Psychological Distress, Somatic Complaints and Their Relation to Negative Psychosocial Factors in a Sample of Swedish High School Students

Nóra Kerekes (✉ nora.kerekes@hv.se)

Institution for Health Sciences, University West, Trollhättan, Sweden

Btissame Zouini

Abdelmalek Essaâdi University

Sofia Tingberg

University West

Soly Erlandsson

University West

Research Article

Keywords: Adolescence, Brief Symptom Inventory, gender differences, psychological distress, somatic health, the experience of physical or psychological abuse

Posted Date: January 19th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-127813/v1>

License: This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Version of Record: A version of this preprint was published at Frontiers in Public Health on July 19th, 2021. See the published version at <https://doi.org/10.3389/fpubh.2021.669958>.

**Psychological distress, somatic complaints and their relation to
negative psychosocial factors in a sample of Swedish high school
students**

Nóra Kerekes¹, Btissame Zouini², Sofia Tingberg¹, Soly Erlandsson³

¹ Institution for Health Sciences, University West, Trollhättan, Sweden

² Department of Biology, Faculty of Sciences, Abdelmalek Essaadi University, Tetouan,
Morocco.

³ Institution for Social and Psychological Sciences, University West, Trollhättan, Sweden

Corresponding author: Nóra Kerekes
nora.kerekes@hv.se
Inst. For Health Sciences
University West
461 86, Trollhättan
Sweden

ABSTRACT

Background

Adolescence is a period in a life characterized by major neurobiological, physiological, and psychological changes. Those changes may give rise to worsened mental health and an increased prevalence of somatic complaints combined with a negative psychosocial environment. Rapid changes in society, which may also affect young people in several ways, call for a renewed screening of today's adolescents' mental and somatic well-being.

Aim

The present study's primary aim was to measure the level of self-rated psychological distress and the prevalence of somatic complaints in a sample of Swedish high school students. As a secondary aim, it identifies gender-specific patterns and examines mental and somatic health in relation to negative psychosocial factors (such as parental alcohol use problems or the experience of physical or psychological abuse).

Method

287 Swedish high school students completed a survey including the Brief Symptom Inventory (BSI) and a questionnaire about the presence of defined somatic complaints. In order to examine the relationship between negative psychosocial factors and mental and somatic health, three groups were formed: those reporting (1) parental substance use problems, (2) previous experience of abuse, (3) none of these problems.

Results

The majority of the Swedish high-school students (> 80%) reported no or only a few problems with psychological distress and no or only one somatic complaint. Female students disclosed a significantly higher psychological distress level captured by each BSI domain. The number of somatic complaints was similarly distributed between the genders. The students rarely reported parental substance use problems, but almost 40% of the male and

50% of the female students indicated the experience of physical and/or psychological abuse. Such negative psychosocial circumstances were related to an increased level of anxiety in the male and an increased general level of psychological distress in female students.

Conclusions

The study confirmed female students' higher psychological distress level, while no gender differences in the number, but the type, of physical complaints were detected. The experience of physical and/or psychological abuse was found to worsen psychological distress in students of both genders significantly.

Keywords: Adolescence, Brief Symptom Inventory, gender differences, psychological distress, somatic health, the experience of physical or psychological abuse

INTRODUCTION

Many different aspects, inherent and contextual, affect young people's psychological and physical health during adolescence. Biological, psycho-developmental, and social changes, that take place almost simultaneously during this developmental period [1] combined with an intensive structural and functional remodeling of the brain (pruning) [2] have an increased impact on adolescents' general well-being. The reconstruction of the brain runs parallel with hormonal changes, which imply an awakening of the sexual desire and, at the same time, the development of cognitive skills [1]. Different norms in social groups, as well as norms in society, have, to a different degree, a life-long impact on individuals. Especially for the adolescent individual, it is vital to learn and follow those norms to be accepted by a group or society. Demands might have a strong influence on young peoples' behavior and well-being [3].

67 Why the changes mentioned above are general, there are also gender-specific patterns in the
68 adolescent developmental phase. Young females usually exhibit an earlier social and
69 cognitive maturation than their age-matched male counterparts [4]. Moreover, they also
70 experience a greater deal of psychological distress compared to young males [5] and a greater
71 proportion of them complain about physical health problems [6, 7]. Most commonly reported
72 by female adolescents are generalized anxiety, panic syndrome, social anxiety, depression [5,
73 8, 9], and headaches [7]. Compared to young women, however, male adolescents experience
74 more social isolation [10], and their mental problems are not seldom observed through norm
75 divergent behavior [11].

76 Both female and male adolescents report that all types of supportive relationships which are
77 based on reciprocity, understanding, and respect have a positive effect on their psychological
78 health [12]; while negative, psychosocial factors seem to increase the prevalence of both
79 physical and mental health complaints [7, 13]. Another important part of adolescents' lives
80 that might impact psychological and physical health is their school environment.

81 Concentration difficulties and low self-esteem, headaches, allergies, and gastrointestinal
82 complaints can result from students' worry and stress experienced in the school environment.
83 Murberg and Bru [14] investigated school-related stress and psychosomatic symptoms in
84 adolescents. They found that although adolescent girls experience more psychosomatic
85 symptoms than their male classmates, peer-related difficulties at school are stronger
86 associated with boys' psychosomatic symptoms than girls. The authors also defined four main
87 dimensions of school-related stress: (1) difficulties with peers at school, (2) worries about
88 school achievement, (3) schoolwork pressure, and (4) conflicts with parents and/or teachers
89 [14]. In accordance with those findings, studies focusing on protective or salutogenic factors
90 deriving from the school-environment in adolescents' life suggest that factors promoting well-

91 being are closeness to parents and friends [15]. High-quality interpersonal relationships have
92 also been found to promote higher academic achievements [15].

93 Parents' behavior towards their children during adolescence are essential for their children's
94 well-being [16-18] and can have a long-term effect on their mental health as adults [19].

95 According to Conger, Stocker and McGuire [20], a disadvantaged family environment can
96 lead to children showing more negative emotionality, being less agreeable, and lack
97 conscientiousness. The strength or more clearly the weakness of personality dimensions, like
98 emotional stability, conscientiousness, and agreeableness, can predict the presence of severe
99 psychiatric ill-health in adolescents, for example, self-harm behaviors and suicidal depression
100 [21]. Notably, the relationship between personality and mental disorders is not affected by
101 gender or age when a disorder was diagnosed [22]. And again, besides family and school
102 environment, societal norms and cultural input during the developmental period of
103 adolescence have a remarkable impact on adolescents' health and well-being [12, 23].

104 While relations of a destructive character can lead to mental distress [12] and may also be
105 coupled to an increased prevalence of physical complaints [24], the importance of supportive,
106 good relationships for physical and psychological health cannot be underestimated. One
107 crucial component of well-being during adolescence is to search and find meaning in life.

108 Previous research has shown a possible link between the lack of meaning in life and the
109 prevalence of psychosomatic symptoms in youth [25]. Performed studies over several years
110 across-countries and cultures have shown that meaningfulness (sense of coherence) can be a
111 powerful coping strategy and a potential protective factor in stressful situations [26]. A
112 holistic care approach by which both somatic and mental health and the complex bio-psycho-
113 social matrix are in focus should be relevant and sought-after aspects of adolescent health
114 research. To meet some of those goals, the prevalence and gender-specific distribution of self-

reported somatic and mental health were investigated in a sample of Swedish high school students.

METHOD

The Mental and Somatic Health without borders" MeSHe -project [27] is an international project focusing on culture-specific risk- and protective factors of adolescent substance use and aggressive antisocial behavior. This project collects data by a standardized survey (the MeSHe survey) that includes seven validated scales (Life history of aggression; Brief Symptom Inventory; Alcohol Use Disorder Identification Test; Drug Use Disorder Identification Test; Positive Affect and Negative Affect Schedule; Godin Leisure-Time Exercise Questionnaire and a personality inventory). The survey also includes a health questionnaire assessing the respondent's age, gender, nationality, and defined negative psychosocial factors and somatic health.

The present study's data collection was performed at a high school in western Sweden during a week in May 2018. Teachers were present in the entire survey, but students could work in privacy alone. The time devoted to the students to complete the questionnaires was 60 minutes. In the meantime, students who chose not to participate in the survey worked with an alternative task. Students who required extra time or support to fill in the questionnaire were offered help, which implied that those with reading/writing difficulties could be included in the survey. The students placed the completed survey in a separate, sealed envelope and gave it to the teacher.

Study population

The study population consisted of high school students in a medium-large city in the west part of Sweden. The inclusion criteria for participation were to be able to read and understand Swedish. The principal at the high school asked 407 students (16% studied at the Program of Business and Administration, 17% at the Program of Child and Recreation, and 66% at the Program of Business Management and Economics) about their interest in participating in the study. Of those who were asked to participate, 29,7% (121 students) chose not to participate in the study (attrition rate), which resulted in a response rate of 70,3% (286 students). Of 286 responding students, 46 (16%) did not fully complete the BSI questionnaires (internal dropout).

Moreover, one participant declared "other gender," and four did not answer the question about their gender, adding a proportion of 1.75% of the data's internal dropout in the gender-specific analyzes. Thus, the final study population consisted of 281 high school students (114 male and 167 female) to analyze gender-specific psychological distress. The youngest participant in the study was 15 years old, the oldest 20 years old, and the average age of the study population was 17.30 years, with a standard deviation of 0.60 years.

The number of missing answers varied in the somatic health questionnaire section between zero/no missing answer (to the question regarding complaints about constipation for a more extended period than 14 days) and nine (to the question regarding previous head injuries). It resulted in a response frequency between 286 and 277 students. Due to four students who could not be categorized to the male or female gender, the gender-specific analyses of the prevalence of somatic complaints were based on answers from 163 to 164 females and 109 to 114 male students.

Instruments

Brief Symptom Inventory (BSI) is a self-assessment form that measures the individual's

perceived mental distress [28] [28]. It consists of 53 items divided into nine domains (primary symptoms scales) and also can be described with the full scale of the General Severity Index (GSI). Each question measures to what extent individuals estimate their experiences according to the claims of the questions on a Likert scale ranging from zero to four (0 = not at all, 1 = a little, 2 = moderate, 3 = pretty much, 4 = very much; [28]. The BSI instrument has been tested for reliability in its original English form and the Swedish translation for an adult population [29, 30]. The instrument was previously used in an adolescent population in a Turkish [31] and an Arabic [13] translated version. In the current study, the high school students received a Swedish translation of the original English version of BSI, where they estimated their mental suffering during the past year. Data analyses confirmed that the questionnaire and its nine domains had acceptable internal reliability in our study population (Chronbach $\alpha = 0.97$ for GSI). The following text describes how the nine domains capture psychological distress.

Somatization: Mental suffering can manifest itself in physical symptoms, and common somatic problems are symptoms of the cardiovascular, digestive and respiratory system or other areas affected by the autonomic nervous system [28]. Examples of this domain's items are: Faintness or dizziness; Pain in the heart or chest; Nausea or upset stomach. Internal reliability of the Somatization domain was $\alpha = 0.78$ in the current population.

Obsessive compulsiveness. Characteristic signs of obsessive compulsiveness are recurrent and irresistible thoughts and actions such as repeatedly double-check if a task is performed, difficult to concentrate, difficult to make decisions [28]. Examples of items are: Trouble remembering things; Feeling blocked in getting things done; Having to check and double-check what you do. The internal reliability of this domain was $\alpha = 0.84$ in the current population.

184 *Interpersonal sensitivity or Social insecurity*: Signs of social insecurity are considering having
185 a low intrinsic value, feeling of concern, and highly uncomfortable social interactions [28].
186 Examples of items are: Feeling that people are unfriendly or dislike you; Feeling inferior to
187 others; Feeling very self-conscious with others: The internal reliability of the domain was $\alpha =$
188 0.85 in the current population.

189 *Depression*: There is a broad repertoire of symptoms that indicate depression, including
190 dysfunctional effects, decreased interest in things that have been of interest before, low energy
191 levels, and a sense of hopelessness [28]. Examples of items are: Thoughts of ending your life;
192 Feeling lonely; Feeling blue; Feeling no interest in things. The internal reliability of the
193 domain was $\alpha = 0.87$ in the current population.

194 *Anxiety*: This domain is characterized by typical symptoms of severe anxiety, such as
195 unprovoked anxiety, panic attacks, muscle tension, restlessness, and nervousness [28].
196 Examples of questions are: Nervousness or shakiness inside; Suddenly scared for no reason;
197 Spells of terror or panic. Internal reliability in the domain was $\alpha = 0.84$ in the current
198 population.

199 *Hostility*: The hostility domain is characterized by threatening behavior in thought, emotion,
200 and action. Standard features are becoming easily irritated, getting quickly into trouble,
201 feeling the need to break something, and outbursts of anger [28]. Examples of questions are:
202 Feeling easily annoyed or irritated; Temper outbursts that you cannot control; Having urges to
203 beat, injure, or harm someone. Internal reliability in the domain was $\alpha = 0.82$ in the current
204 population.

205 *Social phobia* (i.e., phobic anxiety): Social phobia has a resemblance to agoraphobia, meaning
206 that the person feels very uneasy staying in large human gatherings, use collective transport,
207 be in public places and events, or to travel [28]. Examples of questions are: Feeling afraid in
208 open spaces; Feeling afraid to travel on buses, subways or trains; Having to avoid certain

209 things, places or activities because they frighten you. Internal reliability in the domain was α
210 = 0.84 in the current population.

211 *Paranoid Ideation:* The paranoid mindset is assumed to be a natural syndrome experienced as
212 symptoms with adversary effects, such as projection, hostility, suspicion, self-centering, and a
213 suspicion that someone will deprive you of your autonomy [28]. Examples of questions are:
214 Feeling that others are to blame for most of your troubles; Feeling that most people cannot be
215 trusted; Feeling that you are watched or talked about by others. Internal reliability in the
216 domain was $\alpha = 0.81$ in the current population.

217 *Psychoticism:* This domain covers the area between a deviant lifestyle and total psychosis,
218 and here a non-clinical populations' socially abnormal behavior is measured [28]. Examples
219 of questions are: The idea that someone else can control your thoughts; Feeling lonely even
220 when you are with people; The idea that you should be punished for your sins; Never feeling
221 close to another person; The idea that something is wrong with your mind. Internal reliability
222 in the domain was $\alpha = 0.80$ in the current population.

223 *The somatic health questionnaire* is part of the MeSHe survey's health questionnaire
224 assessing the presence of selected physical complaints and diseases. The questionnaire was
225 developed by the project leader (NK) based on a similar questionnaire in a nation-wide twin
226 study in Sweden [32]. The MeSHe Somatic health questionnaire assesses the presence of the
227 following selected physical complaints or diseases: Problems with diarrhea with diarrhea or
228 constipation for a period longer than 14 days; the existence of head injury; cancer/leukemia or
229 other tumor diagnoses; epilepsy; rheumatological diseases; diabetes, asthma; other allergies;
230 skin diseases; celiac diseases; tuberculosis; migraines; thyroid diseases. The MeSHe Somatic
231 health questionnaire previously showed high test-retest reliability [7].

232 The presence of *negative psychosocial factors* in the students' life was measured with four
233 questions: (1) "Do any of the adults you live with have a problem with alcohol (alcoholism)"?

(2) "Do any of the adults you live with have a problem with drugs?" (3) "Have you ever experienced physical abuse (for example, have you been pushed, kicked, beaten, slapped, etc.)?" (4) "Have you ever experienced psychological abuse (for example, have you been threatened, forced to do something that feels wrong, violated by humiliating and insulting words, etc.)"? Three groups were formed based on the affirmative answers:

- "Parental Substance use Problems" (PSP), i.e., those indicating having adults in their life with alcohol and/or drug use problems.
- "Physical or Psychological Abuse" (PPA), i.e., those indicating having experienced physical and/or psychological abuse.
- The comparison group (CG), i.e., those dissenting to all four questions regarding negative psychosocial factors

Data analysis

The computer program Statistical Package for the Social Sciences (SPSS) software version 24.0 (IBM) was used for data analysis. Since data differed significantly from the normal distribution ($p < 0.001$ in Shapiro-Wilk test), and the calculated scores were not normally distributed (Kolmogorov-Smirnov test' significance < 0.05), non-parametric statistical analyses were used. The Mann-Whitney U-test for comparing the scores of male and female students. The Kruskal-Wallis H-test for comparing the mean ranks between adolescents belonging to the different groups (CG, PSP, PPA), followed by a post hoc test for analyzing pairwise the differential interactions between the three groups. All the above analyses were two-tailed, and the significance level was set at 5%.

Concerning the somatic health dimension, contingency square analysis was performed to assess the relationship between somatic symptoms and diseases, on the one hand, and psychosocial variable groups, on the other. The strength of the statistically, significant relationship was

evaluated using Cramer's V effect size (values from 0.07 to 0.20 indicate a small effect, 0.21 to 0.35 a medium effect, and 0.36 and above suggesting a large effect [33] or $\text{Eta}^2 = Z^2 / (n - 1)$ (0.01 to 0.05 indicate a small, 0.06 to 0.13 a medium and values above 0.14 a large effect size [34]. Corrections for Type I errors were performed by Bonferroni correction [35, 36] setting the significance cut-off at α/n ($0.05/3 = 0.017$), where n refers to the number of compared groups.

Ethical consideration

The Regional Ethical Review Board in Gothenburg approved the study; protocol No. 689 - 17. Ethical approval ensures that the study follows the Helsinki Declaration's and the Swedish law ethical guidelines for scientific research on people. The Act on ethical review of research involving humans according to the Swedish Law (2003: 460) § 18 declares: "If the research person has reached the age of 15 but not 18 and realizes what the research means for him or her, he or she shall be informed of and consent to the research in the manner specified in §§ 16 and 17" [37]. The Ethical Review Board's required all high school students to be informed of available support organizations when the assessments took place. All students received written and oral information that participation was voluntary and anonymous. Furthermore, they were informed that participation would not affect their study results and that they could cancel their participation at any time. The surveys collected were processed so that only authorized persons had access to the data material.

RESULTS

1. Level of psychological distress

On the Brief Symptom Inventory (BSI) almost one third (29.6%) of the students reported none, and about half of them (52.1%) a low level of psychological distress. 15% reported a moderate problem with distress, and 3.2% a very high level of psychological distress.

Mirroring the over-all distribution of the level of distress, the mean value of the students' psychological distress, measured with the General Severity Index (GSI), was 0.93 (SD = 0.68), and the median value was 0.75. The response rate varied between 264 and 272 on BSI's different primary domains. The mean values of the GSI and the nine primary domains in the whole study population and by gender are summarized in Table 1. The nine domains' mean value varied between 0.56 (Psychoticism) and 1.29 (Obsessive compulsiveness). The primary domains of Obsessive compulsiveness, Anxiety, Paranoid Ideation, and Depression were found to have the highest scores. On the item level, the five most highly rated items were: A feeling of nervousness or shakiness inside (M=2.13); Blocked in getting things done (M=1.85); Difficulty in making decisions (M=1.5); That most people cannot be trusted (M=1.44); Being easily hurt (M=1.28).

Female high school students indicated a significantly higher general level of psychological distress than their male classmates. In all BSI domains, the female students compared to the males estimated themselves as having significantly more psychological distress and each of those with large effect size (except Psychoticism with medium effect size and Hostility with a small effect size). The domains that predominantly were found to distinguish the genders by effect size are Anxiety ($\eta^2 = 0.21$) and Interpersonal sensitivity/social insecurity ($\eta^2 = 0.16$).

Table 1: Self-reported psychiatric problems in the general population of a sample of Swedish adolescents (N=286).

BSI Subscales	Swedish adolescents M (SD) min-max	n	Male M (SD) min-max	n	Female M (SD) min-max	p	Eta ²
Somatization	0.78 (0.7) 0-3	104	0.48 (0.5) 0-3	160	0.98 (0.75) 0-3	<0.001	0.12
Obsessive compulsive	1.3 (0.86) 0-4	106	0.91 (0.73) 0-3	163	1.55 (0.85) 0-4	<0.001	0.13
Psychoticism	0.56 (0.74) 0-4	107	0.32 (0.59) 0-4	164	0.71 (0.8) 0-4	<0.001	0.07
Depression	1.04 (0.94) 0-4	104	0.64 (0.74) 0-4	163	1.3 (0.96) 0-4	<0.001	0.12
Interpersonal Sensitivity	0.97 (0.99) 0-4	108	0.48 (0.68) 0-4	162	1.3 (1.04) 0-4	<0.001	0.16
Hostility	0.88 (0.8) 0-4	108	0.73 (0.78) 0-4	164	0.97 (0.81) 0-3	0.012	0.02
Phobic Anxiety	0.61 (0.82) 0-4	106	0.22 (0.52) 0-4	162	0.86 (0.87) 0-4	<0.001	0.15
Anxiety	1.11 (0.87) 0-4	102	0.61 (0.58) 0-4	166	1.42 (0.87) 0-4	<0.001	0.21
Paranoid Ideation	1.05 (0.89) 0-4	108	0.69 (0.76) 0-3	164	1.28 (0.89) 0-4	<0.001	0.11
GSI	0.93 (0.68) 0-4	92	0.6 (0.55) 0-4	148	1.14 (0.68) 0-3	<0.001	0.14

2. *The prevalence of somatic complains*

Half (51.3%) of the student sample indicated no somatic complaints at all, another one-third of them (31.3%) indicated complaints with one somatic problem, and only eight students (3,5%) reported three or more somatic problems. The prevalence of somatic complaints was similarly distributed in the female and male students (Figure 1). The most prevalent somatic complaint was allergy (37.8% and 26.3% in male and female students respectively) and migraine (11.1% and 20.2% in male and female students respectively). Significant differences in the prevalence of somatic complaints between the genders could be found in constipation (1.8% in male and 9.4% in female students; $p = 0.008$) and migraine (11.1% in male and

20.2% in female students; $p = 0.048$). Somatic complaints were significantly more prevalent in female students, while other allergies were significantly more prevalent in male students (37.8% in male and 26.3% in female students; $p = 0.04$) (Table 2).

Insert Figure 1 around here

Table 2: Prevalence of defined somatic symptoms and diseases in a sample of Swedish students (N=286).

	Total sample (yes/no) ^a %	Boys (yes/no) ^a %	Girls (yes/no) ^a %	Chi-Square test		
				χ^2	p -value	Cramer's V
Diarrhea	(7/260) 2.6	(4/104) 3.7	(3/156) 1.9	0.83	0.36	0.06
Constipation	(17/253) 6.3	(2/109) 1.8	(15/144) 9.4	6.45	0.008	0.16
Cancer	(1/272) 0.4	(0/110) 0	(1/162) 0.6	0.68	0.41	0.05
Epilepsy	(3/274) 1.1	(1/112) 0.9	(2/162) 1.2	0.07	0.79	0.02
Rheumatologic Disease	(5/268) 1.8	(2/109) 1.8	(3/159) 1.9	0.01	0.98	0.02
Diabetes	(2/274) 0.7	(1/112) 0.9	(1/162) 0.6	0.07	0.79	0.02
Asthma	(38/235) 13.6	(15/96) 13.5	(23/139) 14.2	0.03	0.87	0.01
Other Allergy	(84/187) 31	(42/69) 37.8	(42/118) 26.3	4.11	0.040	0.12
Skin disease	(18/251) 6.7	(5/104) 4.6	(13/147) 8.1	1.3	0.25	0.07
Gluten intolerance	(6/268) 2.2	(3/108) 2.7	(3/160) 1.8	0.23	0.63	0.03
Migraine	(45/226) 16.6	(12/96) 11.1	(33/130) 20.2	3.91	0.048	0.12
Thyroid disease	(2/269) 0.7	(1/110) 0.9	(1/159) 0.6	0.07	0.79	0.02

^an includes those answering yes or no to the question

3. *Distribution of negative psychosocial factor*

The overlap of the affirmative answers to the four questions about negative psychosocial factors in the students' life, separated by gender is illustrated in Figures 2 and 3. From the participating

111 male students, there was only one (1 %) who reported having adults in his life with drug problems. Four male students (3,6%) reported having adults with alcohol use problems in their lives. The overlap between parental substance use (drug or alcohol use) and the experience of abuse was reported by two male students (1,8%). 37,8% (n=42) of male students reported that they had experienced physical and/or psychological abuse; almost half of them (n=20) reported both (Figure 2).

No one of the 165 responding female participants reported having adults with drug use problems in her life. Of seven females (4%) who reported adults with alcohol use problems in their family, five (71%) had experienced abuse (Figure 3). Almost half (47%; n=78) of the female students had experiences of psychological abuse, and almost one third (29%; n=48) reported experiences of physical abuse (Figure 3). 46,5% (n=40) of those female students reporting abuse (n=86) reported the experience of both.

Insert Figure 2 and Figure 3 here

As students reporting both PSP and PPA were very few (two males and five females), no statistical analyses for this group were specifically performed; instead, their reports were accounted for in both the PSP and the PPA groups.

4. Psychological distress and negative psychosocial factor

The presence of an adult(s) with substance use problem (PSP) in the students' life and the experience of physical and/or psychological abuse (PPA) contributed to an increased level of psychological distress in all primary dimensions as well as in the overall level of psychological distress of the students (Table 3). A significant difference could be measured in the GSI of the PSP group compared to the CG group. At the primary domain level, a significant difference was measured in Paranoid ideation, Anxiety, Phobic Anxiety,

Depression, and Psychoticism between these groups. All primary domains and the GSI were significantly increased in the PPA group compared to the CG group (Table 3).

Table 3: Self-reported psychiatric distress level in a sample of Swedish adolescent's according to psychosocial variable groups.

	CG (n=143)	PSP (n=12)	PPA (n=128)	Difference between groups		
	<i>M (SD)</i> (Min-Max)	<i>M (SD)</i> (Min-Max)	<i>M (SD)</i> (Min-Max)	Test-stat (<i>H</i>)	<i>p</i>-value	Post hoc
Somatization	0.62 (0.63) (0-3)	1.09 (0.87) (0-3)	0.97 (0.73) (0-3)	21.17	<0.001	CG<PPA***
Obsessive-Compulsive	1.08 (0.81) (0-3)	1.42 (0.88) (0-3)	1.56 (0.86) (0-4)	21.59	<0.001	CG<PPA***
Psychoticism	0.36 (0.54) (0-2)	0.98 (0.92) (0-2)	0.78 (0.88) (0-4)	28.96	<0.001	CG<PPA*** CG<PSP*
Depression	0.77 (0.8) (0-4)	1.53 (1.11) (0-3)	1.35 (0.99) (0-4)	29.58	<0.001	CG<PPA *** CG<PSP *
Interpersonal - Sensitivity	0.7 (0.89) (0-4)	1.34 (1.01) (0-3)	1.29 (1.05AQ) (0-4)	29.06	<0.001	CG<PPA **
Hostility	0.66 (0.65) (0-3)	0.98 (0.72) (0-2)	1.12 (0.9) (0-4)	20.92	<0.001	CG<PPA ***
Phobic – Anxiety	0.47 (0.72) (0-4)	0.85 (0.51) (0-2)	0.79 (0.91) (0-4)	17.54	<0.001	CG<PPA *
Anxiety	0.82 (0.73) (0-4)	1.58 (0.86) (0-3)	1.43 (0.9) (0-4)	38.39	<0.001	CG<PPA *** CG<PSP *
Paranoid-Ideation	0.71 (0.72) (0-3)	1.43 (1) (0-3)	1.39 (0.92) (0-4)	42.95	<0.001	CG<PPA *** CG<PSP *
GSI	0.72 (0.6) (0-3)	1.43 (0.69) (0-2)	1.17 (0.71) (0-4)	31.64	<0.001	CG<PPA *** CG<PSP *

CG = Comparison Group

PSP = Adolescents reporting Parental Substance use Problems

PPA = Adolescents reporting the experience of Physical or Psychological Abuse

** = $p < 0.001$

* = $p < 0.05$

When we analyzed separately for male and female students how the psychological distress level changes in association with the two negative psychosocial factors (PSP and PPA), a gender-specific pattern was discovered. In the group of male students reporting parents with substance use problems (PSP) a significantly increased Phobic anxiety level was measured compared to CG and PPA groups (Table 4). In those male students who reported the experience of abuse (PPA) a significantly increased score in the domains of Psychoticism, Interpersonal sensitivity, Anxiety, and Paranoid ideation, as well as in their GSI was detected (Table 4).

Table 4: Self-reported psychiatric distress level in a sample of male adolescents according to psychosocial variable groups.

	CG (n=66)	PSP (n=5)	PPA (n=42)	Difference between groups		
	<i>M(SD)</i> (Min-Max)	<i>M(SD)</i> (Min-Max)	<i>M(SD)</i> (Min-Max)	Test-stat (<i>H</i>)	<i>p</i> -value	Post hoc
Somatization	0.41 (0.4) (0-2)	0.43(0.31) (0-1)	0.58 (0.63) (0-3)	2.08	0.35	-
Obsessive-Compulsive	0.77 (0.65) (0-3)	1.07 (0.89) (0-2)	1.13 (0.81) (0-3)	5.77	0.06	-
Psychoticism	0.18 (0.33) (0-1)	0.56 (1.04) (0-2)	0.54 (0.8) (0-4)	12	0.002	CG<PPA*
Depression	0.51 (0.67) (0-3)	0.9 (1.32) (0-3)	0.83 (0.84) (0-4)	4.91	0.09	-
Interpersonal - Sensitivity	0.35 (0.55) (0-2)	0.75 (1.13) (0-3)	0.68 (0.82) (0-4)	9.15	0.010	CG<PPA**
Hostility	0.57 (0.62) (0-3)	0.72 (0.56) (0-1)	0.96 (0.96) (0-4)	5.76	0.06	-
Phobic – Anxiety	0.16 (0.4) (0-2)	0.52 (0.36) (0-1)	0.31 (0.69) (0-4)	9.59	0.008	CG<PSP ** PPA<PSP*
Anxiety	0.43 (0.41) (0-2)	0.79 (0.83) (0-2)	0.85 (0.71) (0-4)	11.99	0.002	CG<PPA **
Paranoid-Ideation	0.47 (0.59) (0-2.2)	1.61 (0.88) (0-3.6)	0.95 (0.83) (0-3.2)	12.07	0.002	CG<PPA **
GSI	0.44 (0.4) (0-2)	1.03 (0.99) (0-2)	0.8 (0.68) (0-4)	10.31	0.006	CG<PPA **

CG = Comparison Group

PSP = Adolescents reporting Parental Substance use Problems

379 PPA = Adolescents reporting the experience of Physical or Psychological Abuse
 380 * = $p < 0.05$; ** = $p < 0.001$

381 In female students, a significant increased GSI and complaints to each of the nine primary
 382 domains were found in those who reported any negative psychosocial factor in their life
 383 (Table 5). A distinct pattern was recognized in the female students who belong to the PSP
 384 group. Their psychological distress was significantly worse in GSI and the primary domains
 385 of Paranoid ideation, Anxiety, Depression, and Psychoticism. Female students of the PPA
 386 group reported a significantly higher level of distress in each BSI domain than females of the
 387 CG (Table 5).

388 **Table 5:** Self-reported psychiatric distress level in a sample of female adolescents according
 389 to psychosocial variable groups

	CG (<i>n</i> =77)	PSP (<i>n</i> =7)	PPA (<i>n</i> =86)	Difference between groups		
	<i>M</i> (<i>SD</i>) (Min-Max)	<i>M</i> (<i>SD</i>) (Min-Max)	<i>M</i> (<i>SD</i>) (Min-Max)	Test-stat (<i>H</i>)	<i>p</i> -value	Post hoc
Somatization	0.78 (0.72) (0-3)	1.47 (0.87) (0-3)	1.16 (0.7) (0-3)	16.5	<0.001	CG<PPA **
Obsessive-Compulsive	1.32 (0.84) (0-3)	1.77 (0.8) (1-3)	1.78 (0.81) (0-4)	12.98	0.002	CG<PPA **
Psychoticism	0.5 (0.63) (0-2)	1.29 (0.76) (0-2)	0.91 (0.9) (0-4)	16.72	<0.001	CG<PPA** CG<PSP*
Depression	0.97 (0.84) (0-4)	1.98 (0.73) (1-3)	1.62 (0.96) (0-4)	25.36	<0.001	CG<PPA*** CG<PSP**
Interpersonal - Sensitivity	0.99 (1) (0-4)	1.83 (0.63) (1-3)	1.59 (1.02) (0-4)	18.06	<0.001	CG<PPA***
Hostility	0.73 (0.67) (0-3)	1.17 (0.79) (0-2)	1.2 (0.86) (0-3)	14.13	0.001	CG<PPA **
Phobic – Anxiety	0.71 (0.81) (0-4)	1.13 (0.47) (0-2)	1.03 (0.91) (0-4)	9.07	0.01	CG<PPA*
Anxiety	1.09 (0.79) (0-4)	2.02 (0.5) (1-3)	1.7 (0.85) (0-4)	26.6	<0.001	CG<PPA *** CG<PSP**
Paranoid-Ideation	0.9 (0.76) (0-2.8)	1.74 (0.72) (0.6-2.6)	1.61 (0.88) (0-3.6)	28.94	<0.001	CG<PPA *** CG<PSP*
GSI	0.91 (0.63) (0-3)	1.72 (1.44) (2-2)	1.36 (0.65) (0-3)	22.85	<0.001	CG<PPA *** CG<PSP*

390 CG = Comparison Group
 391 PSP = Adolescents reporting Parental Substance use Problems

PPA = Adolescents reporting the experience of Physical or Psychological Abuse
 * = $p < 0.05$; ** = $p < 0.001$

5. *Somatic complaints and negative psychosocial factor*

The most dramatic risk increase considering the prevalence of somatic complaints was found in those few participants included in the PSP group. For them the risk of having epilepsy increased 22 times (RR=22.00), followed by approximately six times increased risk of having rheumatoid complaints (RR= 5.93) and gluten intolerance (RR=5.50), and almost five times increased risk of constipation (RR=4.64). Moreover, participants in the PSP group had a tripled risk to suffer from migraines (RR=2.96). For those belonging to the PPA group, the risk to suffer from epilepsy (RR=3.29), diarrhea (RR=2.93), and constipation (RR=2.92) were close to tripled, while the risk of having gluten intolerance and rheumatoid diseases (both values: RR=2.21) was doubled (Table 6).

Table 6: Prevalence and risk ratio (RR) of defined somatic symptoms and diseases according to psychosocial groups.

	CG (n=143)	PSP (n=12)		PPA (n=128)		Chi-Square test		
	%	%	RR	%	RR	χ^2	p-value	Cramer's V
Diarrhea	1.4	0	0	4.1	2.93	2.21	0.33	0.09
Constipation	3.6	16.7	4.64	10.5	2.92	4.28	0.12	0.13
Cancer	0	0	0	0.8	-	1.22	0.54	0.07
Epilepsy	0.7	15.4	22	2.3	3.29	4.59	0.1	0.13
Rheumatologic Disease	1.4	8.3	5.93	3.1	2.21	0.56	0.75	0.05
Diabetes	1.4	0	0	0	0	1.99	0.37	0.09
Asthma	12.2	15.4	1.26	14.8	1.21	0.54	0.76	0.04
Allergy	30.2	41.7	1.38	30.4	1	0.66	0.72	0.05
Skin disease	7.4	0	0	6.3	0.85	0.99	0.61	0.06
Gluten intolerance	1.4	7.7	5.5	3.1	2.21	2.5	0.29	0.09
Migraine	13	38.5	2.96	19.5	1.5	7	0.03	0.16
Thyroid disease	0.7	0	0	0.8	1.14	0.08	0.96	0.02

Significance level set at $p < 0.017$ after Bonferroni adjustment

CG = Comparison Group

PSP = Adolescents reporting Parental Substance use Problems

PPA = Adolescents reporting the experience of Physical and/or Psychological Abuse

DISCUSSION

Psychological distress

The measure of the General Severity Index (GSI) can be used as an overall indicator of mental health complaints. Only a few studies have investigated self-reported psychological complaints in a general population of high-school students [13, 38]. When comparing GSI scores between these studies, we find that Swedish high school students' general severity index ($M=0.93$) is lower than that found in Morocco ($M= 1.38$) [13], but indicates higher general psychological distress than was found in an adolescent population of Israeli ($M=0.83$) [38] and America ($M=0.75$) [39]. However, a simple comparison of the students' results in the four countries is not adequate because data collections occurred a long time apart. Data in Sweden was collected in 2018, in Morocco 2014, while the Israelis and American studies are from the beginning of the 1990s. To be able to compare culture-specific BSI norm-data in the adolescent population, data collection should take place simultaneously. It has been shown that the level of psychological distress very sensitively reflects environmental changes in adolescents' life, where already with a few years difference in assessment could specific differences detected in the results [5].

The finding that female students experienced a significantly higher level of psychological distress than their male classmates do not seem to be affected by either time or culture. In the present study, Swedish female students compared to the male students reported a higher level of psychological distress on each of the BSI primary domain, which is in accordance with previous studies' results from several other countries [5, 8, 9, 13, 40-43]. The domains that predominantly were found to distinguish between gender by the largest effect size were: "Anxiety" and "Interpersonal-sensitivity". Anxiety as an important vulnerability factor in female adolescent development was previously discussed by Van Droogenbroeck et al. [5] in a study including Belgian adolescents and young adults. According to a WHO-based study

including 42 countries [44], boys more often than girls have been found to have stress-related problems up to puberty, and the trend is reversed, i.e., at the age of 15, girls report more internalized emotional problems, which tend to last throughout most of the adulthood [8]. Landstedt and colleagues [12] suggested that young females' anxiety and stress have their roots in experienced high demands in different areas of their life, such as family and school. Other hypotheses about gender differences in stress-related problems suggest that girls' experience more physically drastic puberty changes, more pronounced social demands, contradictory role expectations, and burn-out related to the school situation [45, 46]. An interesting detail of our study was that even hostility was rated higher by the female Swedish students (with a small effect size) compared to their male classmates. This finding has not previously been shown in adolescent populations in other countries. However, it has been shown previously that aggressive behavior (conduct disorder-like problem) is influenced only by specific environmental and not genetical factors in girls [47]. Our results in this sense may indicate the existence of new or stronger cultural and societal factors that may result in an increased distress in form of hostility in females. Therefore, the higher level of hostility detected in the female adolescents in the present study might be interpreted as seen as a reaction to a threat to self-esteem or status and/or lack of respect. In this sense, hostility grows out of anger [48]. The result may also be explained by the implication of an internalizing problem [49, 50], particularly the finding that the female adolescents also reported a higher level of anxiety. In fact, anxiety and pathological worry in general, are sometimes characterized by hostile traits, which may result in in prompting the individual to adopt an attitude of closure towards the world and others after an episode of rage [51]. Questions that captured the highest distress level in the Swedish high school students were feeling nervous, being blocked in getting things done, doubts whether or not others can be trusted, difficulties in decision making, and getting easily hurt. The highest scores found on

the BSI domain level were on the Obsessive compulsiveness, Anxiety, Paranoid Ideation and Depression domains. According to several other studies summarizing young peoples' health, the most commonly reported psychological health problems are generalized anxiety, panic syndrome, social anxiety, and depression [5, 8, 9]. In a Moroccan high-school population, the Obsessive compulsiveness domain of BSI had the highest score, followed by Paranoid Ideation, Psychoticism, and Anxiety domains [13]. Results from the Moroccan study suggest that high school students, in a different culture as Morocco, report quite similar psychological distress factors as the Swedish students in the present study; such as "trouble remembering things", "problem getting things done", "feeling a need to re-check things", "being nervous", "difficulties to trust others" and "getting easily hurt". An explanation would be that there are common stress factors which are coupled to the intensive biopsychological changes during adolescence. In previous studies, students' self-related psychological, psychosomatic, and emotional problems were first and for most associated with perceived stress over schoolwork and academic performance and conflicts with friends or family, rather than with socioeconomic adversities [52-54].

Somatic complains

About 50% of the Swedish high school students reported one or several somatic complaints, a similar prevalence to what was found in a large-scale nation-wide Swedish study [55]. There were no gender differences in the number of reported somatic complaints, a result that may contradict previous observations, where female adolescents reported more somatic complaints [6, 7, 55]. The most prevalent somatic complaint was allergy (found in more than one-third of the study population), followed by migraine and asthma (reported by about 15% of the study population). Male students experienced more allergies, other than asthma, compared to the female students, and this difference was significant. While migraine and constipation were

significantly more often reported by female students. Gender-specific aspects of allergies have previously been coupled to immunological facts that point towards the differential role of sex hormones in immune functions [56]. The most extensive study of allergy testing in the USA [57] showed that males have a higher overall allergen sensitization rate than females of all ages. The higher prevalence of migraine and longer periods with constipation could follow explanations raised in the USA investigation, i.e., reasoning linked to the function of estrogen [58, 59]. However, it could also easily be explained by the higher level of anxiety measured in our and others' studies [13, 60-62] and possibly by lower self-esteem [63] and higher academic demands and expectations in the female students [64], which also reflect the coexistence of mental and physical health problems.

Negative psychosocial environmental factors and adolescent mental and somatic health

To begin with, there is a need to reflect on the fact that "only" a tiny number (0.4%) of Swedish high-school students reported problems with parental alcohol use and only one male student admitted to a parental drug use problem. In recent years, nearly 6 % of the Swedish population are estimated to be either dependent on or abuse alcohol [65]. Based on the number of Swedish adults who are alcohol or drug-addicted, it seems that there are adolescents in the present study who do not recognize their parents' substance use as a problem. If Swedish students do not recognize parental substance use as a problem, that may lead to a lower threshold for them to start to use substances in their everyday life. It is known that wider social, economic and cultural factors are the key drivers of the prevalence of substance use. In fact, the norms of substance use/abuse vary considerably across cultures. The use of the same substance may be prohibited in one culture, tolerated in another, and even required in a third. The acceptance of substances and alcohol use depends on cultural norms [66]. This can be confirmed also, if we compare the number of Swedish students recognizing

511 parental substance use as a problem with the number of Moroccan high-school students
512 reporting a parent with alcohol use problem [7, 11, 13]. In Morocco, an Islamic culture, where
513 substance use is prohibited and punished, 8.8% of the high-school student indicated parental
514 alcohol use as a problem.

515 The strong cultural and societal impact on psychosocial environment in the youths' life could
516 also be clearly recognized in the prevalence of experiencing physical or psychological abuse.

517 An alarming number (47%) of the Swedish female adolescents - almost every second of them
518 - and more than one third (37%) of the Swedish male adolescents reported the experience of
519 some kind of abuse in their lives. Approximately 50% of them reported the experience of both
520 physical and psychological abuse. In comparison, the prevalence of physical and
521 psychological abuse reported by the adolescent student sample in the Moroccan study [7, 11,
522 13] were 17% of the females and 13% of the males. We hypothesize, that this significant
523 discrepancy can be explained not only by cultural differences (between Sweden and Morocco)
524 but also by a difference in time between the two data collections. In Sweden, data was
525 assessed in 2018, just following the "me-too" movement, which has left a substantial impact
526 on a society that is strongly influenced already by feministic philosophy, while data from
527 Morocco was assessed between 2013 and 2015 (before the "me, too" movement swept
528 through the world). This difference observed in the percentage of reporting abuse between the
529 two populations could also be linked to the influences of the norms of society, these norms
530 that can protect against abuse, but they can also support and encourage the use of it depending
531 on the culture and societies.

532 However, the impact of negative psychosocial factors on somatic and mental health can
533 clearly be observed in both (Swedish and Moroccan) cultures. The presence of any negative
534 psychosocial factors was coupled in the present study with significantly worsened mental
535 health (increased psychological distress), similarly as it has been found in the Moroccan

population [13]. The domains that showed significant increased psychological distress level with the presence of any negative psychosocial factor in the students' life were Psychoticism, Paranoid ideation, Anxiety, and Depression. These changes in the youth mental health are not surprising. The trauma of abuse or betrayal by parents, or living in a stressful, unsafe environment, indeed lead to anxiety, depression, psychotic-like events and increased suspiciousness, each based on fear and unpredictability of life events [67-70]. In female students every aspect of psychological distress increased significantly in the presence of negative psychosocial factors, while in male students the Phobic anxiety domain's scores increased most in those who reported parental substance use problems. However, Psychoticism, Interpersonal-sensitivity, Paranoid ideation and Anxiety domains' scores increased significantly in those who had experienced abuse. That higher variance in response to social vulnerability was measured in female students may be based on simple statistical reasons, as a substantial amount (almost 50%) of female students reported these negative psychosocial factors in their lives, and females generally reported significantly higher level of psychological distress on each domains of BSI. However, it can also be hypothesized that Swedish female adolescents in the given sociocultural environment respond not unanimously with increased anxiety, suspicion, depression, interpersonal-sensitivity and psychotic symptoms, but that a few of them may react with increased anger and hostility. Hardy and colleagues [71] studied gender differences in moral ideal self, the conceptualization of moral identity, and its relation to adolescent outcomes. They found that female adolescents have higher levels of moral ideal self than their male mates, and that moral ideal self is negatively correlated with aggression. It may appear that their results contraindicate our hypothesis. However, we argue that differences in cultural impacts (in this case between US and Sweden) and the differences in outcome measures (aggression and rule breaking versus hostility) may allow both postulates.

The presence of negative psychosocial factors did not significantly increase the presence of any somatic problem; however, the risk of having epilepsy, rheumatological problems, gluten intolerance (celiac), migraine and constipation increased dramatically.

It has been previously described that negative environmental circumstances can change adolescent brain development on a structural and functional level [72-74]. Those findings may contribute to or explain the increased prevalence of epilepsy in the studied group. As a consequence, or as a separate cascade, negative life events, such as abuse, might enhance biological susceptibility to an accelerated response to stressors, which augment the probability to induce epileptic activity [75]. Similarly, an increased risk of migraine could be explained by the neurological effects of abuse on brain functions [76] and amplified stress that can be involved in migraine pathogenesis [77].

The relationship between the negative psychosocial factors and gastrointestinal problems is not a new finding. The experience of abuse is coupled to multi-component psychophysiological consequences, which influence gastrointestinal reactivity, either directly or as a consequence of psychological comorbidities [78]. This can occur via gut motility changes, especially as there is a variety of neural and humoral pathways that link the brain and the gut, which may be influenced by stress exposure [79]. The exposure to stress alters the brain-gut interactions, leading to the development of a broad array of gastrointestinal disorders [80, 81].

It is also important to recognize that gastrointestinal problems and neurological problems are closely linked to each other [82, 83].

The augmentation of the risk of having rheumatological problems in students who report negative psychosocial factors highlights the role of multiple stressors and increasing vulnerability to autoimmune disease. In a recent Swedish register study, including data from over 100 000 adult patients with stress-related disorders, ten times as many matched unexposed individuals, and more than 120 000 full siblings. The association between stress-

related disorders and autoimmune diseases were further proven, mainly in younger ages [84]. Dube and colleagues [85] found in their study that individuals reporting two or more traumatic childhood events were at a 100% increased risk for rheumatic disease compared with those showing no childhood trauma. The mechanisms presumed to underlie the associations between negative psychosocial factors and rheumatic problems including stress-related changes in the functioning of the autonomic, neuroendocrine, and/or immune systems [86].

STRENGTHS AND LIMITATIONS

There are limitations to the study that should be recognized. The MeSHe project has a cross-sectional design; consequently, no conclusions about causal associations can be drawn from the collected data. In the present study data collection was limited to one high-school in West Sweden; therefore, generalization of the results should be cautiously made. However, in that school the response rate was high (70%), which is a strength of the study. This high response rate is the result of the organized data collection during teacher supervised classes – while still ensuring anonymity to all respondent. Students with reading or writing disabilities, attention problems and other complaints, were offered extra time and special pedagogue's help in the understanding of the survey. Therefore, we can assume that the final study population was a representative sample. An obvious limitation of the study is that data collection is based on self-report. It is shown that self-reported data are accurate when individuals understand the questions and when there is a strong sense of anonymity. Considering the existence of different diagnoses, it is suggested that self-report may be used as a proxy when register data are unavailable [87]. Importantly, the survey utilizes previously validated instruments for data assessment, that is a strength of our study.

CONCLUSION

The results of the present study strengthen previous findings on gender differences in the level of psychological distress and the significant impact of negative psychosocial factors on adolescents' physical and mental health. The study also presents new evidence about the decisive effect of culture and societal norms on the perception of threat and problem areas in the youths' life. The study describes that the majority in the sample of Swedish high school student from 2018 report none or very little psychological distress and no or only one somatic complaint. The most frequent psychological distress is coupled to obsession, anxiety, and the most frequent somatic complaint is allergy. Female students report a higher level of psychological distress, but a similar frequency of somatic complaints as their male classmates. The impact of parental substance use and the adolescents' experience of physical or psychological abuse is substantial on their mental health.

FUTURE RESEARCH

For future studies we would suggest approaches to enhance adolescent health and well-being, based on holistic methodology. The association between somatic and mental health and their susceptibility to the individual's unique and complex bio-psycho-social matrix is well-known and accepted today. However, health- and social-care and educational systems are not yet adapted to this new knowledge. An important first step is making this comprehension available to all promoting life-long learning and ensure new academical programs to build on interdisciplinary grounds and holistic awareness.

LIST OF ABBREVIATION

BSI: Brief Symptom Inventory

635 **CG:** Comparison Group
636 **GSI:** General Severity Index
637 **M:** Mean
638 **MeSHe:** Mental and Somatic Health without borders
639 **PPA:** Physical and/or Psychological abuse
640 **PSP:** Parental Substance use Problems
641 **RR:** Risk Ratio
642 **SD:** standard deviation
643 **SPSS:** Statistical Package for the Social Sciences
644

645 **DECLARATIONS**

646 **Ethics approval and consent to participate:** The Regional Ethical Review Board approved
647 the study in Gothenburg; protocol No. 689 - 17. All students received written and oral
648 information that participation was voluntary and anonymous. Furthermore, they were informed
649 that participation would not affect their study results and that they could cancel their
650 participation at any time. Their participation (completion of the survey) was an anonymous
651 written consent. The surveys collected were processed so that only authorized persons had
652 access to the data material.

653 **Consent for publication:** Not applicable

654 **Availability of data and materials:** The dataset supporting this article's conclusions is
655 available with a request to the first and corresponding author (Nóra Kerekes).

656 **Competing interests:** The authors declare that they have no competing interests.

Funding: Not applicable

Authors' contributions: First author NK has designed the study and grounded the MeSHe project, drafted the manuscript, supervised statistical calculations, and the took responsibility for the intellectual content of the manuscript. BZ contributed to statistical analyses, took responsibility for the content of the results and critically revised the manuscript. ST contributed to the manuscript with scientific responsibilities of references. SE contributed to the intellectual content and critically revision of the manuscript.

Acknowledgements: We would like to acknowledge Linda Röine Baltra & Viola Pieper who prepared a bachelor thesis in the subject of “Measuring psychological distress of Swedish high school students” in 2019 Spring semester in University West, Sweden with the supervision of ST.

REFERENCES

1. Paus T, Keshavan M, Giedd J. Why do many psychiatric disorders emerge during adolescence?. *Nature Reviews Neuroscience*. 2008; 9(12):947-957.
2. Romer D, Reyna VF, Satterthwaite TD. Beyond stereotypes of adolescent risk taking: Placing the adolescent brain in developmental context. *Developmental Cognitive Neuroscience*. 2017; 27:19-34.
3. Killen M, Rutland A, Abrams D, Mulvey K, Hitti A. Development of Intra- and Intergroup Judgments in the Context of Moral and Social-Conventional Norms. *Child Development*. 2013; 84(3):1063-1080.
4. Chiasson V, Vera-Estay E, Lalonde G, Dooley JJ, Beauchamp MH. Assessing social cognition: age-related changes in moral reasoning in childhood and adolescence. *The Clinical Neuropsychologist*. 2017; 31(3):515-530.

- 680 5. Van Droogenbroeck F, Spruyt B, Keppens G. Gender differences in mental health
681 problems among adolescents and the role of social support: results from the Belgian
682 health interview surveys 2008 and 2013. *BMC Psychiatry*. 2018; 18(1).
- 683 6. Romero-Acosta K, Canals J, Hernández-Martínez C, Penelo E, Zolog TC, Domènech-
684 Llaberia E. Age and gender differences of somatic symptoms in children and
685 adolescents. *Journal of Mental Health*. 2013; 22(1):33-41.
- 686 7. Zouini B, Sfindla A, Senhaji M, Råstam M, Kerekes N. Somatic health and its
687 association with negative psychosocial factors in a sample of Moroccan adolescents.
688 *SAGE Open Medicine*. 2019; 7:2050312119852527.
- 689 8. Hankin B. Development of Sex Differences in Depressive and Co-Occurring Anxious
690 Symptoms During Adolescence: Descriptive Trajectories and Potential Explanations
691 in a Multiwave Prospective Study. *Journal of Clinical Child and Adolescent*
692 *Psychology*. 2009; 38(4):460-472.
- 693 9. Ohannessian CM, Milan S, Vannucci A. Gender Differences in Anxiety Trajectories
694 from Middle to Late Adolescence. *Journal of Youth and Adolescence*. 2016;
695 46(4):826-839.
- 696 10. Matthews T, Danese A, Wertz J, Odgers CL, Ambler A, Moffitt TE, Arseneault L.
697 Social isolation, loneliness and depression in young adulthood: a behavioural genetic
698 analysis. *Social Psychiatry and Psychiatric Epidemiology*. 2016; 51(3):339-348.
- 699 11. Zouini B, Senhaji M, Kerekes N: Self-reported aggressive and antisocial behaviors in
700 Moroccan high school students. *Psihologija*. 2019; 52:1-13.
- 701 12. Landstedt E, Asplund K, Gillander Gådin K. Understanding adolescent mental health:
702 the influence of social processes, doing gender and gendered power relations.
703 *Sociology of Health & Illness*. 2009; 31(7):962-978.

- 704 13. Zouini B, Sfindla A, Hedman Ahlström B, Senhaji M, Kerekes N. Mental health
705 profile and its relation with parental alcohol use problems and/or the experience of
706 abuse in a sample of Moroccan high school students: an explorative study. *Annals of*
707 *General Psychiatry*. 2019; 18(1):27.
- 708 14. Murberg TA, Bru E. School-Related Stress and Psychosomatic Symptoms among
709 Norwegian Adolescents. *School Psychology International*. 2004; 25(3):317-332.
- 710 15. Kiuru N, Wang M-T, Salmela-Aro K, Kannas L, Ahonen T, Hirvonen R. Associations
711 between Adolescents' Interpersonal Relationships, School Well-being, and Academic
712 Achievement during Educational Transitions. *Journal of Youth and Adolescence*.
713 2020; 49(5):1057-1072.
- 714 16. Ekwemalor CC, Rozmus CL, Engebretson JC, Marcus MT, Casarez RL, Harper AR.
715 Treatment recidivism in adolescents with mental illness: A focused applied medical
716 ethnography. *Journal of Child and Adolescent Psychiatric Nursing*. 2017; 30(1):25-
717 34.
- 718 17. Lucktong A, Salisbury T, Chamrathirong A. The impact of parental, peer and school
719 attachment on the psychological well-being of early adolescents in Thailand.
720 *International Journal of Adolescence and Youth*. 2017; 23(2):235-249.
- 721 18. Milevsky A, Schlechter M, Netter S, Keehn D. Maternal and Paternal Parenting Styles
722 in Adolescents: Associations with Self-Esteem, Depression and Life-Satisfaction.
723 *Journal of Child and Family Studies*. 2007; 16(1):39-47.
- 724 19. Berg N, Kiviruusu O, Karvonen S, Rahkonen O, Huurre T. Pathways from problems
725 in adolescent family relationships to midlife mental health via early adulthood
726 disadvantages—a 26-year longitudinal study. *PloS one*. 2017; 12(5):e0178136.
- 727 20. Conger KJ, Stocker C, McGuire S. Sibling socialization: the effects of stressful life
728 events and experiences. *New Dir Child Adolesc Dev*. 2009; 2009(126):45-59.

- 729 21. Kotrla Topić M, Perković Kovačević M, Mlačić B. Relations of the Big-Five
730 personality dimensions to autodestructive behavior in clinical and non-clinical
731 adolescent populations. *Croatian medical journal*. 2012; 53(5):450-460.
- 732 22. Krueger RF, Caspi A, Moffitt TE, Silva PA, McGee R. Personality traits are
733 differentially linked to mental disorders: a multitrait-multidiagnosis study of an
734 adolescent birth cohort. *Journal of abnormal psychology*. 1996; 105(3):299.
- 735 23. Institute of Medicine (US) Committee on Assessing Interactions Among Social,
736 Behavioral, and Genetic Factors in Health; Hernandez LM, Blazer DG, editors. Genes,
737 Behavior, and the Social Environment: Moving Beyond the Nature/Nurture Debate.
738 Washington (DC): National Academies Press (US); 2006. Available from:
739 <https://www.ncbi.nlm.nih.gov/books/NBK19929/> doi: 10.17226/11693
- 740 24. Umberson D, Karas Montez J. Social Relationships and Health: A Flashpoint for
741 Health Policy. *Journal of Health and Social Behavior*. 2010; 51(1_suppl):S54-S66.
- 742 25. Rätty LKA, Larsson G, Söderfeldt BA, Wilde Larsson BM. Psychosocial aspects of
743 health in adolescence: the influence of gender, and general self-concept. *Journal of*
744 *Adolescent Health*. 2005; 36(6):530.
- 745 26. Sagy S, Eriksson M, Braun-Lewensohn O: The salutogenic paradigm. In: *Positive*
746 *psychology in practice: Promoting human flourishing in work, health, education, and*
747 *everyday life*. Joseph S. Hoboken John Wiley & Sons, editors. 2015 (volume 2).p. 61-
748 79.
- 749 27. Mental and Somatic Health without borders: <https://meshe.se/meshe-epidemiology/>.
750 Accessed: 20 nov 2020.
- 751 28. Derogatis LR, Melisaratos N. The Brief Symptom Inventory: an introductory report.
752 *Psychological Medicine*. 1983; 13(3):595.

- 753 29. Sfindla A, Malmström P, Torstensson S, Kerekes N. Yoga Practice Reduces the
754 Psychological Distress Levels of Prison Inmates. *Frontiers in Psychiatry*. 2018;
755 9(407).
- 756 30. Boulet J, Boss MW. Reliability and validity of the Brief Symptom Inventory.
757 *Psychological Assessment: A Journal of Consulting and Clinical Psychology*. 1991;
758 3(3):433-437.
- 759 31. Sahin NH, Batigün AD, Uğurtaş S. Kısa Semptom Envanteri (KSE): Ergenler İçin
760 Kullanımının Geçerlik, Güvenilirlik ve Faktör Yapısı. [The validity, reliability and
761 factor structure of the Brief Symptom Inventory (BSI).]. *Türk Psikiyatri Dergisi*.
762 2002; 13(2):125-135.
- 763 32. Anckarsäter H, Lundström S, Kollberg L, Kerekes N, Palm C, Carlström E,
764 Långström N, Magnusson PKE, Halldner L, Bölte S *et al.* The Child and Adolescent
765 Twin Study in Sweden (CATSS). *Twin Research & Human Genetics*. 2011;
766 14(6):495-508.
- 767 33. Gravetter FJ, Wallnau LB. Statistics for the behavioral sciences, 6 ed. Belmont, CA:
768 Thomson/Wadsworth; 2004.
- 769 34. Khalilzadeh J, Tasci ADA. Large sample size, significance level, and the effect size:
770 Solutions to perils of using big data for academic research. *Tourism Management*.
771 2017; 62:89-96.
- 772 35. García-pérez MA, Núñez-antón V. Cellwise Residual Analysis in Two-Way
773 Contingency Tables. *Educational and Psychological Measurement*. 2003; 63(5):825-
774 839.
- 775 36. MacDonald PL, Gardner RC. Type I Error Rate Comparisons of Post Hoc Procedures
776 for I j Chi-Square Tables. *Educational and Psychological Measurement*. 2000;
777 60(5):735-754.

- 778 37. Lag (2003:460) om etikprövning av forskning som avser människor 18§; Retrieved
779 from [https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-](https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/lag-2003460-om-etikprovning-av-forskning-som_sfs-2003-460)
780 [forfattningssamling/lag-2003460-om-etikprovning-av-forskning-som_sfs-2003-460](https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/lag-2003460-om-etikprovning-av-forskning-som_sfs-2003-460)
- 781 38. Canetti L, Shalev AY, De-Nour AK. Israeli adolescents' norms of the Brief Symptom
782 Inventory (BSI). *Israel Journal of Psychiatry and Related Sciences*. 1994; 31(1):13-
783 18.
- 784 39. Derogatis LR. SCL-90-R: Administration, Scoring & Procedures Manual-II, for the R
785 (Revised) Version and Other Instruments of the Psychopathology Rating Scale Series,
786 2nd ed. Towson: Clinical Psychometric Research, Inc.; 1992.
- 787 40. Garber J, Walker LS, Zeman J. Somatization symptoms in a community sample of
788 children and adolescents: Further validation of the Children's Somatization Inventory.
789 *Psychological Assessment: A Journal of Consulting and Clinical Psychology*. 1991;
790 3(4):588-595.
- 791 41. Park J, Bang Y, Kim C. Sex and Age Differences in Psychiatric Disorders among
792 Children and Adolescents: High-Risk Students Study. *Psychiatry Investigation*. 2014;
793 11(3):251-.
- 794 42. Vivan AdS, Rodrigues L, Wendt G, Bicca MG, Braga DT, Cordioli AV. Obsessive-
795 compulsive symptoms and obsessive-compulsive disorder in adolescents: a
796 population-based study. *Brazilian Journal of Psychiatry*. 2014; 36:111-118.
- 797 43. Wigman JTW, Vollebergh WAM, Raaijmakers QAW, Iedema J, van Dorsselaer S,
798 Ormel J, Verhulst FC, van Os J: The Structure of The Extended Psychosis Phenotype
799 in Early Adolescence--A Cross-sample Replication. *Schizophrenia Bulletin*. 2009;
800 37(4):850-860.
- 801 44. World Health Organization. Growing up unequal: gender and socioeconomic
802 differences in young people's health and well-being. In: Inchley J, Currie, D., Young,

- 803 T., Samdal, O., Torsheim, T., Augustson, L., Mathison, F., Aleman-Diaz, A., Molcho,
804 M., Weber, M. and Barnekow, V, editors. Copenhagen, Denmark; 2016.
- 805 45. Angold A, Costello EJ, Erkanli A, Worthman CM. Pubertal changes in hormone levels
806 and depression in girls. *Psychol Med.* 1999; 29(5):1043-1053.
- 807 46. Salmela-Aro K, Kiuru N, Pietikäinen M, Jokela J. Does school matter? The role of
808 school context in adolescents' school-related burnout. *European Psychologist.* 2008;
809 13(1):12-23.
- 810 47. Kerekes N, Lundström S, Chang Z, Tajnia A, Jern P, Lichtenstein P, Nilsson T,
811 Anckarsäter H. Oppositional defiant-and conduct disorder-like problems:
812 neurodevelopmental predictors and genetic background in boys and girls, in a
813 nationwide twin study. *PeerJ.* 2014; 2:e359.
- 814 48. Berkowitz L. McGraw-Hill series in social psychology. Aggression: its causes,
815 consequences, and control. New York: McGraw-Hill Book Company; 1993.
- 816 49. Asberg K. Hostility/Anger as a Mediator Between College Students' Emotion
817 Regulation Abilities and Symptoms of Depression, Social Anxiety, and Generalized
818 Anxiety. *The Journal of Psychology.* 2013; 147(5):469-490.
- 819 50. Rude S, Chrisman J, Burton Denmark A, Maestas K. Expression of direct anger and
820 hostility predict depression symptoms in formerly depressed women. *Canadian*
821 *Journal of Behavioural Science/Revue canadienne des sciences du comportement.*
822 2012 ; 44(3):200-209.
- 823 51. Brosschot J, Thayer J. Worry, perseverative thinking and health. In: *Emotional*
824 *expression and health: Advances in theory, assessment and clinical applications.*
825 Nyklicek IT, L.R Vingerhoets, A.J.J.M. editors; 2004.p. 99-114.
- 826 52. Frydenberg E. Adolescent coping: Advances in theory, research and practice:
827 Routledge; 2008.

- 828 53. Gustafsson J-E, Allodi Westling M, Alin Åkerman B, Eriksson C, Eriksson L,
829 Fischbein S, Granlund M, Gustafsson P, Ljungdahl S, Ogden T *et al.* School, Learning
830 and Mental Health : A systematic review. Stockholm: Kungl. Vetenskapsakademien;
831 2010.
- 832 54. Phillips SP, Reipas K, Zelek B. Stresses, Strengths and Resilience in Adolescents: A
833 Qualitative Study. *The Journal of Primary Prevention*. 2019; 40(6):631-642.
- 834 55. van Geelen SM, Rydelius P-A, Hagquist C. Somatic symptoms and psychological
835 concerns in a general adolescent population: Exploring the relevance of DSM-5
836 somatic symptom disorder. *Journal of Psychosomatic Research*. 2015; 79(4):251-258.
- 837 56. Jensen-Jarolim E, Untersmayr E. Gender-medicine aspects in allergology. *Allergy*.
838 2008; 63(5):610-615.
- 839 57. Quest Diagnostics Health Trends. Allergies Across America: The Largest Study of
840 Allergy Testing in the United States. In. Secaucus, NJ; 2011.
- 841 58. Chai NC, Peterlin BL, Calhoun AH: Migraine and estrogen. *Curr Opin Neurol*. 2014;
842 27(3):315-324.
- 843 59. Jacenik D, Cygankiewicz AI, Fichna J, Mokrowiecka A, Małecka-Panas E, Krajewska
844 WM. Estrogen signaling deregulation related with local immune response modulation
845 in irritable bowel syndrome. *Molecular and Cellular Endocrinology*. 2018; 471:89-96.
- 846 60. Bellini B, Arruda M, Cescut A, Saulle C, Persico A, Carotenuto M, Gatta M,
847 Nacinovich R, Piazza F, Termine C *et al.* Headache and comorbidity in children and
848 adolescents. *The Journal of Headache and Pain*. 2013; 14(1).
- 849 61. Cheng C, Chan AOO, Hui WM, Lam SK. Coping strategies, illness perception,
850 anxiety and depression of patients with idiopathic constipation: a population-based
851 study. *Alimentary Pharmacology & Therapeutics*. 2003; 18(3):319-326.

- 852 62. Jayashree K, Mithra P, C. Nair MK, Unnikrishnan B, Pai K. Depression and anxiety
853 disorders among schoolgoing adolescents in an urban area of South India. *Indian*
854 *Journal of Community Medicine*. 2018; 43(5):28-.
- 855 63. Aanesen F, Meland E, Torp S. Gender differences in subjective health complaints in
856 adolescence: The roles of self-esteem, stress from schoolwork and body
857 dissatisfaction. *Scandinavian Journal of Public Health*. 2017; 45(4):389-396.
- 858 64. Peleg O, Deutch C, Dan O. Test anxiety among female college students and its
859 relation to perceived parental academic expectations and differentiation of self.
860 *Learning and Individual Differences*. 2016; 49:428-436.
- 861 65. The Swedish Council for Information on Alcohol and Other Drugs (CAN). Drug
862 Trends in Sweden 2017. Report 163. Stockholm; 2017. URN:NBN:se:can-2017-2
- 863 66. Oetting ER, Donnermeyer JF, Trimble JE, Beauvais F. Primary Socialization Theory:
864 Culture, Ethnicity, and Cultural Identification. The Links between Culture and
865 Substance Use. IV. *Substance Use & Misuse*. 1998; 33(10):2075-2107.
- 866 67. Ered A, Ellman LM. Specificity of Childhood Trauma Type and Attenuated Positive
867 Symptoms in a Non-Clinical Sample. *Journal of Clinical Medicine*. 2019; 8(10):1537
- 868 68. Freeman D, Fowler D. Routes to psychotic symptoms: Trauma, anxiety and psychosis-
869 like experiences. *Psychiatry Research*. 2009; 169(2):107-112.
- 870 69. Goldsmith RE, Freyd JJ, DePrince AP. Betrayal Trauma:Associations With
871 Psychological and Physical Symptoms in Young Adults. *Journal of Interpersonal*
872 *Violence*. 2012; 27(3):547-567.
- 873 70. Sullivan T, Fehon D, Andres-Hyman R, Lipschitz D, Grilo C. Differential
874 relationships of childhood abuse and neglect subtypes to PTSD symptom clusters
875 among adolescent inpatients. *Journal of Traumatic Stress*. 2006; 19(2):229-239.

- 876 71. Hardy SA, Walker LJ, Olsen JA, Woodbury RD, Hickman JR. Moral identity as moral
877 ideal self: Links to adolescent outcomes. *Developmental Psychology*. 2014; 50(1):45-
878 57.
- 879 72. Coates D. Impact of Childhood Abuse: Biopsychosocial Pathways Through Which
880 Adult Mental Health is Compromised. *Australian Social Work*. 2010; 63(4):391-403.
- 881 73. Ito Y, Teicher MH, Glod CA, Harper D, Magnus E, Gelbard HA. Increased prevalence
882 of electrophysiological abnormalities in children with psychological, physical, and
883 sexual abuse. *The Journal of Neuropsychiatry and Clinical Neurosciences*. 1993;
884 5(4):401-408.
- 885 74. Teicher MH, Glod CA, Surrey J, Swett C. Early childhood abuse and limbic system
886 ratings in adult psychiatric outpatients. *The Journal of Neuropsychiatry and Clinical*
887 *Neurosciences*. 1993; 5(3):301-306.
- 888 75. van Campen J, Jansen F, Steinbusch L, Joëls M, Braun KJ. Stress sensitivity of
889 childhood epilepsy is related to experienced negative life events. *Epilepsia*. 2012;
890 53(9):1554-1562.
- 891 76. Kaufman J, Plotsky PM, Nemeroff CB, Charney DS. Effects of early adverse
892 experiences on brain structure and function: clinical implications. *Biological*
893 *Psychiatry*. 2000; 48(8):778-790.
- 894 77. Tietjen G, Peterlin BL. Childhood Abuse and Migraine: Epidemiology, Sex
895 Differences, and Potential Mechanisms. *Headache: The Journal of Head and Face*
896 *Pain*. 2011; 51(6):869-879.
- 897 78. Leserman J, Drossman DA: Relationship of Abuse History to Functional
898 Gastrointestinal Disorders and Symptoms: Some Possible Mediating Mechanisms.
899 *Trauma, Violence & Abuse*. 2007, 8(3):331-343.

- 900 79. Kiser LJ, Heston J, Millsap PA, Pruitt DB. Physical and sexual abuse in childhood:
901 Relationship with post-traumatic stress disorder. *Journal of the American Academy of*
902 *Child & Adolescent Psychiatry*. 1991; 30(5):776-783.
- 903 80. Konturek PC, Brzozowski T, Konturek SJ. Stress and the gut: pathophysiology,
904 clinical consequences, diagnostic approach and treatment options. *Journal of*
905 *physiology and pharmacology : an official journal of the Polish Physiological Society*.
906 2011; 62(6):591-599.
- 907 81. Million M, Larauche M. Stress, sex, and the enteric nervous system.
908 *Neurogastroenterology & Motility*. 2016; 28(9):1283-1289.
- 909 82. Arzani M, Jahromi SR, Ghorbani Z, Vahabizad F, Martelletti P, Ghaemi A, Sacco S,
910 Togha M. Gut-brain Axis and migraine headache: a comprehensive review. *The*
911 *Journal of Headache and Pain*. 2020; 21(1):15-undefined.
- 912 83. Pfeiffer RF. Gastroenterology and neurology. *Continuum.Lifelong Learning in*
913 *Neurology*. 2017; 23(3):744-761.
- 914 84. Song H, Fang F, Tomasson G, Arnberg FK, Mataix-Cols D, de la Cruz LF, Almqvist
915 C, Fall K, Valdimarsdóttir UA. Association of stress-related disorders with subsequent
916 autoimmune disease. *Jama*. 2018; 319(23):2388-2400.
- 917 85. Dube SR, Fairweather D, Pearson WS, Felitti VJ, Anda RF, Croft JB. Cumulative
918 childhood stress and autoimmune diseases in adults. *Psychosom Med*. 2009;
919 71(2):243-250.
- 920 86. Hassett AL, Clauw DJ. The role of stress in rheumatic diseases. *Arthritis Res Ther*.
921 2010; 12(3):123-123.
- 922 87. Short ME, Goetzl RZ, Pei X, Tabrizi MJ, Ozminkowski RJ, Gibson TB, DeJoy DM,
923 Wilson MG. How Accurate are Self-Reports? Analysis of Self-Reported Health Care

924 Utilization and Absence When Compared With Administrative Data. *J Occup Environ*
925 *Med.* 2009; 51(7):786-796.

926

927

Figures

Figure 1

Prevalence of different number of somatic complains in male (n=93) and female (n=137) Swedish high school student sample.

Figure 2

The prevalence of male high school students reporting the existence of different negative psychosocial (n=111).

Figure 3

The prevalence of female high school students reporting the existence of different negative psychosocial problems (n=165).