the change was significant. For individualized effect size calculation, we used the pooled standard deviation as the standardizing unit of mean difference score over time, so as to avoid overestimation of effects (28). According to the thresholds of Cohen, health status was classified as deteriorated with an effect size ≤-0.20, as stable with an effect size between -0.19 and +0.19, and as improved with an effect size ≥+0.20, only in cases when the mean difference was not due to random error ($P<0.05$). For $\chi^2$ differences Cohen's effect size "w" was used (29). Thresholds of effect size "w" for appraisal of "small," "medium," and "large" differences between proportions were 0.10, 0.30, and 0.50, respectively.

In the second step, we used the individualized effect size to detect proportions of those who reported improvement (positive effect size), remained stable (trivial effect size), or reported deterioration (negative effect size), and tested the significance of differences in proportions (30) and estimated the magnitude of the difference between proportions with Cohen's effect size "h" (31). Thresholds of effect size "h" for appraisal of "small," "medium," and "large" differences between proportions were 0.20, 0.50, and 0.80, respectively. For effect size interpretation, Cohen (27) used the term trivial, which we prefer to the term "insignifi-cant," since the term "insignificant" carries the relationship to statistical significance.

### Statistical analysis

Analyses were performed using the Statistical Package for the Social Sciences, version 12.0.1 (SPSS Inc. Chicago, IL, USA) and for all tests *P*-values of <0.05 were considered significant. Differences between the means were not normally distributed (Shapiro Wilk, $P<0.05$) and, therefore, paired testing was done using a non-parametric test. Longitudinal change between the ages of 15 and 19 years was analyzed with Wilcoxon matched-pairs signed ranks test for continuous variables and McNemar test for dichotomized data. We calculated 95% confidence intervals (95% CI) for the differences in proportions (30). Discrete variables were compared with the $\chi^2$ (Fisher exact test when appropriate).

### Results

The sample consisted of 844 adolescents who participated in the study at the age of 15 and 19. At baseline, 1850 students participated and were invited to fill out the questionnaire at the age of 19. The response rate was 45.6%. At baseline boys and girls did not differ in the six health indicators used in this study (Table 1). Girls were over-represented in the responder group, in comparison with the non-response group (Table 1). More general secondary school students and fewer apprentice students participated in the second stage of the study. Students who participated in the second stage of the study had at the age of 15 a significantly worse mental health, vitality, a higher number of physical complaints, a better long-term well-being, and a lower prevalence of long standing illness than those who did not participate in the second stage. However, according to Cohen's thresh-

**Table 1.** Characteristics of student responders and non-responders at baseline

| Parameter | Non-responders (n = 1006) | Responders (n = 844) | P | Effect size |
|---|---|---|---|---|
| Sex*: | | | | |
| female | 468 (46.5) | 483 (57.2) | 0.001† | 0.21‡ |
| male | 538 (53.5) | 361 (42.8) | | |
| Type of school*: | | | | |
| general | 193 (19.2) | 247 (29.3) | 6.2-14.0§ | |
| specialized | 420 (41.7) | 382 (45.3) | -10.2-8.0§ | |
| apprentice | 393 (39.1) | 215 (25.5) | -9.3-17.7§ | |
| Short-Form-36 (SF-36) self-rated health*: | | | 0.356† | 0.09‡ |
| excellent/very good | 518 (61.4) | 636 (63.5) | | |
| good/fairly good/bad | 325 (38.6) | 637 (36.5) | | |
| Long-standing illness >3 mo*: | | | 0.043† | 0.12‡ |
| yes | 83 (9.8) | 72 (7.2) | | |
| no | 761 (90.2) | 933 (92.8) | | |
| SF-36 vitality‖ | 983 (0.63±0.17) | 838 (0.60±0.17) | 0.003¶ | 0.18 (0.08-0.27)** |
| SF-36 mental health‖ | 983 (0.69±0.16) | 838 (0.67±0.16) | 0.005¶ | 0.13 (0.03-0.22)** |
| Number of self-rated health complaints (VOEG)‖ | 1003 (2.12±2.44) | 844 (2.47±2.39) | 0.016¶ | 0.14 (0.05-0.24)** |
| Long-term well-being‖ | 983 (1.58±0.49) | 838 (1.55±0.50) | 0.027† | 0.06 (0.03-0.15)** |

*No. (%).
†Fisher exact test.
‡Cohen's H
§95% confidence interval for difference of proportions.
‖ No.; mean (standard deviation).
¶*t* test.
**Cohen's d - pooled effect size (95% confidence interval for effect size ) (27).
††Mann-Whitney U-Wilcoxon-W test.

olds these significant differences were trivial in size (Table 1) (27).

### Longitudinal changes in mental and physical health among boys and girls

Boys and girls reported a significant deterioration (*P*<0.05 for both) in vitality and mental health between the ages of 15 and 19. Among girls the longitudinal change in vitality was trivial in size (although significant), but the change in mental health in both genders exceeded the criterion of effect size ≥0.20. Boys and girls reported a significant deterioration in long-term well-being with moderate effect sizes. No significant differences between boys and girls aged from 15 to 19 were found in the number of self-reported physical complaints assessed with the VOEG and in the prevalence of a long-standing illness. Only in boys, self-rated health deteriorated significantly from excellent or very good at the age of 15 to good, fairly good, or bad at the age of 19. According to Cohen's thresholds for the effect size "w," this change was found to be

small since it exceeded the criterion of effect size ≥0.10.

We showed that, on average, boys and girls experienced a deterioration in their self-perceived health, which confirms the general trend in measuring health in this important stage of life (Table 2). However, this average outcome does not imply that there are no subjects who improved in health or remained stable.

Although young adolescents deteriorated in 6 domains of health status (6-60% of boys; 6-56% of girls), but relevant proportions of boys and girls improved (8-40% of boys; 8-45% of girls) or remained stable (13-86% of boys; 10-86% of girls) between the age of 15 and 19 (Table 3).

The proportions of girls who reported an improvement, remained stable, and reported a deterioration in long-term well-being, health complaints, and long-standing illness were not significant in comparison with boys. The differences in proportions between boys and girls who remained stable and who reported a deterioration in self-rated health and mental health were not significant. Also, the differ-

**Table 2.** Change in mental and physical health status between boys and girls aged 15 and 19

| Scale | Boys (n = 359) | | | | Girls (n = 479) | | | |
|---|---|---|---|---|---|---|---|---|
| | 15 y* | 19 y* | P (Z) | effect size | 15 y* | 19 y* | P (Z) | effect size§ |
| SF-36 vitality | 63.8±16.6 | 58.5±17.1 | 0.001† | -0.32§ | 57.4±17.6 | 54.1±17.6 | 0.001† | -0.18 |
| SF-36 mental health | 71.2±14.8 | 63.5±15.8 | 0.001† | -0.52§ | 64.6±15.7 | 58.9±17.9 | 0.001† | -0.36 |
| Long-term well-being | 2.4±0.9 | 2.8±1.3 | 0.001† | 0.54§ | 2.4±0.9 | 2.9±1.3 | 0.001† | 0.71 |
| Number of self-rated health complaints (VOEG) | 2.0±2.2 | 1.8±2.3 | 0.532† | | 2.8±2.4 | 2.8±2.6 | 0.849† | |
| Long-standing illness >3 mo (%) | 7.9 | 7.2 | 0.942‡ | | 8.7 | 8.7 | 0.368† | |
| SF-36 self-rated health | | | | | | | | |
| | Excellent/very good 19 y | Good/ fairly good/bad 19 y | | | Excellent/very good 19 y | Good/fairly good/bad 19 y | | |
| Excellent/very good at 15 y | 181 | 68 | 0.047‡ | 0.1‖ | 192 | 76 | 0.218† | |
| Good/fairly good/bad at 15 y | 46 | 64 | | | 93 | 120 | | |

*Mean±standard deviation.
†Wilcoxon matched pairs signed rank test.
‡McNemar test.
§Cohen's d.
‖ Cohen's W

**Table 3.** Proportions of boys and girls who reported improvement, remained stable, and reported deterioration in six health measures and the differences between boys and girls*

| Scale | Boys (%) | | | Girls (%) | | | Difference in proportions (boys vs girls; 95% confidence interval) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | improvement | stable period | deterioration | improvement | stable period | deterioration | improvement | stable period | deterioration | P | effect size/ Cohen's H |
| Self-rated health | 13 | 68 | 19 | 19 | 65 | 16 | 0.01-0.11 | -0.04-0.09 | -0.02-0.08 | 0.031i | 0.164 |
| Vitality | 32 | 13 | 55 | 39 | 13 | 48 | 0.04-13.6 | -0.04-0.05 | 0.01-0.15 | 0.033i/0.024d | 0.146i/0.140d |
| Mental health | 27 | 13 | 60 | 34 | 10 | 56 | 0.01-12.8 | -0.01-0.07 | -0.03-0.11 | 0.041i | 0.152 |
| Long-term well-being | 40 | 36 | 24 | 45 | 34 | 21 | -0.13-0.01 | -0.04-0.09 | -0.03-0.09 | | NA |
| Health complaints | 38 | 29 | 33 | 44 | 18 | 38 | -0.04-0.04 | 0.05-0.17 | -0.12-0.01 | | NA |
| Long-standing illness | 8 | 86 | 6 | 8 | 86 | 6 | – | – | – | – | NA |

*Abbreviations: i – improvement; d – deterioration.

ence between stable boys and girls on vitality was not significant. However, the proportion of girls who reported an improvement in perceived self-rated health (19%) differed significantly from the proportion of boys who reported an improvement (P = 0.031; 95% CI, -0.01 to -0.11). The proportion of girls who reported an improvement in vitality between the age of 15 and 19 (39%) differed significantly from the proportion of boys (32%) (P = 0.033; 95% CI, 0.04-13.6). Furthermore, the difference in the proportion of boys and girls who reported a deterioration in vitality (55% vs 48%) was significant (P = 0.024; 95% CI, 0.01-0.15). The proportion of girls who reported an improvement in mental health (34%) differed significantly from that of boys (27%) (P = 0.041; 95% CI 0.01- 12.8). However, although significant, these differences were, according to the thresholds of Cohen's "h" effect size, trivial in size.

## Discussion

In the current study, boys reported a small deterioration in self-rated health. Both boys and girls reported a deterioration in vitality and mental health. However, the change in vitality was small for boys and trivial in size for girls. Furthermore, the extent of deterioration in mental health in boys was moderate, compared with the small extent of deterioration in girls. Both boys and girls reported a moderate deterioration in long-term well-being according to the thresholds of Cohen's effect size. Thus, in the three domains of self-reported health, boys reported more deterioration than girls.

Contrary to the general trend of deterioration in health status in adolescence observed in the literature, we detected substantial proportions of boys and girls who reported an improvement in health. For the health indica-

tors used in this study, the proportions of adolescents who reported an improvement ranged from 8% to 40% in boys and from 8% to 45% in girls. Four out of 18 comparisons between boys and girls who reported an improvement were, although significant, trivial in size.

Most of 19-year-old adolescents refused to participate in the research dealing with questions on personal health, psychological well-being, and risky health-related behavior. Furthermore, at the age of 19 many changed the place of residence to go to study or start a professional career, which resulted in the return of a substantial number of mailed questionnaires, with the annotation "address unknown." Nevertheless, 844 (46%) subjects filled out a questionnaire that was identical to the questionnaire they filled out at the age of 15. Female adolescents were more likely to participate as they were general secondary school students, who are presumed to have a better health status. Responders had worse health status according to SF-36 and VOEG scales. Still, these differences were, according to Cohen's thresholds, trivial in size.

The main purpose of this study was to perform a longitudinal comparison of self-rated health status of adolescents from age 15 to age 19. Subjects were their own controls in a repeated measurement. The study also focused on analyzing gender differences and identifying proportions of male and female adolescents who reported an improvement, remained stable, and reported a deterioration. Both boys and girls reported deterioration in vitality and mental health between the age of 15 and 19, while only boys reported a deterioration in self-rated health. The prevalence of perceived health complaints and long-standing illness at 19 remained unchanged since baseline.

In comparison with boys, girls reported having worse health in five health indicators both at the age of 15 and at the age of 19,

which is in line with several previous studies (2-4,32-35). However, in this study, differences in health indicators between boys and girls were not significant between the baseline and follow-up. According to the literature, it could be assumed that there would be a general lifelong trend of deterioration of health with increasing age. This general trend is disturbed by some further deterioration in the periods of major life transitions (2,8,11,12,14,15). Worse health in adolescents and adult females seems to be a general finding. However, although it is widely accepted, this belief should not be generalized for all health indicators. This study shows that for both sexes, scores on mental health measures (eg, vitality, mental health, long-term well-being) deteriorated, while the scores on physical health measures (number of physical health complaints and long-standing illness) did not change between the baseline (age 15) and follow-up (age 19). Only boys reported a significant deterioration in self-rated health. The period of life investigated in this study is a period of important life transition associated with numerous stressful events, ie, preparing for end-of-school exams, going to university, or looking for a job. Studies covering health in adolescence mostly reported either stability or worsening of health status in the period between the 15th and 19th year (10,12,14). Furthermore, some studies reported alternating periods of worsening, as well as plateaus, in health status (11,15,16).

To our knowledge, no studies have detected substantial improvement in self-reported health during this phase of adolescence. However, our study has shown that the health status of some subgroups of adolescents improved with increasing age. Adolescence is a time in which life-style and health-related behaviors are being established. A substantial part of research efforts are aimed

at studying young adolescents at risk of getting involved in smoking, drug, and alcohol use, which may negatively affect health. However, improvement in health in the current study may be related to a health-protective lifestyle.

Friis et al (36) found in a 4-5-year-long longitudinal study that absence of stressful school and family events was related to improvement in depressive disorders in respondents aged 14-24 years at baseline.

With regard to the statistical conclusion validity, the most relevant strength of this study is its follow-up nature, where each participant serves as his or her own control. Due to high costs and complex management, longitudinal studies are not very common, especially studies focusing on young people. Most information about health of this age group is obtained by cross-sectional studies, whereas less data are obtained by longitudinal studies. The main limitation of this study is the low response rate at follow-up. This is common in longitudinal studies among school-attending young adolescents, since a large proportion move to study or work elsewhere. Although differences in gender and education between response and non-response groups did not occur due to sampling error, they were small according to standardized indices of differences between groups (effect sizes). Since in large samples, small or trivial differences are likely to become significant, we have come to the conclusion that the external validity is not hampered by unacceptably large differences.

Another strength of this study is the sample size. The sample was randomly selected from each type of secondary schools in Slovakia. The sample represents the school population of school-attending adolescents in eastern part of Slovakia. Differences between the ages of 15 and 19, due to sample fluctuation or chance, were not used to estimate the change with effect sizes.

The importance of this study is that we identified not only deterioration, but also improvement and stability in self-reported health among boys and girls between the ages of 15 and 19. More longitudinal studies, with shorter time intervals, should be designed to determine factors that may explain changing mental and physical health and their (causal) paths with structural equation modeling. Outcomes of such studies should provide support for a well-tailored and evidence-based health policy for the adolescent population and relevant strata.

### Acknowledgment

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