Psychosomatic Health under Pressure

The Stress-Buffering Role of Social Support on the Association between School Satisfaction, School Pressure, and Psychosomatic Health Complaints between 2013 and 2017

Aniek van den Braak (6294227)
Master Youth Studies
Faculty of Interdisciplinary Social Sciences
University of Utrecht
Supervisor: Prof. dr. T. ter Bogt
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Abstract

Introduction. Although school-related stress has increased among adolescents, a number of studies showed stable trends of psychosomatic health complaints (PSHC). Therefore, this study investigates time (2013-2017) and gender differences regarding the change in both prevalence and associations between school pressure, school satisfaction, PSHC, and the stress-buffering role of support from family, friends, and teachers. **Method.** Repeated cross-sectional data from the Health Behaviour in School-aged Children study (HBSC) in 2013/2014 and 2017/2018 were used. A total sample of 12233 Dutch adolescents (aged 11-17) in secondary schools participated in self-reported questionnaires. **Results.** High pressure at school and low school satisfaction were both associated with more PSHC, particularly for girls. Nonetheless, PSHC remained stable across time, while school pressure increased and school satisfaction decreased. Social support buffers the adverse effects of school pressure, but does not buffer low school satisfaction. Family support was a limited stress-buffering factor for PSHC when high pressure at school was present. Teacher support buffered only low school pressure. Friend support was no stress buffer. These findings were highly similar in 2013 and 2017. **Conclusion.** Future research should follow adolescents over a longer period of time due to indications of increasing stressful school environments, which could increase PSHC prospectively.

Keywords: psychosomatic health complaints, school pressure, school satisfaction, school-related stress, social support, time.

Samenvatting

Introductie. Hoewel school-gerelateerde stress onder adolescenten is gestegen, toonde meerdere studies stabiele trends in psychosomatiche gezondheidsklachten (PSHC). Deze studie onderzoekt daarom in hoeverre tijd (2013-2017) en gender verschillen aanwezig zijn met betrekking tot veranderingen in zowel de prevalentie als associaties tussen schooldruk, schooltevredenheid, PSHC, en in hoeverre steun van familie, vrienden en leerkrachten een bufferende rol hebben. **Methode.** Cross-sectionele data van de Health Behavior in School-aged Children (HBSC) studie uit 2013/2014 en 2017/2018 is gebruikt. Een totale steekproef van 12233 Nederlandse adolescenten (11-17 jaar) vulden een zelf-gerapporteerde vragenlijst in op middelbare scholen. **Resultaten.** Een hoge schooldruk en lage schooltevredenheid zijn beide geassocieerd met meer PSHC, specifiek voor meisjes. Hoewel schooldruk is gestegen en schooltevredenheid is afgenomen, zijn PSHC gelijk bleven tussen 2013-2017. Sociale steun fungeert als buffer bij schooldruk, maar niet bij een lage schooltevredenheid. Steun van familie vermindert, in beperkte mate, de negatieve effecten van een hoge schooldruk. Steun van leerkrachten fungeert alleen als buffer bij lage schooldruk. Steun van vrienden was geen stress buffer. De bevindingen in 2013 kwamen sterk overeen met 2017. **Conclusie.** Toekomstig onderzoek zal adolescenten over een langere periode moeten volgen vanwege signalen van een stresvollere schoolomgeving, waardoor PSHC in de toekomst kunnen toenemen.

Kernwoorden: psychosomatische gezondheidsklachten, schooldruk, schooltevredenheid, school-gerelateerde stress, sociale steun, tijd.

Introduction

Psychosomatic health complains (PSHC) are prevalent during adolescence and have become a health concern in Western countries (Özdemir, Utkualp, & Palloş, 2016; Wiklund, Malmgren-Olsson, Öhman, Bergström, & Fjellman-Wiklund, 2012). Although research reported higher rates of PSHC among adolescents (Hjern, Alfven, & Östberg 2008; Wiklund et al., 2012), a considerable number of studies showed fairly stable trends in PSHC (Duinhof, Stevens, Van Dorsselaer, Monshouwer, & Vollebergh, 2015; Friberg, Hagquist, & Osika, 2012; Ottová-Jordan et al., 2015; Potrebny, Wiium, Lundegård, 2017). According to Ravens-Sieber and colleagues (2008) PSHC refer to both psychological (e.g. feeling low, irritability/bad temper, feeling nervous or difficulties in falling asleep), and somatic symptoms (e.g. headache, stomach ache, back ache or feeling dizzy).

School pressure and school satisfaction, which are indicators of school-related stress, are identified as predictors of PSHC, particularly for girls (Låftman & Modin, 2012; Wiklund et al., 2012). In recent decades, school-related stress has increased (Vašíčková, Hollein, Sigmund, Salonna, & Boberová, 2017; Wiklund et al., 2012). Therefore, it seems plausible that increasing rates of school-related stress are linked with increasing rates of PSHC. However, there is still some inconsistency whether PSHC have increased across time. One theoretical explanation for this inconsistency might be embedded in the availability of compensatory resources, i.e. social support (Cohen & Wills, 1985). Thus, the aims of this study are to explore (1) time (2013-2017) and gender differences, (2) regarding the change in prevalence and associations between school pressure, school satisfaction and PSHC, (3) and the stress-buffering role of social support.

Theoretical framework

According to the *stress-buffering model* by Cohen and Wills (1985), social support protects individuals from the potentially adverse effects of stressful events. Therefore, social support is closely associated with mental health, and is regarded as a stress-buffering factor. In addition, social support, for example at workplace, is beneficial for psychosomatic health according to the *demand-control-support model* (Karasek & Theorell, 1990). This model suggests that PSHC increase when psychological demands are high and controllability over work is low. Social support is a source to deal with these psychological demands (Stansfeld & Candy, 2006). Adolescents, whose workplace is at school, can perceive support from friends, teachers and family to deal with school demands and pressure (Låftman & Modin, 2012). Thus, these theoretical models could confirm that social support prevents adolescents from

developing PSHC as a consequence of school-related stress.

Indicators of school-related stress

School experiences are considered to be predictors for health and well-being (Bond et al., 2007). *School pressure* might be an important indicator in understanding how adolescents' school experiences are associated with their psychosomatic health (Klinger et al., 2015). A number of studies have revealed that high pressure at school within contemporary school settings is associated with more PSHC (Hjern et al., 2008; Plenty, Östberg, Almquist, Augustine, & Modin, 2014; Sweeting, West, & Young, 2010; Wiklund et al., 2012). Therefore, school pressure is assumed to be a predictor for developing PSHC.

School satisfaction might also be an indicator in understanding the association between school experiences and psychosomatic health. Dissatisfaction at school may constitute a risk factor for PSHC (Bond et al., 2007; Eamon, 2002; Huebner & Gilman, 2006). Since school satisfaction is an underexposed topic in research in contrast to life satisfaction (Elmore & Huebner, 2010), it is relevant to consider school satisfaction while predicting PSHC.

Social support

Social support is a frequently used coping strategy to handle stress among adolescents (Zimmer-Gembeck & Skinner, 2011). In particular, girls are believed to benefit more from social support compared to boys (Saphire-Bernstein & Taylor, 2013). High demands at school combined with a lack of social support are associated with more PSHC (Modin & Östberg, 2009). Therefore, social support can assist in optimizing adolescent' psychosomatic health (Plenty et al., 2014). Social support is categorized into three sources: family-, friend- and teacher support.

Family support is associated with fewer PSHC in both genders, but particularly for girls (Kjellström, Modin, & Almquist, 2017; Moreno, 2009; Stewart & Suldo, 2011). Bad relationships between adolescents and parents increased the probability of PSHC (Hagquist, 2015). Family support is more important than teacher support for PSHC (Kjellström et al., 2017). Thus, it might be that family support has a strong stress-buffering effect on developing PSHC.

Friend support has also been recognized as a protective factor of psychological well-being during adolescence (Lester & Cross, 2015). Close relationships with friends are associated with less PSHC (Bergh, Hagquist, & Starrin, 2010; Kidger, Araya, Donovan, & Gunnel, 2012). Therefore, it might be assumed that friend support is a buffer for developing PSHC when school-related stress is present.

Teacher support is also associated with less psychological complaints (Kidger et al., 2012). It is essential to provide adolescents with a supportive school environment to prevent them from developing PSHC (Kjellström et al., 2017; Stewart & Suldo, 2011). Thus, teacher support should be assumed as an important stress-buffering factor for developing PSHC.

Gender

School-related stress is an important predictor of PSHC in adolescence, with greater risk for girls compared to boys (Klinger et al., 2015). Although school demands have increased for both genders (Östberg et al., 2015), a number of studies have shown that girls experience more school-related stress compared to boys (Ollfors & Andersson, 2007; Plenty et al., 2014; Wiklund et al., 2012). PSHC are also prevalent in both genders during adolescence, but especially in girls (Wiklund et al., 2012). This highlights the need to consider gender as moderator in order to understand the link between school-related stress and PSHC during adolescence.

Conclusion

Given these theoretical and empirical findings, high pressure at school and low school satisfaction should be associated with more PSHC, particularly for girls. Supportive family, friends and teachers are assumed to be essential for assisting adolescents in their psychosomatic health. Improvements in perceived social support might therefore be an explanation why PSHC have rather shown stable trends, while school-related stress should have been increased. Research has not yet determined if social support buffers and whether the source of support is relevant in preventing PSHC from school-related stress.

Current study

The previous assumptions should be further explored. Therefore, this study investigated time (2013-2017) and gender differences regarding the associations between school satisfaction, school pressure and PSHC, and to what extent social support (e.g. from family, friends or teachers) is a stress-buffering factor. First, the change in prevalence of the variables of interest and the associations between them across time were tested. Furthermore, 6 hypotheses were investigated which are visualized in Figure 1. School pressure is positively associated with PSHC (Hypothesis 1). School satisfaction is negatively associated with PSHC (Hypothesis 2). Social support from family (Hypothesis 3), friends (Hypothesis 4), and teachers (Hypothesis 5), buffers for developing PSHC when school-related stress is present. Girls are at greater risk of developing PSHC if they experience school-related stress (Hypothesis 6). Additionally, whether girls benefit more from social support compared to boys is tested exploratively.

Age, gender and educational level are taken into account as control variables. School-related stress and PSHC are both more common in girls (Wiklund et al., 2012), which increases with age (Klinger et al., 2015; Vašíčková et al., 2017). Adolescents in vocational training showed generally more health complaints (Goldman, & Smith, 2011).

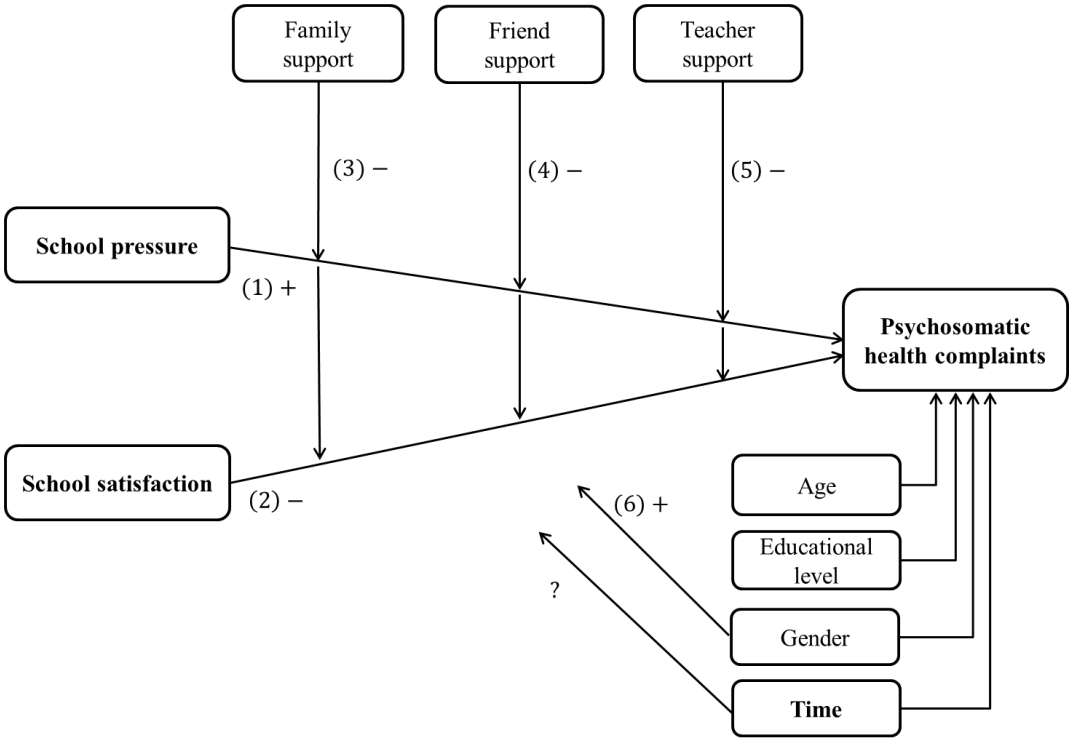

Figure 1. Research model

Method

Sample

This repeated cross-sectional study is based on data from the Health Behaviour in School-aged Children (HBSC) survey, which were collected in 2013/2014 and 2017/2018 in the Netherlands. The questionnaire was answered by a total of *N* = 13074 Dutch adolescents who were participating in one of the first four classes of the secondary school. After excluding unreliable and incomplete questionnaires, a total of *N* = 12233 adolescents remained. Participants in this study were within the age range of 11-17 years (*M* = 14.00, *SD* = 1.48). Nonresponse was mainly due to adolescents being absent from school when the questionnaire was administered or adolescents who declined to answer the questionnaire.

Procedure

The HBSC study was conducted in collaboration between the University Utrecht, the Trimbos Institute and the Social and Cultural Planning Office. A randomized stratified cluster sample was used. Only regular secondary schools were selected if they provide vocational training and higher secondary education. A total of 67 schools in 2013, and 85 schools in 2017 participated in this study. Prior to visiting schools, parents received a letter including (passive) informed consent. Data was collected through self-reported questionnaires administered in the classroom, after adolescents gave their active consent. Participants were informed that participation was voluntary and that their responses were anonymous and confidential. This study was ethically approved by the Ethical Commission of University of Utrecht.

Measuring instruments

PSHC was measured with the Health Behaviour in School-aged Children symptom checklist (HBSC-SCL), which is an international scoring system for self-reported health complaints in adolescents (Ravens-Sieberer et al., 2008). The HBSC-SCL assesses the occurrence of eight common PSHC in the past six months, such as headache or bad temper. These items were scored on a 5-point Likert scale ranging from "Almost never or never" (1) to "Almost every day" (5). This study showed good internal consistency with a Cronbach's alpha of .81

School pressure was measured with a single-item: 'How much school pressure do you experience?' This variable was scored on a 4-point Likert scale ranging from "Not at all" (1) to "A lot" (4). *School satisfaction* was assessed by using the single-item: 'How much do you like school?'. This variable was scored on a 4-point Likert scale ranging from "Not at all" (1) to "Like a lot" (4).

Family support was assessed with a 4-item subscale of the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988). This dimension includes for example the item: 'I get the emotional help and support I need from my family'. Family support was scored on a 7-point Likert scale ranging from "Very strongly disagree" (1) to "Very strongly agree" (7). In this study the internal consistency was good, as is shown by a Cronbach's alpha of .92.

Friend support was measured with a 4-item subscale of the MSPSS (Zimet et al., 1988). This dimension includes for example the item: 'I can talk about my problems with my friends'. Responses were recorded using a 7-point Likert scale ranging from "Very much disagree" (1) to "Very much agree" (7). The Cronbach's alpha was equal to .93 in this study.

Teacher support was measured with a 3-item scale designed by the HBSC International network (Torsheim, Wold, & Samdal, 2000). Adolescents were asked to rate their teachers. For example: 'I feel that my teachers care about me as a person'. A 5-point Likert-scale was used ranging from "Strongly disagree" (1) to "Strongly agree" (5). In this study, the internal consistency was good (Cronbach's alpha = .83).

Adolescents reported their *gender* (boy = 0, girl = 1) and date of birth (*age*). *Educational level* was categorized in combined groups indicating vocational education = 0 and higher secondary education = 1. Data assessed at the two time points were categorized in the variable *time,* (2013 = 0, 2017 = 1).

Data-analysis

For analysing the data, SPSS Statistics 25.0 was used. First, both datasets of 2013 and 2017 were merged into one dataset. Cases with any missing responses were discarded from the analysis, which was based on the listwise deletion method. Mean values and standard deviations were calculated for all variables in both years. Gender differences across time and time differences according to gender were investigated with an independent t-test. Pearson's correlation coefficient was used between the indicators of school-related stress and sources of social support.

As the outcome variable was continuous and multiple predictors were used, the method applied for testing the hypotheses was hierarchical multiple linear regression analysis (Field, 2014). All continuous variables were standardized and relevant assumptions were tested prior to analysing. In model 1, the control variables age, gender and educational level were included. The main effect of time was included in model 2. In model 3, school pressure and school satisfaction were included, and the main effects of family-, friend-, and teacher support. In model 4, the two-way interaction effects between the variables of interest and time were included. The two-way interaction effects between school pressure, school satisfaction, gender, family-, friend- and teacher support were included in model 5. In model 6, the three-way interactions between the indicators of school-related stress, different types of social support and time, were included. Three-way interactions with gender were included in model 7.

Results

All assumptions of the hierarchical multiple regression analysis were tested prior to analysing, no abnormalities were found. In this study, a significance level of $\alpha = .01$ is maintained.

Descriptive statistics

Table 1 presents an overview of the descriptive statistics. Both samples consisted of participants in the early and middle adolescence. Boys and girls were approximately equally distributed in both samples. Interestingly, in 2017 a larger number of high educated adolescents participated in the study compared to 2013.

Table 1

Overview of general descriptive statistics

	2013	**2017**
	(*N* = 5147)	(*N* = 7086)
Age (*M, SD*)	13.86 (1.33)	14.09 (1.57)
Gender (%)		
Boys	48.7	48.3
Girls	51.3	51.7
Educational level (%)		
Vocational education	50.6	43.5
Higher secondary education	49.4	56.5

Note. Mean (*M*), standard deviation (*SD*) and total number of participants (*N*).

Gender differences across time

In 2013 and 2017, similar patterns of gender differences in the variables of interest were found, which are presented in Table 2. Girls experienced significantly more PSHC compared to boys ($t(5044) = -17.98$, $p < .001$; $t(7042) = -18.79$, $p < .001$, respectively). In contrast to boys, girls experienced significantly more school pressure ($t(5142) = -10.80$, $p < .001$; $t(7079) = -15.39$, $p < .001$). Boys were significantly less satisfied at school compared to girls ($t(5145) = -4.42$, $p < .001$; $t(6999) = -6.25$, $p < .001$). Both genders did not significantly differ in perceiving family support ($t(5134) = 2.27$, $p = .023$; $t(7083) = 0.95$, $p = .343$), and in perceiving teacher support ($t(5060) = 0.15$, $p = .884$; $t(6973) = 1.45$, $p = .149$). Girls perceived significantly more support from friends in contrast to boys ($t(5084) = -16.15$, $p < .001$; $t(6909) = -18.39$, $p < .001$).

Time differences according to gender

The patterns of time differences according to gender were similar. Boys in 2013 did not significantly differ in scores on PSHC compared to 2017 ($t(5930) = -1.41$, $p = .160$), which holds the same for girls ($t(6299) = 0.77$, $p = .442$). Boys experienced significantly more school pressure ($t(5582) = -8.93$, $p < .001$), and less school satisfaction across time ($t(5484) = -9.12$, $p < .001$), similarly for girls ($t(5920) = -12.31$, $p < .001$; $t(5843) = 8.69$, $p < .001$, respectively). Boys perceived significantly higher family support ($t(5395) = -3.90$, $p < .001$), but less teacher support across time ($t(5531) = 2.92$, $p < .01$), idem for girls ($t(5526) = -5.28$, $p < .001$; $t(6299) = 4.45$, $p < .001$). No significant time differences were found in perceiving friend support for boys ($t(5678) = 0.62$, $p = .538$), similarly for girls ($t(5930) = 0.35$, $p = .730$).

Table 2

Gender differences in mean scores (*M*) and standard deviations (*SD*) of psychosomatic health complaints (PSHC) and the independent variables, within 2013 (*N* = 5147), within 2017 (*N* = 7086) and between 2013 and 2017

	2013						**2017**					
	Boys (*N* = 2509)		**Girls** (*N* = 2638)		**Total** (*N* = 5147)		**Boys** (*N* = 3423)		**Girls** (*N* = 3663)		**Total** (*N* = 7086)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Dependent variable												
PSHC	*1.80*	0.70	*2.18*	0.84	1.99	0.78	*1.82*	0.72	*2.17*	0.83	2.00*	0.80
Independent variables												
School pressure	***2.02***	0.80	***2.26***	0.82	**2.15**	0.82	***2.21***	0.85	***2.53***	0.89	**2.38**	0.89
School satisfaction	***3.05***	0.84	***3.15***	0.78	**3.10**	0.81	***2.84***	0.86	***2.97***	0.82	**2.91**	0.84
Family support	**5.92**	1.30	**5.83**	1.44	**5.87**	1.37	**6.05**	1.30	**6.02**	1.37	**6.03**	1.34
Friend support	*5.48*	1.33	*6.06*	1.25	5.78	1.32	*5.47*	1.37	*6.04*	1.25	5.77	1.34
Teacher support	**3.78**	0.84	**3.78**	0.77	**3.78**	0.81	**3.71**	0.83	**3.68**	0.83	**3.70**	0.85

Note. Italic statistics are significant gender differences within 2013 or within 2017 (gender differences across time). Bold statistics are significant time differences between 2013 and 2017, for boys, girls and total respectively (time differences according to gender).

*Estimated marginal mean scores were calculated for both total mean scores of PSHC in 2013 and 2017 due to a change in sample composition across time. Both estimated mean scores were similar across time (*M* = 2.00), when controlled for educational level, age and gender.

Significant differences are at the level of $p < .01$.

Correlations

The correlations between PSHC and the independent variables were conducted with a Pearson correlation. Table 4 presents an overview of these correlations. There was a significant negative correlation between school satisfaction and PSHC. Thus, higher school satisfaction is associated with less PSHC. School pressure was positively but significantly correlated with PSHC. This means that high pressure at school is associated with experiencing more PSHC. Finally, all sources of family-, friend- and teacher support were negatively but significantly correlated with PSHC. Thus, perceiving more social support is associated with experiencing less PSHC. Approximately all correlations were similar between 2013 and 2017. This might indicate that the structure of the model remains similar across time.

Table 4

Correlations between PSHC and the independent variable for both datasets of 2013 and 2017.

	1	2	3	4	5	6
1. PSHC	-	**-.27****	**.36****	**-.28****	**-.12****	**-.23****
2. School satisfaction	*-.25***	-	**-.30****	**.21****	**.15****	**.35****
3. School pressure	*.32***	*-.22***	-	**-.14****	**-.05****	**-.22****
4. Family support	*-.29***	*.23***	*-.11***	-	**.40****	**.22****
5. Friend support	*-.11***	*.15***	*-.06***	*.34***	-	**.15****
6. Teacher support	*-.23***	*.39***	*-.19***	*.29***	*.19***	-

Note. Italic statistics = 2013, bold statistics = 2017.

Correlation criteria: < .3 is small, <.5 is medium, >.5 is large

** $p < .001$

Hierarchical multiple regression

A hierarchical multiple regression analysis was performed to predict PSHC. These results are presented in Table 5. The results of three-way interactions with time, and similarly for gender, were left out the analysis due to nonsignificant effects.

In model 1, the control variables age, gender and educational level were included in the regression model. This model explained 6% of the variance, $R^2 = .06$, $F(3) = 107.56$, $p < .001$. The effect size was small[1], Cohen's $f^2 = .06$. Age ($t(3) = 8.89$, $p < .001$), gender ($t(3) = 26.23$, $p < .001$), and educational level ($t(3) = -4.98$, $p < .001$) were significant control variables in predicting PSHC. These results indicate that in particular older adolescents, girls,

[1] Effect sizes in multiple regression analysis are conducted with Cohen's f^2. According to Cohen's (1988) criteria represents $f^2 > .02$, $f^2 > .15$ and $f^2 > .35$ small, medium and large effect sizes.

and adolescents in vocational education, experience more PSHC.

In model 2, the main effect of time was tested. No significant time effect was found ($t(4) = -0.06$, $p = .956$), indicating that PSHC did not change across time. This model did not significantly differ compared to the previous model, $\Delta R^2 = 0.00$, $\Delta F(4, 12233) = 0.00$, $p = .956$.

In model 3, school pressure and school satisfaction were included. Consistent with Hypothesis 1, school pressure was a significant predictor for PSHC, $t(9) = 28.02$, $p < .001$. Thus, adolescents develop more PSHC if they experience school pressure. Consistent with Hypothesis 2, school satisfaction was a significant predictor for PSHC ($t(9) = -15.77$, $p < .001$), indicating that adolescents experience more PSHC if they are less satisfied at school. Given the higher absolute beta coefficient, school pressure ($\beta = 0.24$) is a stronger stressor for developing PSHC than school satisfaction ($\beta = -0.14$).

Additionally, different sources of support were included in model 3. Family- ($t(9) = -20.96$, $p < .001$), friend- ($t(9) = -4.81$, $p < .001$), and teacher support ($t(9) = -9.19$, $p < .001$) were significant predictors for PSHC. These results indicate that perceiving more family-, friend- or teacher support is associated with experiencing less PSHC. Given the highest absolute beta coefficient ($\beta = -0.19$), family support was the strongest buffer of social support for developing PSHC. Surprisingly, a significant main effect of time was found in model 3 ($t(9) = -3.94$, $p < .001$), indicating that PSHC slightly decreased across time. Finally, this model explained 24.3% of the variance, $R^2 = .243$, $F(9) = 435.31$, $p < .001$, $f^2 = 0.32$.

In model 4, the interaction effects with time were included. This model was not significantly different compared to the previous model, $\Delta R^2 = .00$, $\Delta F(15, 12233) = 0.78$, $p = .584$. As can be seen in Table 5, no significant interaction time effects were found. Thus, the mechanisms which were tested in 2013 were not significantly different from 2017 in predicting PSHC.

In model 5, the interaction effects between school-related stress and the sources of social support were included. This model explained 25.2% of the variance ($R^2 = .252$, $F(23) = 178.37$, $p < .001$), indicating a medium effect ($f^2 = 0.34$). In general, significant stress-buffering effects of social support were found for school pressure, but not for low school satisfaction. Partially consistent with Hypothesis 3, family support significantly buffers school pressure, ($t(16) = -2.80$, $p < .01$), but does not buffer low school satisfaction ($t(16) = 0.90$, $p = 0.37$). These results indicate that perceived family support buffers for developing PSHC when adolescents experience high pressure at school (Figure 2). However, as can be

seen from the value of the beta coefficient and the minimal increase of explained variance when comparing model 4 to model 5, the effect of this buffering factor is limited.

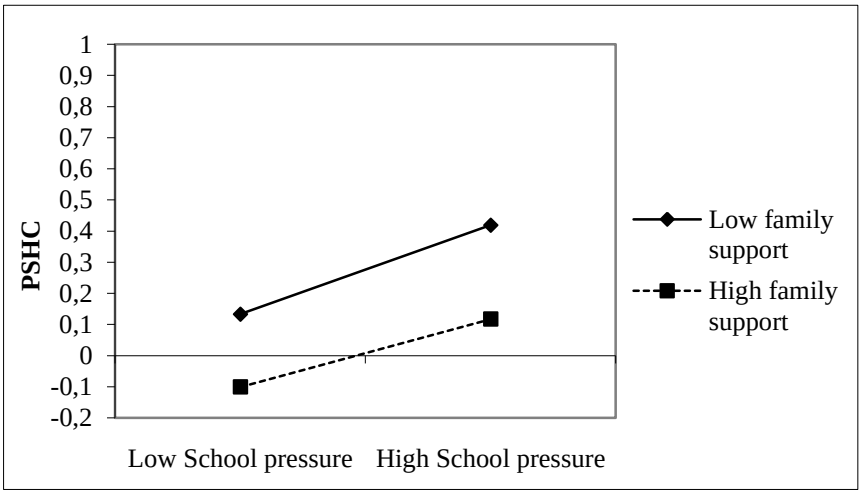

Figure 2. Interaction effect between school pressure and family support in predicting psychosomatic health complaints (PSHC) (N = 12233).

Inconsistent with Hypothesis 4, friend support was no stress-buffering factor for PSHC. No significant interaction effect was found between school satisfaction and friend support in predicting PSHC, $t(16) = 2.15$, $p = 0.32$. Similarly, the interaction between school pressure and friend support was not significant, $t(16) = -1.23$, $p < .01$.

Partly consistent with Hypothesis 5, a significant stress-buffering effect was found for teacher support when school pressure was present ($t(16) = 3.78$, $p < .001$), but not for low school satisfaction ($t(16) = -0.97$, $p = 0.32$). Surprisingly, Figure 3 shows that teacher support only buffers low school pressure, indicating that teachers could not buffer the adverse effects of high pressure at school. The interactions, which are included in model 5, did not increase the amount of explained variance, from 24% to 25%, indicating that the effects found are small.

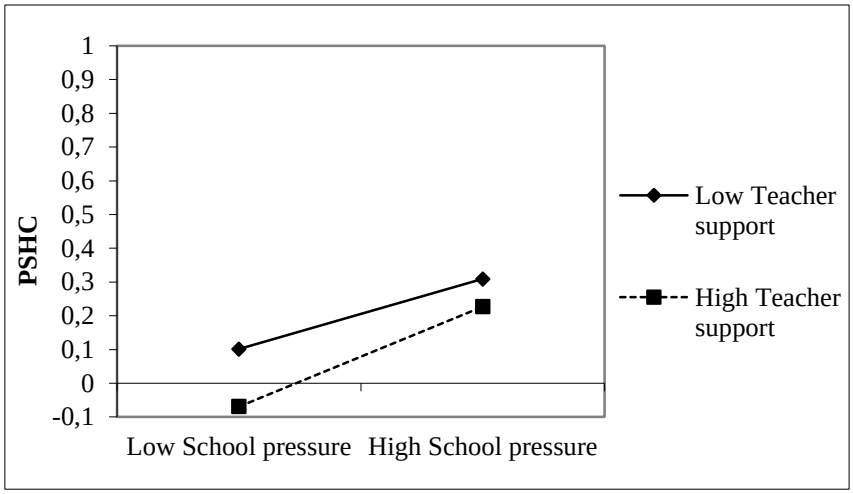

Figure 3. Interaction effect between school pressure and teacher support in predicting psychosomatic health complaints (PSHC) (*N* = 12233).

Interaction effects with gender were included in model 5. Consistent with Hypothesis 6, results showed a significant gender effect on PSHC when school pressure was present ($t(16) = 4.93$, $p < .001$), similarly when low school satisfaction was present ($t(16) = -7.24$, $p < .001$). Thus, girls are at greater risk for developing PSHC if they experience school pressure and low school satisfaction (see Figure 4 and 5).

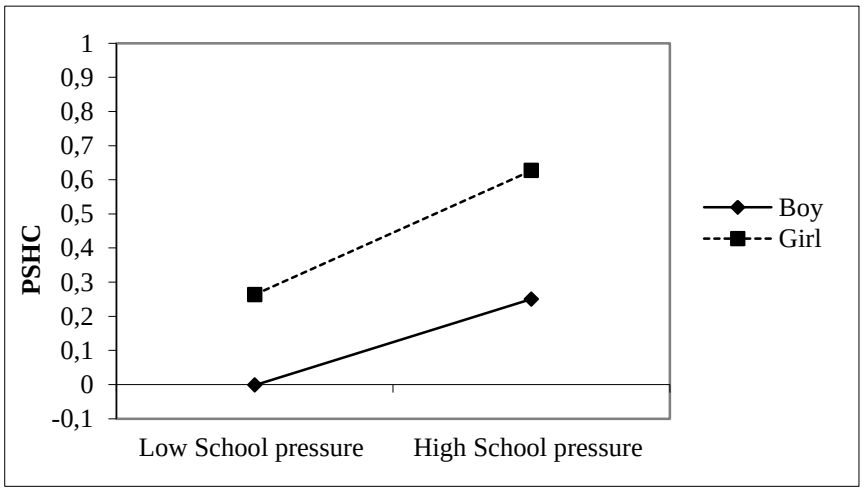

Figure 4. Interaction effect between school pressure and gender in predicting psychosomatic health complaints (PSHC) (*N* = 12233).

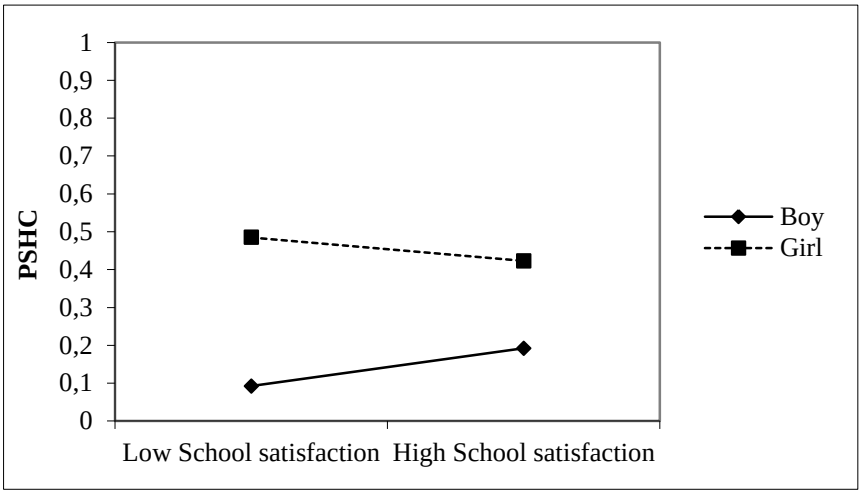

Figure 5. Interaction effect between school satisfaction and gender in predicting psychosomatic health complaints (PSHC) (*N* = 12233).

Despite the fact that time had no significant main effect, the interaction between gender and time was significant in model 5, $t(16) = -3.50$, $p < .001$. PSHC slightly decreased for girls, but not for boys across time (see Figure 6).

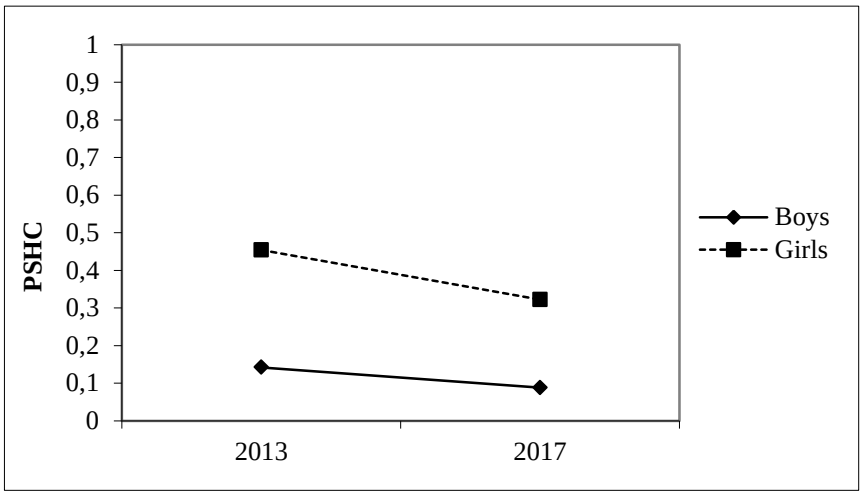

Figure 6. Interaction effect between gender and time in predicting psychosomatic health complaints (PSHC) (*N* = 12233).

Table 5

Overview of hierarchical multiple regression analysis including unstandardized- (*B*), estimated standard deviation (*SE B*) and standardized (β) regression coefficients to predict psychosomatic health complaints (PSHC), in a combined dataset of 2013 and 2017 (*N* = 12233).

	Model 1			Model 2			Model 3			Model 4			Model 5		
Age	.04	.00	.08**	.04	.00	.08**	-.02	.00	-.03**	-.02	.00	-.03**	-.02	.00	-.04**
Gender	.30	.01	.23**	.30	.01	.23**	.27	.01	.20**	.29	.02	.22**	.31	.02	.24**
Educational level	-.06	.01	-.04**	-.06	.01	-.04**	-.09	.01	-.06**	-.09	.01	-.06**	-.09	.01	-.07**
Time				-.00	.01	.00	-.04	.01	-.03**	-.03	.08	- .02	-.05	.08	-.04
School satisfaction							-.09	.01	-.14**	-.09	.01	-.06**	-.05	.01	-.08**
School pressure							.16	.01	.24**	.16	.01	.24**	.13	.01	.19**
Family support							-.14	.01	-.19**	-.14	.01	-.19**	-.13	.01	-.18**
Friend support							-.03	.01	-.04**	-.03	.01	-.05*	-.03	.01	-.04*
Teacher support							-.06	.01	-.08**	-.07	.01	-.08**	-.06	.01	-.08**
School satisfaction x time										-.01	.01	-.02	-.01	.01	-.02
School pressure x time										.01	.01	.01	.01	.01	.02
Family support x time										.00	.01	-.00	.01	.01	.02
Friend support x time										.00	.01	.01	.01	.01	.03
Teacher support x time										.01	.01	.03	-.00	.01	-.00
Gender x time										-.04	.02	-.03	-.08	.02	-.05**

School satisfaction x family support						.01	.01	.01
School satisfaction x friend support						.01	.01	.02
School satisfaction x teacher support						-.01	.01	-.01
School satisfaction x gender						-.08	.01	-.09**
School pressure x family support						-.02	.01	-.03*
School pressure x friend support						-.01	.01	-.01
School pressure x teacher support						.02	.01	.03**
School pressure x gender						.06	.01	.06**
R^2	.060**		.060	.243**	.243			.252**
F change	261.93		.003	588.65	.781			17.36

Note. * $p < .01$ ** $p < .001$

Discussion

The aim of this study was to investigate time and gender differences regarding the change in both prevalence and associations between school pressure, school satisfaction, PSHC, and the stress-buffering role of social support. Low school satisfaction and high pressure at school were both associated with more PSHC, particularly for girls. Nonetheless, PSHC remained stable across time, while school pressure increased and school satisfaction decreased. Social support buffered the adverse effects of school pressure on PSHC, but it did not buffer the effects of low school satisfaction on PSHC. Family support was a limited stress-buffering factor for PSHC when high pressure at school was present. Teacher support buffered only low school pressure. Friend support was no stress buffer. The structure of the research model (Figure 1) was highly similar between 2013 and 2017, regardless of significant changes in the levels of the variables of interest.

Time changes

One of the main purposes was to investigate the prevalence of school pressure, school satisfaction, PSHC and social support, and whether the associations between them changed across time. School pressure increased and school satisfaction decreased between 2013 and 2017. Increased school pressure could be linked to increased levels of perfectionism across time (Curran & Hill, 2019), due to more unrealistic expectations and more competitive environments for adolescents. Declined levels of school satisfaction may be primarily due to increased school demands (Rathmann et al., 2018), higher rates of exposure to bullying (Callaghan, Kelly, & Molcho, 2019) and lower satisfaction with teachers (Arciuli et al., 2019). These changes may indicate that adolescents experience more stressful school environments than before.

Increased levels of school-related stress should be associated with increased levels of PSHC across time. However, this study showed that PSHC remained stable between 2013 and 2017. One possible explanation could be that social support increased, which buffers the adverse effects of school-related stress. Indeed, for both genders family support increased, but teacher support decreased and friend support remained stable across time. The stress-buffering role of social support was limited in both 2013 and 2017. It could also be that the adverse consequences of increased school-related stress are not yet visible.

Surprisingly, significant time effects were found after including other variables and interaction effects in multivariate analyses. These results should be questioned due to a nonsignificant pure main effect of time in both univariate and multivariate analyses. It should

be noted that the sample composition has changed across time; more high educated adolescents participated in 2017, although we controlled for this.

Indicators of school-related stress

School pressure within contemporary school settings is a critical indicator of PSHC (Hjern et al., 2008; Wiklund et al., 2012). Conforming Hypothesis 1, this study found that school pressure is associated with more PSHC, which could be explained by the mechanisms of stress responses. Stress provokes the body's psychological (e.g. feeling low, bad temper) and physiological (e.g. increasing heart rates, muscles tighten) reactions (Nakao, 2010). This suggests that school pressure affects adolescents' psychosomatic health.

Previous research suggested that school satisfaction is an indicator of PSHC (Bond et al., 2007; Eamon, 2002). Consistent with Hypothesis 2, this study revealed that low school satisfaction was associated with more PSHC. A possible explanation is that adolescents spend a considerable amount of their time at school (Slot, Akkerman, & Wubbels, 2019), thus the school environment may have an impact on adolescents' feelings. Negative school experiences may affect adolescents' school satisfaction, and in turn their psychosomatic health (Bond et al., 2007). This study provides new insights about school satisfaction in relationship with PSHC, which is an underexposed topic in research (Elmore & Huebner, 2010).

Social support

Family support is essential for adolescent psychosomatic health (Kjellström et al., 2017; Moreno, 2009). According to the *stress-buffering model* (Cohen & Wills, 1985) and *demand-control-support model* (Karasek & Theorell, 1990), family support buffers the adverse effects of school-related stress. Partially consistent with Hypothesis 3, this study found both a main and buffering effect of family support on PSHC when school pressure was present, but not when school satisfaction was low. Though, family support seems the most important stress-buffering factor, the effect was limited, which could be explained by the bilateral role of family. The family is a compensating resource, since family support is a stress-buffering factor. On the other hand, the family could be a potential agent for experiencing school pressure (Beehr, Bowling, & Bennet, 2010; Camara, Bacigalupe, & Padilla, 2017). Parents may be unaware of their expectations of success they impose on their children, and thereby increase the pressure to perform well at school.

Previous research showed that friend support is important for adolescent psychosomatic health (Kidger et al., 2012; Lester & Cross, 2015). Indeed, this study found a main effect of friend support. Surprisingly, in contrast with Hypothesis 4, friend support was

no stress-buffering factor for PSHC. One methodological explanation could be that key experiences of friend support in adolescence are those evolving around amusement, spending time together and sharing activities (Moreno et al., 2009), rather than talking, as measured in this investigation. Respondents could also have interpreted 'friendship' differently (e.g. close friends, classmates, romantic partners), which could explain the irrelevance of friend support in this study. It could be that classmate support is a better substantial stress-buffering factor because it is more focused on the school environment. Instruments that clearly define friendship and another operationalization of the type of friend support are recommended.

Teacher support is associated with less PSHC in previous research (Kjellström et al., 2017; Stewart, & Suldo, 2011). Partially consistent with Hypothesis 5, this study found a main and buffering effect of teacher support when school pressure was present, but it does not buffer low school satisfaction. Unexpectedly, teacher support buffers only when low school pressure was present, indicating that adolescents who experience high pressure at school do not benefit from teacher support. This could be explained by a possible change of teachers' position across time. In 2014, the 'Law of Appropriate Education'[2] was introduced in the Netherlands, which results in an increase of special needs children in regular education (Van der Woud, & Beliaeva, 2015). Consequently, time pressure for teachers may be increased (Klassen & Chiu, 2010), combined with more disruptive classroom behaviour (Oliver, Wehby, & Reschly, 2011). This might negatively affect the quality of teacher support. These assumptions could be further investigated.

Gender differences

Gender differences were found for school-related stress in predicting PSHC (Plenty et al., 2014; Wiklund et al., 2012). Consistent with Hypothesis 6, this study showed that girls are at greater risk for developing PSHC if they experience school-related stress, compared to boys. These results could be explained by differences in coping mechanisms. Boys are better at expressing a more relaxed attitude than girls towards school demands, and seek distraction by physical activity as a coping strategy instead of social support (Frydenberg, 2008; Wilhsson, Svedberg, Högdin, & Nygren, 2016). Previous research showed that physical activity is a stress-buffer on psychosomatic health (Gerber & Puhse, 2009; Haugland, Wold, & Torsheim, 2003). Therefore, it is important to explore whether other stress-buffering factors are more substantial than social support.

[2] In Dutch it is referred to 'Wet Passend Onderwijs'.

Strengths & limitations

The major strengths of this HBSC study were the large sample size and the national representativeness of the sample among Dutch adolescents aged 11-17. One of the main objectives of this study was to investigate size and patterns of change between 2013 and 2017. For these purposes, two waves of measurement were sufficient for validating and confirming the results. This research model could be investigated over a longer period of time, in order to observe the effects of societal changes.

The results should also be evaluated in light of potential limitations. Although well validated, single items of school pressure and school satisfaction were used in this study. Therefore, different perceptions about these concepts cannot be ruled out. The findings are also based on self-reported data which can be somewhat biased, but obtaining data from adolescents themselves is advantageous when exploring subjective constructs such as PSHC (Ottova et al., 2012). Furthermore, using repeated cross-sectional data allows testing time differences, but no inferences about causality can be made. It could be that adolescents who have PSHC, experience more school-related stress. In addition, the participants who were absent during data collection were probably the ones experiencing PSHC (Mikkelsson Salminen, & Kautiainen, 1997), therefore the results could be somewhat underrated. Finally, it should be noted that the effect sizes are better indicators of meaningful results in this study due to the large sample size.

Conclusion & implications

School-related stress is associated with more PSHC. Although school pressure increased and school satisfaction decreased, PSHC remained stable between 2013 and 2017. Although family support increased, it has a limited stress-buffering effect in preventing PSHC. This suggests that increased family support across time does not univocally explain the stable trend of PSHC. Therefore, future research should clarify the stress-buffering role of social support, and could explore other substantial stress-buffering factors in preventing PSHC. Changes in PSHC are not yet visible, but there are indications of increasing stressful school environments. Future research needs to follow adolescents for a longer period of time. Interventions are essential for assisting adolescents in managing school-related stress. In fact, it is even better to raise societal awareness and prevent adolescents from school-related stress. Otherwise, adolescent' psychosomatic health could be under pressure prospectively.

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Appendix 1 – Interdisciplinary approach

An interdisciplinary approach is preferred when investigating a topic because it promotes a comprehensive view rather than a specific view on a complex topic. A comprehensive model includes expertise of different disciplinary perspectives and is therefore essential to advance a better understanding of a complex problem.

In this study, the adolescents need to be viewed in the context of their interaction with family, school, friends or peers, i.e. micro-level. Therefore, the discipline of social psychology might be involved in this topic because the thoughts, feelings and behaviors of an individual can be influenced by the presence of others. It is important to distinguish whether adolescents perceive social support or feeling pressured by their social network to perform well at school. Schools are tightening up their criteria, which may contribute to more school-related stress and psychosomatic health complaints.

The family composition and the connections between family members are also interrelated with the individual, i.e. meso-level. Nowadays, a lot of families are incomplete (e.g. divorced parents, new family compositions, single mother or father). This might be associated with perceiving not enough family support; feeling pressured at school; as well as more psychosomatic health complaints because an incomplete family might have an emotional impact for adolescents. The role of media, which is part of the exo-system, might also be related to more stress and psychosomatic health complaints because smartphone use and social media may distract adolescents from their schoolwork. Therefore, the discipline of pedagogy might be involved as an approach to teach adolescents how to cope with school-related stress and other factors (e.g. incomplete families, social media) may improve stress, and in turn psychosomatic health complaints.

Finally, Western societies are becoming more competitive, materialistic and individualistic. Cultural values and beliefs about the so-called Dutch ‘performance society’ are more common among adolescents and adults, and therefore the discipline of sociology might be involved in this topic. People believe that a higher educational level is needed to achieve a good societal position and that might increase more pressure in school settings, which in turn might have consequences for adolescents’ psychosomatic health. Thus, this study would be at the intersection of the individual- (e.g. adolescent), family- (parents, brothers/sisters), school- (e.g. teachers and classmates) and friend- or peer context. Additionally, different disciplines are involved in this topic such as social psychology, pedagogics and sociology, which might indicate that an interdisciplinary approach will be used to advance a better understanding of a complex topic.

Appendix 2 – Contract data use

Utrecht, 2019

This letter constitutes formal confirmation of the fact that the data from the Utrecht University Master Youth Studies have been made available to Aniek van den Braak of Utrecht University.

These data will not be made available to others, and the data may be used only for analysis and reporting on topics for the thesis, about which agreement has been reached with Prof. Tom ter Bogt.

Aniek van den Braak will receive access to the data from the dataset in order to answer the following research questions within the framework of the thesis:

Research question:

This study will investigate whether school-related stress is associated with psychosomatic health problems, and to what extent social support buffer this relationship. Additionally, it is relevant to explore whether this relationship have changed over time between 2001 and 2017, and if gender differences do matter.

The following variables will be used:

Dependent variable: Psychosomatic health complaints (V57A-H)

Independent variables: School satisfaction (V69), school pressure (V70), and school performance (V71)

Other variables: Teacher support (V72D-F), friend support (V50A-D), family support (V47A-B), sex (V2), school level, birth year.

No report based on the data from the project entitled HBSC-study may be made public, unless permission has been obtained in advance from the Project Coordinator for the HBSC-study.

After the expiration of this contract, dated 1 August 2019, Aniek van den Braak shall delete the HBSC data.

Dates and signature: 27-01-2019

Name of student:	Name of Project Coordinator:
Aniek van den Braak	Prof. T. ter Bogt

Appendix 3

Table 6

Overview of hierarchical multiple regression analysis including unstandardized- (*B*), estimated standard deviation (SE B) and standardized (β regression coefficients to predict PSHC in 2013 (*N* = 5147).

2013	Model 1			Model 2			Model 3			Model 4		
	B	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β
Age	.04	.01	.07**	-.01	.01	-.01	-.02	.01	-.03	-.02	.01	-.03
Gender	.39	.02	.24**	.35	.02	.22**	.35	.02	.22**	.35	.02	.22**
Educational level	-.09	.02	-.05**	-.14	.02	-.09**	-.11	.02	-.07**	-.11	.02	-.07**
School satisfaction				-.16	.01	-.20**	-.11	.01	-.13**	.05	.03	.06
School pressure				.20	.01	.25**	.18	.01	.23**	.13	.03	.17**
Family support							-.17	.01	-.19**	-.16	.01	-.18**
Friend support							-.04	.01	-.04**	-.03	.01	-.04*
Teacher support							-.07	.01	-.08**	-.08	.01	-.09**
School satisfaction x family support										.00	.01	.01
School satisfaction x friend support										.02	.01	.03
School satisfaction x teacher support										-.01	.01	-.02
School satisfaction x gender										-.10	.02	-.20**
School pressure x family support										-.02	.01	-.03
School pressure x friend support										-.01	.01	-.02
School pressure x teacher support										.04	.01	.05**
School pressure x gender										.03	.02	.07
R^2		.068			.187			.238			.247	
F change		125.58**			375.41**			115.35**			7.47**	

Note.** p < .001, * p < .01

Appendix 4

Table 7

Overview of hierarchical multiple regression analysis including unstandardized- (*B*), estimated standard deviation (SE B) and standardized (β) regression coefficients to predict PSHC in 2017 (*N* = 7086).

2017	Model 1			Model 2			Model 3			Model 4		
	B	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β
Age	.03	.01	.08**	-.01	.01	-.02	-.02	.01	-.04**	-.02	.01	-.04**
Gender	.29	.02	.22**	.24	.02	.18**	.25	.01	.19**	.25	.01	.19**
Educational level	-.05	.02	-.03**	-.10	.02	-.08**	-.08	.01	-.06**	-.08	.01	-.06**
School satisfaction				-.14	.01	-.21**	-.10	.01	-.15**	.01	.02	.02
School pressure				.19	.01	.28**	.17	.01	.25**	.05	.02	.08
Family support							-.13	.01	-.18**	-.13	.01	-.17**
Friend support							-.03	.01	-.04**	-.03	.01	-.04**
Teacher support							-.06	.01	-.08**	-.06	.01	-.08**
School satisfaction x family support										.01	.01	.01
School satisfaction x friend support										.01	.01	.02
School satisfaction x teacher support										-.00	.01	-.01
School satisfaction x gender										-.08	.02	-.18**
School pressure x family support										-.02	.01	-.03
School pressure x friend support										-.00	.01	-.01
School pressure x teacher support										.01	.01	.02
School pressure x gender										.07	.02	.18**
R^2		.054			.197			.245			.253	
F change		135.13**			629.38**			152.25**			10.88**	

Note.** p < .001, * p < .01