Scientific Report

PROCESSES THAT BUFFER AGAINST YOUTH MENTAL HEALTH PROBLEMS: A LONGITUDINAL-EXPERIMENTAL APPROACH

ÖREBRO UNIVERSITY
SCHOOL OF LAW, PSYCHOLOGY AND SOCIAL WORK

"Processes that buffer against youth mental health problems: a longitudinal-experimental approach" ("Three Cities Study"/ "Trestadsstudien") is a research program that stretched across seven years (2012 to 2018) and was co-financed by the Research Council for Working Life and Social Sciences (Forte), Formas, the Swedish Research Council (VR) and VINNOVA. The purpose of the project was to identify the contributing factors and buffers that are common to various mental health problems among adolescents.

The project started as a collaboration between two research groups in psychology: Center for Developmental Research, CDR, and Center for Health and Medical Psychology, CHAMP, both at Örebro University, combining the strengths of expertise on developmental longitudinal cohort research with expertise on theoretical mechanisms for mental health problems and intervention research from clinical psychology.

Main persons involved in the project were:

The project was led by Katja Boersma, Professor of Psychology at Örebro University. The senior management group included Professor Lauree Tilton Weaver (Developmental Psychology, Örebro University), Professor Steven Linton (Clinical Psychology, Örebro University), Professor Maria Tillfors (Clinical and Developmental Psychology, Karlstad University), Professor Maarten van Zalk (Developmental Psychology, Osnabruck University, Germany), Professor Jeff Hearn (Sociology, Örebro University), and Associate Professor Thomas Strandberg (Social Work, Örebro University). The project also included historian Anna-Karin Larsson, PhD, senior researcher Ylva Svensson, PhD, post-doctoral researcher Kelly Mazzer, PhD, doctoral students Malin Anniko (PhD 2018) and Serena Bauducco (PhD 2017), project secretaries, project assistants, test leaders as well as a number of national and international collaborators.

TABLE OF CONTENTS

Background

Despite decades of research on the development of youth mental health problems, systematic knowledge is lacking in two areas, and this prohibits us from developing effective interventions. One is the high comorbidity among different problems, which suggests that they might have the same root causes. The other is buffering effects, or factors that might offset problem development. Knowledge in these two areas would suggest how interventions could be best targeted to have the greatest effects.

Theoretical starting point: The transdiagnostic perspective

The transdiagnostic perspective on mental health problems is a relatively new approach that was developed to explain the high comorbidity of problems (Harvey et al., 2004). Comorbidity refers to the phenomenon that people diagnosed with one condition are likely to have other diagnoses, and comorbidity of problems is the rule rather than the exception. The main idea of the transdiagnostic perspective is that different mental health problems are caused and maintained by similar factors (Ehring et al., 2008; Harvey et al., 2004). In research to date, the transdiagnostic perspective has proven useful for understanding factors that maintain various internalizing and externalizing disorders but another important question is whether these different problems share common developmental processes. In this research program, we therefore extend the transdiagnostic reasoning from maintaining factors to initial causes. We define a "transdiagnostic risk factor" as any factor involved in the development or maintenance of multiple mental health problems.

The transdiagnostic perspective can also be relevant to understanding buffering processes. It suggests that if there are processes underlying the development of multiple (comorbid) mental health problems, then there should also be processes that can buffer against multiple problems. If transdiagnostic buffering effects can be identified, they could be used as a basis for interventions that would prevent a variety of problems.

Specific Objectives

In the Three Cities Study program, the aim is to identify the contributing factors and buffers that are common to various mental health problems among adolescents. The theoretical point of departure is that the mechanisms underlying the comorbidity of

problems provide a key to being able to intervene in ways that will have the maximum effects. Influencing these factors may provide buffering effects on multiple mental health problems at once, also called transdiagnostic buffering effects. The focus is on four risk factors in adolescent experience for which research evidence suggests transdiagnostic effects - poor sleep, stress, harsh parenting, and peer harassment.

1. Stress and 2. Sleep. The lifestyle of youth has changed dramatically over the past 25 years and has a suspected impact on sleeping patterns and exposure to stress. Major changes have been observed for physical activity, the use of electronic devices e.g. computers and phones and there is concern that modern technology is resulting in media overload and multitasking since they are available 24 hours, seven days a week. These changes may directly influence sleep and stress. Both sleep (Harvey, 2008) and stress are transdiagnostic factors since they both impact on future health (Dahl & Gunnar, 2009). Furthermore, sleep and stress are related so that poor sleep is a stressor and the experience of stress is the main cause of sleep problems reported by poor sleepers (Jansson & Linton, 2006; MacDonald, 2011). Sleep and stress also share a basic link to emotion regulation and several personal and interpersonal factors at home, at school, and in the peer contexts (Dahl & Lewin, 2002). To investigate whether good sleep and low stress buffer against mental health problems and are not simply a consequence of them, the longitudinal study design will enable the determination of the direction of factors over time. The study also includes data from a number of contexts, including social development with peers and relations to parents, to better understand which factors work as buffers. The longitudinal study features measures of mental and somatic health as well as lifestyle factors, so the interplay between these factors can also be studied. Because emotion regulation is a mechanism by which sleep may impact on mental health and which is associated with psychological problems, a range of cognitive and behavioral emotion regulation measures are included. By utilizing the information about peers, the interaction with social relationships may be illuminated.

3. Harsh parenting. The data from the longitudinal study includes information on parenting from both the adolescent and the parent perspective. This allows testing of a model in which harsh parenting results in increased emotion dysregulation, potentially leading to various types of externalizing and internalizing mental health problems (i.e., has transdiagnostic effects). Potential buffering effects of supportive peer relationships; good relationships with teachers; and mastery experiences in school and activities can also be assessed. Because the longitudinal data contains comprehensive measures of parenting,

adolescent adjustment, and peer relationships from both individuals' and peers' perspectives, the data allows analyses that provide a thorough understanding of these processes.

4. Peer harassment. The longitudinal data from this program includes measurement of several aspects of peer harassment, such as bullying and intolerance. This allows for example an examination intolerance as a precipitating factor for peer harassment. This also enables the examination of peer influence on youths' intolerance and harassment and the testing of hypotheses about various buffering effects as well as to what extent personal and ethnic peer harassment predicts increased mental health problems over time.

The specific objectives of the program are:

1. To study transdiagnostic risk factors- and protective factors for the development of comorbid problems.
2. To study the role of emotion regulation mechanisms in the development of comorbid problems.
3. To test ways of intervening to reduce problem development.

Methods

The core of the Three Cities Study is a five-year longitudinal study conducted in three communities in central Sweden (Örebro, Karlskoga and Köping). All 7th and 8th graders (13 and 14 year olds) attending public lower secondary schools (N=18) in these communities in the spring of 2014 were targeted. Adolescents were recruited in the school context and assessed yearly, in class, using a comprehensive survey battery. In the follow up years, all new students in the targeted classes were also invited to partake in the study. Active consent from students and passive consent from parents was sought. Before the study started, parents received a letter with information about the study and could return a prepaid envelope with a form stating that they did not want their child to participate. Not returning this form was consequently interpreted as consent (i.e. passive consent). This procedure for obtaining consent is frequently used in developmental studies to increase participation and reduce sampling bias (Pokorny et al., 2001; Shaw et al., 2015). Each year, this procedure was repeated for new participants who were under the age of 18. Adolescents themselves gave their active consent by filling out the questionnaire after being fully briefed on the study's purpose and procedure and after being informed that participation was voluntary. Research secretaries and trained test leaders visited schools once per year from 2014, during the spring term, to invite adolescents to complete the questionnaire onsite during school hours. Test leaders supervised the process allowing students 90 minutes to complete the questionnaires and distributing snacks for each participant during data collection. In addition, each class received 300 Swedish crowns in recognition of participation. By collecting data from adolescents in schools, a largely representative sample of adolescents was obtained, with the exception of young people who do not speak Swedish, or have other difficulties with understanding written language. The study was approved by the regional ethics board of Uppsala (dnr. 2013/384). All data collection was carried out in accordance with the ethical principles of the Declaration of Helsinki.

In addition, primary caregivers to the adolescents participating in the longitudinal study were assessed with a survey, sent to the home address, in the fall of 2015 and 2016. Parent assessment was used as a complement to adolescent reports as well as to identify participants for the parenting intervention. This part of the study was approved by the regional ethics board of Uppsala (dnr. 2015/311).
During the second and third year (2015 and 2016) an embedded experimental intervention took place (targeting stress). Experimental interventions targeting peer

harassment and sleep, not imbedded in the longitudinal design, complemented the program. Procedures of these interventions are described in their respective result sections in this report.

Response rates

Wave 1, 2014	Wave 2, 2015	Wave 3, 2016	Wave 4, 2017	Wave 5, 2018
7, 8th grade lower secondary school	8, 9th grade lower secondary school	9 th grade, 1 st year upper secondary school	1st, 2nd year upper secondary school	2 nd, 3rd year upper secondary school
N: 2,767 (target 3,336)	N: 2,961 (target 3,352)	N: 3,022 (target 4,038)	N: 3,258 (target 4,049)	N: 3,069 (target 3,782)
		Parents N: 871 (target 2, 887)	Parents N: 575	

Table 1. Cross sectional response rates.

Table 1 displays the cross-sectional response rates across waves 1 to 5. In total N=8,080 adolescents participated in the data collection. As can be seen, yearly response rates varied between 75%-88%. The parental response rate was 30% with a retention rate of 66%. Table 2 presents specific retention rates across the waves.

Wave 1-2 N=2522 (91%)
Wave 1-2-3 N=1892 (68%)
Wave 1-2-3-4 N=1382 (50%)
Wave 1-2-3-4-5 N=1131 (41%)

Table 2. Retention of participants across the waves.

The retention rate from wave 1 to wave 5 (with presence of at least three data points) was N=1564 (57%; 50% girls, 15% immigrant background). None responder analysis according to this definition showed that drop outs were more likely to be boys (χ^2 (1)=12.02, p=.001), non-immigrants (χ^2 (1)= 33.01, p<.001), with slightly higher levels of anxiety (t(2716)=2.3, p=.02) and depression (t(2667)=2.9, p=.004) and higher reported stressor loads in social domains (peers t(2715)=2.8, p=.006 ; romantic relations t(2664)=6.5, p<.001 ; teachers t(2708)=3.4, p=.001) and stress related to school attendance (t(2721)=3.5, p<.001).

Measures

The following measures and variables are included in the adolescent longitudinal study.

The Adolescent Sleep Hygiene Scale (ASHS, W1-4); the Insomnia Severity Index (ISI, W1-5); the School Sleep Habits Survey (SSHS, W1-4); the Adolescent Stress Questionnaire (ASQ, W1-5); the Perceived Stress Scale (PSS, W1-5); the Health Behavior in School-Aged Children symptom checklist (HBSC, W1-5); the Social Phobia Screening Questionnaire for Children (SPSQ-C, W1-5); the Overall Anxiety Severity and Impairment Scale (OASIS, W1-5); the Overall Anger Severity and Impairment Scale (A-OASIS W1, 4, 5); the Penn State Worry Questionnaire (PSWQ, W1-4); the Children's Response Styles Scale (CRSS-rumination subscale, W1-4); the Co-Rumination Questionnaire (short version, W1-4); the Emotion Regulation Questionnaire for children and adolescents (ERQ suppression subscale, W1-4); the Cognitive-Behavioral Avoidance Scale (CBAS, social avoidance subscale, W1-4); Rosenberg Self Esteem Scale (W1); Deliberate Self-harm Inventory (W1-5); Youth Psychopathic traits Inventory (YPI, W1-4); Epidemiological Studies Depression Scale for Children (CES-DC, W1-5); the Short-Personal Experiences Checklist (PECK, W1-4); the Inventory of Parent and Peer Attachment-revised (IPPA-R, W2-4); Dependency Oriented and Achievement Oriented Psychological Control scale (DAPCS dependency oriented subscale, W2-4); Alabama Parenting Questionnaire (APA-inconsistent discipline subscale, W2-4); questions on different sociodemographic features of the youths and their families (W1-5), media habits (W1-4), physical activity (, pain and pain related function (W1-5), health care seeking (W3-5), medication use (W4, 5), delinquency/normbreaking (W1-5), drinking (W1-5), loitering (W1-5), intercourse (W1-5), skipping school (W1-5), failure expectations (W1-4), friendship nominations (W1-5), friendship quality (W1-5), class climate (W1-4), bullying (W1-4), experience of violence (victim and perpetrator perspective, W1-4)), tolerance (W1-4), impulsivity/urgency (W1-4), anger dysregulation (W1-4), parents' attempted understanding (W1), parental warmth (wave 1), parental attachment/connectedness (wave 1), parents bad reactions to disclosure, coldness/rejection (W1), Self compassion scale (W5), concentration difficulties (ACS, W5), "gymnasieenkäten" IDA (W5), "livsmålsenkäten" IDA (W5), weight & height (W5), content with body (W5 only), body appreciation scale (BAS; W5), body dysmorphic disorder questionnaire (BDDQ; W5), experience of being/ identifying as trans (W5 only), gender non binary (W5) .

A historical outlook on mental health

Mental health issues in young people have been a growing concern in most western countries since the 1990s (Socialstyrelsen 2017; Skolbarns hälsovanor 2013/14). The historical outlook subproject within the Three Cities Study combines expertise from history and psychology and includes two studies:

1. A study of the medical discourse in the Swedish medical journal "Läkartidningen" over the last 40 years, from 1970 to 2017.
2. An empirical comparison of mental health and adaptation self-report data from uppers secondary school students in the 1970s and 2018.

How do professional discussions on youth mental health in the 1970s and 1990s compare to today?

Background

This study is contextualized in the changing conditions of the welfare state in the late 20th century, in a society with new social, political and economic conditions for schools and school health care; an emerging child and youth health care, a more individualized society with increased income differences and rising social inequality (Fritzell, Gähler & Nermo 2007). Previous research has shown an increased awareness during this period of mental illness among young people, but also a rise in the number of girls and boys who feel distressed and who exhibit symptoms within the framework of mental illness (de Looze, Huijts, Stevens, Torsheim, & Vollebergh, 2017). Longitudinal studies have, for example, shown both changes and stability in psychosocial well-being, relationships and health, but also an increase in young people's actual psychological ill-health during the late 1900s. It has been found that ill health and it's prevalence are complex and there are often multiple factors that interact (de Looze et al 2017; Hagquist 2010; Wångby, Magnusson & Stattin 2005). Research has also shown an overrepresentation of girls who feel distressed as compared to boys. It has also been described that interpretations, perceptions and expressions of ill health are closely related to constructions of gender, that is, to notions of female and male (Wiklund, Danielsson, Strömbäck & Bengs 2015).

Comparing the incidence of ill health and morbidity over time is problematic and in some cases even impossible, as definitions, categorizations, diagnoses and expressions of ill

health change over time (Johannisson 1994; Frih 2007). Nevertheless, time trends are relevant to study since conceptualizations and problems associated with mental illness in young people change and reveal thoughts, patterns and beliefs in their time. With the help of history, we can gain an increased understanding of how the view and knowledge of young people's mental health has developed over the past 40 years and how and why different health issues are highlighted at different times.

This study examines how mental illness has been explained over time, whether the issues raised and the explanations have changed, and how girl's and boy's ill health are presented in articles in the Swedish Medical Journal ("Läkartidningen"). The medical discourse in children's and young people's mental health during the 1970s, 1990s and 2000s was investigated based on all articles addressing mental, psychological and psychosocial problems in young people.

Source

Läkartidningen (Swedish Medical Journal) 1970-79; 1990-99; 2010-17.

Summary and interpretation of results

The picture that emerges is characterized by a consistent view of an ongoing increase in mental illness and psychosocial problems, and higher rates of psychosomatic problems for girls. The continuity of the medical discourse in the perception of an increase in mental ill health and higher ill health among girls coincides well with other discourses in the media and public reports and publications between the 1980s and the 2000s (Beckman & Hagquist 2010). The explanation for the increase and how it can be stopped and reversed, however, changes. If the 1970s was a build-up phase of knowledge and organization around the mental health of children and young people, the 1990s was seen as a time of cuts and deterioration. The depiction in the medical journal goes from optimism and belief in increased resources to a gloomy depiction of the situation with cuts and dismantling of welfare.

In the 1970s, and to some extent in the 1990s, there was still an expression of faith in improved structures and more resources for school health, child and adolescent psychiatry. Later, during the 2010s, the need for other changes, such as social habits and lifestyle, is more clearly expressed.

The fragile girl who internalises the ill health is present in the discourse all through the period, as is the outgoing boy whose psychosomatic symptoms are externalizing. Constructions of girls as vulnerable and fragile are also common in history (Gonick 2006; Frih 2007; Wiklund et.al 2015). In the Swedish medical journal, girls are described as being depressed, harming themselves or suffering from headaches, while boys are acting out, getting involved in drinking or criminal behaviour. However, the health problems that are addressed in the journal and the explanations for them change. In the 1970s there is a notion that girls are more fragile than boys and, for these, biological explanations are used. The social circumstances, societal concerns, mobility and other developments in society are seen to affect the boys' health more and are expressed in the form of externalizing destructive and outgoing behaviour. The group of children and young people discussed is still relatively homogeneous. In the 1990s and the 2010s, however, social conditions or circumstances are more often used as explanations for both girls and boys mental health problems.

From the 1990s the discussion becomes increasingly heterogeneous with different health problems, symptoms, expressions and needs. The development of society, a reduction in predictability, cuts in welfare and a greater responsibility on the individual to succeed with education and working life, as well as an understanding of unequal conditions, are used as explanations for both sexes in terms of increasing mental, psychosomatic and social ill-health. While the difference in ill health between the sexes is rarely mentioned in the 1970s, it is present in almost all texts in the 1990s and 2010s. In the early articles, authors are describing how *teenagers*' mental health problems are increasing, but texts from the later decades are concerned that *girls*' mental health problems are increasing. Hence, a greater gender awareness can be traced. This difference in focus reflects not only a supposedly increase in ill health among girls, but also an increased awareness of gender perspective in research and a social debate with elements of gender analysis.

Another change over time is the emergence of new diagnoses, behaviours and symptoms described. While the problems during the 1970s are described in the form of depression, headache, and self-destructive behaviour, from the 1990s onwards stress-related problems with psychosomatic expressions are observed and described to a greater extent. There is an obvious change in the new attention given to the importance of life style habits for psychosocial problems and mental health. Sedentary behaviour, eating habits and television/computer gaming also reveal a development and change of youth's leisure habits. Boys are no longer only described as disturbing elements in the public space. They have moved into the home, become sedentary and now constitute an "invisible risk group" together with the girls who are not seen or heard when they feel bad.

Time trends in upper secondary school youth's self-reported mental health and adaptation in Örebro – How does 1973/74 compare to 2018?

Background

Mental health complaints among youth in Sweden have increased in the past decades (e.g. National Board of Health and Welfare, 2017). Suggested factors influencing this development are changes in youth's social context, particularly school, as well as larger societal factors, such as labor market changes and individualization. These factors can be hypothesized to directly (e.g. through increased school demands) or indirectly (e.g. via influencing perceptions of current and future prospects and control) influence mental health. Comparison of youth's perceptions of their health and living conditions with other time periods in the last century could increase our understanding of how the current trend could be interpreted. Using unique data from the Individual Development and Adaptation program (IDA; Örebro University, 2017) and the Three Cities Study, the purpose of this analysis was to compare health complaints, as well as perceptions of school, current life situation and future among youths who attended higher secondary school grade 2 and 3 in Örebro 1973/74 and respectively in 2018.

Method

Design

A cross sectional study comparing cohort data from 1973/74 and 2018. Data was collected in the context of the IDA research program (Individual Development and Adaptation) and the Three Cities Study (Örebro University, 2017b).

Participants

The 1973/74 cohort included higher secondary school year 2 and 3 in Örebro (N=523; 47% girls; age M=18.4, SD=0.5). Data from 2018 included youth in higher secondary school year 2 and 3 in Örebro, Karlskoga and Köping (N=3035; 51% girls; age M=17.8, SD=0.8). Both cohorts filled out "*Gymnasieenkäten*" ("higher secondary school survey", see appendix 1 for specific items). *Gymnasieenkäten* was originally designed to be used within the IDA program with the aim of "highlighting how students who have gone through the higher secondary school judge, among other things, the school, their current situation and the future" (Samrén, 1975, p. 1). The questionnaire consists originally of 28 questions of which 26 are used in this study (items on headache and stomachache were left out due to overlap with other items in the 2018 questionnaire battery).

Statistics

Differences between cohorts were analyzed using t-test and ANCOVA. First, factor analysis was conducted, to reduce the number of items. This process revealed three factors with acceptable internal consistency: *"Distress symptoms"* (alpha = .76; items "Does it happen that you have trouble sleeping or do you sleep uneasy"?, "Does it happen that you feel anxious and worried, without any direct reason"? and "Does it happen that you feel tired and without energy"?): "*Dejection toward current and future life"* (alpha = .64; items "Does it happen that you feel annoyed and uneasy about starting a new workday/school day?", "Does it happen that you become discouraged when you think about the future?" and "Would you like life to be less monotonous?") and *"Perceptions of freedom and choice in leisure time and at home"* (alpha = .62; items "Do you think you get enough out of your leisure time"?, "How much freedom do you think you have to decide about your life: at home"? and

"How much freedom do you think you have to make decisions about your leisure time"?). All other items did not distinctly load into identifiable factors and were therefore analyzed individually. Bonferoni corrections, setting the p value at <.003, were used to reduce risks for type 1 error. Cohen's d was calculated to estimate the effect size of the differences. Effect sizes of 0.2–0.5 were considered small, 0.5–0.8 moderate and ≥0.8 large.

Results

Table 1 gives an overview of means and standard deviations on scales and items where no significant interaction between cohort and gender was found, meaning that results are summarized for each cohort as a whole, and apply to both boys and girls. As can be seen, several significant differences between the cohorts were found. The 2018-cohort rated significantly more distress symptoms, less dejection toward their current and future life and perceived to have less freedom and choice to decide over their lives. There was no difference between the cohorts in how relations with parents and peers were judged, or the degree of confidence adolescents had in their ability to behave in ways that promote good mood and satisfaction. When it comes to school there was no difference between cohorts in how meaningful school was considered; however, the 2018-cohort, judged school as harder work than the 1973/74 cohort, regretted their decision on choice of gymnasium orientation to a higher degree, judged themselves as more gifted compared to their peers to a higher degree and considered to have received too high a grade to a lesser extent than the 1973/74 cohort.

Table 1. Means and standard deviation for scales and items without significant interactions cohort x gender	Cohort	M (SD)	Effect size
Distress symptoms *1=Often - 4=Never*	2018-cohort	2.39 (.80)**	*d*=.36
	1973/74-cohort	2.67 (.64)	
Dejection toward current and future life *1=Often – 4=Never* #	2018-cohort	2.30 (.55)**	*d*=.11
	1973/74-cohort	2.24 (.48)	
Perceptions of freedom and choice *1=A lot – 5=Very little* #	2018-cohort	1.88 (.72)**	*d*=.15
	1973/74-cohort	1.77 (.63)	
Do you think it is hard work at school? *1=almost never - 5=almost always*	2018-cohort	3.25 (1.2)**	*d*=.44
	1973/74-cohort	2.74 (1.0)	
How have you and your parents understood one another during school years? *1=very good - 5=very bad*	2018-cohort	1.99 (1.0) *ns*	
	1973/74-cohort	1.86 (.87)	
How have you and your peers understood one another during school years? *1=very good - 5=very bad*	2018-cohort	1.72 (.81) *ns*	
	1973/74-cohort	1.66 (.70)	
Have you ever thought that school was meaningless? *1=Yes, very often - 5=No, never*	2018-cohort	2.71 (1.1) *ns*	
	1973/74-cohort	2.75 (1.2)	
Would you make the same decision, if you could redo your choice of gymnasium orientation? *1=Yes, absolutely - 5=No, absolutely not*	2018-cohort	2.43 (1.2)*	*d*=.08
	1973/74-cohort	2.25 (1.3)	
How study gifted do you think you are compared to your classmates? *1=Less gifted - 5=More gifted*	2018-cohort	3.3 (1.1)**	*d*=.19
	1973/74-cohort	3.14 (.64)	
Do you think you can act in ways that gives you a good mood and general satisfaction? *1=Yes, most of the time - 4=No, almost never*	2018-cohort	2.0 (.74) *ns*	
	1973/74-cohort	2.04 (.70)	
How much freedom do you think you have to decide about your life: at school? *1=A lot - 5=Very little*	2018-cohort	2.55 (1.1)**	*d*=.15
	1973/74 cohort	3.13 (1.1)	
In how many subjects do you think you have received too high a grade, given your knowledge? *1=No subject - 5=Most subjects*	2018-cohort	1.61 (1.0)**	*d*=.19
	1973/74-cohort	1.43 (.66)	

 # = exact wording varies somewhat for each item included in the scale.

On seven of the items significant interactions were found between cohort and gender, signaling that differences between cohorts depended on gender. To visualize these differences, these items are displayed as figures below.

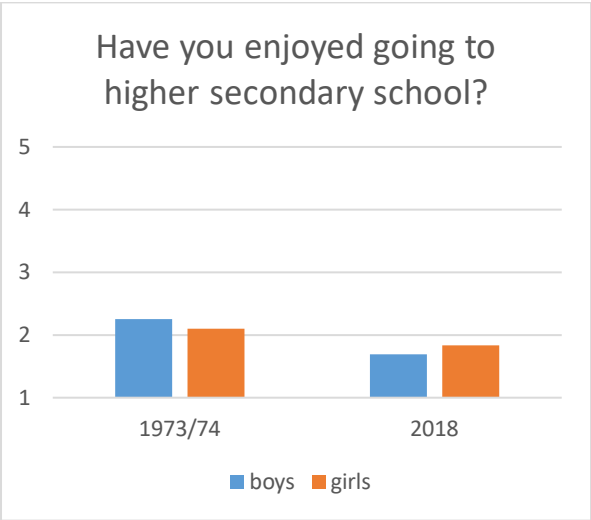


Figure 1. 1= Almost always – 5=Almost never

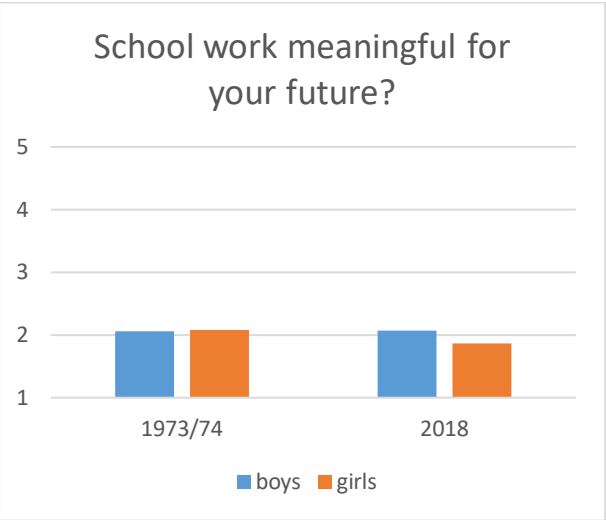


Figure 2. 1=Yes, absolutely – 5=No, absolutely not

As can be seen in figure 1, the 2018-cohort rated that they enjoyed higher secondary school to a higher degree than the 1973/74 cohort. Differences between cohorts was larger for boys (*d*=.62) than for girls (*d*=.30), meaning that time trends for increased satisfaction with higher secondary school was more pronounced for boys (moderate effect size) than for girls (small effects size). Perception of whether youths considered schoolwork meaningful for their future showed no difference between the cohorts for boys, but girls in the 2018-cohort rated school as more meaningful for their future than their 1973/74 counterparts (*d*=.22; figure 2).

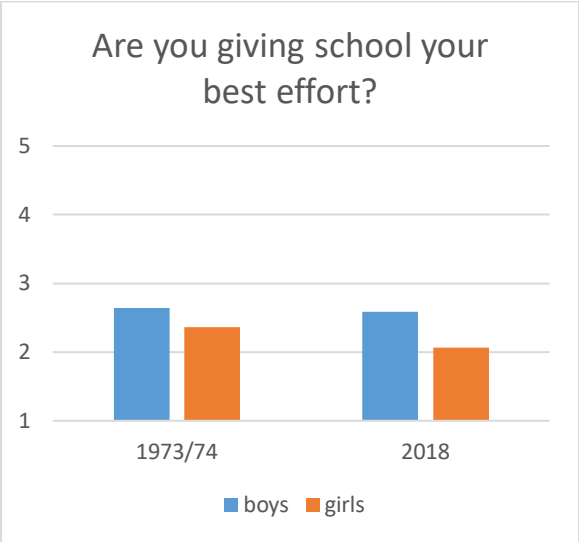


Figure 3.

1= Yes, a lot – 5=Very little

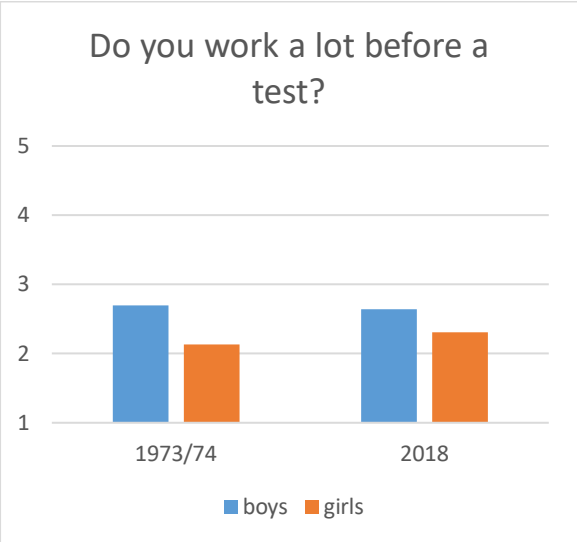
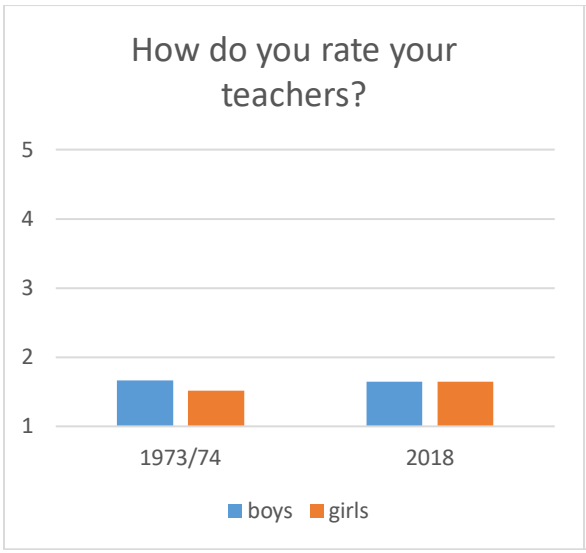


Figure 4. 1= Almost always – 5=Almost never

While girls in the 2018-cohort to a higher degree than girls in the 1973/74 cohort rated that they gave school their best effort (*d*=0.31; figure 3), the opposite was true for self-rated efforts put into studying for tests (*d*=.16; figure 4). Girls in the 1973/74 cohort rated putting more work into preparation for a test than their 2018 counterparts. On both these aspects there were no significant cohort differences between boys.



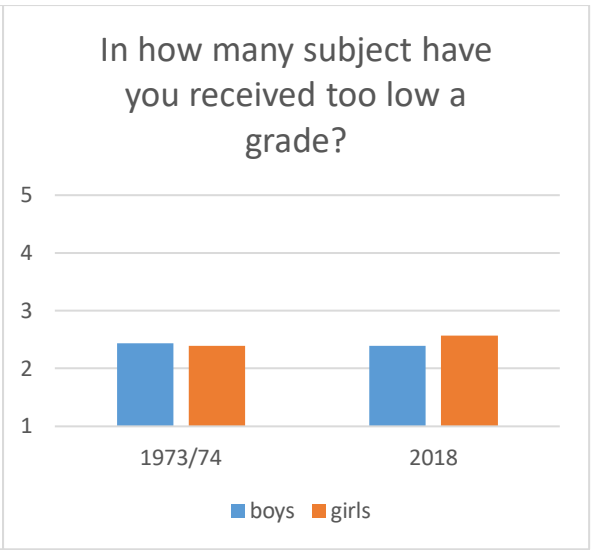
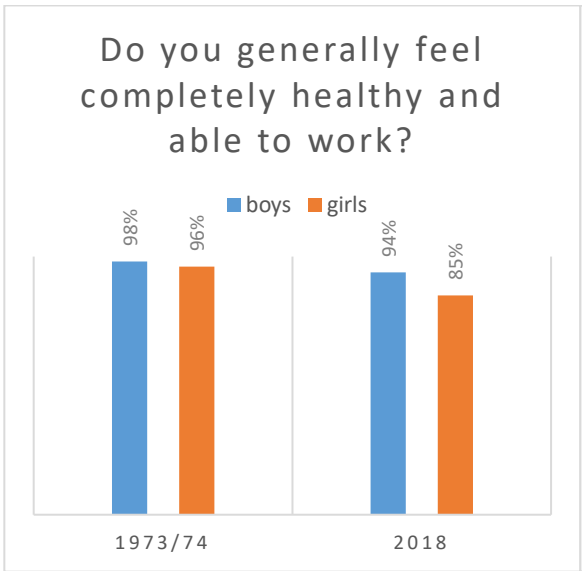


Figure 5. 1= Most were good – 4=None were good *Figure 6. 1=No subject - 5=Most subjects*

Girls in the 1973/74 cohort rated their teachers slightly more positive (*d*=.18; figure 5), and perceived to a lesser extent than girls in the 2018-cohort that they had received too low grades t (*d*=.24; figure 6). Again, there were no differences between boys in the two cohorts.



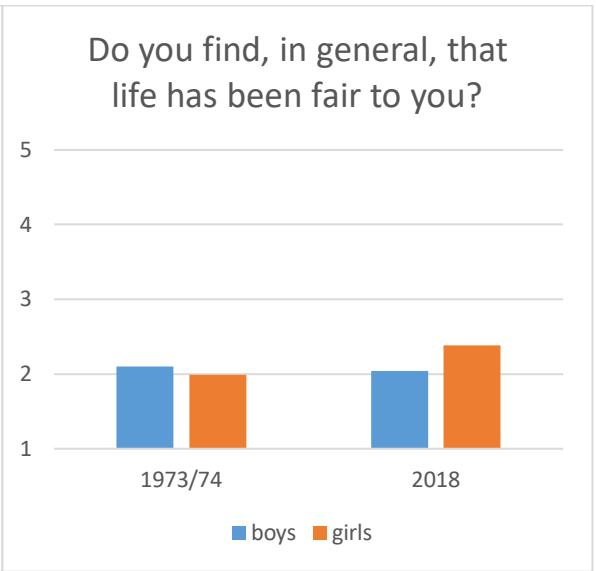


Figure 7. %Yes *Figure 8. 1=Yes, absolutely - 5=No, absolutely not*

Gender differences in self-ratings of general health and work ability were more pronounced in the 2018-cohort. Girls in the 2018-cohort rated their own health and workability as significantly lower compared to girls in the 1973/74-cohort.
There was a difference between boys in the two cohorts as well, but much less pronounced. Lastly, girls in the 2018-cohort perceived to a lesser degree than boys and girls in the 1973/74 cohort and boys in 2018-cohort, that life has been fair to them (*d*=.35; figure 8).

Conclusions

The medical discourse in the journal "Läkartidningen" showed a consistent view of an ongoing increase in mental illness and psychosocial problems. From the 1990s, stress-related problems with psychosomatic expressions were described to a greater extent. There was an increase in the attention given to the importance of life style habits. Moreover, while the difference in ill health between the sexes was rarely mentioned in the 1970s, it is present in almost all texts in the 1990s and 2010s.
The results of the time trends analysis indicate both general and gender specific differences between how youth in 1973/74 and 2018 rate their health and their living conditions. Most differences are small to very small. Lifting only small effects and above (e.g. Cohens *d*>.20), results can be interpreted as follows. Compared to youth in 1973/74, today's youth rate higher levels of psychological and somatic distress symptoms and consider school harder work. However, they also seem to enjoy school more, especially boys. Some consistent gender differences appear in judgement of school-related aspects. Compared to girls in 1973/74 but also today's boys, today's girls judge that schoolwork to a higher degree is meaningful for their future, and they put more effort into maximizing its output. However, they also perceive more often that they don't get the grades they deserve and that life does not treat them fairly. Lastly, while there is decreasing time trend in the proportion of boys who rate themselves as fully healthy and able to work, the time trend for girls is much more pronounced, with the proportion of girls not rating themselves as fully health and able to work increasing from 4% in the 1970s to 15% in 2018.
While these results should be interpreted with caution due to methodological limitations, they are in line with the literature and suggest that negative time trends in health and perceptions of living conditions in youth need to be understood in relation to changes in social and cultural context, not in the least including a clear gender perspective.

Appendix 1

Dessa frågorna handlar om skoltiden och framtidstro. Kryssa i den rutan som stämmer bäst överens med dig.					
Har Du trivts med att gå i gymnasieskolan?	Nästan alltid ☐	För det mesta ☐	Ibland ☐	Sällan ☐	Nästan aldrig ☐
Tycker Du att skolarbetet i stort sett är meningsfullt för DIN framtid	Ja, absolut ☐	Ja, kanske ☐	Vet ej ☐	Nej, knappast ☐	Nej, absolut inte ☐
Tycker Du det är arbetsamt i skolan?	Nästan aldrig ☐	Någon gång ☐	Ganska ofta ☐	Ofta ☐	Nästan alltid ☐
Arbetar Du mycket strax före en skrivning (ett prov)?	Nästan alltid ☐	För det mesta ☐	Ibland ☐	Sällan ☐	Nästan aldrig ☐
Anstränger Du Dig för att det skall gå så bra som möjligt i skolan?	Ja, mycket ☐	Ja, ganska mycket ☐	Varken mycket eller litet ☐	Ganska litet ☐	Mycket litet ☐
Hur har Du och Dina föräldrar förstått varandra under skoltiden?	Mycket bra ☐	Ganska bra ☐	Varken bra eller dåligt ☐	Ganska dåligt ☐	Mycket dåligt ☐
Hur har Du och Dina kamrater förstått varandra under skoltiden?	Mycket bra ☐	Ganska bra ☐	Varken bra eller dåligt ☐	Ganska dåligt ☐	Mycket dåligt ☐
Har Du någon gång under skoltiden tyckt att allt som har med skolan att göra har varit meningslöst?	Ja, mycket ofta ☐	Ja, ibland ☐	Tveksam ☐	Nej, sällan ☐	Nej, aldrig ☐
Skulle Du välja på samma sätt, om Du fick göra om Dina linjeval under skoltiden?	Ja, absolut ☐	Ja, kanske ☐	Tveksamt ☐	Nej, antagligen inte ☐	Nej, absolut inte ☐
I hur många ämnen tycker Du att Du fått för lågt betyg med tanke på Dina kunskaper?	I inget ämne ☐	I ett ämne ☐	I några ämnen ☐	I ungefär hälften av ämnena ☐	I de flesta ämnena ☐
I hur många ämnen tycker Du att Du fått för högt betyg med tanke på Dina kunskaper?	I inget ämne ☐	I ett ämne ☐	I några ämnen ☐	I ungefär hälften av ämnena ☐	I de flesta ämnena ☐
Tycker Du att Du får ut tillräckligt mycket av Din fritid?	Ja, absolut ☐	Ja, kanske ☐	Tveksamt ☐	Nej, antagligen inte ☐	Nej, absolut inte ☐
Tycker Du i stort sett att livet varit rättvist mot Dig?	Ja, absolut ☐	Ja, kanske ☐	Tveksamt ☐	Nej, antagligen inte ☐	Nej, absolut inte ☐

Hur studiebegåvad tror Du att Du är?

☐ Mindre begåvad än de flesta klasskamraterna

☐ Kanske något mindre begåvad än de flesta klasskamraterna

☐ Ungefär lika studiebegåvad som de flesta klasskamraterna

☐ Kanske något mer studiebegåvad än de flesta klasskamraterna

☐ Mer studiebegåvad än de flesta klasskamraterna

Känner Du Dig i allmänhet helt frisk och arbetsför?	Ja ☐	Nej ☐			
Händer det att Du har svårt att somna eller sover Du oroligt?	Ofta ☐	Ibland ☐	Sällan ☐	Aldrig ☐	
Händer det att Du är ängslig och orolig, utan att det finns någon direkt anledning?	Ofta ☐	Ibland ☐	Sällan ☐	Aldrig ☐	
Händer det att Du känner Dig trött och hängig?	Ofta ☐	Ibland ☐	Sällan ☐	Aldrig ☐	
Händer det att Du känner Dig irriterad och olustig över att behöva börja en ny arbetsdag/skoldag?	Ofta ☐	Ibland ☐	Sällan ☐	Aldrig ☐	
Tycker Du att Du kan företa Dig just sådant som ger Dig gott humör och allmän tillfredsställelse?	Ja, det tycker jag för det mesta ☐	Ja, så tycker jag rätt ofta ☐	Nej, så tycker jag mer sällan ☐	Nej, så tycker jag nästan aldrig ☐	
Händer det att Du blir missmodig när Du tänker på framtiden?	Ja, mycket ofta ☐	Ja, rätt ofta ☐	Nej, mer sällan ☐	Nej, nästan aldrig ☐	
Skulle Du vilja att livet vore mindre enformigt?	Ja, mycket gärna ☐	Ja, ganska gärna ☐	Nej, inte särskilt gärna ☐	Nej absolut inte ☐	
Om Du ser tillbaka på Din skoltid, hur tycker Du att Dina lärare varit?	De flesta har varit bra ☐	Några har varit bra ☐	Någon enstaka har varit bra ☐	Ingen har varit bra ☐	
Hur mycket frihet tycker Du att Du har att bestämma över Ditt liv?	Mycket	Ganska mycket	Varken mycket eller litet	Ganska litet	Mycket litet
I skolan	☐	☐	☐	☐	☐
Hemma	☐	☐	☐	☐	☐
På fritiden	☐	☐	☐	☐	☐

Descriptives

1. Sources of stress in adolescence

Adolescence is marked by a variety of new situations and challenges to be handled in both the family, school and peer context, leading to a potential increase in stressor load. Although part of normal development, this also is a period where many of the most common mental health problems such as anxiety and mood disorders have their onset. The relationship between an increased stressor load and the development of mental health problems is well documented. However to fully understand the impact of stressors over the adolescent period, we need to know more about to what adolescent ascribe their stress and whether this changes across development. For example, it might be that specific sources of stress (e.g. managing romantic relationships or school performance) becomes more prominent at different time periods. Increasing our understanding of this would give us important information as to when and where to intervene with promotion and preventive efforts.

These analyses explored to which sources adolescents ascribe their stress and whether this changes during the period from early to the mid-adolescence and from mid to late- adolescence. Self-reported stressor load in the family, peer, romantic and school performance domains were assessed in a subsample of the Three Cities Study of 7th graders (N = 1137; 46 % girls, M_{age} = 13.2) and of 1st year higher secondary school students (N = 915; 51% girls, M_{age} = 16.4) with follow-up assessments one and two years later.

Which are the most common sources of subjective stressor load among girls and boys in the 7th through the 9th grade?

Descriptive statistics were used to graph the means of subjective stressor load within the family, peer, romantic and school performance domains for girls and boys respectively (Figure 1). Repeated measure analysis of variance (rANOVA) was used to investigate changes over time.

Girls reported higher levels of subjective stressor load than boys at all time-points,

except for in the domain of romantic relationships where no differences were observed. For both boys and girls the school performance domain was reported as the most prominent source of stress.

Mean level reported stress due to arguments at home, romantic relationships and school performance increased significantly over time in both girls and boys. In contrast, no change in stress due to peer pressure was observed.

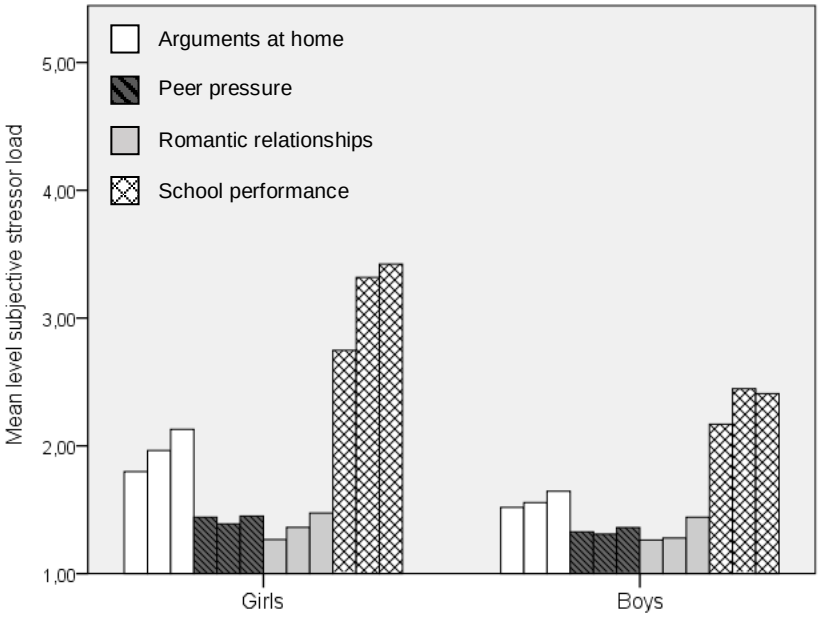


Figure 1. *Mean level subjective stressor load in the 7th, 8th and 9th grade due to arguments at home, peer pressure, romantic relationships and school performance for girls and boys. For each life domain, the left bar displays mean levels in the 7th grade, the middle in the 8th grade and the right in the 9th grade.*

Which are the most common sources of subjective stressor load among girls and boys in the 1st through the 3rd year of higher secondary school?

Descriptive statistics were used to graph the means of subjective stressor load within the family, peer, romantic and school performance for girls and boys respectively (Figure 2). Repeated measure analysis of variance (rANOVA) was used to investigate changes over time.

Girls reported higher levels of subjective stressor load than boys at all time-points,

except for in the domain of romantic relationships where no differences were observed. For both boys and girls the school performance domain was reported as the most prominent source of stress.

Mean level reported stress due to arguments at home and due to school performance decreased significantly over time in both girls and boys. No change in stress due to peer pressure and romantic relationships was observed.

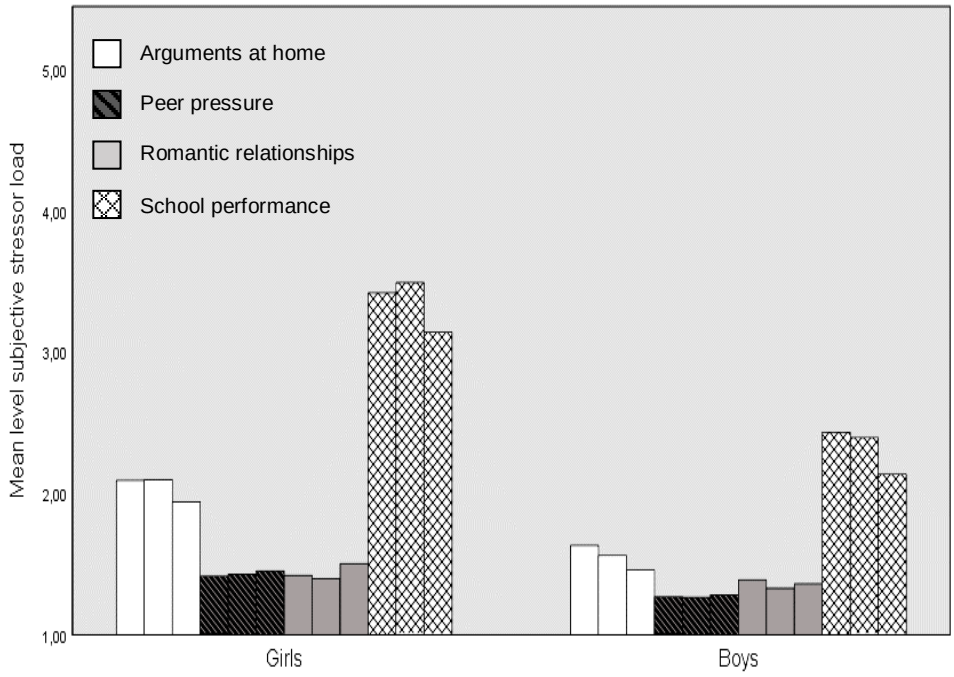


Figure 2. *Mean level subjective stressor load in the 1st, 2nd and 3rd grade of gymnasium due to arguments at home, peer pressure, romantic relationships and school performance for girls and boys. For each life domain, the left bar displays mean levels in the 1st grade, the middle in the 2nd grade and the right in the 3rd grade*

Conclusions

Our results show that adolescent girls report higher levels of stressor load than boys across the whole adolescence period and in all areas except for romantic relationships. Social stressors such as arguments at home and romantic stress increase somewhat in both genders from early- to mid-adolescence but school performance stress was by far the most prominent and increasing reported source of stress during this time period. However, from mid- to late adolescence the subjective stressor load in the school and home domain decreases for both girls and boys while stressor load resulting from peer

interactions and romantic relations generally remains on a relatively low and stable level. Thus, results indicate that there seems to be a general, but especially school related, increase in stressor load during the period from early to mid-teens, which then peaks and begins to decline during upper secondary school years.

For more details on the analysis concerning early- to mid-adolescent stress we refer to: Anniko, K.M., Boersma, K., & Tillfors, M. (2018). Sources of stress and worry in the development of stress-related mental health problems: A longitudinal investigation from early- to mid-adolescence. *Anxiety, Stress, & Coping*. https://doi.org/10.1080/10615806.2018.1549657

Descriptives

2. Sleep duration and patterns in adolescents: Correlates and the role of daily stressors

Sleep deficit is a growing problem in adolescence and has negative consequences on physical and mental health, but how much should adolescents sleep to function well? The National Sleep Foundation (NSF) has recently updated its sleep duration recommendations according to age group (see Table 1). These recommendations are an important tool to describe the extent of the problem and to identify psychosocial and contextual factors related to insufficient sleep duration, which in turn can inform the development of effective sleep interventions. Existing programs have shown limited effects, and this may be due to the fact that they do not take into account the many barriers to adolescents getting adequate sleep; such as school obligations, socializing with peers and use of information and communication technology (ICT). Therefore, the aim of this analysis was to 1) assess the prevalence of sleep deficit using the new NSF´s guidelines; 2) assess whether short sleep duration was associated with emotional and behavioral problems including depression, anxiety, anger and norm-breaking and 3) assess whether there was any association between sleep duration and potential protective/risk factors.

Table 1.

Sleep duration (Total Sleep Time, TST) recommendations by age according to the NSF.

Age	Optimal TST	Borderline TST	Poor TST
6-13 y	9-11	7-8	<7
14-17 y	8-10	7	<7

Participants were adolescents in the 7th and 8th grade during wave 1 (N = 2768; 48% girls, age range: 12-16 years; assessed spring 2014). Emotional/behavioral problems and risk/protective factors were self-reported, as well as sleep duration which was calculated from reported bed-times, wake-times and sleep onset latency. Participants were then divided in three groups according to the sleep recommendations for the analyses.

How do adolescents sleep? Sleep patterns in boys vs girls & grade 7 vs 8

Of the younger adolescents (grade 7, age 12-13), 58% reported optimal weekly TST, 30% reported borderline TST and 12% reported poor TST. In the older age group (grade 8, age 14-16), 48% reported optimal sleep duration during the week, 33% reported borderline TST, and 19% reported poor TST. Girls and older adolescents generally reported shorter sleep duration. Moreover, sleep timing and duration were significantly different during the school-week as compared to the weekend, with later bedtimes (ca. 2 hours) and later wake times (ca. 3-4 hours) for both younger and older adolescents.

Is sleep duration associated with emotional & behavioral problems?

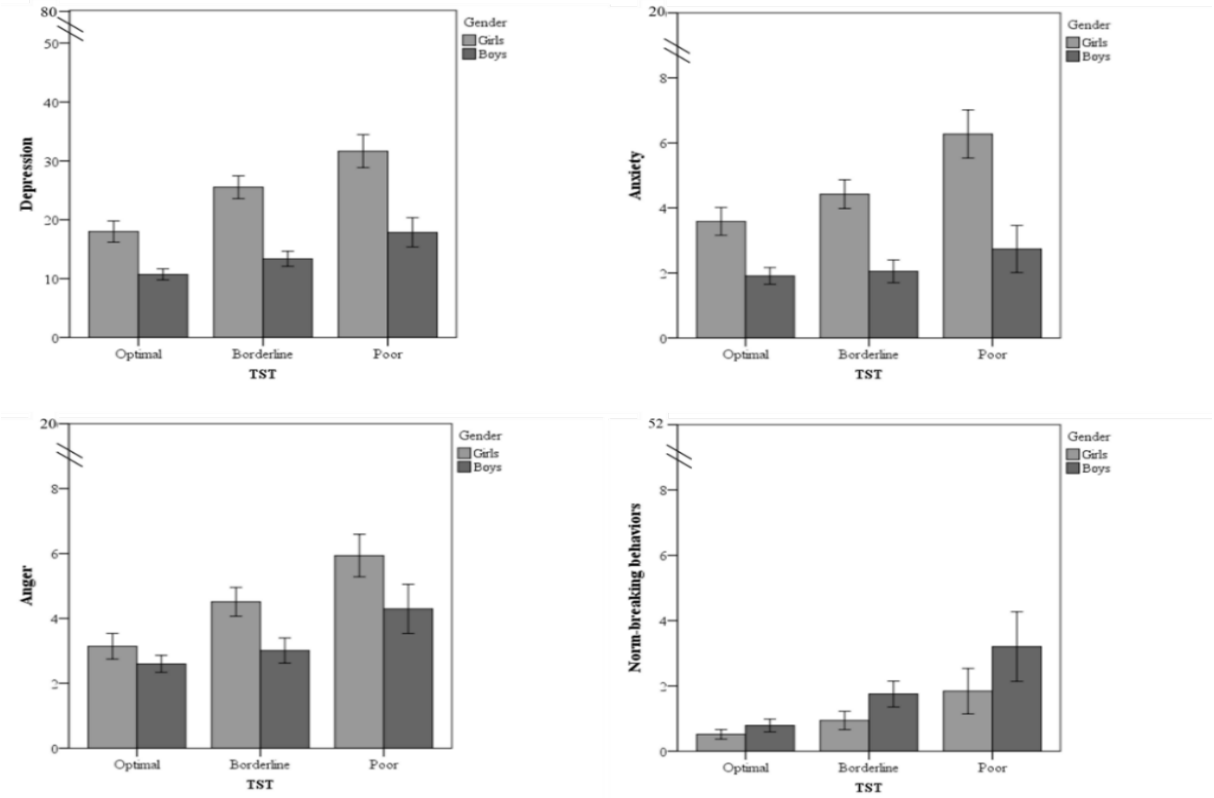


Figure 1. *Interaction between gender and emotional and behavioral problems for older adolescents (age 14-16, N = 1426) reporting optimal, borderline and poor sleep duration (TST = total sleep time).*

Adolescents sleeping in the poor TST range, reported significantly higher levels of emotional and behavioral problems as compared to those sleeping in the borderline or optimal range (grade 7, V = 0.12, F(8, 2210) = 17.4, $p < .001$, $\eta_p^2 = .06$; grade 8, V = 0.12, (8, 2836) = 22., $p < .001$, $\eta_p^2 = .06$). Girls generally reported higher rates of emotional problems (see Figure 1).

Sleep duration: Risk & protective factors

Sleep duration was closely related to sleep hygiene and ICT use at bedtime, with adolescents who were sleeping poorly as compared to optimal TST also reporting worse sleep hygiene and more frequent use of ICT at bedtime. With regard to daily stressors, school demands were relevant for sleep of older adolescents, whereas arguments at home were associated with poor sleep for younger adolescents (Table 2).

Table 2

Multinomial Logistic Regression Exploring How Stressors, ICT in bed and Sleep Hygiene relate to Borderline and Poor TST for the two Age Groups.

	Age 12-13 (*N* = 1069)		Age 14-16 (*N* = 1386)	
Variable	OR	95% CI	OR	95% CI
Stress-School performance				
Borderline	1.02	(0.85-1.24)	1.12	(0.95-1.31)
Poor	1.16	(0.90-1.51)	1.26*	(1.04-1.53)
Stress-School/leisure				
Borderline	1.05	(0.88-1.26)	0.99	(0.85-1.16)
Poor	1.03	(0.81-1.32)	1.10	(0.91-1.32)
Stress-Home				
Borderline	1.12	(0.90-1.39)	1.14	(0.95-1.38)
Poor	1.40*	(1.06-1.84)	1.20	(0.96-1.50)
Stress-Peers				
Borderline	1.60*	(1.07-2.38)	0.88	(0.69-1.12)
Poor	1.04	(0.57-1.90)	0.84	(0.64-1.10)
Sleep Hygiene				
Borderline	0.80*	(0.68-0.95)	0.75***	(0.65-0.87)
Poor	0.64***	(0.52-0.80)	0.58**	(0.49-0.69)
ICT in bed				
Borderline	1.37***	(1.21-1.55)	1.30**	(1.17-1.45)
Poor	1.43***	(1.19-1.71)	1.61**	(1.40-1.85)

*Note. Model fit (age 12-13) $R^2 = .149$ (Cox & Snell), .176 (Nagelkerke) and model fit (age 14-16) $R^2 = .157$ (Cox & Snell), .181 (Nagelkerke). *p < .05 **p < .01, ***p < .001 ICT = information and communication technology; TST = total sleep time.*

Conclusion

A significant proportion of adolescents reported insufficient sleep duration, but more so for older adolescents. So, in order to prevent sleep deprivation, interventions should be implemented in early adolescence, before poor sleep habits become deeply rooted. Furthermore, adolescents significantly delayed their sleep phase during weekends, which may lead to delayed bedtimes during the week and further sleep deprivation. The new NSF recommendations are informative, and we found a significant association with both emotional and behavioral problems and potential targets for intervention. In particular, poor sleep hygiene, use of electronic media and stress might represent barriers to sleep. So, targeting these risk factors (e.g., ICT) in future interventions might be a promising option.

For more details on this study we refer to: Bauducco, S. V., Flink, I. K., Jansson-Fröjmark, M., & Linton, S. J. (2016). Sleep duration and patterns in adolescents: Correlates and the role of daily stressors. *Sleep Health, 2*, 211-218.

Descriptives

3. Prevalence and development of intolerance and peer harassment.

Tolerant and intolerant attitudes are a most current subject following the recent global rise in refugees being forced to relocate across the world. The purpose of this analysis was to investigate the development of intolerance and peer harassment in adolescents from age 13/14 to age 15/16. The sample consisted of 2,769 adolescents who participated in wave 1-3 (2014 to 2016). The retention rate across time was 68% (n=1869). We measured tolerance (e.g. "I treat everyone equally, even if they are different from me"), being a victim of violence and being perpetrator of violence. Analysis consisted of cross sectional hierarchical and k-means cluster analyses that were linked over time.

What are the patterns of tolerance and peer harassment for girls?

Results showed there were five subgroups with different scoring patterns on tolerance, being the victim of violence and being the perpetrator of violence (see figure 1). More than 85 % of the girls reported tolerant attitudes and 9% of the girls reported intolerant attitudes. Neither of these subgroups reported any violent behavior. In addition, 3% of the girls reported tolerant attitudes but were victims of violence and 2% of the girls reported intolerant attitudes and were both victims and perpetrators of violence.

In general, levels of tolerance increased from wave 1 (M = 4.03, SD = 0.72) to wave 2 (M = 4.25, SD = 0.64), $F\ (869) = 14.40$, $p < 0.001$, and from wave 2 to wave 3 (M = 4.37, SD = 0.65), F (869) = 13,04, $p < 0.001$.

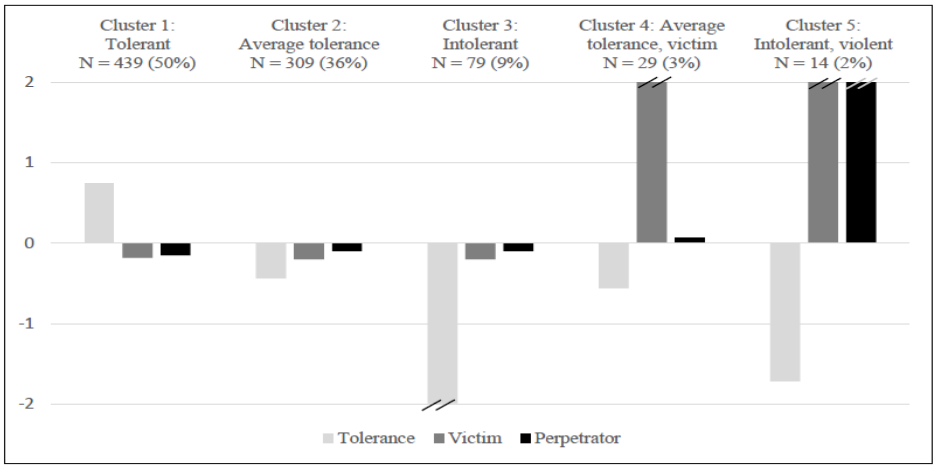


Figure 1. Z-score levels for tolerance, victim of violence as well as perpetrator of violence for girls in the five different subgroups. Bars above respectively below midpoint average (0) indicate above respectively below diversions from group averages (1= 1 standard deviation, 2= 2 standard deviations)

What are the patterns of tolerance and peer harassment for boys?

About 75% of the boys reported tolerant attitudes and 19% reported intolerant attitudes (see figure 2). Neither of these groups reported any violent behavior. A group consisting of 3% reported average tolerance attitudes but violent behaviors and another 3% reported intolerant attitudes and were both victims and perpetrators of violence. In general, levels of tolerance increased from wave 1 (M = 3.70, SD = 0.85) to wave 2 (M = 3.91, SD = 0.80), F (998) = 13.73, $p < 0.001$, and from wave 2 to wave 3 (M = 3.99, SD = 0.84), F (998) = 14.12, $p < 0.001$.

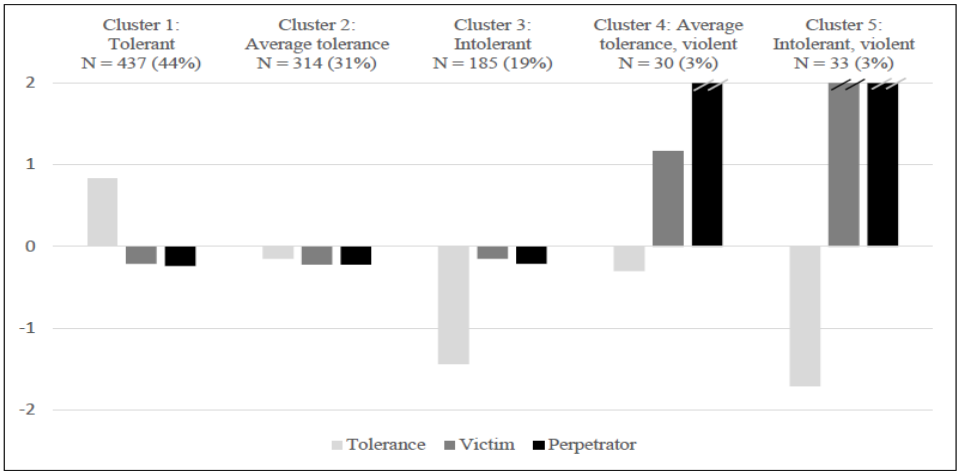


Figure 2 Z score levels for tolerance, victim of violence as well as perpetrator of violence for boys in five different subgroups. Bars above respectively below midpoint average (0) indicate above respectively below diversions from group averages (1= 1 SD, 2= 2 SD)

In summary, the large majority of adolescents reported a high level of tolerance, but there were small subgroups with intolerant attitudes and high levels of peer harassment. Tolerance increased over time for both genders and girls reported a higher degree of tolerance than boys (X^2 (2) = 41.49, p < .001). A difference between girls and boys was that for boys, no subgroup with average tolerance and only being victim of violence, was identified. In boys, the subgroup with average tolerance and above average levels of being a victim of peer harassment also displayed high levels of perpetrator behavior.

How does tolerance and peer harassment develop in girls?

Figure 3 shows the patterns of change of the subgroups across time. The arrows represent typical developmental trajectories. A typical trajectory is one where occurrence is higher than what is expected by chance. The typical developmental trajectory is one of stability. The greatest likelihood of stability was found in the subgroup "average tolerance and victim", showing a 12x higher than chance likelihood of remaining average tolerant and a victim of violence from wave 1 to 2. However, girls in this subgroup were also almost 3x more likely to move to the intolerant subgroup at wave 2. In addition, girls in the intolerant subgroup at wave 1 were > 5x more likely to move to a subgroup characterized by violent behavior one year later. Notably, few change patterns were significant from wave 2 to 3, indicating that, for girls, few systematic changes could be identified during this time period.

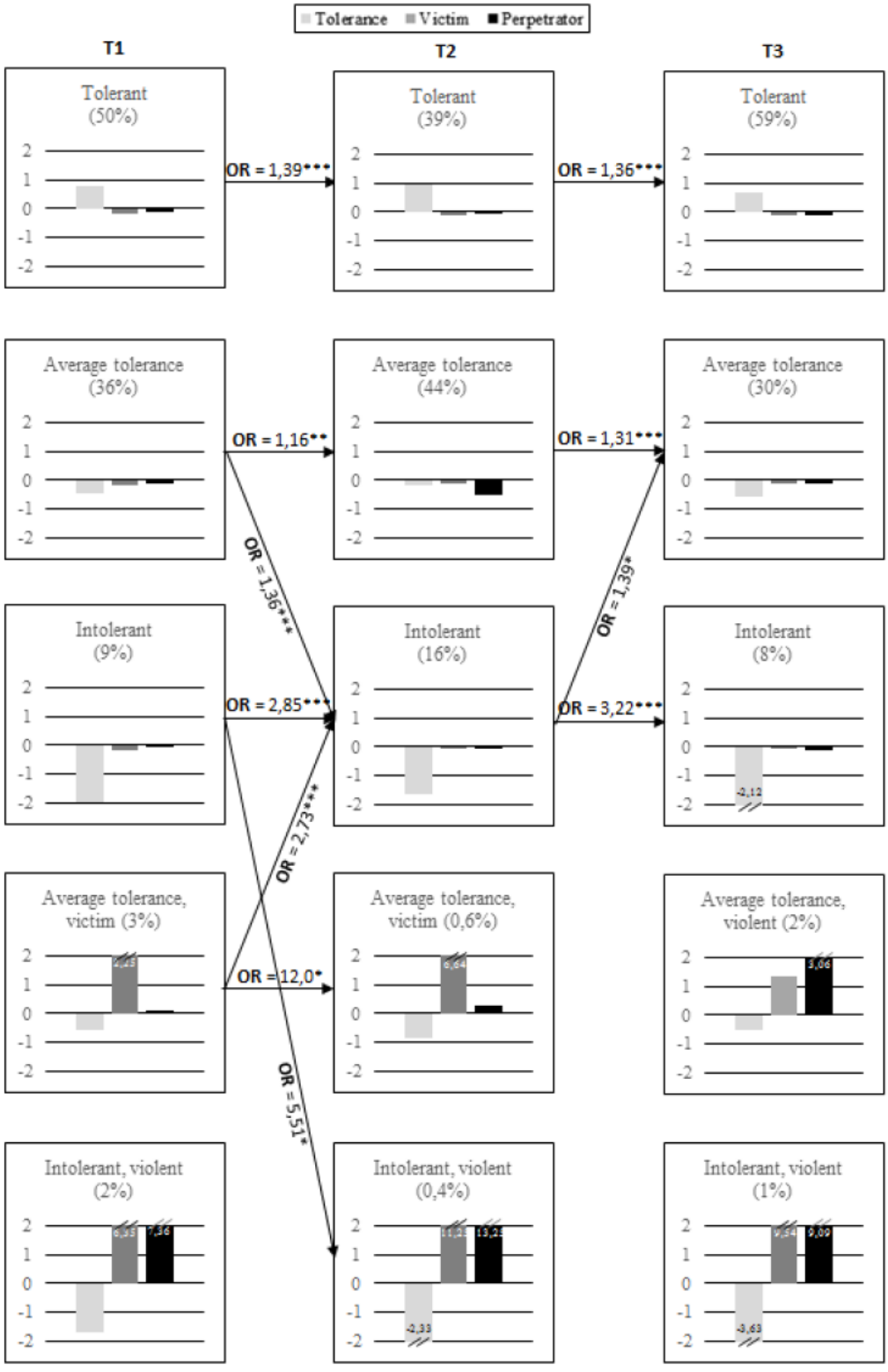


Figure 2 Developmental trajectories for girls in the different clusters. The number at each arrow shows how many more times than expected by chance adolescents moved to similar, or dissimilar, groups across time.

How does tolerance and peer harassment develop in boys?

Figure 3 shows that, also for boys, the typical trajectory is one of stability. The greatest likelihood of stability was observed in the subgroup "average tolerance and violent", where boys were 8 to 14x more likely to show this pattern across time. In addition, boys who were intolerant were almost 2x more likely to become violent from wave 2-3. Another typical trajectory was for boys in the violent and intolerant subgroups to becoming somewhat less intolerant across time. Boys were 4 to 5x more likely to develop from being intolerant and violent to becoming averagely tolerant and violent.

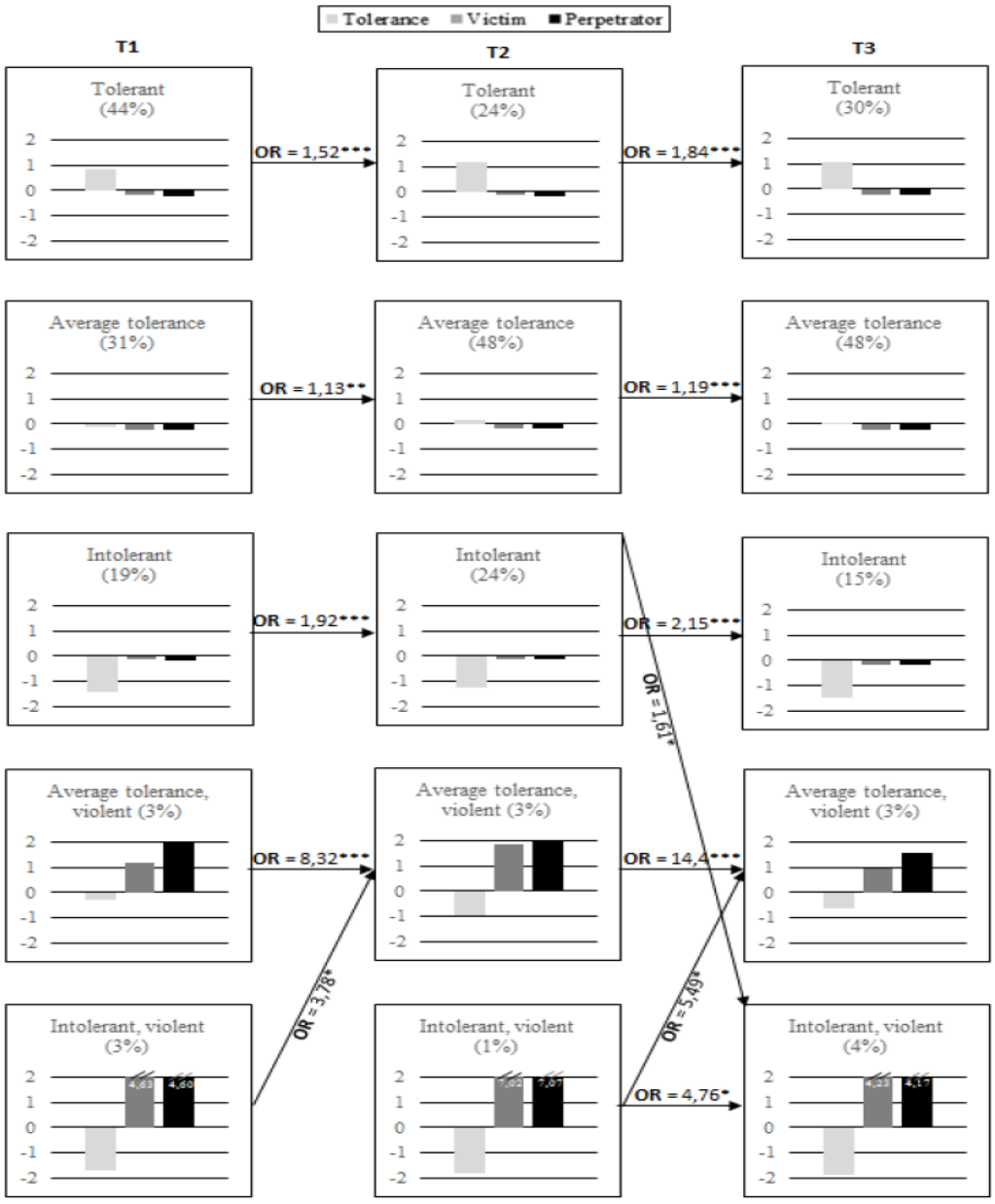


Figure 3 Developmental trajectories for boys in the different clusters. The number at each arrow shows how many more times than expected by chance people moved to similar, or dissimilar, groups across time.

Conclusions

The findings indicate that the large majority of adolescents aged 13-16 are tolerant and that tolerance levels increase from early to mid-adolescence. On average, girls report higher levels of tolerance than boys. Although in clear minority, intolerant and violent subgroups could be identified. Besides developmental stability in tolerance and peer harassment levels across the whole time period, not in the least for boys, the results indicate that, for both girls and boys, harboring intolerant attitudes may be a risk to develop harassing behaviors. A clear implication is that there is a need to identify predictors of stability and change and that adolescents - already in - or moving to subgroups with these characteristics warrant further research and should be targets for intervention.

For more details on this study we refer to: Dahlberg, A. & Björklund, D. (2016). Psychosocial predictors and developmental trajectories of tolerance among Swedish adolescents: a longitudinal study, examensuppsats, psykologprogrammet, Örebro Universitet.

Descriptives

4. The interplay between technology use and sleep

Technology use has been the focus of much concern for adolescents´ sleep health. The purpose of this analysis was to explore the strength and direction of relationship between sleep duration and time spent using technology over a year period. Specifically, we investigated whether adolescents who used more technology are at risk for insufficient sleep duration and/or whether adolescents who report short sleep duration are more likely to engage in increased time spent using technology one year later. Participants were students in the 8th ('cohort 1') and 9th grade ('cohort 2') during the spring of 2015 and in 9th grade and 1 year of higher secondary school one year later ('10th grade'). The retention rate in the two waves of data used was 75% (n=1620). Time spent using technology was self-reported and sleep duration was calculated from reported bed-times, wake-times and sleep onset latency. Analysis consisted of a longitudinal cross-lagged path analysis. School grade cohort and gender differences were also assessed using multiple group structural equation modelling.

How do sleep duration and technology use change over time?

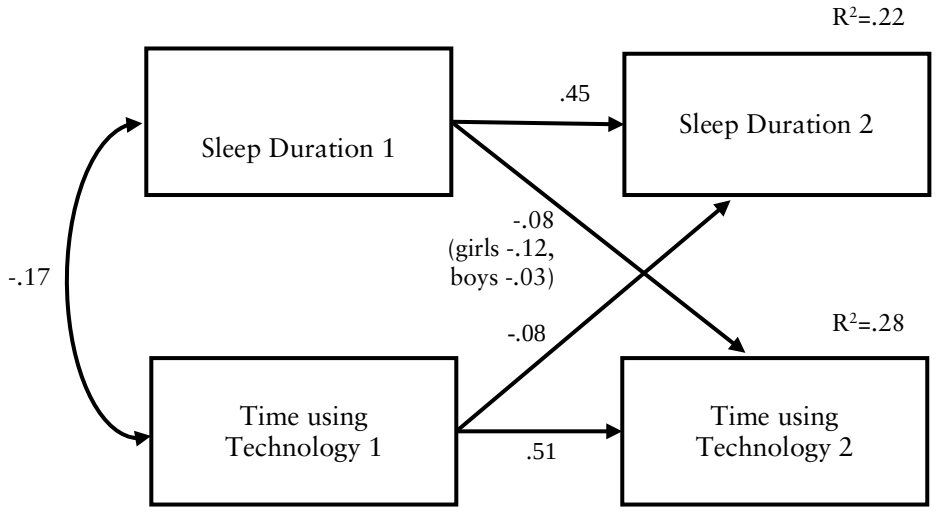
Table 1

Descriptive statistics, by grade cohort and gender

	Mean (*Standard Deviation*)			
	sleep duration time 1	sleep duration 2	time using technology 1	time using technology 2
Grade Cohort 1				
Female	7:44 (1:10)	7:34 (1:12)	4:30 (1:41)	4:44 (1:39)
Male	8:13 (1:04)	8:01 (1:12)	4:14 (1:43)	4:25 (1:46)
Grade Cohort 2				
Female	7:38 (1:08)	7:30 (1:10)	4:31 (1:43)	4:49 (1:37)
Male	7:57 (1:02)	7:38 (1:07)	4:29 (1:34)	4:36 (1:32)
Total	7:53 (1:07)	7:41 (1:11)	4:26 (1:40)	4:38 (1:40)

Table 1 displays the means and standard deviations for sleep duration and time spent using technology. Sleep duration is known to decrease with age, and particularly throughout adolescence. A significant reduction in sleep duration was evident from Time 1 to Time 2. For cohort 1 this represented a reduced sleep duration from Grade 8 to Grade 9, and for cohort 2 a reduction from Grade 9 to Grade 10 (1st grade higher secondary school). Boys reported significantly greater sleep duration (*M* = 8 hours 13 minutes, *SD* = 3 minutes) than girls (*M* = 7 hours 44 minutes, *SD* = 3 minutes) in Grade 8, and, consistent with developmental expectations, both sexes show a decline in sleep duration through to Grade 10, where there is no longer a gender difference. The duration of time adolescents spent using technology was consistent over the year with no significant difference from Time 1 to Time 2. Both males and females reported a mean of 4-5 hours per weekday spent using technology.

How are sleep duration and technology use related across time?



Sleep duration and time spent using technology were found to be moderately correlated over time (*r* = .46 & *r* = .52 respectively). The hypothesised reciprocal model as revealed to fit the observed data well.

Figure 2 illustrates the interrelations between sleep duration and technology use across one year along with estimates of the direction and strength of the relations. The coefficients presented in Figure 2 for the cross-lagged paths were significant at .05 level and give support to bidirectional associations.

The negative value of the cross-lag coefficients revealed that greater time spent using technology at Time 1 was associated with lesser sleep duration at Time 2, and lesser sleep duration at Time 1 was associated with greater time spent using technology at Time 2. More specifically, a 1 hour mean change in time using technology was associated with a 4.8 minute mean change in sleep duration one year later, and similarly, a 1 hour mean change in sleep duration was associated with a 4.8 minute mean change in time using technology. The model explained 22% of the variance in sleep duration and 28% of the variance in time spent using technology. This result supports the view that large amounts of time spent using technology throughout the day and night impact young people's duration of sleep, and that those experiencing less sleep hours use technology for a larger amount of time.

These effects were similar for the two cohorts but when comparing gender groups, there was indication of a difference in the reciprocal influence of sleep duration and time spent using technology for males and females. Follow up tests found the association between sleep duration at Time 1 and time spent using technology at Time 2, to be significantly stronger for girls (r = -.12) than boys (r = -.03). This means, a 1 hour mean reduction in sleep duration at Time 1 is associated with a 7.2 minutes increase in time spent using technology at Time 2 for girls, compared to a 1.8 minute increase for boys. The associations between time spent using technology at Time 1 and sleep duration at Time 2 did not differ between boys and girls.

Conclusion

This is one of the first studies to investigate the bidirectional association between time spent using technology and sleep duration in a normal adolescent population. We found that time spent using technology and sleep duration exhibited a perpetuating influence toward each other. Not only did greater time spent using technology predict shorter subsequent sleep duration, but shorter sleep duration also predicted greater time subsequently spent using technology to a similar extent.

These findings suggest that public health advocates educating others about the negative impacts of technology on sleep must also be mindful of the opposite, that many young people may turn to technological devices when experiencing difficulty sleeping. Although these effects were small, they were predictive over a one year period. Nonetheless, it is likely that other biological and lifestyle factors, along with previous sleep history, play a larger role in adolescents' sleep health.

For more details on this study we refer to: Mazzer, K, Bauducco, S, Linton, SJ, Boersma, K (2018). Longitudinal associations between time spent using technology and sleep duration among adolescents. *Journal of Adolescence, 66,* 112-119.

Mechanisms

1. The role of worry in the development of stress-related mental health problems during adolescence

A range of social, cognitive, and biological changes also take place during adolescence which intensify the number of stressors in youths' lives. Social changes are normative during this time (for example rising importance of peers and change of school and in school demands) and youths have to cope with new social situations and demands to a greater extent. Coping with stressors is commonly referred to as emotion regulation.

One type of emotion regulation that increases during early teens is worry. We know that this increase parallels the rise of stressors and stress-related mental health problems but we don't know whether worry plays a causal role. Therefore, the aim of this analysis is to explore whether worry mediates the link between stressors and mental health problems and whether this process is different for boys and girls.

The focus in this analysis is on social stressors and stressors related to schoolwork. Self-reported subjective stressor load (family-, peer-, romantic-, and school performance domains), worry, anxiety and depressive symptoms were assessed in the cohort of 7th graders (N = 1137; 46 % girls, mean age 13.2) during wave 1 (spring of 2014) with follow-up assessments at wave 2 and 3. We used two separate analytical models to test moderated mediation (one with anxiety and one with depressive symptoms as outcome). These analyses were conducted in PROCESS v 2.16 macro (Hayes, 2013) for SPSS with 5000 bootstrap samples and heteroscedasticity-consistent standard errors.

Is the link between stressors and anxiety and depressive symptoms mediated by worry?

Figure 1 and 2 depict the results of the main analyses. These figures illustrate that worry mediated the link between overall stressor load and stress-related mental health problems over time, both for anxiety (indirect effect: *b* = .01, 95 % PCa CI [.005; .016] with an effect size of P_M = .32) and depressive symptoms (indirect effect: *b* = .02, 95 % PCa CI [.009; .041] with an effect size of P_M = .21).
These results did not differ between boys and girls. These results indicate that general

stress load leads to an increase in worry which in turns leads to an increase in anxiety and depressive symptoms.

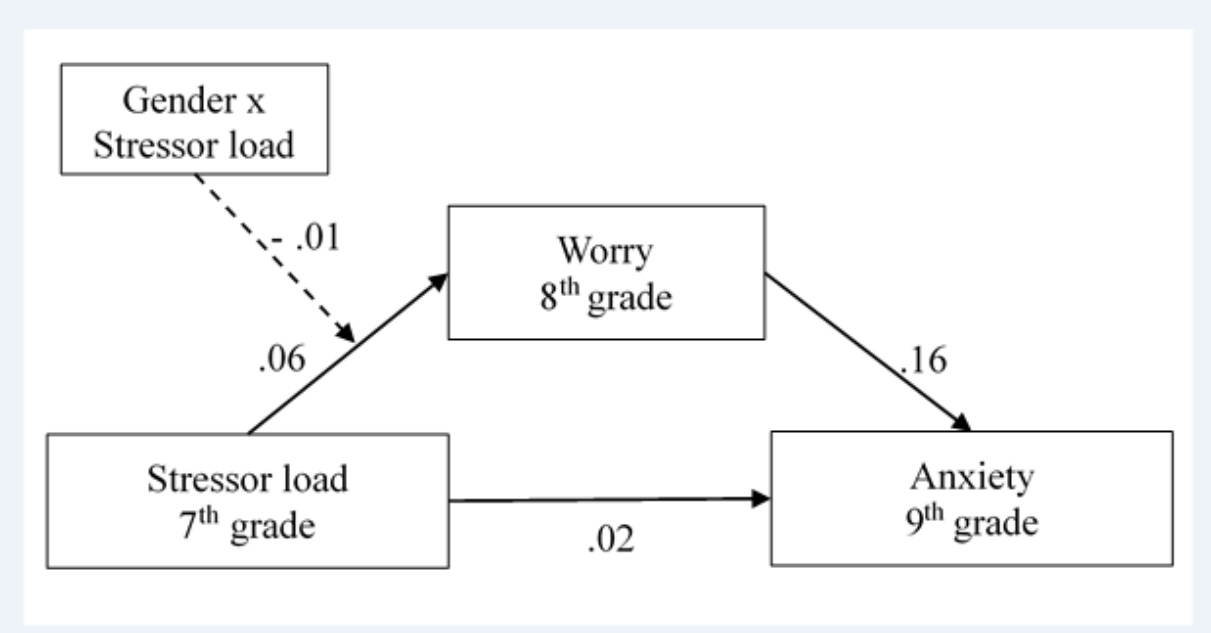


Figure 1. *A model of the relation between stressors, worry and anxiety.*

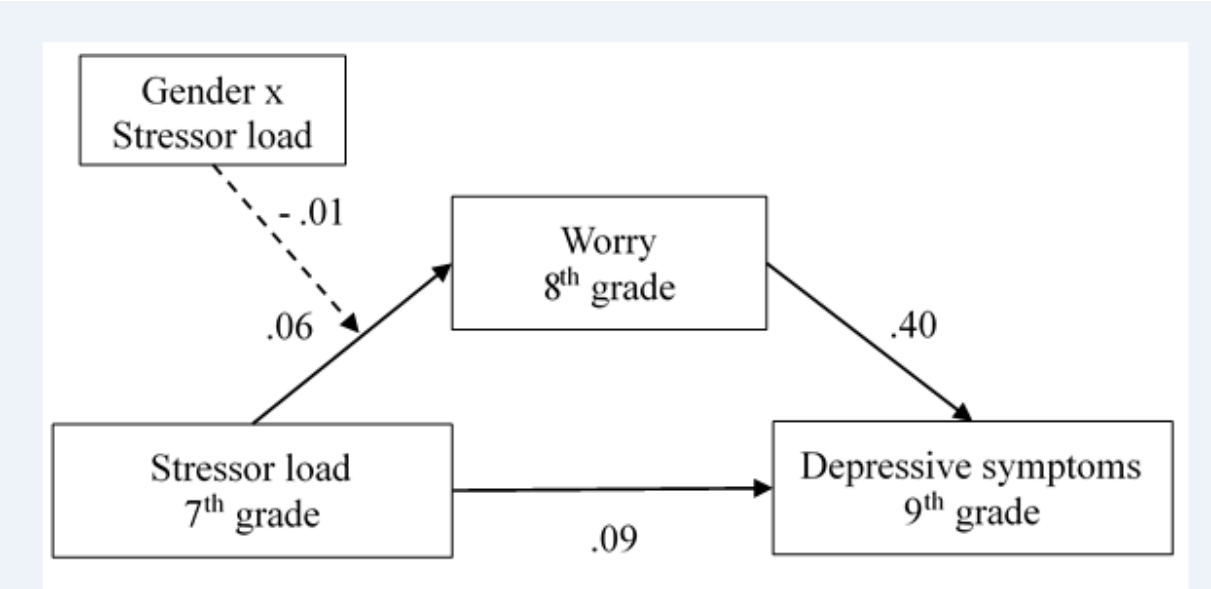


Figure 2. *A model of the relation between stressors, worry and depressive symptoms.*

In addition, we tested separate models for stressors within specific domains (arguments at home, peer pressure, romantic relationships and school performance) as predictors. Results for depressive symptoms showed a significant interaction of gender (p <.05) for the model with stress due to peer pressure as a predictor, with an indirect effect through worry for girls (*b* = .17, 95 % PCa CI [.05; .31] but not for boys (*b* = .02, 95 % PCa CI [-.06; .11]. For the other domains, the interaction of gender and domain specific stressor load was not significant (*p*s > .20). The results for anxiety showed a similar pattern, with a significant interaction effect of gender (p <.05) for the model with subjective stress due to peer pressure as a predictor, with an indirect effect through worry for girls (*b* = .07, 95 % PCa CI [.02; .12] but not for boys (*b* = .01, 95 % PCa CI [-.03; .04]. For the other domains, the interaction of gender and domain specific stressor load was not significant (*p*s > .10). This means that the link between peer pressure-worry-anxiety/depressive symptoms applies to girls but not boys.

To conclude, our results support the hypothesis that worry is a mechanism involved in the development of adolescent stress-related mental health problems for both girls and boys. We found gender unspecific effects of worry for all stressor domains except for peer pressure. The relation between peer pressure, worry and mental health problems (both anxiety and depressive symptoms) was only present for adolescent girls but not for boys. This indicates that the importance of worry as a mediator in the link between stressors and adolescent mental health problems is dependent on the type of stressor and gender. Lastly, our results indicate that worry may be an appropriate target to prevent and treat adolescent mental health problems.

For more details on this study we refer to: Anniko, K.M., Boersma, K., & Tillfors, M. (2018). Sources of stress and worry in the development of stress-related mental health problems: A longitudinal investigation from early- to mid-adolescence. *Anxiety, Stress, & Coping*, 1-13. https://doi.org/10.1080/10615806.2018.1549657

Mechanisms

2. A longitudinal view of rumination, poor sleep and psychological distress in adolescents

Difficulties in emotion regulation, specifically rumination predict increases in depressive and anxiety symptoms over time and may also be directly associated with poorer sleep. Poor sleep is both a common symptom of and a risk factor for psychological disorders such as anxiety and depression. Therefore, given that sleep duration – a potential protective factor – declines throughout adolescence, whereas rumination – a potential risk factor – increases, together with psychological distress, the purpose of this study was to investigate the longitudinal relationship between rumination and psychological distress and whether sleep mediated this relationship over a 2 year period.

Participants (N = 1620) were students in the 8th ('cohort 1') and 9th grade ('cohort 2') during the spring of 2015 and in 9th grade and 10th grade one year. Rumination, sleep timing, anxiety and depression were self-reported; psychological distress was calculated as a composite score of total depression and anxiety scores, and sleep duration was calculated from reported bed-times, wake-times and sleep onset latency. PROCESS for SPSS (Hayes, 2017) was used to analyze the cross-sectional mediation model and structural equation modelling (SEM) was then conducted to assess a longitudinal mediation model of rumination, sleep duration and psychological distress, measured at three time points (see Fig. 1).

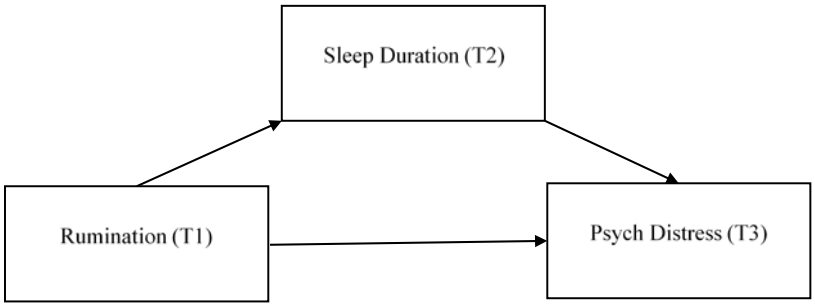


Figure 1. Longitudinal mediation model of rumination, sleep and psychological distress.

How do rumination, sleep duration and psychological distress change over time?

There was a significant reduction in sleep duration from Wave 1 to Wave 2 (t (1619) = 5.20, p<.001, r = .13) and Wave 2 to Wave 3 (t (1619) = 6.76, p<.001, r = .17), for both cohorts. As can be seen in figure 2, boys reported significantly (t (949) = -7.24, p<.001, r = .23) greater sleep duration (M = 8 hours 26 minutes, SD = 57 minutes) than girls (M = 7 hours 57 minutes, SD = 1 hour 4 minutes) in Grade 7, and both showed a decline in sleep duration through to Grade 10, where there no longer was a gender difference (t (667) = -1.46, p =.14, r = .003).

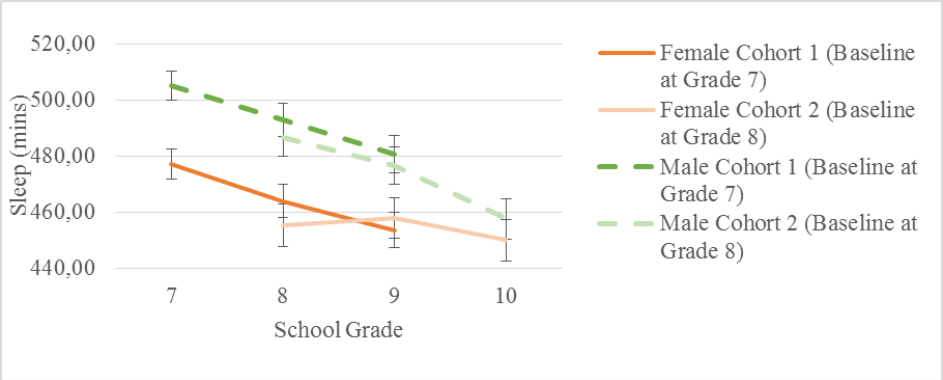


Figure 2. Changes in sleep duration.

Rumination increased over time from Wave 1 to Wave 2 (t (1619) = -19.77, p<.001, r = .44) and Wave 2 to Wave 3 (t (1619) = -5.05, p<.001, r = .12). Furthermore, as can be seen in figure 3, girls report significantly greater rumination than boys at all time points.

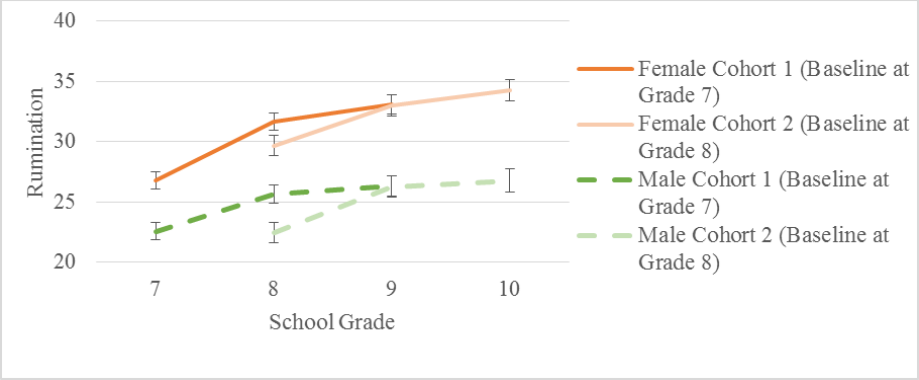


Figure 3. Changes in rumination.

Psychological distress also increased significantly over time from Wave 1 to Wave 2 (t (1619) = -8.55, p<.001, r = .21) and Wave 2 to Wave 3 (t (1619) = -5.40, p<.001, r = .13). Girls, again reported significantly greater psychological distress than boys in Grades 7 to 10 (see Fig. 4).

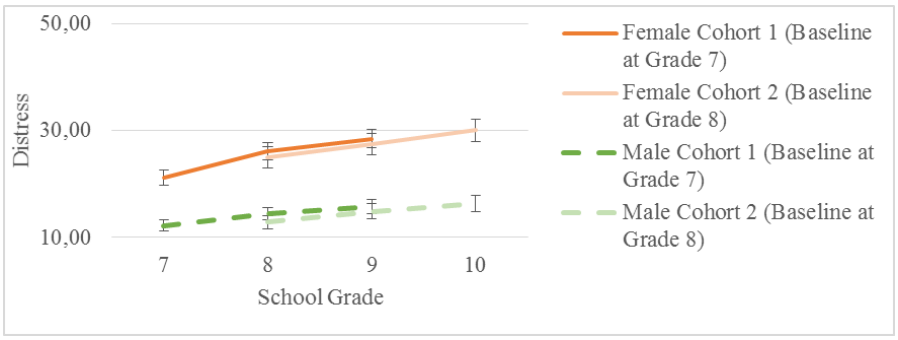


Figure 4. Changes in psychological distress.

Does sleep duration mediate the cross-sectional association between rumination and psychological distress?

Figure 5 depicts the relations between rumination, sleep and psychological distress. Rumination predicted sleep duration and psychological distress. Sleep duration was also predictive of psychological distress to a lesser extent. Partial mediation was shown to be present in this model, ab = .08, CI [.05, .11], p<.001. Sleep duration, accounted for 8% (P_M = .08) of the total effect (1.07, p<.001), with a small R^2 mediation effect size of .07.

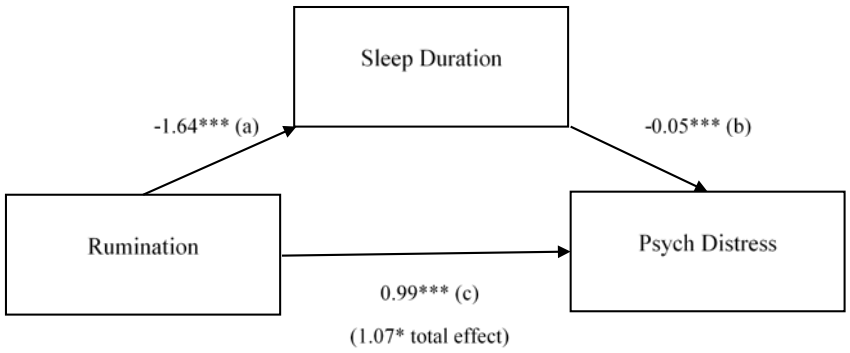


Figure 5. Cross-sectional mediation model of rumination and psychological distress via sleep duration.

Does sleep duration mediates the <u>longitudinal</u> association between rumination and psychological distress?

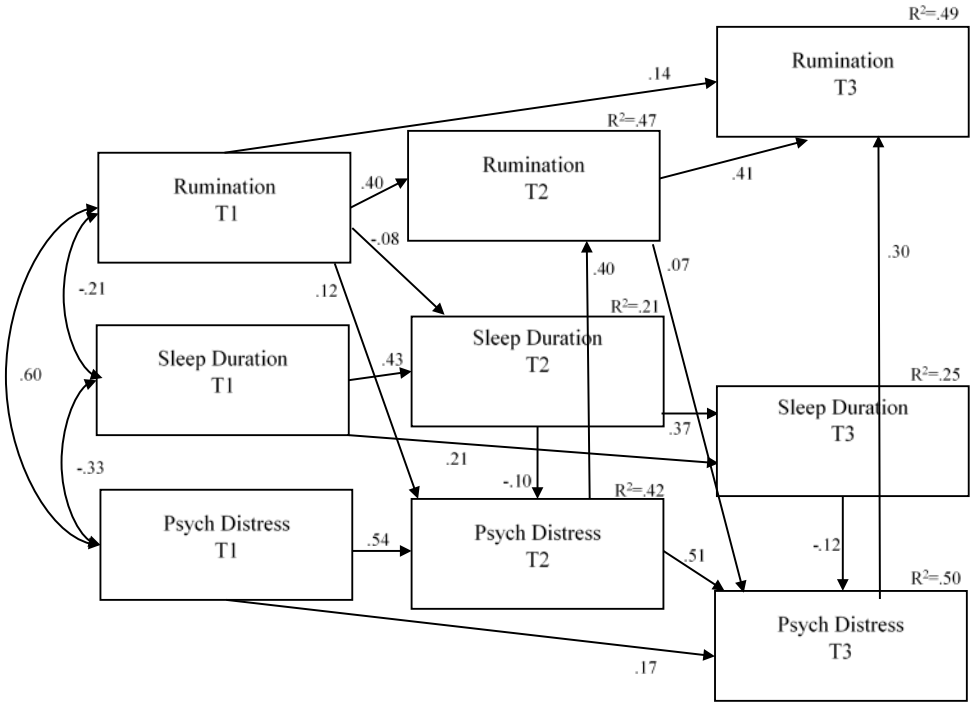


Figure 6. Longitudinal model of rumination and psychological distress via sleep duration.

The hypothesized mediation model did not fit the observed data well. The final model is presented in Figure 6. The strongest predictors of future rumination, sleep duration and psychological distress were previous reports of rumination, sleep duration and distress respectively. Rumination predicted future psychological distress, r=.12 and .07, p <.05, but sleep duration did not consistently mediate that relationship. Sleep duration was negatively related to psychological distress cross-sectionally, but was not significantly predictive of future psychological distress. Moreover, rumination at Wave 1 positively predicted psychological distress at Wave 2, r = .12, p<.05, which in turn predicted rumination cross-sectionally (i.e. at Wave 2), r = .40, p<.05.

Conclusions

This study shows that sleep duration declined from early- to mid adolescence, whereas rumination and psychological distress increased. Rumination was predictive of future psychological distress and distress at a given time was predictive of concurrent rumination. Sleep duration mediated the association between rumination and psychological distress cross-sectionally, but not longitudinally. Therefore, targeting rumination directly may prevent the development of a number of psychological problems and is a strategy anticipated to function across disorders to improve young people's mental wellbeing.

For more details on this study we refer to: Mazzer, K., Boersma, K., & Linton, S. J. (2019). A longitudinal view of rumination, poor sleep and psychological distress in adolescents. *Journal of affective disorders,* 686-696. https://doi.org/10.1016/j.jad.2018.11.053

Mechanisms

3. Peer related stress and the development of somatic health problems. What is the role of worry?

Adolescence is a time during which several health problems, such as pain problems, increase. Pain often goes hand in hand with other symptoms. Adolescents with pain problems have higher school absenteeism, higher prevalence of depression and anxiety, more difficulties regarding friendships, and lower quality of life. Little is known about the mechanisms of pain development. Social stressors may be a central risk factor. For example it has been found that bully-victimized adolescents were twice as likely to have psychosomatic problems, including pain. However, less is known about the role of more common, everyday social stressors. Also, possible mechanisms need to be studied further. For example, while peers gradually become more important for all adolescents, peer-related stress has been shown to be a more potent stressor for girls than for boys. Moreover, in comparison to boys, adolescent girls may have a higher tendency to worry and ruminate in response to stressors. Thus, the aim of this analysis was to investigate the role of peer-related stress, worry, and gender in the development of musculoskeletal pain problems over time.

Method

Adolescents from all 18 schools in the Three Cities Study were followed from 7th to 9th grade (N = 1181). Moderated mediation analysis was used to study whether peer-related stress in 7th grade predicted musculoskeletal pain two years later *and* whether this relationship was mediated by worry in 8th grade. Gender was entered as a moderator and pain at baseline was controlled for. Peer-related stress was assessed using the peer pressure subscale of the ASQ-S. Worry was assessed with the PSWQ-C. Musculoskeletal pain was operationalized as pain in the back, neck or shoulders. Participants were asked how often during the last 6 months they had suffered from pain in the back/neck/shoulders, how intense the pain was and if pain had impaired function concerning a) school, b) leisure activities or c) contact with friends.

Participants were thereafter categorized into five pain grades:

- Grade 0: Pain frequency rarely or never;
- Grade I: Pain at least every month, low pain intensity, no/low impairment;
- Grade II: Pain at least every month, high pain intensity, no/low impairment;
- Grade III: Pain at least every month, medium impairment; and,
- Grade IV: Pain at least every month, high impairment.

Results

How prevalent is pain?

Table 1 displays the prevalence of pain across time. No significant gender differences were detected regarding prevalence in 7th grade (χ^2 (1)=3.06, p=.08). In contrast, in 8th (χ^2 (1)=18.75, p<.001) and 9th grade (χ^2 (1)=13.94, p<.001) significantly more girls (14.3/13.4%) than boys (7.1/6.9%) reported pain problems.

Prevalence of pain grades over time (%).

Pain grades	7th grade			8th grade			9th grade		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
0	58.2	50.3	54.4	52.8	42.0	47.8	54.5	39.7	47.7
I	28.4	29.4	28.8	31.1	32.3	31.7	29.8	33.1	31.3
II	6.3	10.6	8.3	9.0	11.3	10.1	8.8	13.8	11.1
III	5.0	6.4	5.6	4.7	10.8	7.6	4.4	9.0	6.5
IV	2.2	3.3	2.8	2.4	3.5	2.9	2.5	4.4	3.4
Total	765	688	1453	708	628	1336	637	544	1181

Table 1. Prevalence of pain problems.

Is worry a mechanism in the development of pain problems?

Results of the moderated mediation.

		Outcome						
		M (Worry 8th grade)			Y (Pain 9th grade)			
Predictor		Coeff.	SE	p		Coeff.	SE	p
Interpersonal stress 7th grade	a[1]	0.84	0.31	< 0.01	c'	0.11	0.03	< 0.001
Worry 8th					b	0.04	0.01	< 0.01
Interpersonal stress 7th grade × gender	a[3]	−0.39	0.18	< 0.05				
Covariates								
Pain 7th grade		0.46	0.88	0.60		1.55	0.26	< 0.001
Worry 7th grade		0.56	0.04	< 0.001		0.01	0.02	0.47
Constant		15.03	2.00	< 0.001		−4.58	0.43	< 0.001

Tabel 2 results of the moderated mediation analysis.

Table 2 and figure 1 show the results of the moderated mediation analysis. Interpersonal stress in 7th grade significantly predicted musculoskeletal pain two years later and there was an indirect effect through worry in 8th grade. Also, there was an interaction between interpersonal stress and gender. The conditional indirect effect for girls was significant but not for boys, indicating that worry mediates the relation between interpersonal stress and the development of pain in girls but not in boys.

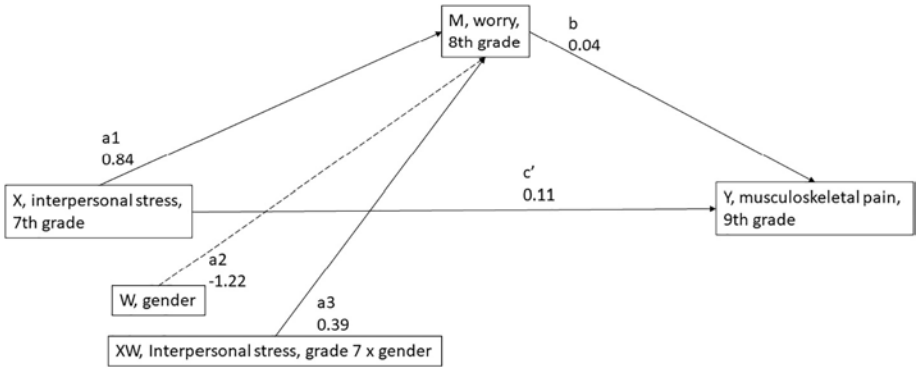


Figure 1. Overview of the moderated mediation model.

Conclusions

Peer-related stress was associated with the development of musculoskeletal pain problems over time and worry mediated this relationship for girls. These findings indicate that the association between peer-related stressors and pain problems suggested by studies on bullying can be extended to more low-level everyday stressors. Also, the role of worry in the development of pain problems was confirmed, at least for girls. The results contribute to the understanding of peer-related stress and worry as risk factors for somatic health problems in adolescents.

For more details on this study we refer to: Wurm, M., Anniko, M., Tillfors, M., Flink, I., & Boersma, K. (2018). Musculoskeletal pain in early adolescence: A longitudinal examination of pain prevalence and the role of peer-related stress, worry, and gender. *Journal of psychosomatic research*, *111*, 76-82.

Interventions

1. YAPI-Sleep: A school based preventive program to improve adolescents' sleep health

This study is one of four intervention subprojects within the Three Cities Study and is aimed at evaluating the long-term effects of a school-based universal intervention to improve sleep duration in lower secondary school students (Swedish "högstadiet"). Adolescents' lack of sleep can be explained by biological changes naturally occurring during this developmental period, but is also the byproduct of a 24/7 society, which is facilitated by unlimited access to the internet.

Insufficient sleep comes with serious consequences (see Shochat et al., 2014 for a review), yet many adolescents report that they do not feel they have the time to sleep more (Bauducco, 2017). Therefore, the aim of this sleep intervention was to reduce stress and technology use via time management and to ultimately improve sleep duration, also via sleep education. We delivered the intervention in the classroom with the help of an app, YAPI (Your App for Psychological Interventions). This study is the first to evaluate the long-term effectiveness of a school-based sleep intervention. Previous sleep interventions have not shown significant improvements in adolescents' sleep duration (Cassoff et al., 2013). However, a major limitation of these studies is that, by not including long-term follow-ups, it is impossible to evaluate the potential preventive effect of such universal interventions. In fact, the majority of students in a school will report sufficient sleep (defined as >8 hours/night), a smaller group will report just enough sleep (between 7-8 hours), and another small group will report insufficient sleep (< 7 hours) (National Sleep Foundation's guidelines, see Hirshkowitz et al., 2015). Therefore, the majority of adolescents receiving the intervention are not expected to change their sleep but rather to maintain their good sleep habits later on, as compared to adolescents who have not received any intervention.

Therefore, the aim of this study was to:

1. Investigate whether adolescents who participated in the sleep intervention were less likely to report insufficient sleep duration one year later as compared to controls.
2. Investigate whether perceived stress, sleep hygiene, and technology use also changed as a result of the intervention.

Method

Study design

The study aimed to investigate the effectiveness of YAPI Sleep using a quasi-experimental design. The intervention group filled out questionnaires before, during (not reported here) and one year after the intervention, during the spring 2016 and 2017. The control group was part of the longitudinal Three Cities Study cohort (1st-2nd wave) and filled out questionnaires 2 years earlier, in the spring 2014 and 2015 (see Fig. 1). This study was approved by the Regional Ethical Board in Uppsala, Sweden (dnr 2016/021).

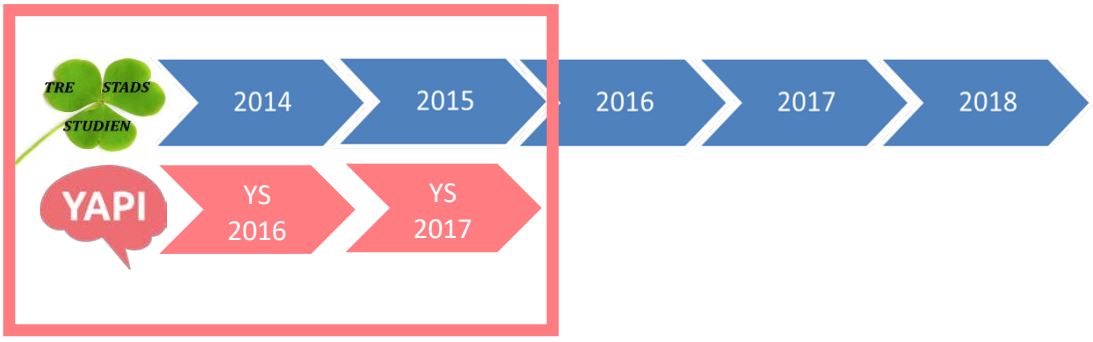


Figure 1. Study design: Intervention and control group.

Participants

Participants were 3,427 adolescents in 18 public lower secondary schools. Two schools from the Three Cities Study showed interest in the sleep program and were offered to participate 2 years after data collection started in 2014 (see flow chart Fig. 2). Thus, the intervention group included students in the same grades (7^{th}-8^{th}) as the control group but different cohorts (2016-17 vs 2014-15). The intervention group was recruited outside of the longitudinal cohort not to affect the original sample with the universal sleep intervention. Moreover, two additional interventions targeting parenting and stress were planned in the longitudinal cohort and would therefore reduce the sample for observing the adolescents' natural development over time. Before data collection, we received active consent from the students and passive consent from the parents. Twenty-two parents declined having their child in the sleep intervention study and 122 declined participation in the longitudinal Three Cities Study cohort study. In addition, some adolescents did not return the consent form and were excluded from the study. Participants with incomplete or unreliable data were also excluded from the analyses, leaving a sample of N = 119 intervention and N = 2269 controls. Participants who did not complete the follow-up measurement were less likely to be boys (OR = .609, p = .005), to live with both parents (OR = .563, p = .001), and slightly more likely to report shorter sleep duration (OR = .997, p = .01). Participants in the intervention cohort were slightly older, more likely to be girls, to live with both parents and to report better sleep hygiene at baseline as compared to the control group (see Table 1).

Table 1. Descriptive statistics of participants in the intervention and control group & significant differences.

Characteristic	Control (n = 2269)	Intervention (n = 119)	P value
Age (years)			
Mean, SD	13.6 (0.6)	13.9 (0.7)	0.001*
Sex, % (N)			
Female	47.4 (1076)	64.3 (72)	0.001*
Male	52.6 (1193)	35.7 (40)	
Born in Sweden, % (N)			
No	90.5 (2041)	88.3 (98)	0.45
Yes	9.5 (215)	11.7 (13)	
Living with both parents, % (N)			
Yes	73.2 (1633)	83.6 (92)	0.02*
No	26.8 (597)	16.4 (18)	
Technology use at baseline, % (N)			
Never	22.6 (497)	23.7 (28)	0.48
Sometimes	29.6 (651)	22.9 (27)	
Often	15.3 (337)	16.9 (20)	
Almost always	32.6 (718)	36.4 (43)	
Perceived stress score at baseline (mean)			
Mean (SD)	2.5 (0.6)	2.6 (0.6)	0.10
Sleep hygiene at baseline (mean)			
Mean (SD)	4.0 (1)	3.7 (1)	0.001*
Sleep duration at baseline (hrs)			
Mean (SD)	7:58 (1:09)	7:50 (1:15)	0.19

Sleep program

The intervention consisted of 5 sessions, 50-60 min, once per week for 6-7 weeks. Parental involvement included a brochure with recommendations and information about teenagers' sleep. The components are described in details in Table 2. The sleep classes were led by two members of the research team who were trained in the protocol (six psychology students, one psychologist and one research assistant).

Table 2. YAPI Sleep components in detail.

Component	Description	Activity in class	Session
Sleep education	Social jetlag, bedtime routine, technology and sleep, caffeine, consequences on daytime functioning etc.	**Information** & interactive **discussion** **Homework**: Plan and evaluation of behavioral experiment (reduce social jetlag, quiet time). **Individualized feedback (app)** between sessions. **Problem-solving** anticipated difficulties & review homework following lesson	1-2, 5-summary
Time management	To do list (both leisure and school activities), timing activities, setting reminders on the phone, etc.	**Visual diagram** of real vs. ideal daytime scenario (app), interactive **discussion**. **Information** about time management **Homework**: Plan a time management strategy. **Individualized feedback (app)** between sessions. **Problem-solving** barriers/distractions & review homework	3 5-summary
Technology use	Effect of technology on sleep (bright light & arousal) and on time management (distraction)	**Information** Interactive **discussion** **Homework**: Plan and evaluation of time management (e.g. mobile free homework) **Individualized feedback (app)** between sessions. Problem-solving barriers/distractions & review homework	4 5-summary

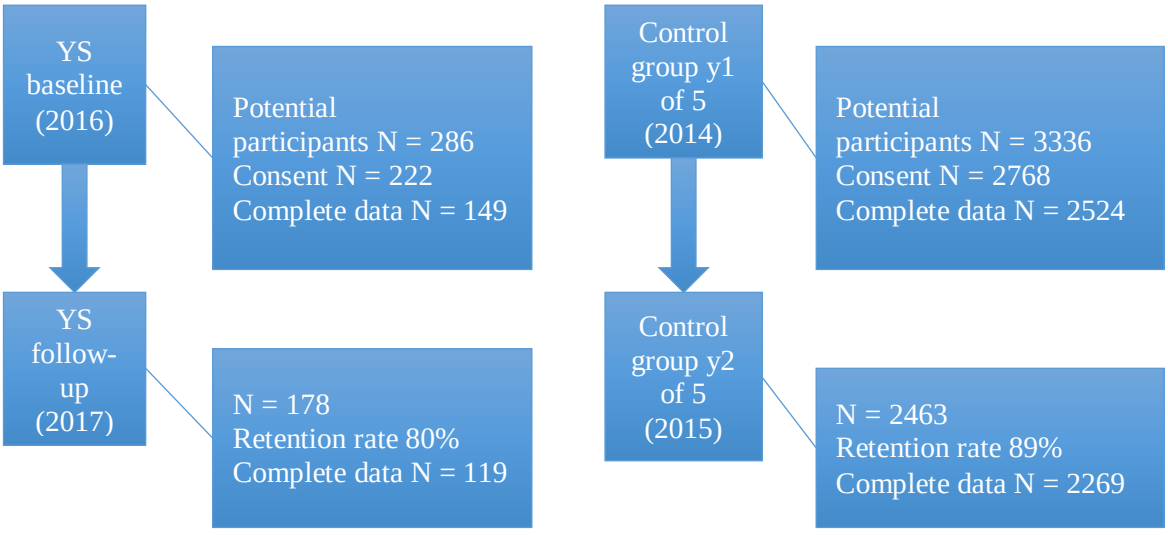


Figure 2. Flow chart of study participant

Measures

The primary outcome was *sleep duration*, measured via self-reported bed- and wake-times and sleep onset latency from the School Sleep Habits Survey (SSHS) (Wolfson & Carskadon, 1998). The secondary outcomes included *perceived stress*, measured through the Perceived Stress Scale, 14 items (PSS-14) (0-never to 4-very often) (Cohen, Kamarck, & Mermelstein, 1983); *sleep hygiene* was measured through the Adolescent Sleep Hygiene Scale, ASHS (Storfer-Isser, Lebourgeois, Harsh, Tompsett, & Redline, 2013), including the cognitive/emotional factor (6 items) and the behavioral arousal factor (3 items) (0-never to 5-always); and *technology use after bedtime,* 1 item developed for the Three Cities study (0-never to 4-almost always).

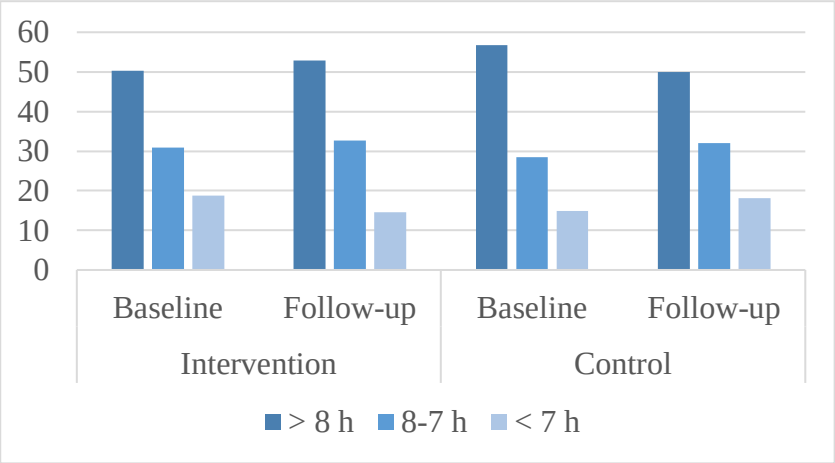
Data analysis

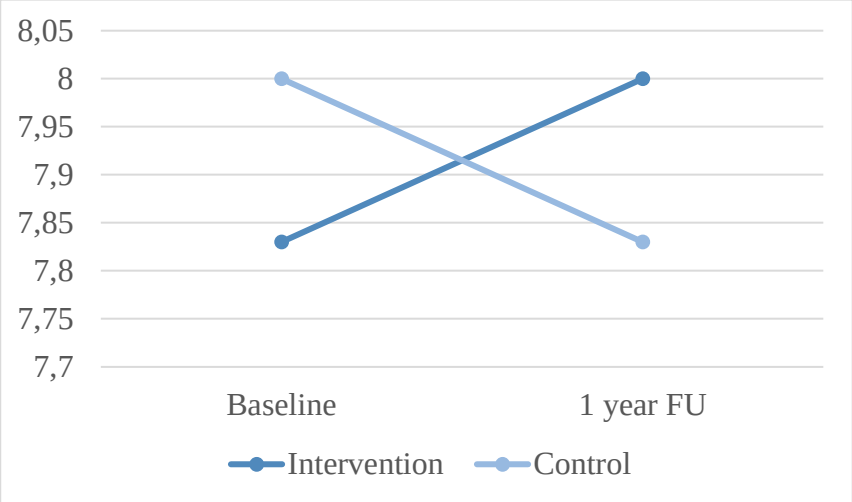
We explored whether changes in sleep duration subgroup (primary outcome) were predicted by intervention condition (yes/no) using logistic regression analysis, and controlling for confounders that showed a significant association with baseline sleep duration (i.e., gender, age, caretakers' ethnic background, family situation, and baseline sleep duration). Similarly, we analyzed sleep duration as a continuous variable using linear regression analysis to investigate the mean changes in sleep duration for the intervention and the control group. Then, we analyzed whether changes in sleep hygiene, perceived stress, and technology use (secondary outcomes) were predicted by intervention condition (yes/no) using three separate regression analyses (logistic regression for technology use, which is a dichotomous variable) and controlling for confounders. We performed multilevel analysis to check for the effect of school, as participants were naturally nested in schools. However, these analyses showed that the effect of school level was negligible and are not reported here.

Results

Were adolescents who participated in the sleep intervention less likely to report insufficient sleep duration one year later as compared to controls?

Adolescents in the intervention group were 1.6 times less likely to report borderline sleep duration (OR = .62, CI [.39; .99], p = .045) and 2.3 times less likely to report insufficient sleep duration (OR = .44, CI [.23; .84], p = .013) as compared to controls (see Fig. 3). Figure 4 shows the mean level changes in sleep duration in the intervention and control group (b = -0.04, p = .034).





Did perceived stress, sleep hygiene, and technology use also changed as a result of the intervention?

There was no effect of the intervention on perceived stress (b_{adj} = .005, CI [-0.08; 0.11], p = .74) and no effect on cognitive-emotional sleep hygiene (b_{adj} = -.024, CI [-0.25; 0.03], p = .13) but there was a small significant improvement in behavioral sleep hygiene for the intervention group (b_{adj} = .033, CI [0.002; 0.363], p = .05). Moreover, there was a significant change in technology use at bedtime, although in the opposite direction than expected. That is, adolescents who participated in the sleep classes were 2.3 times more likely to report using technology in bed as compared to the control group (OR_{adj} = 2.27, CI [1.53; 3.36], p < .001).

Conclusions

The results of this study indicate that the school-based sleep intervention had a preventive effect on adolescents' sleep duration after one year. That is, adolescents in the intervention group showed an increase in sleep duration over time whereas adolescents in the control group showed a decrease. However, it is less clear *how* the intervention works, as only sleep hygiene showed a small improvement whereas technology use at bedtime increased drastically in the intervention group. One possible explanation for this unexpected finding is that adolescents use their screen as a way to wind down before bed, and have found a better way to do so (e.g., listening to music). Some reasons for caution when interpreting the results are the non-randomized design of the study and the significant dropout rate. Is this change really due to the intervention? This study does not give a definite answer to the question. However, one strength of the study is the possibility to compare the intervention group with a large population that is likely to be representative of adolescents' normative sleep development over time. An increase in sleep duration goes against the trends seen most studies on adolescents' sleep (Kronholm at al., 2015) and indicates the potential for school-based interventions to prevent what has become a widespread health problem.

Interventions

2. Yapi stress, a longitudinal cluster randomized prevention trial

This study is one of four intervention subprojects within the program and conducted in collaboration with Ed Watkins, professor of Experimental and Applied Clinical Psychology at Exeter University, United Kingdom. The project concerns the development and evaluation of an indicated preventative intervention for stress-related health problems. Adolescence is a period of steep increase in experienced stressor load. In general, high overall stressor load is predictive of higher risk for developing emotional health problems and research indicates that repetitive negative thinking patterns such as worry and rumination may be central mechanisms that drive the development of these problems. As worry and rumination can be seen as modifiable coping behaviors they may be suitable targets for preventive intervention. Successfully targeting worry and rumination in adolescents could result in prevention of the development of stress-related emotional problems. In collaboration with Professor Watkins, we developed a guided, self-help, and internet-based intervention (coined "YAPI-stress") that aims to assist adolescents in exchanging worry and rumination in response to stress with more active and helpful coping strategies. YAPI stands for Your Application for Psychological Intervention, a generic mobile telephone and computer application developed within the Three Cities Study program to convey psychological interventions. The aim of this subproject was to investigate whether YAPI-stress affects stress-related health problems in youth.

Specifically, the research questions were:

1. Is YAPI-stress acceptable and does it reduce worry and levels of stress-related health problems in participants?
2. Does YAPI-stress result in preventative effect on stress-related health problems in youth with high worry and stress?

Method

Design

This is a cluster randomized, indicated prevention trial embedded in the longitudinal cohort of the Three Cities Study program. We conducted this trial in the 9th grade of lower secondary school and in 1st year of higher secondary school in nine randomly selected target schools in Örebro municipality. The other nine schools in Örebro served as passive controls. Students were assessed prior to the trial (baseline) and at a 1 and 2 year follow up. The study was approved by the Regional Ethics Board (Dnr: 2015/328).

Participants, procedure, measures

The intervention was conducted during the fall of 2015 and the spring of 2016. Parents were informed of the trial prior to study start and were given the opportunity to decline their child's participation. Students in the 9 target schools were informed of the study in class, and were invited to partake in a screening procedure consisting of the Penn State Worry Questionnaire for Children (PSWQ-C; Chorpita et al., 1997) and the Adolescent Stress Questionnaire-Short Version (ASQ-S, Byrne et al, 2007; Anniko et al., 2018). Students with elevated worry and stress levels ("at risk", operationalized as > 18.99 of the PSWQ-C and at least one items score > 2 on the ASQ-S) were subsequently offered further screening for exclusion criteria (psychological problems on a clinical level, assessed with MINI interviews) and, when eligible, participation in YAPI-stress. As can be seen in the flow chart (figure 1), 40% of students had elevated levels of worry and stress (= students at risk) and 13% of those eventually entered YAPI-stress. N=143 (32%) of the at risk students showed an initial interest in participating but the majority changed their mind and dropped off instead of signing up for participation. Nine percent (n=13) had to be excluded due to clinical problem levels and were referred to other care instances. Outcome was assessed with the PSWQ, the Center for Epidemiological Studies Depression Child Survey (CES-DC; Olsson & von Knorring, 1997), the perceived stress scale-14 (PSS-14; Cohen et al., 1983) and the Overall Anxiety Severity and Impairment Scale (OASIS; Norman et al., 2006).

In addition to baseline and 1 and 2 year follow ups, participants in YAPI-stress also filled out these measures halfway through the intervention and directly after it was

completed. Table 1 gives an overview of baseline characteristics of trail participants. As can be seen, there were no differences between students in target and intervention schools in levels of worry and stress and age. There was a significant difference in the proportion of girls/boys "not at risk" between the target and control schools. Therefore, gender was entered as a covariate in the comparative analyses.

Table 1.	Subgroup	Target	Control	Statistic
Age M (Sd)	Not at risk	16.0 (.7)	16.0 (.9)	*ns*
	At risk	16.0 (.8)	16.1 (.9)	
	YAPI-stress	16.1 (1.0)		
Gender (% female)	Not at risk	29%	40%	χ^2 (1) = 18.08**
	At risk	69%	73%	χ^2 (1) = 1.62 *ns*
	YAPI-stress	86%		
Worry (PSWQ; 0-42)	Not at risk	10.6 (5.3)	10.7 (4.9)	*ns*
	At risk	27.5 (6.5)	27.3 (6.54)	
	YAPI-stress	29.1 (6.3)		
Stressor load (ASQ; 27-137)	Not at risk	45.2 (15.0)	46.9 (15.1)	*ns*
	At risk	65.0 (16.2)	65.8 (17.4)	
	YAPI-stress	65.3 (15.7)		

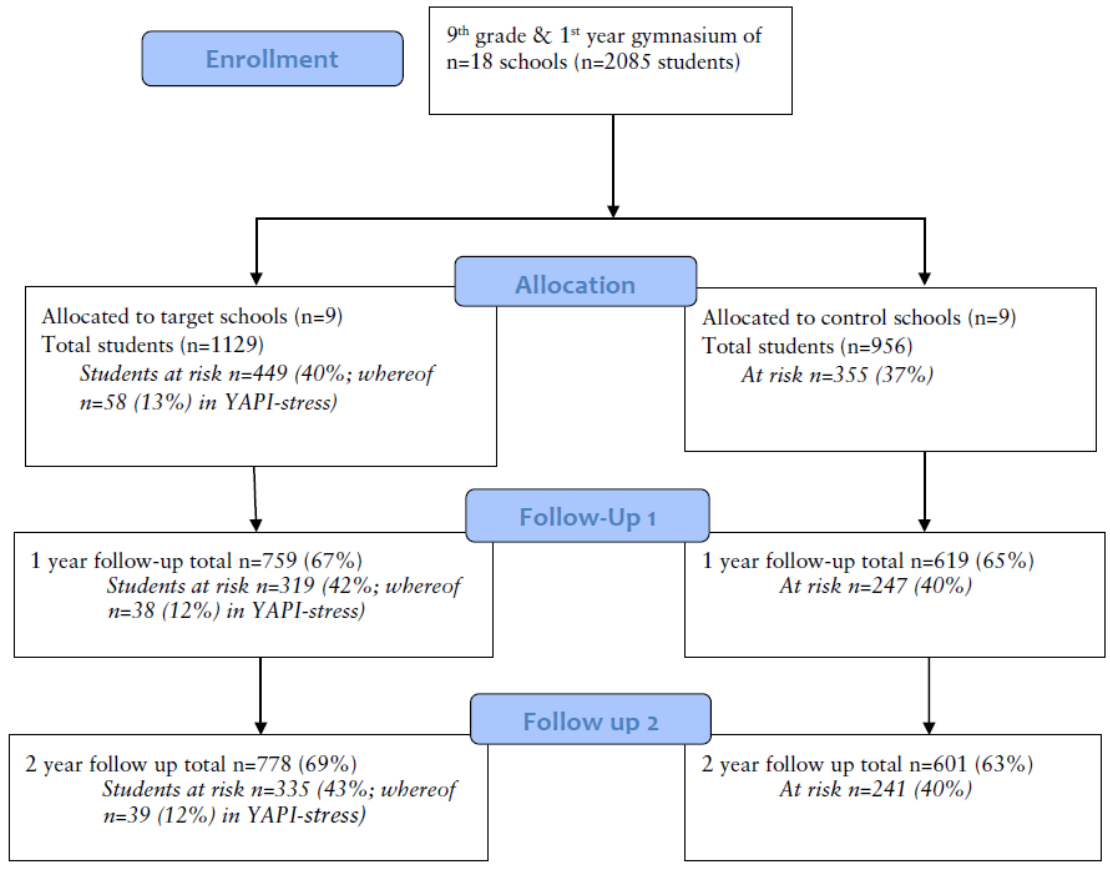


Figure 1. Flow chart.

The intervention

YAPI-stress is based on rumination focused cognitive behavior therapy (RF-CBT; Watkins, 2007), a principle based CBT, originally developed to target rumination and worry in chronically depressed patients. As rumination and worry have been found to be prominent transdiagnostic emotion regulation mechanisms in development of emotional problems, this treatment has also been adapted for youth with emotional health problems, with promising results (Topper et al., 2017). Based on this adaptation, we further adapted the treatment to Swedish circumstances.

YAPI-stress was delivered via the internet (accessible via mobile telephone and computer) and included 6 modules. The modules consisted of educational texts, pictures, case examples, video and audio files and homework assignments. Figure 2 provides an overview of the main theory behind the intervention.

In short, participants were trained to become aware of situations and early stress warning signals that triggered worry and rumination ("If then" relations) and were taught new behavioral strategies to cope with stress ("doing things differently"). Students were guided by coaches who were in the final phase of the clinical psychology master's program or who were licensed psychologists. All coaches received training and supervision in the protocol. Before the start of the intervention, the coaches contacted participants over phone to conduct a clinical interview (MINI) and to provide instruction on the details of the YAPI application and the intervention. All further communication was conducted via the chat function of the YAPI-app. Students could ask questions on a need basis receiving a response within 24 hours during the work week. Contingent upon completing homework assignments, written support and feedback was provided.

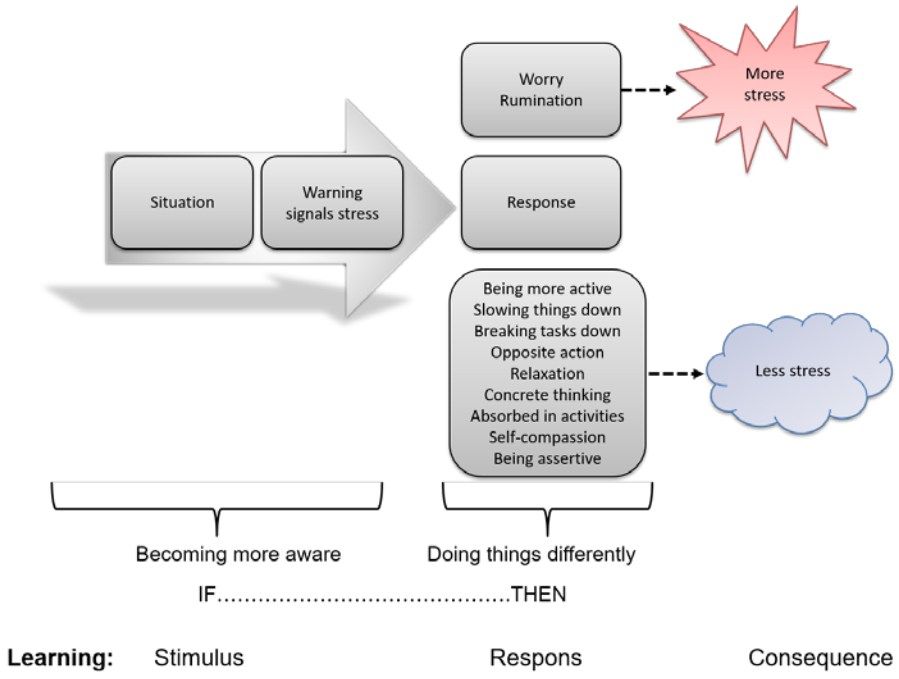


Figure 2. A model over the main theory behind YAPI-stress

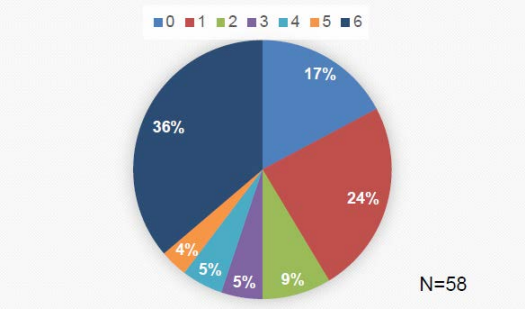
Analysis

Results were summarized using descriptive statistics. Changes across time were analyzed using dependent t-tests and factorial ANOVA. Cohens d was calculated, effect sizes of 0.2–0.5 were considered small, 0.5–0.8 moderate and ≥ 0.8 large (Cohen, 1988). Comparisons with the control group were made using factorial ANOVA.

Due to the low participation rate and the consequential lack of power in the comparisons, we further conducted a secondary analysis matching YAPI-stress participants' profiles (using case-control matching and PSWQ-C, age and gender as variables to match on) to profiles of students in the control school arm. Subsequently, we used factorial ANOVA to analyze differences.

Results

Figure 3 displays the proportion of participants completing the different modules. Of the n=58 who showed interest and were eligible for participation, n=10 (17%) did not start the intervention, n=22 (38%) completed 1-3 modules and n=26 (45%) completed 4-6 modules. The number of modules completed was unrelated to worry, depression, anxiety, stress, age or gender but showed a borderline significant relation to stressor load (ASQ, r=-.24; p=.07).



Within group improvements in YAPI-stress participants.

Table 2 shows the results for students who took part in YAPI-stress on pre, mid and post measures. There were significant decreases across the intervention for worry (F(2, 31)=21.79, p=.0001); depressive symptoms (F(2, 37)=11.71, p=.0001; and stress (F(2, 36)=6.39, p=.004). The effects were moderate to large in effect size. There was no significant decrease in anxiety (F(2, 35)=2.51, p=.096). There were significant associations between the numbers of modules completed and change in worry (r=.54, p=.001); depressive symptoms (r=.39, p=.02) and stress (r=.54, p=.001). The more modules completed the more participants improved.

Measure	Baseline *M* (*Sd*)	Mid *M* (*Sd*)	Post *M* (*Sd*)	*Effect size*

Worry (PSWQ 0-42)	29.3 (5.9)		22.8 (6.9)	*d*=1.01
Anxiety (OASIS 0-20)	3.0 (3.1)	2.9 (2.2)	2.1 (2.6)	*d*=0.31
Depressive symptoms (CES-DC 0-60)	23.8 (10.2)	20.9 (8.6)	16.3 (10.4)	*d*=0.73
Stress (PSS-14 0-42)	30.0 (7.5)	29.6 (7.6)	25.7 (8.7)	*d*=0.53

Table 2. Descriptives of outcomes at baseline, mid- and post intervention for participants YAPI-stress

Does the intervention result in a preventative effect on stress-related health problems?

Table 3 shows descriptive statistics of students in target and control schools on the outcome variables. There were no significant differences in change on any of outcome variables between students with "at risk" worry and stress levels in the target schools and the control schools.

Measure	Condition	Baseline *M* (*Sd*)	1 year Follow Up *M* (*Sd*)	2 year Follow Up *M* (*Sd*)
Worry (PSWQ 0-42)	Control			
	Not at risk	10.3 (5.1)	13.2 (8.5)	
	At risk	**27.0 (6.3)**	**25.2 (9.3)**	
	Intervention			
	Not at risk	10.7 (5.2)	13.2 (7.4)	
	At risk	**27.3 (6.3)**	**25.5 (9.1)**	
Anxiety (OASIS 0-20)	Control			
	Not at risk	2.2 (2.5)	1.0 (2.2)	1.2 (2.3)
	At risk	**6.5 (4.1)**	**3.2 (3.1)**	**2.3 (3.0)**
	Intervention			
	Not at risk	2.4 (2.9)	1.1 (2.1)	1.1 (2.0)
	At risk	**7.1 (4.2)**	**3.2 (4.4)**	**3.1 (3.3)**
Depressive symptoms (CES-DC 0-60)	Control			
	Not at risk	9.9 (7.1)	9.8 (6.2)	6.6 (7.2)
	At risk	**21.5 (11.2)**	**16.3 (9.0)**	**12.1 (8.2)**
	Intervention			
	Not at risk	10.7 (8.3)	9.6 (5.5)	7.11 (6.9)
	At risk	**22.8 (10.9)**	**15.7 (8.0)**	**12.1 (8.2)**
Stress (PSS-14 0-42)	Control			
	Not at risk	18.3 (8.1)	19.9 (8.9)	21.6 (9.2)
	At risk	**27.8 (7.8)**	**28.6 (8.4)**	**29.7 (8.2)**
	Intervention			
	Not at risk	18.9 (8.6)	20.65 (8.9)	22.5 (8.9)
	At risk	**28.6 (8.0)**	**28.5 (8.7)**	**28.7 (9.0)**

Table 3. Descriptives at baseline, 1 year and 2 year follow up for all participants in the prevention trial. "At risk" indicates > 18.99 of the PSWQ-C and at least one items score > 2 on the ASQ at baseline.

Does the intervention result in a preventative effect on stress-related health problems?

Case control matching

Table 4 displays descriptive statistics for the YAPI-stress participants and their matched controls in the control arm (n=54, 80% girls, age M=15.7 (Sd=.8)). Matching succeeded in that groups showed no differences on any of the outcome variables at baseline and on gender distribution. However, the YAPI-stress was on average slightly older (age M=16.1, Sd=1.0) and we therefore entered age as a covariate in the analyses. While mean level changes suggest a possible trend for a larger average improvement on worry for the YAPI-stress group, the results show no significant differences between YAPI-stress and control participants on any of the outcome variables.

Measure	Condition	Pre M_{est} (*SE*)	1 year Follow Up M_{est} (*SE*)	2 year Follow Up M_{est} (*SE*)
Worry (PSWQ 0-42)	Matched control	29.3 (1.0)	29.5 (1.4)	
	YAPI-stress	29.2 (1.0)	26.8 (1.5)	
Anxiety (OASIS 0-20)	Matched control	6.9 (.7)	4.1 (.6)	3.6 (.6)
	YAPI-stress	6.8 (.7)	3.4 (.6)	3.2 (.6)
Depressive symptoms (CES-DC 0-60)	Matched control	25.4 (1.8)	17.0 (1.5)	14.5 (1.7)
	YAPI-stress	24.4 (1.9)	16.4 (1.6)	11.8 (1.8)
Stress (PSS-14 0-42)	Matched control	31.5 (1.4)	31.6 (1.4)	31.3 (1.6)
	YAPI-stress	29.5 (1.4)	30.3 (1.4)	28.8 (1.7)

Table 4. Estimates for YAPI-stress and matched controls on outcomes at baseline and 1 and 2 year follow up.

Conclusions

While initial interest in participation in YAPI-stress was promising (32%) the eventual participation rate was low. Only 13% of the students who fulfilled the inclusion criteria ended up signing up for participation in the intervention. In addition, a sizable proportion of these (17%) did not complete any of the modules and only half completed more than 3 of 6 modules.

This resulted in a small intervention group and a trial that was underpowered to address the main research question of whether the YAP-stress intervention could have a preventative effect on stress-related health problems in youth with high worry and stress.

In summary, the results suggest that the intervention itself had a clear effect for participating youth on worry, stress and depressive symptoms and that the degree of engagement in the intervention was positively related to outcome. However, the results did not show any indication of a preventative effect of the intervention.

Interventions

3. Feasibility and preliminary effectiveness of internet delivered parent management training for parents to teenagers. A single case experimental study.

This study is one of four intervention subprojects within the program and conducted in collaboration with the research group of Associate Professor Pia Enebrink at the Department of Clinical Neuroscience, Division of Psychology, Karolinska Institute. We investigated the feasibility and preliminary effectiveness of a guided, internet-delivered parent management training for parents of teenagers. Parent management training programs have been found to be effective and are widely used in Sweden (e.g. Stattin et al., 2015). However, a concern in the dissemination of these programs is that attendance may compete with busy schedules and that parents may feel uncomfortable with the standard group-format. Delivery via the internet provides a modern route to increased accessibility and lowered threshold for participation. In general, psychological interventions via the internet have found to be an effective and acceptable treatment option for a wide range of problems (Andersson & Titov, 2014). Preliminary efforts to study the feasibility and effectiveness of internet programs for parents of young children are positive (Enebrink et al., 2012) but the effects of programs designed for parents of adolescents have not been systematically evaluated. The aim of this study was therefore to:

1. Investigate whether participation in an Internet-based parenting program is considered acceptable and helpful
2. Investigate whether an Internet-based parenting program leads to improved sense of competency, emotion regulation abilities and positive parenting strategies.

Method

Study design

This study used a replicated single-case AB design (Kazdin, 2010). Parents filled out repeated weekly dairy measures during a four to six-week baseline phase (phase A; median 4 weeks), before the training program was provided. Thereafter, parents continued to fill out repeated diary measures while working through the 5 module training program spanning over 6-8 weeks period (phase B; median 7 weeks). In this design, the baseline (Phase A) serves the same function as a no treatment control group. If changes, relative to the baseline phase, occur during the period when parents work with the program (Phase B), it is assumed that this is related to the program. The study was approved by the Regional Ethics Boards in Uppsala (Dnr: 2015/394).

Participants

Parents of adolescents attending secondary school grade 9 and first year of higher secondary school (age ~14-16) in the municipalities of Karlskoga and Köping were the target group for this subproject. On two occasions (2015, 2016), parents of adolescents in the study cohort were invited to fill out a questionnaire sent to their home address. Parents in Karlskoga and Köping who had responded to the invitation with a returned and filled out questionnaire were notified of this subproject through targeted invitations sent to their home address (N=305). The subproject was also announced on web platforms of the participating schools. Inclusion criteria were: 1. Being parent of an adolescent who participated in the Three Cities Study in the designated schools. 2. An average score of 3 (midscale) or higher (alternatively lower, dependent on the direction of the question) on screening questions selected from measures indicating difficulties in parenting (*inconsistent discipline*, 4 items from Shelton et al., 1996; *emotional invalidation*, 3 items from Paterson et al., 2012; *low power parenting*, 4 items from Krohn et al., 1992; and *low resilience to parenting stress*, 4 items from Bandura et al., 2001).

Exclusion criterion was parenting difficulties that showed clear relations with clinical problems in adolescents (screened with Kiddie-Sads-Aktuell och Livstid Version (K.SADS-PL), 2009). In that case parents were informed about more suitable treatment options. Figure 1. provides a flow chart over study inclusion. Of 305 invitations to households with parents participating in the Three Cities Study (Karlskoga & Köping), twenty parents (7%) replied with interest in participation in the study and were contacted to provide further information. Seven withdrew their interest and 13 parents were thereafter screened on inclusion and exclusion criteria. Ten parents fulfilled criteria and two withdrew their participation before the start of the intervention. Eight parents (six mothers and 2 fathers) participated in the study. Their median age was 44.5 years (range 41-49). They had completed secondary school (n=1), high school (n=1), continued professional education (n=3) or a university degree (n=3).

Open invitation to apply for participation in the study N=305		
→		Did not respond to invitation n=285
Replied showing interest N=20		
→		Withdrew after more information N=7 Below risk level cut off N=3
Fulfilled inclusion criteria N=10		
→		Drop out N=2
Completed study N=8		

Figure 1. Flow chart of study inclusion procedure.

Parenting program

The program 'föräldrawebben' (https://www.ipsykologi.se/), developed by Martin Foster, Pia Enebrink and Ata Ghaderi, is a web-based program for parents of children aged 11-17 years. Participants in the study received access to a web portal for a period of 6-8 weeks, where they were guided through a course with five sections (see table 1 for themes) that addressed different ways to strengthen the relationship with their teenager and how to handle common challenges. The program integrates aspects of several established programs and uses knowledge on risk/protective factors and emotion regulation/validation as a point of departure for influencing relationship quality and stress. A family guide (clinical psychologist in training for licensing) supported the participants systematically using a detailed manual (e.g. encouragement, systematic follow up on home work, reminders and response to queries).

5 standard modules:	Selection of 1 bonus module:
• Time together • Listen and validate • Choosing battles • Problem-solving & "Jag-budskap" • To let go and still be around	• Mental health problems • Help around the house • School • Friends and bullying • Internet and gambling • Alcohol and drugs

Table 1. Overview of the program

Measures

Self-evaluation of program

After the program, participants filled out five questions concerning their satisfaction with the program and the degree to which the program was helpful in influencing the relationship with their teenager and their ability to handle difficulties. All questions were rated on 0-5 point scales anchored depending on the question.

Weekly diary

The weekly diary was constructed for the purpose of the study and targeted sense of competency, general and parenting specific emotion regulation (using items adapted from: the parental sense of competency scale; the Affect regulation checklist; Resilience to Parenting Stress scale and the Counter Control questionnaire). Parents were asked to think of the past week and rate each item on a 1 ('not at all')-10 ('a lot') numeral rating scale. As the program aims to increase the amount of positive parenting strategies, we also assesed the number of joint activities conducted during the week as well as the degree of positive interactions (1 'not at all'-10 'a lot'). Table 2 shows the items used to asses parents' sense of competency (average item 1, 2), general emotion regulation difficulties (average item 3, 4) and emotion regulation difficulties specific to parenting (average item 5, 6, 7).

This past week… *1...I have felt like a good model as a parent.* *2... I have lived up to my own demands on myself as a parent when it comes to the parenting my child* *3…I have had difficulty controlling my feelings.* *4. It has been difficult for me to calm down when I got upset.* *5. I have managed to avoid feeling sad or depressed over my parenting when what I tried did not to work.* *6. I have been able to resist getting rattled over my teenager's behavior.* *7. I have been worried about how to deal with my child without making his / her behavior worse and harder to control.*

Table 2. Overview of items used to assess sense of competency and parentings specific and general emotion regulation.

Data analysis

Weekly dairy ratings were graphed and the percentage of data points exceeding the median of baseline phase (PEM) approach was used to complement visual inspection of changes in level and trend between baseline and treatment (Ma, 2006; Kazdin, 2011). In the PEM approach, the baseline median is used as a benchmark to judge change during the treatment phase against. The percentage of treatment phase data points above or below the baseline median (dependent on the expected change of direction) is calculated. As criteria for interpretation, 90-100% of treatment phase data points below the median signified a strong effect, 70-90% a moderate effect and < 70% a questionable or no effect (Scruggs, Mastropieri, Cook & Escobar, 1986). As this study used a relatively short baseline, the mean baseline score was used as a benchmark, instead of the median.

Results

Do parents consider the Internet-based parenting program acceptable and helpful?

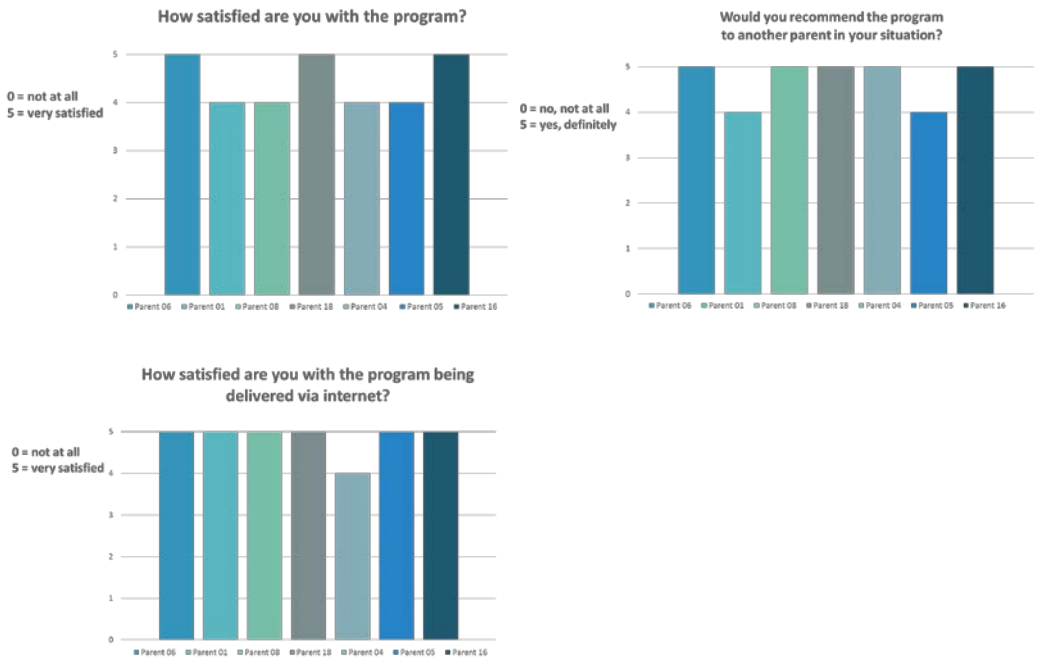


Figure 2-4. Parental evaluation of satisfaction with program.

The above graphs display parental responses to questions concerning their satisfaction with the program. Seven of the eight participants answered these questions. As can be seen, parents reported they were very satisfied with the program (range 4 to 5 on the 5 point scale) and its delivery via the internet (mostly 5 on the 5 point scale). Five of seven would definitely recommend it to another parent in their situation (range 4 to 5 on the 5 point scale).

Did parents consider the program helpful?

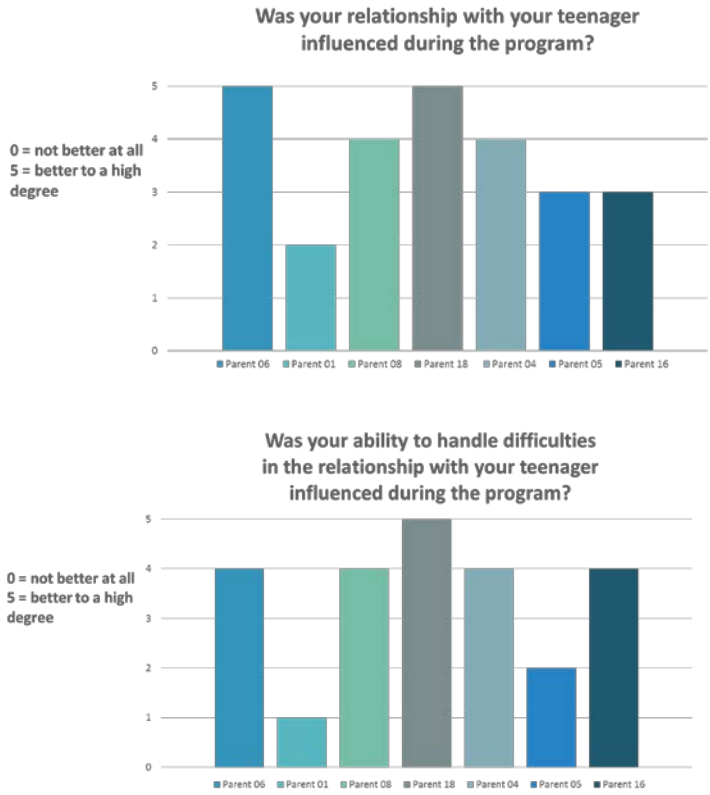


Figure 5, 6. Parental evaluation of helpfulness of program.

The above graphs display parental responses to questions regarding the helpfulness of the program. Seven of the eight participants answered these questions. As can be seen, there was variation in whether parents considered whether their relationship with their teenagers was influenced during the program.

Four out of seven parents rated that the relation was better to a high degree (4 or 5 on the 5 points scale) while the other three parents reported more moderate improvements (2 or 3 on the 5 points scale). There was also variation in whether parents found that their ability to handle difficulties was influenced during the program. Five out of seven parents rated that their ability had improved to a high degree (4 or 5 on the 5 points scale) while the other two parents reported only slight improvements (1 or 2 on the 5 points scale).

Did the Internet-based parenting program lead to improved sense of competency, emotion regulation abilities and positive parenting strategies?

Figure 7, 8 and 9 show weekly mean ratings (± 1 Standard deviation, N=8) of parents' sense of competency, general emotion regulation difficulties and emotion regulation difficulties specific to parenting, along baseline (A1-A4), intervention (B1-B8) and at 6 month follow up, respectively.

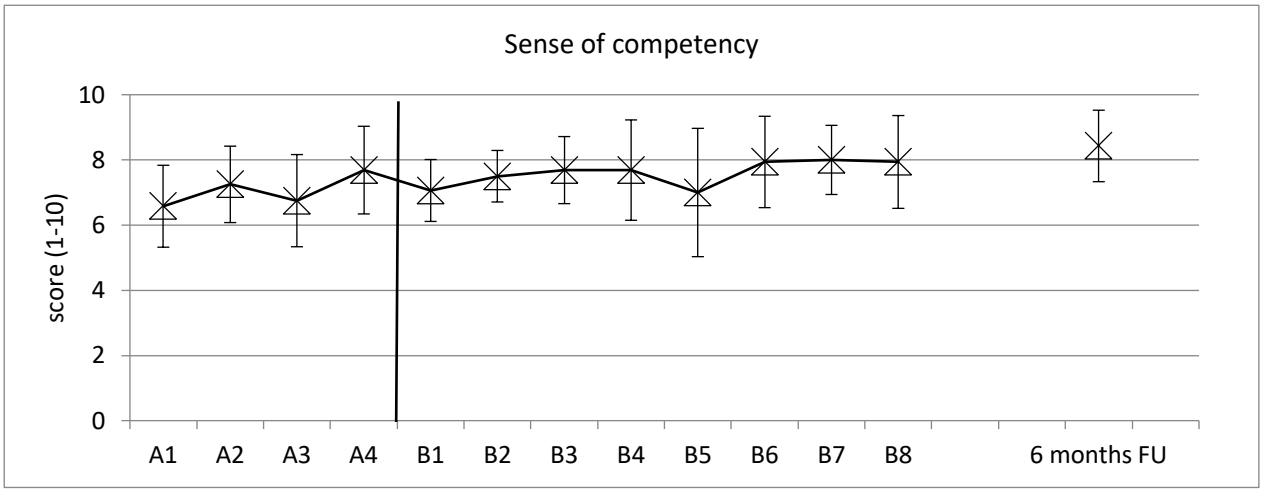


Figure 7. Dairy ratings sense of competency. A1-4= Phase A; B1-8= Phase B; 6 months FU= 6 months follow up

On parents' sense of competency, 2 participants had a strong effect with > 90% of intervention phase data points above their baseline mean. Two participants had a moderate effect (70-90% of treatment phase data points above their baseline mean) and 4 participants had a questionable or no effect (< 70% of treatment phase data points below their baseline mean), respectively. Percentage of data points above the means ranged from 0-100%. Visual inspection of the level of sense of competency at follow up suggests further improvements.

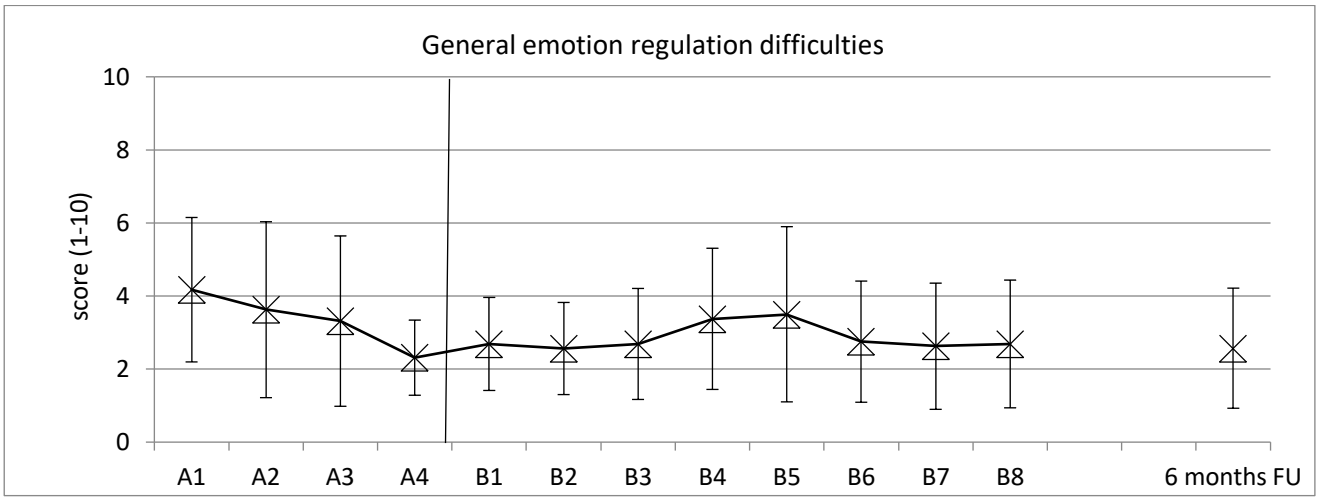


Figure 8. Dairy ratings general emotion regulation difficulties. A1-4= Phase A; B1-8= Phase B; 6 months FU= 6 months follow up

On general emotion regulation difficulties, 2 participants had a strong effect with > 90% of treatment phase data points below their baseline mean. Two participants had a moderate effect (70-90% of treatment phase data points below their baseline mean) and 4 participants had a questionable or no effect (< 70% of treatment phase data points below their baseline mean), respectively. Percentage of data points below the means ranged from 13-100%. Visual inspection of the level of general emotion regulation difficulties at follow up suggests stability as compared to the intervention phase.

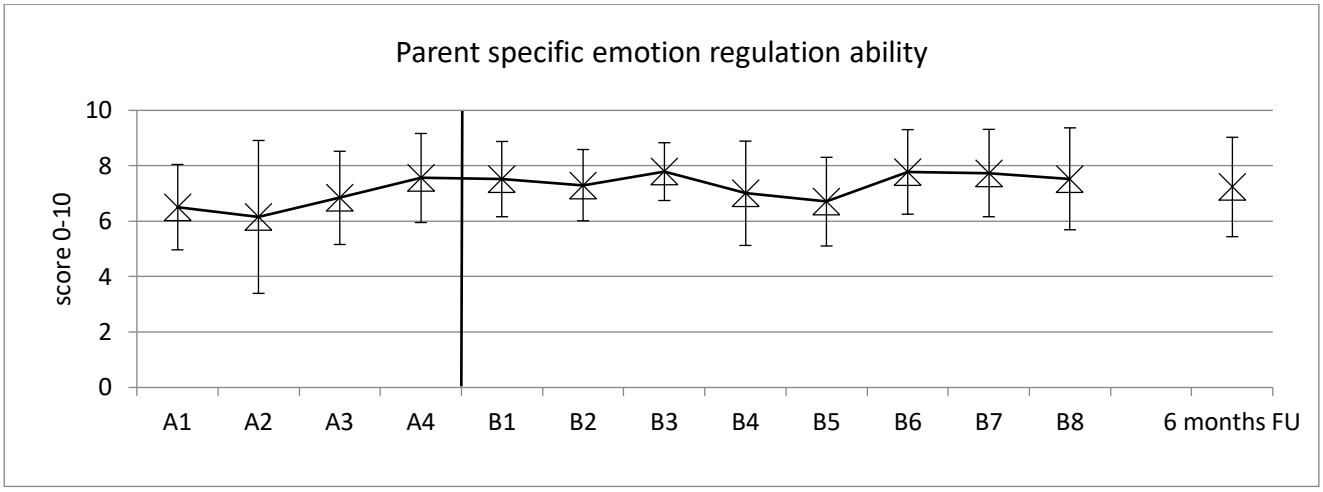


Figure 9. Dairy ratings parent specific emotion regulation ability, A1-4= Phase A; B1-8= Phase B; 6 months FU= 6 months follow up

On emotion regulation ability specific to parenting, 1 participant had a strong effect with > 90% of treatment phase data points above the baseline mean. Three participants had a moderate effect (70-90% of treatment phase data points above their baseline mean) and 4 participants had a questionable or no effect (< 70% of treatment phase data points above their baseline mean), respectively. Percentage of data points below the means ranged from 25-100%. Visual inspection of the level of parenting specific emotion regulation ability follow up suggests stability as compared to the intervention phase.

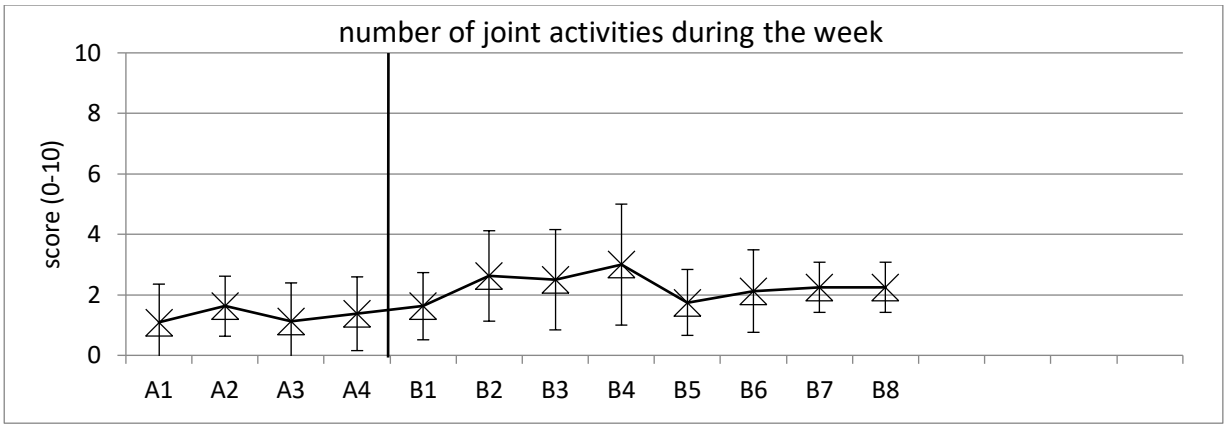


Figure 10. Dairy ratings of number of joint activities between parents and teenagers, A1-4= Phase A; B1-8= Phase B; 6 months FU= 6 months follow up

On the number of joint activities carried out during the past week, 2 participants had a strong effect with > 90% of treatment phase data points above their baseline mean. Three participants had a moderate effect (70-90% of treatment phase data points above their baseline mean) and 3 participants had a questionable or no effect (< 70% of treatment phase data points above their baseline mean), respectively. Percentage of data points above the means ranged from 50-100%.

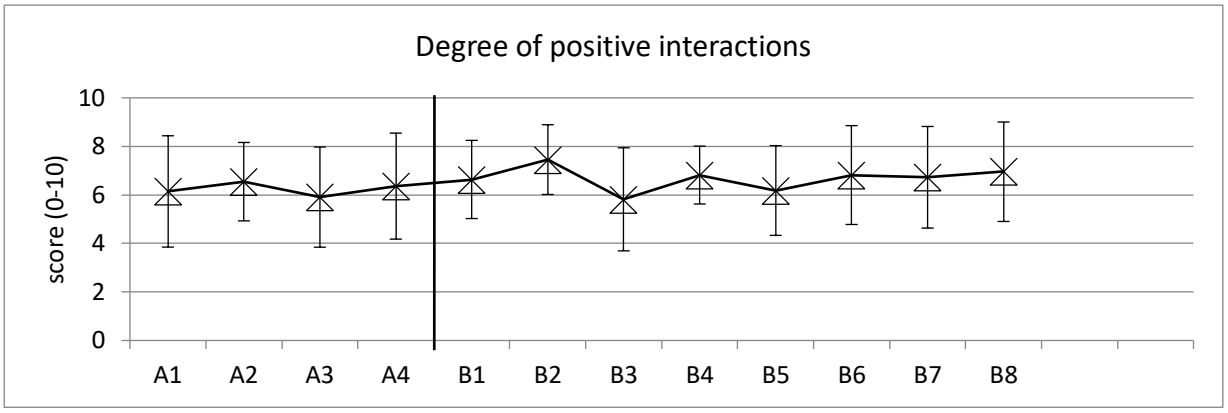


Figure 10. Dairy ratings of degree of positive interactions between parents and teenagers, A1-4= Phase A; B1-8= Phase B; 6 months FU= 6 months follow up

On degree of positive interactions, 1 participant had a strong effect with > 90% of treatment phase data points above the baseline mean. Two participants had a moderate effect (70-90% of treatment phase data points above their baseline mean) and 5 participants had a questionable or no effect (< 70% of treatment phase data points above their baseline mean), respectively. Percentage of data points below the means ranged from 14-100%.

	Strong effect	Moderate effect	No/questionable effect
Sense of competency	2	2	4
General emotion regulation difficulties	2	2	4
Parenting specific emotion regulation ability	1	3	4
Number of joint activities	2	3	3
Degree of positive interactions	1	2	5

Table 2. Overview of reliable changes on the variables in the weekly diary.

Table 2 gives an overview of the number of individuals receiving reliable changes from baseline to intervention on the variables assessed in the weekly diary. In summary, for the majority of the variables assessed, half of the participants showed reliable improvement as compared to the baseline period.

Conclusions

Only a small percentage (7%) of parents who were offered participation responded to the invitation to participate in this study. It is unknown what the reasons for non-response are. The parents that participated reported being highly satisfied with the program and the majority evaluated the program as helpful in influencing the relationship with their teenager and their ability to handle difficulties. Weekly diary ratings showed small but reliable improvements for about half of the participants. The level of problems parents experienced in relation to their teenager varied from mild to more severe. Further studies are needed to discern for whom this type of program may be of help. These preliminary results show promise and this format of delivery has the potential to reach out to more parents needing support in their parenting. This may address well-known concerns of dissemination of parenting programs, although reasons for not starting the program need to be investigated further.

Interventions

4. To prevent intolerance in school: A quasi-experimental study of the Tolerance project in Kungälv

This study is one of four intervention subprojects within the Three Cities Study. We investigated the effectiveness of the Tolerance project in Kungälv, a school-based intervention aimed at reducing intolerance in secondary school students. This project started in response to the increasing negative climate created by Nazi organizations in the city of Kungälv and has continued even after these organizations ceased their activities. The current aim of the Tolerance project includes increasing students' tolerance and prevent xenophobia (Mattsson & Hermansson-Adler, 2012). Although the program has been implemented in schools for the last 20 years, no empirical study has yet evaluated its effectiveness. Therefore, the aim of this study was to:

1. Investigate whether Tolerance-project participants showed a decrease in intolerant and prejudiced attitudes and behaviors after the intervention.
2. Examine whether the effects of the intervention were maintained 1 year after the intervention.

Method

Study design

This study used a quasi-experimental design. Students volunteered to participate in the intervention group and were finally selected by a team of teachers and recreation leaders based on their experience and knowledge of the individual students. The control group included students from the same schools and age group as the students participating in the intervention. All students filled out questionnaires on three occasions: Before the intervention (baseline), after the intervention (1 year post baseline) and 1 year after the intervention ended (follow-up). The study was approved by the Regional Ethics Boards in Uppsala (dnr. 2013/298).

Participants

Participants were 553 students from three schools in the municipality of Kungälv (see Fig. 1 for a flow chart of study participation). A total of 376 students completed measures at baseline and post intervention, these included 28 participants who received the intervention (57.1% girls, mean age = 14.22, 21% immigrant background) and 348 students (53.3% girls, mean age = 14.17, 11% immigrant background) who were part of the control condition. The intervention and control group did not differ in terms of gender distribution, age and ethnic background. However, students in the intervention group reported significantly higher rates of norm-breaking behaviors at baseline as compared to controls ($t(370) = -2.35$, $p = .026$). Moreover, attrition rates were 32% from baseline to post-test and 54% from post-test to follow up. Attrition analyses showed that students who did not fill out post measurements reported less xenophobic prejudices ($F(1, 485) = 5.51$, $p = .019$). Students who did not fill out the follow-up measurements reported higher rates of baseline norm-breaking behaviors ($t(534) = 3.16$, $p = .002$), and more so in the intervention as compared to the control group ($F(1, 352) = 15.26$, $p < .001$).

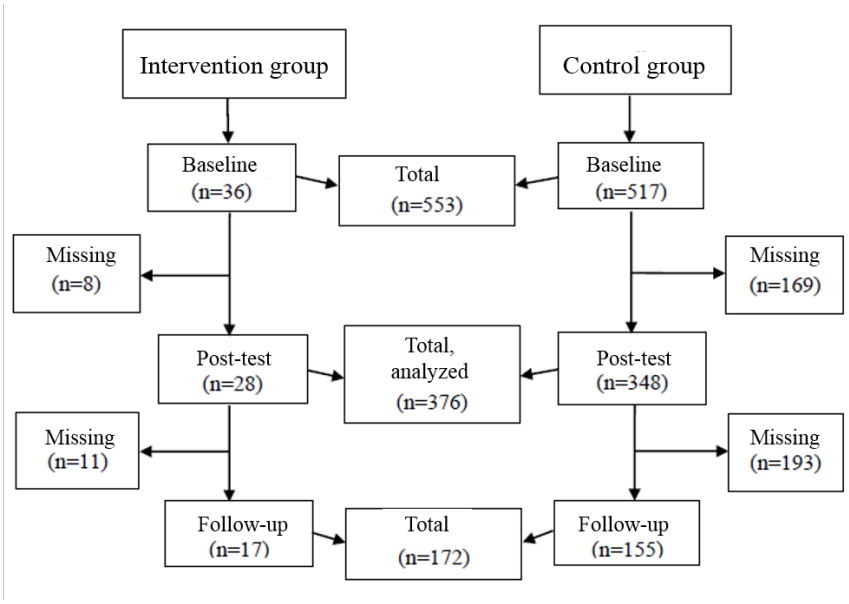


Figure 1. Flow chart of participants from baseline to follow-up.

Tolerance project

The Tolerance project is a psychopedagogical intervention that stretches across the whole school year and is structured as a course (20 classes, 160 hours) as part of the regular school curriculum. The target group for the Tolerance project includes 2/3 adolescents who are assessed to be at risk for developing intolerant attitudes and behaviors and who raise concern for the school climate. The remaining 1/3 includes adolescents defined as "high-performance" students, in order to increase diversity within the intervention group. The teaching team includes teachers and a program leader (always present), social workers, leisure leaders and special educators. The main idea behind the Tolerance project is to create a connection between historical and current events that the adolescents can relate to in order to develop their critical thinking and promote actions to prevent segregation and discrimination in school (Mattsson & Hermansson-Adler, 2012). Each class consists of three parts; 1) narrative, 2) discussion, 3) teamwork exercise, 4) homework. The narrative consists of a concrete event from the Holocaust, which is discussed in the group. Discussions might be about, for example, moral dilemmas, human behavior and the historical context of the event. Finally, the course includes a one-week trip to Poland to visit places related to the Holocaust such as concentration camps. After the trip, the 5 final lessons are dedicated to discuss what the students have experienced in Poland and to arrange an art exhibition where they can share their experiences and new knowledge.

Measures

All measures were self-reported by the participants (Appendix 1). The *primary outcomes* for this study were intolerant attitudes, xenophobic prejudices, and intolerant behaviours. The *secondary outcomes* were homonegativity, empathy, norm-breaking behaviors, deductive reasoning, and tolerant friend communications.
These outcomes are based on the psychosocial model of intolerance shown in Figure 2, which shows that empathy can attenuate the effects of normal processes such as categorization and in/outgroup perception and thus reduce prejudice and increase contact with the "outgroup" (i.e., "Contact hypothesis") (Allport, 1954).

Furthermore, friends have an important role as they provide the opportunity to develop abstract thinking through discussions and exchange of ideas about politics, society and values (Ekström & Östman, 2013). Abstract thinking in turn promotes empathy, described as the ability to take the other's perspective.

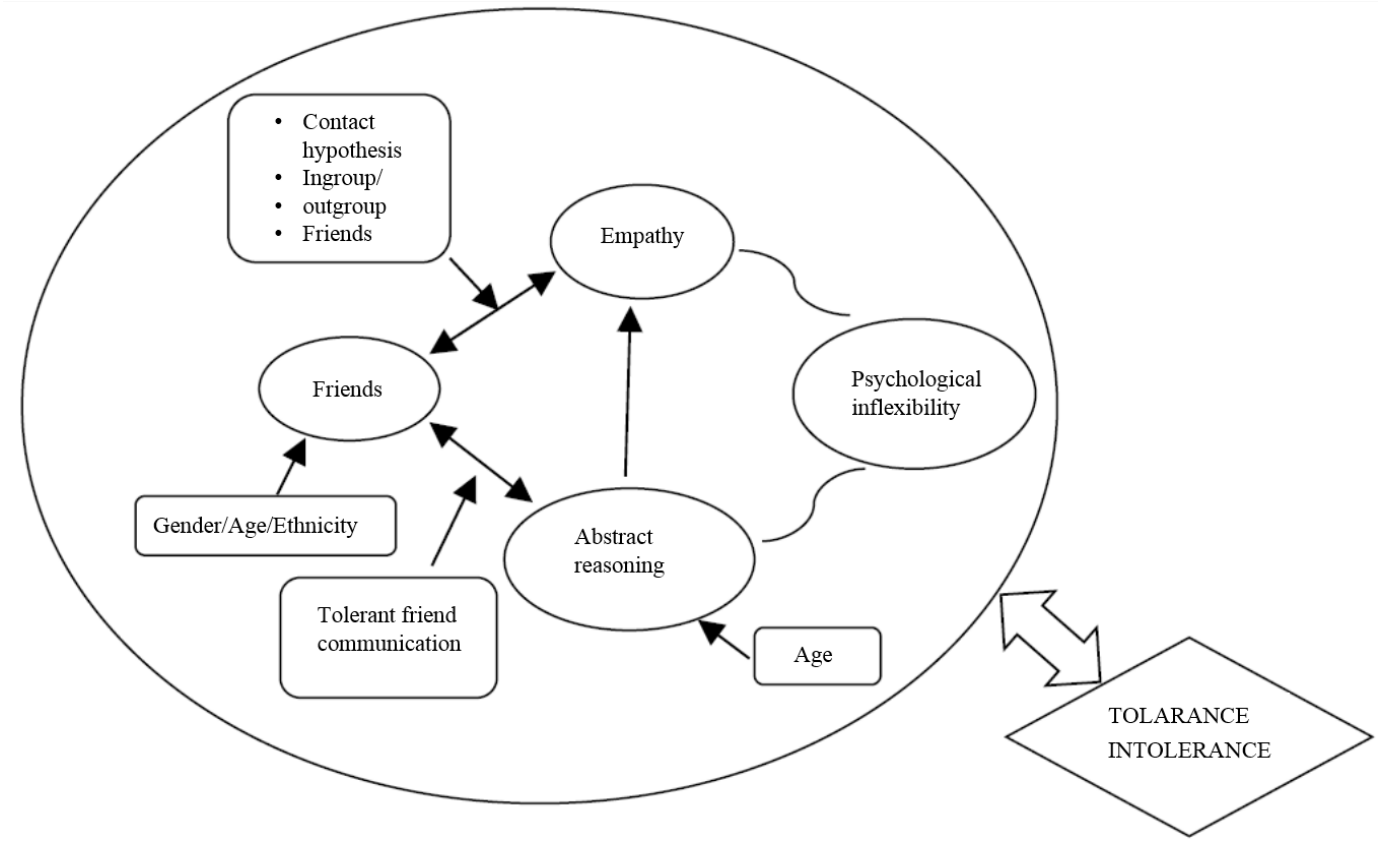


Figure 2. Theoretical model of psychosocial factors explaining tolerance/intolerance.

Data analysis

We used two-way repeated measures ANOVA to investigate the differences in intervention and control group over time for the outcomes of interest. In addition, significant differences were further explored via post-hoc analyses using two-way univariate ANOVA. When examining subgroups differences based on gender, ethnicity and deductive reasoning, we used three-way repeated measures ANOVA.

Results

Do Tolerance-project participants show a decrease in intolerant and prejudiced attitudes and behaviors after the intervention? And were the changes maintained at the 1-year follow-up?

Primary outcomes. There was no change in intolerant attitudes, behaviors and xenophobic prejudices after the intervention and at year follow up and no differences were found between intervention and control group over time.

Secondary outcomes. Both groups showed a significant increase in norm-breaking behaviors (η_p^2 = .122). This increase was maintained after 2 years and it was somewhat larger in the intervention group (F (1, 169) = 7.87, p = .006; M_i = 1.49, SE = 0.83 vs M_c = 1.24, SE = 0.27, η_p^2 = .034) (see Fig. 3). On the other hand, tolerant friend communications showed an increase (p = .06, η_p^2 = .078), somewhat larger in the intervention group (see Fig. 4). There were no significant changes in homonegativity.

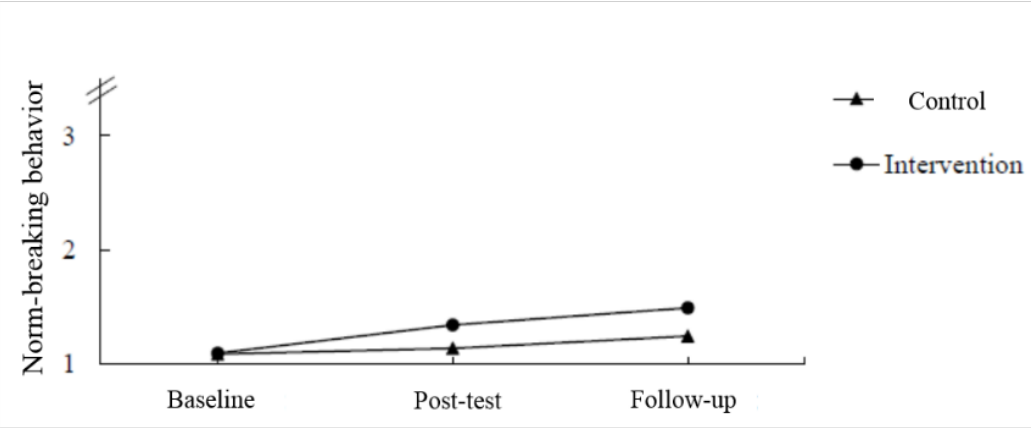


Figure 3. Changes in norm-breaking behaviors over time in the intervention and control group.

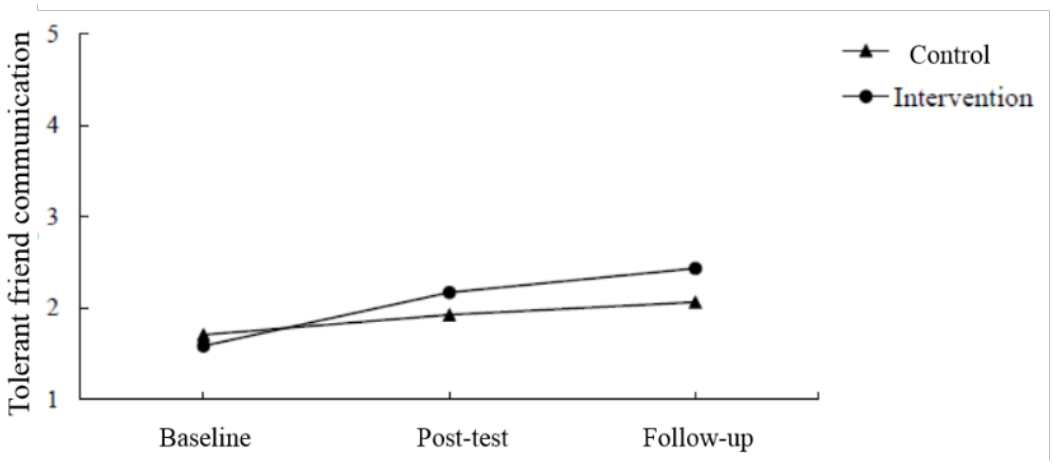


Figure 4. Changes in tolerant friend communication over time in the intervention and control group.

Conclusions

The results of this study should be interpreted with caution due to methodological shortcomings but shows no convincing support for the thesis that the Kungälv Tolerance project reduces intolerance and xenophobia among adolescents. Young people's attitudes are influenced by a variety of factors, and it is likely that broad efforts in all relevant contexts are a prerequisite to change deeply rooted negative attitudes about other people.

While the young people in the Tolerance project received a substantial intervention in comparison to the standard school curriculum, other key context of the youth remained untouched. Thus, the lack of a clear effect could be explained by the limitations of the intervention in the ability to influence youths' context and environment.

For more details on this study we refer to: Strindhall, H. & Westerberg, B. (2016). Att motarbeta intolerans i skolan. En kvasiexperimentell utvärdering av Toleransprojektet i Kungälv, examensuppsats, psykologprogrammet, Örebro Universitet.

Appendix 1. Measures

	Measure	Scale	Response scale	Example item
Primary outcomes	Intolerant attitudes	Scale created for the present study, 5 items	1-completely agree to 5-completely disagree	"Immigrants should have the same right as non-immigrants"
	Xenophobic prejudices	"Classical and modern racial prejudice scale" (Akrami, Ekehammar, & Araya, 2000), 17 items	1-completely agree to 5-completely disagree	"Immigrants are getting too demanding in the push for equal rights"
	Intolerant behaviors	Scale created for the present study, 3 items	1-never to 5-very often	"How often have you bullied, threatened or harassed others because of their ethnicity/sexuality/ appearance?"
Secondary outcomes	Homonegativity	"Modern Homonegativity Scale" (Morrison & Morrison, 2002), 17 items	1-completely agree to 5-comlpetely disagree	"Many gay men use their sexual orientation so that they can obtain special privileges"
	Empathy	"The Empathy Assessment Index" (Lietz et al., 2011), 14 (of 50 total) items	1-completely agree to 6-comlpetely disagree	"I can imagine what it's like to be in someone else's shoes"
	Norm-breaking behaviors	Checklist of norm-breaking behaviors (see Skoog, 2008), 11 items	1-it has never happened to 5-more than 10 times	"Have you threatened or forced someone to give you money, cigarettes or the like?"
	Deductive reasoning	Scale created for the present study, 5 items: 2 items about logical reasoning and 3 items measuring the ability to make decisions independent of prejudice	First 2 items: 1-logical, 2-unlogical Last 3 items: 1-yes, definitely to 6-definitely not	"1) Flying is the best way to travel; 2) Flying is good for the economy. Conclusion: Flying is definitely not good for the economy"
	Tolerant friend communications	Scale created for the present study, 5 items	1-never to 5-very often	"How often do you discuss whether immigrants have the same possibilities as non-immigrants?"

Conclusions

This scientific report presents a selection of findings of the Three Cities Study program as of March 2019. The longitudinal database, mapping the development of mental health from early to late adolescence has however the potential to significantly strengthen research on child and adolescent mental health in Sweden in the years to come.

The results, so far, support the role of transdiagnostic risk factors and mechanisms in the development of a range of mental health problems and provide a future basis for actions to buffer their development. In line with other research, we found that early adolescence is a period when stressors increase in parallel with an increase mental health problems. On the positive side, our data also indicate that stressors and mental health problems decrease from mid to late adolescence. Furthermore, and also in line with the literature, we found consistent support for the importance of emotion regulations mechanisms such as worry and rumination in propelling the development of a variety of emotional ill-health symptoms. As such, these emotion regulation mechanisms show transdiagnostic reach. There is however, not in the least from a school and public health perspective, a continued need to study how maladaptive coping with stress may be addressed in order to have long term preventive effects. One promising avenue to prevent stress-related ill health may be through improving sleep. Our results show that a significant proportion of youth report insufficient sleep duration and this is related to poor sleep hygiene, use of electronic media and stress. The results from our primary prevention trial indicate that we may be able to influence sleep duration by addressing the barriers adolescents themselves report: school stress, need for leisure time, use of technology and fear of missing out.

References

Methods

Pokorny, S.B., Jason, L.A., Schoeny, M.E., Townsend, S.M., Curie, C.J., 2001. Do participation rates change when active consent procedures replace passive consent. Eval. Rev. 25, 567–580.

Shaw, T., Cross, D., Thomas, L. T., & Zubrick, S. R. (2015). Bias in student survey findings from active parental consent procedures. *British Educational Research Journal*, *41*(2), 229-243

Historical Outlook

- Beckman L, & Hagquist C. Hur mår barn och ungdomar i Sverige?: Analys av den officiella bilden, mediebilden och bilden från forskningen: 2010.
- De Looze MED, Huijts T, Stevens GWJM, et al. The Happiest Kids on Earth : Gender Equality and Adolescent Life Satisfaction in Europe and North America. 2017;est Kids on Earth : Gender Equality and Adolescent Life Satisfaction in Europe and North America. Journal of Youth and Adolescence. ISSN 1573-6601.
- Frih A-K. Flickan i medicinen: ungdom, kön och sjuklighet 1870-1930. Örebro : Örebro University, 2007.
- Fritzell J, Gähler & M,Nermo M. Vad hände med 1990-talets stora förlorargrupper? Välfärd och ofärd under 2000-talet. Socialvetenskaplig tidskrift 2007.
- Folkhälsomyndigheten. Svenska skolbarns hälsovanor 2013/14: grundrapport: Östersund: Statens folkhälsoinstitut; 2014.
- Gonick, M. Between "Girl Power" and "Reviving Ophelia": Constituting the Neoliberal Girl Subject. NWSA Journal 18(2):1-23 2006.
- Johannisson K. Den mörka kontinenten : kvinnan, medicinen och fin-de-siècle: Stockholm: Stockholm : Norstedt; 1994.
- Samren, E. (1975). Genomgången gymnasieskola - vid en skiljeväg (Psykologexamensarbete, IDA rapport nr 31). Psykologiska institutionen. Stockholms universitet. Tillgänglig: https://www.oru.se/globalassets/oru- sv/forskning/forskningsprojekt/jps/kriminologi/ida-rapporter/ida-report-no-31.pdf
- Socialstyrelsen. (2017). *Utvecklingen av psykisk ohälsa bland barn och unga vuxna. Till och med 2016.* http://www.socialstyrelsen.se/publikationer2017/2017-12-29
- Wiklund, M, Strömbäck, M & Bengs C. Forskarperspektiv på ungas psykiska ohälsa. Dissonanser och möjligheter – i ljuset av genus, normativitet och samhällets individualisering. I När livet känns fel. Ungas upplevelser kring psykisk ohälsa. Stockholm: 2015.

- Wångby M, Magnusson, & D, Stattin H. Time trends in the adjustment of Swedish teenage girls: A 26-year comparison of 15-year-olds. Scandinavian Journal of Psychology. 2005;46:145-56.
- Örebro universitet. (2017a). *IDA-programmet.* https://www.oru.se/forskning/forskningsproj/jps/ida-rogrammet/

Interventions 1

-Bauducco, S. V. (2017). Adolescents´ sleep in a 24/7 society: Epidemiology and prevention. (Doctoral dissertation). Örebro: Örebro University.
-Cassoff, J., Knäuper, B., Michaelsen, S., & Gruber, R. (2013). School-based sleep promotion programs: Effectiveness, feasibility and insights for future research. Sleep medicine reviews, 17(3), 207-214. doi:10.1016/j.smrv.2012.07.001
-Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. Journal of health and social behavior, 385-396.
-Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., . . . Kheirandish-Gozal, L. (2015). National Sleep Foundation's sleep time duration recommendations: methodology and results summary. Sleep Health, 1(1), 40-43.
-Kronholm, E., Puusniekka, R., Jokela, J., Villberg, J., Urrila, A. S., Paunio, T., . . . Tynjälä, J. (2015). Trends in self-reported sleep problems, tiredness and related school performance among Finnish adolescents from 1984 to 2011. Journal of sleep research, 24(1), 3-10. doi:https://doi.org/10.1111/jsr.12258
-Shochat, T., Cohen-Zion, M., & Tzischinsky, O. (2014). Functional consequences of inadequate sleep in adolescents: a systematic review. Sleep medicine reviews, 18(1), 75-87.
-Storfer - Isser, A., Lebourgeois, M. K., Harsh, J., Tompsett, C. J., & Redline, S. (2013). Psychometric properties of the adolescent sleep hygiene scale. Journal of sleep research, 22(6), 707-716.
-Wolfson, A. R., & Carskadon, M. A. (1998). Sleep schedules and daytime functioning in adolescents. Child development, 875-887.

Interventions 2

- Anniko, M. K., Boersma, K., van Wijk, N. P. L., Byrne, D., & Tillfors, M. (2018). Development of a Shortened Version of the Adolescent Stress Questionnaire (ASQ-S): construct validity and sex invariance in a large sample of Swedish adolescents. *Scandinavian Journal of Child and Adolescent Psychiatry and Psychology*, *6*(1), 4-15.
- Byrne, D. G., Davenport, S. C., & Mazanov, J. (2007). Profiles of adolescent stress: The development of the adolescent stress questionnaire (ASQ). *Journal of Adolescence*, *30,* 393-416.
- Chorpita, B. F., Tracey, S. A., Brown, T. A., Collica, T. J., & Barlow, D. H. (1997). Assessment of worry in children and adolescents: An adaptation of the Penn state Worry Questionnaire. *Behavior Research and Therapy, 35*, 569-581.

- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24,* 385-396.
- Cohen, J. Statistical Power Analysis for the Behavioral Sciences. Hillsdale, NJ: Lawrence Erlbaum Associates, 2nd edition, 1988.
- Norman, S. B., Cissell, S. H., Means-Christensen, A. J., & Stein, M. B. (2006). Development and validation of an Overall Anxiety Severity and Impairment Scale (OASIS). *Depression & Anxiety, 23*, 245–249.
- Olsson, G., & von Knorring, A. L. (1997). Depression among Swedish adolescents measured by the self-rating scale Center for Epidemiology Studies Depression Child (CES-DC). *European Child & Adolescent Psychiatry*, *6,* 81-87.
- Topper, M., Emmelkamp, P. M., Watkins, E., & Ehring, T. (2017). Prevention of anxiety disorders and depression by targeting excessive worry and rumination in adolescents and young adults: a randomized controlled trial. *Behaviour research and therapy*, *90*, 123-136.

Interventions 3

- Andersson, G., Cuijpers, P., Carlbring, P., Riper, H., & Hedman, E. (2014). Guided Internet-based vs. face-to-face cognitive behavior therapy for psychiatric and somatic disorders: a systematic review and meta-analysis. *World Psychiatry*, *13*(3), 288-295.
- Enebrink, P., Högström, J., Forster, M., & Ghaderi, A. (2012). Internet-based parent management training: A randomized controlled study. *Behaviour research and therapy*, *50*(4), 240-249.
- Stattin, H., Enebrink, P., Özdemir, M., & Giannotta, F. (2015). A national evaluation of parenting programs in Sweden: the short-term effects using an RCT effectiveness design. *Journal of consulting and clinical psychology*, *83*(6), 1069.
- Moretti, M. M. (2003). The Affect Regulation Checklist (ARC). (Unpublished measure and data). Simon Fraser University: Burnaby, British Columbia, Canada.
Moretti, M. M., Braber, K., & Obsuth, I. (2009). Connect: An attachment focused treatment group for parents and caregivers – A principle based manual (Pre-Adolescent Version). Simon Fraser University, Burnaby, British Columbia, Canada.
- Bandura A., Barbaranelli C., & Caprara, G. V., & Pastorelli, C. (2001). Self-efficacy beliefs as shapers of children's aspirations and career trajectories. *Child Development, 72*, 187-206.
- Kazdin, A, E., (2010) *Research design in clinical psychology*. (4th ed). Boston: Allyn & Bacon.
- Krohn, M. D., Stern, S. S., Thornberry, T. P., & Jang, S. J. (1992). The measurement of family process variables: The effect of adolescent and parent perceptions of family life on delinquent behavior. *Journal of Quantitative Criminology, 8,* 287-315.
- Ma, H. (2006). An alternative method for quantitative synthesis of single-subject researches: Percentage of data points exceeding the median. *Behavior Modification, 30*(5), 598-617.
- Paterson, D. A., Babb, K. A., Camodeca, A., Goodwin, J., Hakim-Larson, J., Velker, S. & Gragg, M.
(2012). Emotion-related parenting styles (ERPS): A short form for measuring parental meta-emotion philosophy. *Early Education & Development, 23,* 583-602.

- Scruggs, T. E., Mastropieri, M. A., Cook, S. B., & Escobar, C. (1986). Early interventions for children with conduct disorders: A quantitative synthesis of single-subject research. *Behavioral Disorders*, *11*, 260-271.
- Shelton, K. K., Frick, P. J., & Wootton, J. (1996). Assessment of parenting practices in families of elementary school-aged children. *Journal of Clinical Child Psychology,* 25, 317–329.

Interventions 4

- Akrami, N., Ekehammar, B., & Araya, T. (2000). Classical and modern racial prejudice: A study of attitudes toward immigrants in Sweden. *European Journal Of Social Psychology, 30(4)*, 521-532
- Allport, G. W. (1954). *The nature of prejudice*. Cambridge, MA: Perseus Books.
- Ekström, M., & Östman, J. (2013). Family talk, peer talk and young people's civic orientation. *European Journal Of Communication, 28*(3), 294-308.
- Lietz, C. A., Gerdes, K. E., Sun, F., Geiger, J. M., Wagaman, M. A., & Segal, E. A. (2011). The Empathy Assessment Index (EAI): A confirmatory factor analysis of a multidimensional model of empathy. *Journal Of The Society For Social Work And Research, 2*(2), 104-124
- Mattsson, C., & Hermansson-Adler, M. (2012). *10 lektioner om tolerans. Lärarhandledning (uppl.1)* Stockholm: Natur & Kultur.
- Morrison, M. A., & Morrison, T. G. (2002). Development and Validation of a Scale Measuring Modern Prejudice Toward Gay Men and Lesbian Women. *Journal Of Homosexuality*, 43(2), 15-37