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## Influence of Health Risk Behavior and Socio-economic Status on Health of Slovak Adolescents

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**Aim.** To investigate the role of health risk behavior, such as smoking and alcohol consumption, in the explanation of socio-economic health differences among adolescents. The hypothesis of different exposure and the hypothesis of different vulnerability were explored.

**Method.** In the study carried out in 1998, the prevalence of health complaints of smokers vs non-smokers, alcohol consumers vs abstainers, and among different socio-economic groups of 2,616 Slovak adolescents (mean age,  $14.9 \pm 0.62$  years) were investigated by means of self-reported questionnaires. The adolescents were stratified according to sex and type of secondary school.

**Results.** Socio-economic disadvantage and the presence of health risk behavior were associated with greater frequency of health complaints by adolescents. Prevalence of smokers was higher in lower socio-economic groups, but no such trend was found for the prevalence of alcohol consumers. Socio-economic status and health risk behavior interactively influenced health, when socio-economic status was assessed according to the mother's characteristics. Socio-economic health differences between non-smokers and abstainers were not significant, unlike the differences between the smokers and alcohol consumers. The influence of health risk behavior was weaker in higher socio-economic groups.

**Conclusion.** Both hypotheses, of different exposure and different vulnerability, could explain socio-economic health differences among Slovak adolescents, with different exposure playing a more important role.

**Key words:** adolescence; alcohol drinking; delivery of health; health; Slovakia; smoking; social class; socioeconomic factors

Scottish (1,2), Finnish (3), and Dutch (4) studies indicated relatively no disparities in health among adolescents, whereas other studies from Nordic countries (5), USA (6), Hungary (7), and Slovakia (8) showed evidence of differences in health among adolescents, with lower socio-economic groups having poorer health status.

Socio-economic status influences health indirectly, through more specific determinants of health and illness (9). The hypothesis of social causation supposes that people in lower socio-economic groups live in less favorable circumstances and more frequently engage in health risk behavior. The question is whether uneven distribution of health determinants (hypothesis of different exposure) or different health impact of these determinants (hypothesis of different vulnerability) can explain disparities in health in the adolescent population (4,6,9-11).

According to the hypothesis of different exposure (11-13), socio-economic health differences may

be explained by different occurrence of health determinants in different socio-economic groups. Determinants of detrimental effects on health (health risk behavior, long-term difficulties, and life-events) occur more frequently, and determinants of protective effects on health (physical exercise and social support) occur less frequently in lower than in higher socio-economic groups.

The differential vulnerability model supposes that higher socio-economic groups have some mechanism at their disposal, which inhibits detrimental effects and stimulates protective effects of health determinants. Lower socio-economic groups are less well equipped to cope with the stressors (4,9).

Kooiker and Christiansen (11), Stronks et al (12), and Ranchor et al (13) explored these hypotheses in the adult population and found support for the hypothesis of different exposure, but not for the hypothesis of different vulnerability.

Call and Nonnemaker (6) studied the indirect and moderating effects of health risk behavior (smoking, alcohol use, and marijuana use) on the relationship between socio-economic status and health outcome in adolescents. The association between socio-economic status and health remained significant even when the influence of health risk behavior was taken into account. Cigarette and marijuana smoking were associated with worse health, whereas the use of alcohol was not. They did not confirm greater effect of health risk behavior on health in lower socio-economic groups (6).

Tuinstra (4) examined whether adolescents in the lower socio-economic groups were more vulnerable to the negative consequences of maladaptive decision-making styles in comparison with adolescents in the higher socio-economic groups, in terms of health risk behavior. However, the hypothesis of different vulnerability was not confirmed.

In previous studies, we confirmed socio-economic differences in both health and health risk behavior among Slovak adolescents, as well as detrimental effects of health risk behavior on the health of adolescents (8,14-16). The aim of this study was to find explanation for these socio-economic health differences, by testing both the hypothesis of different exposure and hypothesis of different vulnerability. Differences in both health and health risk behavior unfavorable for lower socio-economic groups and a significant detrimental effect of health risk behavior on health would be found if the hypothesis of different exposure was valid. In an extreme case, we should find socio-economic health differences only if health risk behavior was present. If the hypothesis of different vulnerability is valid, we should find a lower influence of health risk behavior on health in higher socio-economic groups and a higher influence of health risk behavior on health in lower socio-economic groups. In an extreme case, we should find significant detrimental influence of health risk behavior on health in lower but not in higher socio-economic groups.

Sex differences in health and health risk behavior of Slovak adolescents were the reasons for treating sex as a covariant (17,18). Women are characterized by poorer health but lower incidence of smoking and alcohol consumption in comparison with men. Gijsberg van Wijk et al (19) listed six groups of reasons for sex differences in health reporting: biological reasons, social position of women in society, tendency of women to pay more attention to somatic symptoms, attributions, personality traits, and communicativeness of women. MacIntyre et al (20) stated that women are simply more sensitive than men and more open to report their health problems.

We ascertained that significant socio-economic differences in health unfavorable for lower socio-economic groups of adolescents existed, as well as significant detrimental influences of health risk behavior on the health of adolescents.

Our research was based on the following questions in line with the two hypotheses. For the hypothesis of different exposure, the questions were whether

there were significant socio-economic differences in occurrence of health risk behavior unfavorable for lower socio-economic groups of adolescents, and significant differences in socio-economic health differences between adolescents reporting and not reporting health risk behavior. For the hypothesis of different vulnerability, the question was whether there were significant socio-economic differences in the influence of health risk behavior on health unfavorable for lower socio-economic groups of adolescents.

## Respondents and Methods

### *Respondents*

The sample consisted of 2,616 first-year students of 31 secondary schools in Kosice. There were 52.4% boys and 47.6% (mean  $\pm$  SD age, 14.9  $\pm$  0.6 years). The sample was stratified according to sex and types of secondary schools; the proportion of the five educational levels of the regular Slovak school system was maintained. Individual schools were selected at random. Our sample was representative of the Slovak adolescent population.

### *Survey*

Data were collected in 1998 by means of self-reported questionnaire that included several measures of health risk behavior, socio-economic status, and health. Respondents completed the questionnaire at school, in their classrooms, under the guidance of our field workers. The response rate was 96%; 4% of the students who did not fill out the questionnaire were absent due to illness or other causes. The average occurrence of missing values was 2.7%.

### *Measures of Health Risk Behavior*

Health risk behavior included smoking and alcohol consumption. Adolescents were asked how many cigarettes they smoked and how many times they had drunk alcohol during the preceding 4 weeks. Based on their answers to the first question they were divided into smokers (1 and more cigarettes per day) and non-smokers (I do not smoke). Based on their answers to the second question they were divided into consumers of alcohol (at least once during last 4 weeks) and abstainers (I did not drink during last 4 weeks).

### *Measures of Socio-economic Status*

Two types of socio-economic indicators were used. The first one was based on the education level of father and mother, and their occupational class, whereas the second one was based on the type of school they attended. The adolescents reported what level of education their fathers and mothers had completed. Educational level was classified as: university (20.8% of fathers and 15.6% of mothers), secondary high school (36.6% of fathers and 52.8% of mothers), and vocational or elementary school only (42.7% of fathers and 31.6% of mothers).

The measure of occupational class of parents was based on asking adolescents about their parents current occupation, or their last occupation if they were currently unemployed (11.5% of fathers and 19.6% of mothers in our sample were currently unemployed). The data were transformed into 9 categories of International Standard Classification of Occupation (21,22). Finally, some categories were combined.

The high socio-economic group included category I – legislators, senior officials and managers, and category II – professionals (23.4% of fathers and 16.7% of mothers). The medium socio-economic group included category III – technicians and associate professionals, category IV – clerks, and category V – service workers and shop and market sales workers (21.4% of fathers and 58.9% of mothers). The low socio-economic group included category VI – skilled agricultural and fishery workers, category VII – craft and related trades workers, category VIII – plant and machine operators and assemblers, and category IX – elementary occupations (55.2% of fathers and 24.4% of mothers).

Adolescents were divided according to the type of school they attended into three groups: grammar school students (21.8%),

secondary technical school students (42.4%), and apprentice school students (35.7%).

#### Measures of Health

Health was measured by the Slovak version of a shortened 13-item version of the Perceived Health Status questionnaire (23,24). This questionnaire gives a valid and reliable picture of current health status (25) by asking about the following physical health complaints: stomach feels full and bloated; get short of breath easily; pain in the chest and heart region; bones and muscles ever ache; feel tired; headache; backache; upset stomach; feel dead legs; get tired sooner; feel dizzy; feel listless; get up feeling tired and unrefreshed. We used the Slovak version of a 5-anchor scale expressing the frequency of suffering from the aforementioned health complaints during the previous month. A cut-off point of three times and more was used for dichotomization. Adolescents mostly suffer from headache, backache, and tiredness (17). We examined the sum score of the Perceived Health Status questionnaire, ie, the sum of experienced health complaints.

#### Statistics

Sex was treated as a covariant, socio-economic status and health risk behavior were treated as independent variables (fixed factors), and the sum of health complaints was treated as continuous dependent variable. The analysis (general linear modeling) was computed separately for each socio-economic indicator (education of father, education of mother, occupational class of father, occupational class of mother, and type of school) and health risk behavior indicator (smoking and alcohol consumption). Logistic regression was used to explore socio-economic differences in health risk behavior. For each model adjusted  $R^2$  were computed. Adjusted  $R^2$  attempts to correct  $R^2$  to more closely reflect the goodness of fit of the model in the population (SPSS 10.1.0 tutor). For all statistical analyses, we used SPSS 10 for Windows (SPSS Inc., Chicago, IL, USA).

## Results

We explored separately the influence of socio-economic status and the influence of health risk behavior on health (Table 1). Adolescents from lower socio-economic groups had more health complaints. There were significant socio-economic health differences when father's education, mother's education, mother's occupational group, and type of school were used as socio-economic indicators. When father's occupational group alone was used as socio-economic indicator, socio-economic health differ-

ences were not significant, and when father's education alone was used as socio-economic indicator, socio-economic health differences were significant only between the highest and lowest socio-economic group of adolescents.

Smokers and alcohol consumers had significantly more health complaints. The models including socio-economic status (Table 1, models a-e) explained about 5% of variance in health, whereas the models including health risk behavior (Table 1, models 1-2) explained about 9% of variance in health (adjusted  $R^2$ ).

The occurrence of smokers was higher in lower socio-economic groups in both boys and girls. The prevalence of alcohol consumers in lower socio-economic groups was higher among boys. Significant socio-economic differences were confirmed for smoking variable, but not for alcohol consumption variable (Table 2). When socio-economic status was based on father's characteristics, socio-economic differences were significant only between high and low socio-economic groups, but not between low and medium socio-economic groups (Table 2, models 1a and 1b).

Socio-economic status and sex explained about 2% of variance in smoking and about 0.6% of variance in alcohol consumption (adjusted  $R^2$ ). One exception was the type of school, which, together with sex, explained 6% of variance in smoking (Table 2, model 1e).

We explored models including the main effect of health risk behavior and socio-economic status on health and also the interaction effect of health risk behavior and socio-economic status on health (Table 3). The influence of health risk behavior remained significant in all the models explored, whereas several socio-economic indicators did not. The influence of father's education was not significant in any model, including smoking (Table 3, model a1) or alcohol consumption (Table 3, model a2). The influence of fa-

**Table 1.** Influence of socio-economic status (SES) and influence of health risk behavior on health of adolescents – parameter estimates (general linear modeling)

Explored models			Mean sum score*	Adjusted $R^2$	p	$\beta$ coefficients	95% CI <sup>†</sup>
Influence of socio-economic status:							
a	Father's education:	university	2.10	0.052	0.033	-0.267	-0.514-0.021
		secondary	2.22				
		vocational	2.42				
b	Father's occupation:	high SES	2.07	0.050	0.058	-0.225	-0.458-0.008
		medium SES	2.32				
		low SES	2.35				
c	Mother's education:	university	2.06	0.052	0.021	-0.334	-0.618-0.051
		secondary	2.23				
		vocational	2.48				
d	Mother's occupation:	high SES	2.11	0.048	0.016	-0.369	-0.667-0.070
		medium SES	2.26				
		low SES	2.51				
e	Type of school:	grammar	2.22	0.054	0.007	-0.341	-0.588-0.009
		secondary	2.24				
		apprentice	2.39				
Influence of health risk behavior:							
1	Smoking:	non-smokers	2.06	0.087	<0.001	-1.065	-1.272-0.859
		smokers	2.95				
2	Alcohol consumption:	abstinents	1.87	0.094	<0.001	-1.015	-1.195-0.836
		consumers	2.80				

\* questionnaire for assessment of Subjective Health Score.

† Confidence interval.



ther's occupational group and type of school was not significant in models including smoking (Table 3, models b1 and e1). Significant interaction effects between health risk behavior and socio-economic status

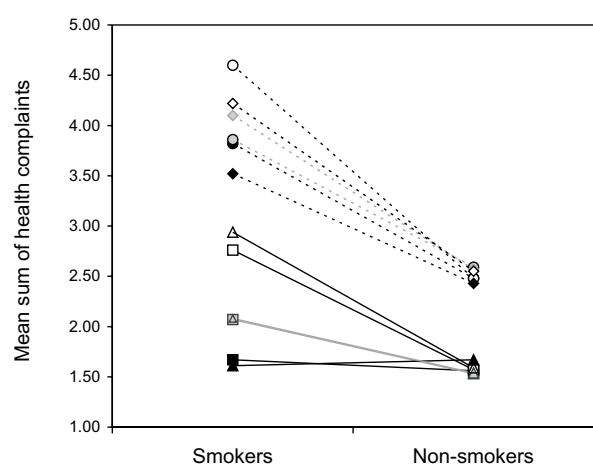
were confirmed in models including mother's education, mother's occupational group, smoking, and alcohol consumption (Table 3, models c1, d1, c2, and d2). The explored models (Table 3, models a1-e1 and

**Table 2.** Differences in socio-economic status (SES) and health risk behavior – parameter estimates (logistic regression)

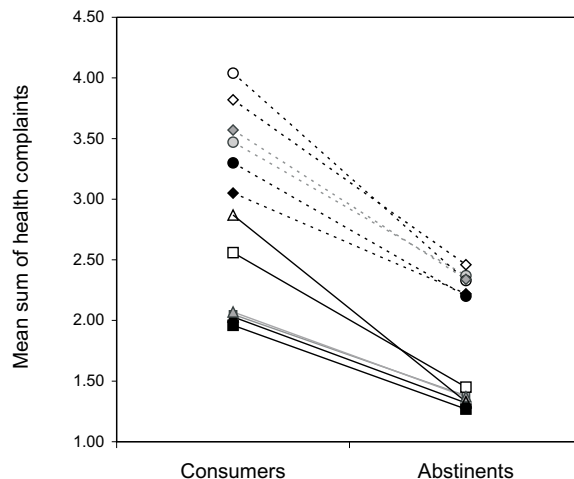
Explored models*			smokers/alcohol consumers (%)	Adjusted R <sup>2</sup>	p	β coefficients	95% CI <sup>†</sup>
<b>Smoking:</b>							
1a	Father's education:	university	18.2	0.025	<0.001	0.543	0.418-0.705
		secondary	26.4		0.229	0.884	0.724-1.080
		vocational	28.3		<0.001		
1b	Father's occupation:	high SES	18.9	0.024	<0.001	0.594	0.463-0.761
		medium SES	25.0		0.278	0.877	0.691-1.112
		low SES	27.5		<0.001		
1c	Mother's education:	university	20.0	0.022	<0.001	0.571	0.427-0.763
		secondary	24.7		0.014	0.780	0.640-0.951
		vocational	29.2		0.001		
1d	Mother's occupation:	high SES	19.1	0.021	<0.001	0.552	0.406-0.751
		medium SES	24.6		0.015	0.765	0.615-0.950
		low SES	29.5		0.001		
1e	Type of school:	grammar	13.3	0.063	<0.001	0.258	0.195-0.340
		secondary	20.7		<0.001	0.438	0.359-0.534
		apprentice	38.8		<0.001		
<b>Alcohol consumption:</b>							
2a	Father's education:	university	45.3	0.005	0.847	1.021	0.827-1.261
		secondary	42.2		0.489	0.939	0.786-1.122
		vocational	44.4		0.693		
2b	Father's occupation:	high SES	45.7	0.005	0.319	1.108	0.906-1.354
		medium SES	45.2		0.381	1.097	0.892-1.350
		low SES	42.9		0.504		
2c	Mother's education:	university	46.1	0.006	0.453	1.097	0.861-1.397
		secondary	44.4		0.687	1.037	0.869-1.237
		vocational	43.3		0.753		
2d	Mother's occupation:	high SES	47.0	0.007	0.167	1.260	0.976-1.628
		medium SES	45.1		0.077	1.164	0.958-1.416
		low SES	41.2		0.127		
2e	Type of school:	grammar	45.7	0.007	0.826	1.024	0.829-1.265
		secondary	41.8		0.133	0.731	0.731-1.042
		apprentice	46.2		0.190		

\*Main effect of sex on health is included into all models as a covariant.

<sup>†</sup>Confidence interval.



**Figure 1.** Interaction effect between influence of socio-economic status (SES, based on mother's education and occupational group) and smoking on health of adolescents. Mean sum scores of health complaints among sex and socio-economic groups. Father, university – closed square; father, secondary – gray square; father, vocational – open square; mother, university – closed circle; mother, secondary – gray circle; mother, vocational – open circle; father, high SES – closed triangle; father, medium SES – gray triangle; father, low SES – open triangle; mother, high SES – closed rhomb; mother, medium SES – gray rhomb; mother, low SES – open rhomb.



**Figure 2.** Interaction effect between influence of socio-economic status (SES, based on mother's education, and mother's occupational group) and alcohol consumption on health of adolescents. Mean sum scores of health complaints among sex and socio-economic groups. Father, university – closed square; father, secondary – gray square; father, vocational – open square; mother, university – closed circle; mother, secondary – gray circle; mother, vocational – open circle; father, high SES – closed triangle; father, medium SES – gray triangle; father, low SES – open triangle; mother, high SES – closed rhomb; mother, medium SES – gray rhomb; mother, low SES – open rhomb.

a2-e2) explained 8-10% of variance in health status (adjusted R<sup>2</sup>).

The influence of health risk behavior on health was stronger in comparison with the influence of socio-economic status on health ( $\beta$  coefficients, adjusted R<sup>2</sup> in Tables 1 and 3).

The influence of health risk behavior was higher in adolescent group with lower socio-economic status (Figs. 1 and 2, skewness of the curves). Socio-economic health differences were very low or absent in the groups of non-smokers and abstainers, but were present in the groups of smokers and alcohol consum-

**Table 3.** Influence of health risk behavior and socio-economic status (SES) on health of adolescents – parameter estimates (general linear modeling)

Explored models*			Adjusted R <sup>2</sup>	p	$\beta$ coefficients	95% CI <sup>†</sup>
a1	Smoking:	non-smokers	0.086	<0.001	-0.865	-1.175-0.555
		smokers				
	Father's education:	university				
		secondary	0.731	0.412	-0.094	-0.627-0.440
		vocational			0.164	-0.228-0.556
	Interaction effects:	non-smoker x university		0.750	-0.010	-0.697-0.502
		non-smoker x secondary		0.079	-0.412	-0.871-0.005
b1	Smoking:	non-smokers	0.081	<0.001	-1.080	-1.364-0.797
		smokers				
	Father's occupation:	high SES				
		medium SES	0.599	0.327	-0.135	-0.638-0.368
		low SES			-0.234	-0.701-0.234
	Interaction effects:	non-smoker x high		0.965	0.013	-0.553-0.578
		non-smoker x medium		0.261	0.317	-0.225-0.859
c1	Smoking:	non-smokers	0.091	<0.001	-1.609	-1.963-1.255
		smokers				
	Mother's education:	university				
		secondary	0.001	<0.001	-1.601	-0.427-3.385
		vocational			-0.746	-1.134-0.359
	Interaction effects:	non-smoker x university		0.002	1.042	0.374-1.709
		non-smoker x secondary		0.001	0.791	0.337-1.246
d1	Smoking:	non-smokers	0.083	<0.001	-1.501	-1.915-1.088
		smokers				
	Mother's occupation:	high SES				
		medium SES	0.001	0.006	-1.049	-1.671-0.427
		low SES			-0.587	-1.010-0.165
	Interaction effects:	non-smoker x high		0.004	1.043	0.336-1.751
		non-smoker x medium		0.023	0.578	0.080-1.076
e1	Smoking:	non-smokers	0.086	<0.001	-1.138	-1.446-0.829
		smokers				
	Type of school:	grammar				
		secondary	0.386	0.189	-0.254	-0.830-0.321
		apprentice			-0.258	-0.644-0.127
	Interaction effects:	non-smoker x grammar		0.489	0.226	-0.414-0.865
		non-smoker x secondary		0.473	0.167	-0.290-0.624
a2	Alcohol consumption:	abstinents	0.095	<0.001	-1.070	-1.348-0.791
		consumers				
	Father's education:	university				
		secondary	0.079	0.229	-0.321	-0.679-0.038
		vocational			-0.188	-0.495-0.118
	Interaction effects:	abstinents x university		0.745	0.080	-0.404-0.564
		abstinents x secondary		0.727	0.073	-0.337-0.482
b2	Alcohol consumption:	abstinents	0.093	<0.001	-1.079	-1.332-0.827
		consumers				
	Father's occupation:	high SES				
		medium SES	0.027	0.795	-0.383	-0.723-0.043
		low SES			-0.047	-0.399-0.305
	Interaction effects:	abstinents x high		0.292	0.246	-0.212-0.704
		abstinents x medium		0.947	0.016	-0.457-0.489
c2	Alcohol consumption:	abstinents	0.098	<0.001	-1.403	-1.726-1.080
		consumers				
	Mother's education:	university				
		secondary	0.002	0.001	-0.660	-1.071-0.249
		vocational			-0.533	-0.838-0.228
	Interaction effects:	abstinents x university		0.058	0.536	-0.019-1.091
		abstinents x secondary		0.010	0.534	0.128-0.940
d2	Alcohol consumption:	abstinents	0.095	<0.001	-1.470	-1.851-1.089
		consumers				
	Mother's occupation:	high SES				
		medium SES	<0.001	0.001	-0.819	-1.257-0.381
		low SES			-0.562	-0.903-0.220
	Interaction effects:	abstinents x high		0.020	0.700	0.111-1.289
		abstinents x medium		0.075	0.525	0.075-0.975
e2	Alcohol consumption:	abstinents	0.096	<0.001	-1.072	-1.372-0.773
		consumers				
	Type of school:	grammar				
		secondary	0.018	0.039	-0.432	-0.790-0.074
		apprentice			-0.321	-0.625-0.016
	Interaction effects:	abstinents x grammar		0.508	0.164	-0.320-0.647
		abstinents x secondary		0.773	0.060	-0.347-0.467

\*Main effect of sex on health is included into all models as a covariant.

† Confidence interval.

**Table 4.** Influence of socio-economic status (SES) and health risk behavior on health of adolescents; additional analysis – parameter estimates

Parameter		Adjusted R <sup>2</sup>	p	β coefficients	95% CI*
A. Hypothesis of different exposure					
Non-smokers					
Mother's education:	university	0.046	0.968	0.006	-0.298-0.310
	secondary		0.733	0.040	0.188-0.268
	vocational				
Mother's occupation:	high SES	0.044	0.910	-0.019	-0.343-0.306
	medium SES		0.891	-0.018	-0.272-0.236
	low SES				
Smokers					
Mother's education:	university	0.127	0.003	-0.981	-1.630- -0.322
	secondary		0.001	-0.712	-1.140- -0.283
	vocational				
Mother's occupation:	high SES	0.114	0.002	-1.081	-1.764- -0.397
	medium SES		0.015	-0.579	-1.044- -0.115
	low SES				
Abstainers					
Mother's education:	university	0.048	0.387	-0.151	-0.494-0.191
	secondary		0.943	-0.009	-0.255-0.237
	vocational				
Mother's occupation:	high SES	0.052	0.471	-0.133	-0.493-0.228
	medium SES		0.733	-0.047	-0.315-0.222
	low SES				
Alcohol consumers					
Mother's education:	university	0.080	0.004	-0.657	-1.107- -0.207
	secondary		0.002	-0.534	-0.868- -0.200
	vocational				
Mother's occupation:	high SES	0.067	0.001	-0.833	-1.313- -0.353
	medium SES		0.003	-0.570	-0.944- -0.196
	low SES				
B. Hypothesis of different vulnerability					
Mother's education: university					
Smoking:	non-smokers	0.069	0.034	-0.562	-1.082- -0.042
	smokers				
Alcohol consumption:	abstainers	0.098	<0.001	-0.867	-1.277- -0.458
	consumers				
Mother's education: secondary					
Smoking:	non-smokers	-0.078	<0.001	-0.823	-1.106- -0.539
	smokers				
Alcohol consumption:	abstainers	0.089	<0.001	-0.871	-1.113- -0.629
	consumers				
Mother's education: vocational					
Smoking:	non-smokers	-0.108	<0.001	-1.605	-1.988- -1.222
	smokers				
Alcohol consumption:	abstainers	0.101	<0.001	-1.401	-1.753- -1.050
	consumers				
Mother's occupation: high SES					
Smoking:	non-smokers	0.046	0.113	-0.446	-0.998-0.105
	smokers				
Alcohol consumption:	abstainers	0.070	<0.001	-0.772	-1.200-0.343
	consumers				
Mother's occupation: medium SES					
Smoking:	non-smokers	0.086	<0.001	-0.938	-1.216- -0.661
	smokers				
Alcohol consumption:	abstainers	0.097	<0.001	-0.949	-1.186- -0.712
	consumers				
Mother's occupation: low SES					
Smoking:	non-smokers	0.089	<0.001	-1.481	-1.870- -1.044
	smokers				
Alcohol consumption:	abstainers	0.096	<0.001	-1.457	-1.927- -1.034
	consumers				

\*Confidence interval.

ers (Figs. 1 and 2). However, this pattern is only partially significant (Table 3). The interaction effect between abstainers and university education of mother and between abstainers and medium socio-economic status of mother was not significant.

Additional analysis confirmed this pattern. We searched for socio-economic health differences separately in the group of smokers, non-smokers, alcohol consumers, and abstainers. We also explored the in-

fluence of health risk behavior on health among socio-economic groups of adolescents (Table 4).

Socio-economic health differences were not significant among non-smokers and abstainers, but strongly significant among smokers and alcohol consumers. These findings supported the hypothesis of different exposure. Socio-economic health differences occurred only when health risk behavior occurred. So it seems that socio-economic status influ-

enced health via exposure to health risk behavior, which was more prevalent among lower socio-economic groups. The influence of health risk behavior, smoking in particular, was weaker ( $\beta$  coefficients), or in one case (smoking when mother's occupational group was used as socio-economic indicator) not significant in higher socio-economic groups. These findings support the hypothesis of different vulnerability. The influence of health risk behavior on health was weaker in higher socio-economic groups.

### Discussion

Our findings confirmed both the socio-economical disadvantage and presence of health risk behavior related to the worse health of adolescents. Health risk behavior seemed to be a stronger predictor of health among adolescents than their socio-economic status.

Including the interaction effects of health risk behavior and socio-economic status on health into the explored models, we found strong evidence for both hypotheses about socio-economic health differences. Significant interaction was confirmed in the model including health risk behavior and socio-economic status based on mother's characteristics. We confirmed socio-economic health differences among smokers and alcohol consumers, but not among non-smokers and abstainers. It is possible that the presence of health risk behavior opens the gate for the detrimental influence of socio-economic disadvantage on the health of adolescents. The detrimental influence of health risk behavior was weaker in the highest socio-economic group of adolescents. Both mechanisms, different exposure and different vulnerability, are valid for the explanation of socio-economic health differences, but the former explains it more strongly.

There are several studies confirming the absence of socio-economic health differences among adolescents (1-4). In contrast, Halldorsson et al (5) confirmed disparities in health according to socio-economic status, as reported by parents, among adolescents in all the Nordic countries. Similarly, in our previous studies, we showed that there was considerable evidence of socio-economic health differences among Slovak adolescents, and that the trends in these differences were less favorable for adolescents of lower socio-economic status (8,15).

Most studies on adolescents have investigated only father's socio-economic status. Other research, as well as our findings in this study, revealed that socio-economic characteristics of the mother showed stronger influence on health and health-related behavior of children and adolescents than those of the father (26,27). The social role of the mother includes monitoring of family members health symptoms, and taking care about health of family members (19). Mother's education, including health education, seems to be of higher importance than the education of fathers. Our previous findings support this hypothesis: adolescents talk about their problems, particularly health problems, mostly with mothers (28).

A frequently discussed issue is the validity of socio-economic indicators based on adolescent's own report. Tuinstra (4) compared answers about the

parents' education and occupation provided by adolescents and parents and found a high degree of agreement. The response rates were higher among adolescents than among parents. Glendinning et al (2) confirmed the stability of the reported paternal social class composition over time.

Smoking and alcohol consumption is related to poorer health among adolescents (16,29-32). Smoking and alcohol drinking can influence health very early, in adolescent age, but we should also take into account the possibility that this behavior is used as a coping mechanism with existing psychosomatic problems. Particularly when only cross-sectional data are available and subjective health indicators used, the reason for the association of the higher prevalence of health problems with the higher prevalence and frequency of smoking and alcohol consumption can be a coincidence and not a causal relationship. To differentiate the causal relationship from the coincidence, we plan to analyze the longitudinal data from second wave collected in December 2002.

There were significant socio-economic differences not only in health, but also in health risk behavior in our sample, although the findings from other published research are not consistent. Some studies (14,33-37) confirmed the socio-economic differences in smoking variable, which are unfavorable for lower socio-economic groups of adolescents, but some did not (38,39). Similarly, socio-economic differences in alcohol consumption unfavorable for lower socio-economic groups of adolescents were confirmed by Green et al (33), Karvonen and Rimpelä (35), Lowry et al (36), Geckova et al (14), and Piko (37), but not by Glendinning et al (40), Tuinstra et al (39), and Challier et al (41). Exceptions from class patterning in alcohol consumption were also reported by Mackenbach (42) and Tuinstra (4).

Adolescents from different socio-economic groups live in different social environments, characterized by different norms, rules, pressures, life-styles, and attitudes. Risky behavior of adolescents coming from lower socio-economic groups may be tolerated and encouraged by their social environment.

There were significantly more smokers among adolescents from lower socio-economic groups in our sample. Similar findings were not confirmed for alcohol consumption. Smoking, which has a detrimental effect on health, occurred more frequently in lower socio-economic groups and contributed to socio-economic health differences among adolescents. Our findings at least partially support the hypothesis of different exposure, e.g., for smoking.

Our findings indicate an interaction between socio-economic status and health risk behavior in their influence on health, but can hardly explain distribution of health disparities or indicate efficient policy implication without further research. Looking for the explanation of socio-economic health differences is just the first step on the way of its reduction and, more generally, health promotion.

There are several possibilities to approach the issue. In our study, we used only negative definition of health (presence of physical complaints), but the



model using positive definition of health (for example well-being) could bring different findings. Likewise, we explored only the model including health risk behavior, but such findings cannot be generalized on health-protective behavior, such as physical exercise. Based on our findings related to the accumulation of health risk behavior and correlation between single types of health risk behavior (18), physical activity seems to be completely different "type" of health-related behavior in comparison to smoking, alcohol consumption, or drug use.

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