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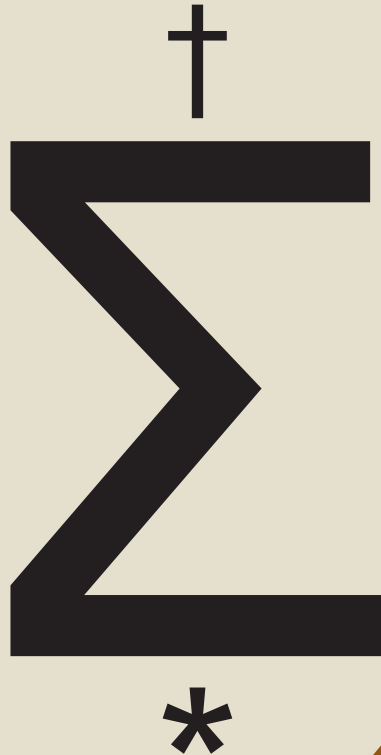
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Perceived Stress

Sleep, Self-Esteem, and Psychiatric Symptoms in Adolescents

FRIDA THORSÉN

DEPARTMENT OF CLINICAL SCIENCES MALMÖ | LUND UNIVERSITY



Perceived Stress

Perceived Stress

Sleep, Self-Esteem, and Psychiatric Symptoms in Adolescents

Frida Thorsén



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DOCTORAL DISSERTATION

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Abstract			
<p>Background:</p> <p>Studies examining perceived stress, sleep, self-esteem and psychiatric symptoms by using validated questionnaires in adolescents are lacking. The aim of this study was to examine the prevalence of, potential associations between, and sex differences in, perceived stress and psychiatric symptoms, sleep quality, self-esteem and self-rated health outcomes.</p> <p>Methods:</p> <p>Questionnaires were used to assess perceived stress (Perceived Stress Scale), psychiatric symptoms (Symptoms Checklist 90), sleep quality (Pittsburgh Sleep Quality Index), self-esteem (I think I Am), and health outcomes (Folkhälsöenkäten). Perceived stress, sleep and psychiatric symptoms were examined in 194 Swedish adolescents aged 15-19 years and compared with Swedish reference data from 1996-1998. Perceived stress, self-esteem and health outcomes were examined in 636 Swedish and Bulgarian adolescents aged 15-16 years.</p> <p>Results:</p> <p>Higher levels of perceived stress and psychiatric symptoms were reported in 2011 compared with 1996-1998. More than 70% had poor sleep quality. Perceived stress was associated with sleep quality, self-esteem and psychiatric symptoms. Girls consistently reported higher levels of stress and more psychiatric and somatic symptoms than boys.</p> <p>Conclusions:</p> <p>The findings support that psychiatric symptoms in adolescents may have increased over time, and that perception of stress and insufficient recovery may partly explain this development. Evaluating preventative measures early in life and their possible effect on the future progression of symptoms, as well as evaluating methods for lessening the perception of stress, both by reducing the actual stress burden (if possible), strengthening coping-abilities and factors of resilience, should be considered.</p>			
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Frida Thorsén



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To my immensely loved family.

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Abstract

Background

Studies examining perceived stress, sleep, self-esteem and psychiatric symptoms by using validated questionnaires in adolescents are lacking. The aim of this study was to examine the prevalence of, potential associations between, and sex differences in, perceived stress and psychiatric symptoms, sleep quality, self-esteem and self-rated health outcomes.

Methods

Questionnaires were used to assess perceived stress (Perceived Stress Scale), psychiatric symptoms (Symptoms Checklist 90), sleep quality (Pittsburgh Sleep Quality Index), self-esteem (I think I Am), and health outcomes (Folkhälsoenkäten). Perceived stress, sleep and psychiatric symptoms were examined in 194 Swedish adolescents aged 15-19 years and compared with Swedish reference data from 1996-1998. Perceived stress, self-esteem and health outcomes were examined in 636 Swedish and Bulgarian adolescents aged 15-16 years.

Results

Higher levels of perceived stress and psychiatric symptoms were reported in 2011 compared with 1996-1998. More than 70% had poor sleep quality. Perceived stress was associated with sleep quality, self-esteem and psychiatric symptoms. Girls consistently reported higher levels of stress and more psychiatric and somatic symptoms than boys.

Conclusions

The findings support the idea that psychiatric symptoms in adolescents have increased, and that perception of stress and insufficient recovery may partly explain this development. Evaluating preventative measures early in life and their possible effect on the future progression of symptoms, as well as evaluating methods for lessening the perception of stress, both by reducing the actual stress burden (if possible), strengthening coping-abilities and factors of resilience, should be considered.

List of Papers

This thesis is based on the following Papers, which will be referred to in the text by the respective Roman numeral.

Paper I.

Thorsén, F., Antonson, C., Sundquist, J., & Sundquist, K. (2016).
“Perceived Stress and Psychiatric Symptoms in Swedish Adolescents”
Journal of Educational & Developmental Psychology, 6(2), p 183-194.
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Paper II.

Thorsén, F., Antonson, C., Sundquist, J., & Sundquist, K. (2020).
“Sleep in relation to psychiatric symptoms and perceived stress in Swedish adolescents aged 15 to 19 years.”
Scandinavian Journal of Child and Adolescent Psychiatry and Psychology, 8, p 10-17.
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Paper III.

Thorsén, F., Antonson, C., Palmér, K., Berg, R., Koltcheva, N., Mutafchieva, M.,
Sundquist, J., & Sundquist, K.
“Associations between self-esteem and perceived stress in adolescents”
Manuscript

Paper IV.

Thorsén, F., Antonson, C., Palmér, K., Berg, R., Sundquist, J., & Sundquist, K.
(2022)
“Associations between perceived stress and health-related outcomes in Swedish adolescents”
Child and Adolescent Psychiatry and Mental Health, 16:75
doi: [10.1186/s13034-022-00510-w](https://doi.org/10.1186/s13034-022-00510-w)

Abbreviations

CHAMPS	Cognition and Health in Adolescents, Mindfulness as Prevention of Stress (Project)
CI	Confidence Interval
DALY	Disability-Adjusted Life Year
FHE	Folkhälsoenkäten (Region Skåne's Public Health Survey, Children and Young People in Skåne)
GEE	Generalised Estimating Equations
GSI	Global Severity Index (from SCL-90)
IQR	InterQuartile Range
ITIA	"I Think I Am"-scale
PSQI	Pittsburgh Sleep Quality Index
PSS	Perceived Stress Scale
RCT	Randomised Controlled Trial
SCL-90	Symptoms CheckList-90
SD	Standard Deviation
ULF	Undersökningar av LevnadsFörhållanden (Statistics Sweden's surveys of living conditions)
WHO	World Health Organization
YLD	Year Lived with Disability
YLL	Year of Life Lost

Introduction

Observed increase in psychiatric symptoms amongst adolescents

In an international, and historical, comparison, children and adolescents in Sweden today have among the best physical health in the world ever (Fridh, Grahn, Lindström, & Modén, 2016). Taking this into consideration, the increase in reported psychiatric symptoms seems to be a bit contradictory, and many possible reasons for this somewhat puzzling development have been suggested. Due to the complexity of the subject, and the limited scientific data available, it is to a large extent uncertain how different factors have influenced the development, and no well-documented explanation has so far been presented (Folkhälsomyndigheten, 2018b; Solveig Petersen, 2010; Utbildningsdepartementet, 2006).

Deficiencies in the school system, with resulting decreased educational performance, as well as a heightened awareness of the increased demands in the labour market, with fear of future unemployment, have been considered likely to have contributed to the increase in psychiatric symptoms among Swedish adolescents (Bremberg & Dalman, 2015; Folkhälsomyndigheten, 2018b; Solveig Petersen, 2010). Psychiatric symptoms are also more common among adolescents who perceive the family's finances as bad compared with those who perceive the family's finances as good, but, importantly, is not associated with objective measurements of assets (Folkhälsomyndigheten, 2018a). Swedish adolescents intuitively suggest that an increase in stress-exposure could be an explanation when asked why they think an increase in psychiatric symptoms has occurred (Bremberg, 2006), referring to potential stressors such as schoolwork, media-exposure and the need to constantly maintain high performance in a diverse range of activities.

Depression and anxiety are causing a significant part of the disease burden among Swedish adolescents, and psychiatric symptoms seem to have increased over time (Folkhälsomyndigheten, 2018b). Large national studies show that Swedish adolescents report an increase in psychiatric and somatic symptoms compared to when these studies

were first initiated in the 1980s (Calling, Midlöv, Johansson, & Sundquist, 2017; Folkhälsomyndigheten, 2018b; S Petersen, 2007).

Statistics Sweden's surveys of living conditions (in Swedish: ULF - Undersökningar av LevnadsFörhållanden) have been conducted since 1980 and show an increase in the proportion of young men and women aged 16–24 who indicate that they have severe problems with worry, anxiety, and distress. During the period 1980 - 2015, the proportion increased from one to 7% among young men, and from two to 11% among young women (Folkhälsomyndigheten, 2018b).

The study “School children's health habits” began in 1985/86 and examines how often the following psychosomatic symptoms have occurred: “been irritated or in a bad mood”, “felt nervous”, “had difficulty falling asleep”, “had headache”, “had stomach ache”, “had back pain”, and “felt dizzy”. It is performed every fourth year. The proportion of adolescents in Sweden who report having at least two of these symptoms more than once a week, during the past six months, has gradually increased. The results from the 2017/18 study show the highest proportions measured in all age groups since the study began (Folkhälsomyndigheten, 2018a). When comparing the results from 1985/86 with the results from 2017/18, among 15-year-old boys the proportion having at least two of these symptoms more than once a week, during the past six months, increased from 15 to 35%, and among 15-year-old girls from 29 to 62%. Among 13-year-old boys, the proportion has increased from 15 to 28% and among 13-year-old girls from 24 to 52% (Folkhälsomyndigheten, 2018a). Among 11-year-olds, no increase was observed until 2017/18. Compared with the results from 2013/14, the increase has now been greater among 11-year-olds than among the other age groups. In the 2017/18 survey, 41 per cent of girls and 30 per cent of boys reported psychosomatic symptoms in this age group (Folkhälsomyndigheten, 2018a). Compared with other Nordic countries, the increase in psychiatric and somatic symptoms has been more extensive in Sweden among both boys and girls (WHO, 2013/14).

In the national public health survey “Health on equal terms”, which was introduced in 2004 and is now performed every other year, no major changes have been observed when looking at the entire period 2004–2015 (Folkhälsomyndigheten, 2018b). It does, however, support the idea that psychiatric symptoms are common, and that they are more prevalent among girls. The survey includes the question "Do you have any of the following problems or symptoms?" followed by (among other items) “Feeling uneasy, worrying or anxiety”? In 2016, 54% of young women and 33% of young men (16–29 years) stated that they had mild or severe psychiatric symptoms.

It is important to note that these studies are based on a limited array of single questions rather than validated, reliable questionnaires. Reporting psychiatric symptoms, such as “feeling nervous” or “feeling down”, does not automatically transfer to having a psychiatric disorder. If the symptoms are mild and/or only occur occasionally, they are considered part of normal daily struggles in life. The symptoms are often divided into two main categories, externalising and internalising symptoms. Externalising symptoms are aimed at the surrounding environment, and include hyperactivity, impulsivity and aggression. The internalising symptoms are directed towards the individual, and include symptoms of anxiety and depression, as well as headache or feeling dizzy (Folkhälsomyndigheten, 2018b).

Psychiatric conditions/disorders, such as manifest depression, involve a more serious mental illness that consists of a cluster of psychiatric and psychosomatic symptoms, with a longer duration, more pronounced suffering, and a reduction of capacity, that fully meet the criteria for a psychiatric diagnosis (Bremberg & Dalman, 2015). On the other hand, mental health is defined as more than the absence of mental illness. It is rather a state of mental well-being and includes the individuals’ capacity to cope with everyday stress, to work productively, to fulfil his or her potential abilities, and to contribute to society (World Health Organization, 2007).

Since very few reliable studies on development of psychiatric conditions over time exist (Bremberg & Dalman, 2015), it is not clear whether the actual prevalence of psychiatric conditions has increased in the population. However, we do know that depression and anxiety are found among the conditions causing the greatest disease burden among adolescents in Sweden (Folkhälsomyndigheten, 2018b) and that both care consumption, and hospitalisation, for psychiatric conditions has indeed increased among adolescents during the same time-period that more symptoms have been reported (Bremberg & Dalman, 2015; Folkhälsomyndigheten, 2014; Fridh et al., 2016).

The paradox of improved living conditions and loss of health

A global perspective

In 1990, the Global Burden of Disease study suggested using disability-adjusted life years (DALYs) for epidemiological purposes, where one DALY corresponds to one year of lost health due to illness or premature death (Murray et al., 2012). It is calculated as

the sum of Years Lived with Disability (YLD) plus Years of Life Lost (YLL) due to premature mortality (World Health Organization, 2020).

Encouragingly, from 1990 to 2017 the total DALYs for children and adolescents decreased by an impressive 46% globally, mostly driven by a reduction in premature mortality due to various infectious diseases. However, during the same period, the rates of YLDs barely (and statistically insignificantly) decreased, and as a consequence, in combination with a decline in premature deaths as well as a general growth in population, the total raw amount of YLDs actually increased by 4.7% globally (Child & Adolescent Health Collaborators, 2019). Being alive thus undoubtedly increases the risk of living with disability, and among children and adolescents worldwide, some potentially easily treated conditions like nutritional deficiencies of vitamin A and iron, are still found among the most common causes of YLDs (Child & Adolescent Health Collaborators, 2019).

DALYs in high-income countries

In high-income countries, however, the kind of conditions mentioned above rarely pose a big problem anymore. In these countries, the increased survival of children with congenital disorders, as well as more advanced neonatal care, contributes to a high share of the YLDs (Child & Adolescent Health Collaborators, 2019). Importantly, this is rather viewed as a result of medical progress. Other conditions that also highly contribute to disability in children and adolescents in high-income countries are asthma, dermatological disorders, headache, and musculoskeletal disorders (Child & Adolescent Health Collaborators, 2019).

The remaining top-10-causes of DALYs among children and adolescents in high-income countries are the fairly large group consisting of various psychiatric conditions (Child & Adolescent Health Collaborators, 2019). In European adolescents, roughly 30% of the total burden of disease is estimated to originate from this heterogeneous group, which includes conduct disorders, autism spectrum disorders and drug use disorders, but also internalising symptoms such as depression and anxiety of different degrees of difficulty (Child & Adolescent Health Collaborators, 2019; WHO, 2014). The two latter account for approximately 16% of the total DALYs in adolescents and young adults (15-29 years of age) in the European region (Bremberg, 2015).

In accordance, depression and anxiety are found among the conditions causing the greatest disease burden among adolescents in Sweden today (Folkhälsomyndigheten, 2018b).

Adolescence

Adolescence

The term adolescence stems from the Latin word *adolescere*, meaning “to grow up”. It is a transitional stage of development that generally occurs during the period from puberty to adulthood (Konrad, Firk, & Uhlhaas, 2013).

At the approximate age of 15, the individual has developed basic thinking abilities that are comparable to those of adults, although the brain is not fully formed until the early 20s. During adolescence, major changes occur in abilities such as processing speed, attention, memory, organisation and metacognition (Konrad et al., 2013).

Processing speed starts improving dramatically around the age of five, levels off at age 15, and then remains relatively stable into adulthood (Robert & Emilio, 2007). Improvements are seen in both selective attention (the ability to focus on only one stimulus while tuning out another) and divided attention (the ability to pay attention to two or more stimuli at the same time). Adolescents are more aware of their thought processes than younger children and can actively use strategies to optimise their capacity (such as mnemonics), and improvements are seen in both working memory as well as long-term memory (Higgins & Turnure, 1984; Schiff & Knopf, 1985).

During adolescence, the capacity for hypothetical and abstract thinking is developed. This builds up the ability to plan ahead and foresee the consequences of an action in the future, although at this stage to a lot lesser extent than adults, with adolescents, in comparison, expressing a typical high-risk behaviour (Konrad et al., 2013). Hypothetical and abstract thinking permits more advanced reasoning and logical processes, and allows reflections on social and ideological matters, such as politics, religion and philosophy (Rankin, Lane, Gibbons, & Gerrard, 2004). This higher cognitive capacity also contributes to a more nuanced and sober assessment of oneself, not least in comparison to others, and a decrease in self-esteem is typically observed in both sexes around the age of 12 to 13 (Harter & Bukowski, 2012).

Stress

Stress

Biological stress is defined by the general, non-specific, reaction to any challenge to an individual, i.e. the physiological and biochemical response that remains after subtracting the specific reaction to a certain exposure (Selye, 1976). A “stressor” is defined as anything that causes this general stress response in an organism, such as excessive exercise, cold exposure, toxins, surgical injury, or the perception of a threat (Selye, 1976). Further, “eustress” is the magnitude of stress that makes an individual deliver results and develop their potential, “to enjoy the eustress of fulfilment”, whereas “distress” is the amount of stress that leads to illness. Stress, and a well-balanced stress-response, is absolutely necessary for thriving, as well as survival (Selye, 1976).

Allostasis

Allostasis means “achieving stability through change”, and is a complex process where the organism actively adjusts to challenges in order to maintain stability (McEwen, 2008).

The concept of allostasis can be described as the resulting sum of all the different processes in the body, each adjusted to optimise the internal environment, in response to external demands. This is achieved through various feedback loops, with the set-points for the different systems varying in adapting to both predictable and unpredictable events (Sterling & Eyer, 1981). The cortical process of predicting possible changes that has not yet taken place is also incorporated, linking cognition, stress, physiology and behaviour through both physiological as well as behavioural changes (Sterling, 2012). The allostatic adaption thus depends on how the external demands - the stressors - are perceived (Sterling & Eyer, 1981). The resulting consequences of these allostatic changes in the body, i.e. the cumulative “cost” of strain over time, is defined as allostatic load (McEwen & Stellar, 1993). A short-term allostatic change might be perfectly accurate, but it may become harmful if maintained over longer periods of time, resulting in allostatic overload, with pathophysiological changes and corresponding disease (McEwen, 2008).

Resilience

Resilience is defined as “the ability of an organism to withstand environmental challenges to normal function”, i.e. the organism’s capacity of performing an adequate, well-regulated allostatic response (Karatoreos & McEwen, 2013), both psychologically (depending on factors such as self-esteem, personality, coping-strategies) as well as physiologically (sleep, adequate food intake, exercise, genetics etc). Increasing resilience by optimising these lifestyle factors is a promising strategy to increase durability and possibly prevent the development of depressive symptoms (Sarris, O’Neil, Coulson, Schweitzer, & Berk, 2014).

Perceived stress

In humans, with our invaluable capacity to formulate plausible scenarios that have not yet taken place, i.e. to some extent predict a future outcome, also thinking about possible threats has been shown to raise the same stress-response as if the threat was real (Schulkin, McEwen, & Gold, 1994). The body thus reacts in a similar way; no matter if the threat is real or imagined. Adding our innate prepossession of a strong bias towards possible negative outcomes, which has been absolutely necessary for our survival as a species, increases the possible stressors multifariously (particularly when relying on limited brain capacity such as when we are tired, hungry, or stressed by other causes) (Sapolsky, 2017; Schulkin et al., 1994).

Additionally, the perception of stress is not necessarily in proportion to objective external demands, nor to the individual’s objective capacity to deal with them (Folkman & Lazarus, 1984). It is rather largely dependent on the individual’s perception, both of the demand in such, as well as their level of confidence in their capacity to handle the situation (Folkman & Lazarus, 1984). Different persons (and populations) could thus react with very different levels of perceived stress when exposed to the same objective stressor/s. The development of psychiatric and somatic symptoms thus seems to rather be linked to the individual’s perception of stress and their allostatic response, in addition to objective exposure.

Sleep

Although psychiatric and somatic symptoms are more common in girls, the increase over time has been observed in both sexes (Folkhälsomyndigheten, 2018b; Solveig Petersen, 2010). In addition to increased stress levels, insufficient recovery, including

lack of adequate sleep has been proposed as a possible explanation. During the past 20 years, a decrease in total sleep time seems to have occurred (Keyes, Maslowsky, Hamilton, & Schulenberg, 2015). For adolescents (14 to 17 years old) to obtain their greatest vitality, 9 to 10 hours sleep per night was earlier recommended (Carskadon et al., 2002; Eaton et al., 2010), although the current recommendation is 8 to 10 hours of sleep per night to support the concept of a larger individual range for optimal duration of sleep (Hirshkowitz et al., 2015).

Importantly, this does not in any way imply that most adolescents can manage with as little as eight hours of sleep per night, but only acknowledges that there might be some individual adolescents who can. It also needs to be stressed that the concept “sleep duration”, the amount of time actually spent sleeping, is not equal to the concept “time in bed”, a wider term that includes time spent before falling asleep, and any awakenings during the night, as well as the time from awakening to actually getting up.

The percentage of adolescents who systematically get less than seven hours sleep per night (one hour less per night than the lowest recommendation) varies considerably, but numbers between 24 to 73% have been reported in different studies (S. V. Bauducco, I. K. Flink, M. Jansson-Fröjmark, & S. J. Linton, 2016). The proportion also seems to be increasing, and remains consistent when adjusting for gender, race, urbanicity and socioeconomic factors (Keyes et al., 2015). This pattern could partly be explained by a rise in the number of adolescents who report difficulties falling asleep (Pallesen et al., 2008), but also high rates of adolescents reporting nightly disturbances have been observed (Gradisar, Gardner, & Dohnt, 2011).

The relation between sleep and psychiatric symptoms is complex, bi-directional and varies extensively among individuals. In a “win-win” sort of way, good sleep is solidly associated with both mental and somatic health, as well as better cognitive functioning (Brand & Kirov, 2011). Invigorating sleep helps maintain vitality, whereas good general health helps maintain good sleep.

Unfortunately, also the opposite seems to be true. Impaired sleep in adolescents may provoke and sustain various psychiatric disorders (Brand & Kirov, 2011), where difficulties falling asleep, short sleep duration and poor sleep quality are bi-directionally associated with anxiety and depression (Dregan & Armstrong, 2010; Sivertsen, Harvey, Lundervold, & Hysing, 2014). This often clinically results in a vicious circle, where the sleep problems explicitly need to be addressed before recovery can occur (Brand & Kirov, 2011). Additionally, stress, and not least perceived stress, seems to be bi-directionally associated with both psychiatric symptoms as well as sleep.

Sex differences

Sex differences

Mental illness and psychiatric care consumption are more common among girls than among boys during adolescence, particularly concerning internalising symptoms, such as depression or anxiety. These conditions are common also among boys, but self-inflicted injuries account for a larger proportion of their DALY's, and their suicide rates are higher (Bremberg & Dalman, 2015; Folkhälsomyndigheten, 2018b).

Adolescent girls are, in conjunction, more likely than boys to report psychosomatic symptoms (Bremberg, 2006; Folkhälsomyndigheten, 2010, 2018b; C. E. I. Hagquist, 2007; S Petersen, 2007; Thorsén, Antonson, Sundquist, & Sundquist, 2016; Wiklund, Malmgren-Olsson, Öhman, Bergström, & Fjellman Wiklund, 2012). This sex difference is not observable among younger children, but rather starts to appear in early adolescence (13 to 15 years of age) (Folkhälsomyndigheten, 2018b).

Possible explanations for sex differences in psychiatric and somatic symptoms

Earlier research has linked the occurrence of health complaints to differences in gender distribution of power, resources, and possibilities in life (Torsheim et al., 2006). In particular, countries with high levels of gender inequality show larger discrepancies in the occurrence of health complaints. Interestingly, in more egalitarian countries, the number of health complaints is reduced overall, for both sexes (Torsheim et al., 2006).

In countries with more equal life-opportunities, the gender difference in health complaints should then logically be smaller. Still, the difference is obviously observable also in Sweden, generally considered to be one of the most gender-equal countries in the world (Wiklund, Bengs, Malmgren-Olsson, & Öhman, 2010). The differences also start to occur at a fairly young age, before entering traditional gender-roles in relation to responsibilities associated with home-maintenance, child-raising, caretaking or occupation.

Even though expectations of the future may play a big role, other explanations also need to be considered. Biological changes during puberty, with hormonal influence on gene-expression, possibly potentiating the risk of developing psychiatric symptoms in adolescent girls, have been suggested (Konishi et al., 2014; Lehto, Akkermann, Parik, Veidebaum, & Harro, 2013). Social construction and practices of gender also appear

to cause a significant amount of stress in girls (Wiklund et al., 2010), including gender differences in self-esteem, discussed in more detail below.

Self-esteem

Definition and importance of self-esteem

Self-esteem is defined by an individual's subjective evaluation of their own worth, i.e. the evaluative component of self-knowledge. High self-esteem refers to a highly favourable global evaluation of the self, whereas low self-esteem refers to an unfavourable definition of the self (Baumeister, Campbell, Krueger, & Vohs, 2003; Harter, 1993; Kling, Hyde, Showers, & Buswell, 1999). Levels of self-esteem appear to be reversely associated with rates of depression and anxiety in adolescents (Birgerstam, 2013; Birndorf, Ryan, Auinger, & Aten, 2005; Bos, Huijding, Muris, Vogel, & Biesheuvel, 2010; Kling et al., 1999).

Gender differences in self-esteem

Around age 12 to 13, a reduction in self-esteem is observed in both sexes. At the same time, a gender difference where girls report relatively lower levels of self-esteem seems to emerge (Folkhälsomyndigheten, 2018a; Major, Barr, Zubek, & Babey, 1999) the difference peaking at age 15-18 (Birgerstam, 2013; Kling et al., 1999).

Different explanations for this difference have been suggested, such as a cultural emphasis on physical appearance, where puberty “helps” boys to achieve a desired body-ideal (becoming stronger, building muscle mass), whereas the girls generally want to become thinner but instead gain both muscle mass as well as body fat deposits. Stereotypical gender roles, where high self-esteem is typically correlated to masculinity and expressed in peer interaction as well as interaction with adults such as teachers, as well as violence against women, have also been hypothesised to influence the observed gender differences (Kling et al., 1999; Wiklund et al., 2010).

The role of self-esteem

Self-esteem has been proposed to be a psychological resource, potentially shielding the individual against developing psychiatric symptoms (Baumeister et al., 2003; Birndorf et al., 2005; Major et al., 1999; Rector & Roger, 1996; William & Donna, 1992). Two

main models, “The stress-buffering hypothesis” and “The scar hypothesis”, have been suggested as explanations for developing/not developing psychopathology (Harter, 1999; Zeigler-Hill, 2011).

“The stress-buffering hypothesis” suggests that high self-esteem absorbs some of the impact of different stressors in life, especially in situations where the self-image is threatened (Cast & Burke, 2002). Individuals with high self-esteem do not seem to take failure personally. They do indeed feel bad about the particular issue, but they do not ruminate or generalise that failure to other areas in life (Brown, 2010). They are generally happier and feel more positively about themselves, and they also have better coping abilities (Birndorf et al., 2005), helping them to recover faster when faced with difficulties (Johnson, Panagioti, Bass, Ramsey, & Harrison, 2017).

“The scar hypothesis” proposes that living with psychiatric disorders leaves “scars” on the individuals’ impression of their own worth, making them feel bad about themselves and less convinced that they can handle upcoming situations well. Psychopathology would thus rather lead to low self-esteem than the opposite way around (Zeigler-Hill, 2011).

Importantly, both mechanisms can operate at the same time in the same person (Harter, 1999; Zeigler-Hill, 2011).

Aims of the Thesis

Overall aims

The overall aim of the thesis was to analyse the occurrence of, and association between, perceived stress, sleep, self-esteem, and psychiatric symptoms in adolescents, using validated scales.

The author hypothesised that:

1. Adolescent perceived stress and psychiatric symptoms have increased over time, also when using validated scales.
2. Insufficient sleep is associated with perceived stress and psychiatric symptoms.
3. Self-esteem is associated with perceived stress and psychiatric symptoms.
4. Perceived stress is associated with the occurrence of psychiatric symptoms as measured in large national studies.

Specific Aims of the Papers

Paper I

The first aim was to examine the prevalence and potential sex differences of perceived stress and psychiatric symptoms among Swedish upper secondary school students, for comparison with Swedish reference populations from 1996 and 1998. The second aim was to examine the correlation between perceived stress and psychiatric symptoms in 2011.

Paper II

The first aim of this study was to investigate the prevalence of poor sleep in a sample of Swedish adolescents aged 15 to 19 years. The second aim was to investigate the correlations between sleep and psychiatric symptoms, and sleep and perceived stress, in both sexes. The third aim was to examine possible sex differences in sleep.

Paper III

The first aim was to investigate if there is an association between self-esteem and perceived stress. The second aim was to investigate possible gender differences. The third aim was to compare samples from two different European countries.

Paper IV

The first aim was to examine the occurrence of perceived stress and several health outcomes in adolescents and to evaluate if there are any gender differences. The second aim was to investigate if there is an association between perceived stress and the health outcomes and, if so, possible gender differences in this association. The third aim was to compare samples of adolescent girls and boys from two different European countries to enhance the generalisability of potential findings.

Material and Methods

The two projects in the thesis

Project 1: The CHAMPS-Project (Cognition and Health in Adolescents, Mindfulness as Prevention of Stress)

Papers I and II are parts of the CHAMPS-study, a study designed to examine stress and psychiatric symptoms in students aged 15-19 years of age. The study was initiated by the author together with Dr. Carl Antonson in 2011-2012. Psychometric scales for measuring perceived stress (Perceived Stress Scale - PSS-14), general psychiatric health (Symptoms Check List 90 - SCL-90) and sleep quality (Pittsburgh Sleep Quality Index - PSQI) were used. The CHAMPS-project was designed as a Randomised Controlled Trial (RCT). It consisted of one interventional group (internet-based Mindfulness-Based intervention), one active control group (internet-based Musical Therapy) and one waiting-list group. The aim was to analyse the feasibility and effect of an internet-based mindfulness-based intervention on adolescent stress (Carl Antonson, Thorsén, Sundquist, & Sundquist, 2018). Papers I and II are based on baseline-data from the CHAMPS-project.

Project 2: The Governance Project

Papers III and IV are parts of a larger study aiming at studying personality development in a Western democracy (Sweden) and a communistic dictatorship (Bulgaria). It commenced in 1988, initiated by Dr Rada Berg. To be able to make comparisons over time, new data for a second time-point was collected 2015-2016. Psychometric scales for measuring perceived stress (Perceived Stress Scale - PSS-14), self-esteem (I think I am-scale-ITIA) were used, and for measurement of different health outcomes a shorter version of the questionnaire that is used in Region Skåne's Public Health Survey - Children and Young People in Skåne (In Swedish: Folkhälsoenkäten, FHE) was used. Papers III & IV are based on the data collected in 2015-2016.

Overview of the material and methods

Table A shows a comprehensive overview of the four Papers in the thesis.

TABLE A. Overview of the materials and methods in the four Papers.

	Paper I	Paper II	Paper III	Paper IV
Project	CHAMPS	CHAMPS	Governance	Governance
Sample size	283	283	635	636
Male	45/48 ^a	45 ^b	426	428
Female	127/138 ^a	130 ^b	200	199
Not specified	7/8 ^a	10 ^b	9	9
Bulgaria	n/a	n/a	471	472
Sweden	n/a	n/a	164	164
Age	15-19	15-19	15-16	15-16
Primary Outcome	Prevalence, sex-diff, change over time PSS & SCL	Prevalence PSQI >5	Association ITIA - PSS	Occurrence PSS - FHE , Gender diff.
Secondary Outcomes	Correlation PSS - SCL	Correlation PSQI - SCL PSQI - PSS PSQI Sex diff.	Gender diff. Country diff.	Association PSS - FHE Gender diff. Country diff
Study Design	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional
Country	Sweden	Sweden	Sweden/ Bulgaria	Sweden/ Bulgaria
Statistical model	T-test, Spearman's rank correlation	T-test, Chi ² , Spearman's rank correlation	Generalised Estimation Equations	T-test, Chi ² , Fisher's exact test, Spearman's rank correlation, Generalised Estimation Equations
Status	Published	Published	Manuscript	Published

PSS - Perceived Stress Scale, SCL - Symptoms CheckList 90, PSQI - Pittsburgh Sleep Quality Index, ITIA - 'I Think I Am'-scale, FHE - Folkhälsoenkäten (Region Skåne's Public Health Survey).

^a n=complete questionnaires with respect to primary outcome

^b n=complete questionnaires with respect to primary outcome

Study Populations

Study Population in Papers I and II

To increase the generalisability of the findings we wanted to include adolescents from two differing schools, with diverging urbanicity and academic achievement. We proposed to the principal of the selected schools to allow inviting the students to participate. The first school to accept our proposal was Gymnasieskolan Spyken in Lund, a classic academic city part of the Metropolitan Malmö region (662,941 inhabitants in 2011) (Statistiska Centralbyrån, 2013). Gymnasieskolan Spyken is a

large upper secondary school with 1,018 students, has high academic performance and the programs are intended to prepare the students for attending higher education.

The second participating school was Bergska skolan, located in the rural town of Finspång (20,747 inhabitants in 2010) (Statistiska Centralbyrån, 2013). Bergska skolan is the only upper secondary school in Finspång with national education programs, has an average academic performance, and is, with its 385 students, considerably smaller than Spyken.

We sent invitation letters to the home addresses of all 1,403 students, aged 15-19 years, in the two participating schools. 283 students agreed to participate and gave written informed consent, and of those, 202 students - 142 female, 50 male, and 10 where the information on sex and/or school was missing - answered the web-based questionnaires. Bergska skolan provided 45 students and the remaining 147 participants came from Spyken. The mean age was 16.9 years and the median age was 17 years (range 15–19 years).

Study Population in Papers III and IV

Data from students in Västerås, Sweden and Sofia, Bulgaria collected in 1988-1989 were available, and the second data-collection in 2015-2016 was designed to match the first data-collection (Carl Antonson, Thorsén, Berg, Sundquist, & Sundquist, 2019). Accordingly, data were collected at upper secondary schools with different socioeconomic profiles in Sweden (total population 9.9 million in 2016) and Bulgaria, (total population 7.2 million in 2016) (Eurostat, 2020). Three schools were located in Västerås, Sweden, with approximately 145 000 inhabitants in 2015. Six schools were located in Sofia, Bulgaria, with a population of about 1.3 million (Eurostat, 2020). Only data collected in 2015-2016 were used in Paper III and IV.

The data-collection took place between October and December 2016 in Sweden and between October 2015 and February 2016 in Bulgaria. During school time, all students aged 15-16 years in the participating schools received an invitation letter in the classroom. To participate, the students needed to be able to read and write the national language. No student who wished to participate was excluded due to this reason. The students agreeing to participate then signed a document of informed consent. In total, 636 students agreed to participate in the study. 164 students (41% girls, 58% boys) were from Sweden, representing 70% of the invited Swedish students. 472 students (28% girls, 71% boys) were from Bulgaria, representing 77% of the invited Bulgarian students.

The data were collected anonymously, where students individually filled in the questionnaires during a school lesson. A teacher was present to answer possible questions from the students.

Methods

Perceived Stress Scale (PSS-14)

Perceived stress was evaluated by using the Perceived Stress Scale 14 (PSS-14), with potential scores between 0-56. Lower scores indicate lower levels of perceived stress (and vice versa). The PSS-14 is, as indicated by the name, based on 14 items, each with possible answers on a five-point Likert-scale (Cohen, Kamarck, & Mermelstein, 1983). Not measuring objective stressors at all, the PSS is completely based on how the individuals experience their conditions, i.e. the individual perception of stress. This allows for higher ecological validity than, for example, self-reported psychiatric symptoms or measuring points based on physiological response (Lavoie & Douglas, 2012).

The PSS is interpreted similarly regardless of gender (Cohen et al., 1983; Eskin & Parr, 1996; Lavoie & Douglas, 2012) and has high test-retest reliability as well as good internal consistency (Cohen et al., 1983; Martin, Kazarian, & Breiter, 1995; Mikolajczyk, Maxwell, Naydenova, Meier, & El Ansari, 2008; Schmeelk-Cone & Zimmerman, 2003) Lee, 2012). The PSS is validated to be used in adolescents to assess outcomes such as academic performance and occurrence of anxiety and depression (Lee, 2012; Suldo, Shaunessy, & Hardesty, 2008).

The results from our data collection were compared with the mean scores (24.4 for both female and male students) from the paper examining the validity of the translation of the questionnaire into Swedish, carried out in 1996 (mean age 25.4 years) (Eskin & Parr, 1996).

The PSS was used in all four papers in the thesis.

Symptoms checklist 90 (SCL-90)

The symptoms checklist 90 (SCL-90), constructed of 90 items, each with a five-point Likert scale (Derogatis, 1994), was used to examine the occurrence of psychiatric symptoms and to assess overall psychiatric health. The total sum of weights (assigned to the five available answers for each item) for all items divided by the total number of

questions answered results in the Global Severity Index (GSI). At least 80% of the questions need to be answered in order to calculate GSI. SCL-90 also contains nine sub-scales: *Somatization*, *Obsessive compulsivity*, *Interpersonal sensitivity*, *Depression*, *Anxiety*, *Hostility*, *Phobic anxiety*, *Paranoid ideation*, and *Psychoticism* (Derogatis, 1994).

The SCL-90 has adequate validity (Derogatis, 1994; Derogatis, Rickels, & Rock, 1976; Koeter, 1992; Wiznitzer, Verhulst, Van den Brink, & Koeter, 1992) as well as test-retest reliability (Derogatis, 1994) (Horowitz, Rosenberg, Baer, Ureño, & Villaseñor, 1988) and internal consistency (Derogatis et al., 1976; Horowitz et al., 1988).

The SCL-90 has a long history of clinical use, starting in the USA in 1973 and is widely used for measuring psychiatric symptoms in Sweden as well (Socialstyrelsen, 2019a). Highlighting its ecological validity, the SCL 90 has been cited about 3,500 times since its introduction (Bech, Bille, Møller, Hellström, & Ostergaard, 2014)

We used values for GSI and the sub-scales obtained from a study in 1998 on 2776 healthy Swedish adolescents 17-20 years of age for comparison over time (Fridell, 2002).

The SCL-90 was used in Papers I and II in the thesis.

Pittsburgh Sleep Quality Index (PSQI)

For measurement of sleep quality, we used the Pittsburgh Sleep Quality Index (PSQI) (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) The PSQI has good test-retest reliability and validity (Backhaus, Junghanns, Broocks, Riemann, & Hohagen, 2002). The global scale is constructed of seven subscales: *sleep quality*, *sleep latency*, *sleep duration*, *habitual sleep efficiency*, *sleep disturbance*, *use of sleeping medication*, and *daytime dysfunction* and is commonly used in both research and clinical practice. Poor sleep is defined as having more than five points on the PSQI. This cut-off level of >5, providing a sensitivity of 89.6% and a specificity of 86.5% in differentiating “poor” sleepers from “good” sleepers, was chosen after comparing healthy controls with patients with depression and/or sleep-disorders over a time period of 18 months (Backhaus et al., 2002; Beck, Schwartz, Towsley, Dudley, & Barsevick, 2004; Benitez & Gunstad, 2012; Buysse et al., 1989; Mollayeva et al., 2016).

The PSQI was used in Paper II in the thesis.

I Think I Am- scale (ITIA)

We used the “I Think I Am”-scale (ITIA, original name in Swedish: “Jag Tycker Jag är”) to measure self-esteem. The scale has high validity and was constructed in 1981 by the Swedish psychologist Pirjo Birgerstam, showing high correlations between clinical psychological assessments of children’s self-esteem, as well as ratings of children’s self-esteem from interviews with their teachers, and the results of the questionnaire (blinded) (Birgerstam, 2013; Ouveinen-Birgerstam, 1984). It has good test-retest reliability and has shown good stability over time (Birgerstam, 2013).

The ITIA consists of a self-reporting questionnaire with 72 items (possible score for each item -2 to +2, zero excluded), further divided into five subscales: *Physical characteristics*, *Talents and skills*, *Psychological well-being*, *Relations with the family*, and *Relations with others*. The total result is reported as a global scale, ranging from -144 to 144, with higher scores reflecting higher levels of self-esteem (Birgerstam, 2013).

The ITIA has earlier been used for comparisons of self-esteem in different cultures (Ouveinen-Birgerstam, 1984), and is validated for children and adolescents 9-18 years of age (Birgerstam, 2013). For our study, we used the “Middle High”-scale (“MH”), designed for the age group in our study population (Ouveinen-Birgerstam, 1985).

The ITIA was used in Paper III in the thesis.

Region Skåne’s Public Health Survey - Children and Young People in Skåne (In Swedish: “Folkhälsoenkäten”, FHE)

Health outcomes, with items concerning somatic and psychiatric symptoms, sleep and social relations, were measured using an abbreviated version of the same questionnaire that is used in Region Skåne’s Public Health Survey - Children and Young People in Skåne (In Swedish: Folkhälsoenkäten, FHE). A pilot-study was conducted to test and evaluate the questionnaire in school students and was made before using it in the first public health survey among children and young people that was conducted in 2012. The study was then repeated, with results published in 2016 (Fridh et al., 2016). The most recent report was published in 2021 (Region Skåne, 2021). As many of the questions are also used in national studies this allows for comparison between studies. Most items have an internal non-response rate of less than 5% (Grahn, Modén, Fridh, Lindström, & Rosvall, 2012).

The FHE was used in Paper IV in the thesis.

Statistical analyses

Paper I

The results from the PSS are presented as medians and means, with interquartile range (IQR) and standard deviations (SDs) in brackets (Table 1.1). For allowing comparison between the study population and the reference groups from 1996 and 1998 (where the data were presented as means and standard deviations) we used the Student's t-test for comparison (Table 1.1). As the data were non-parametric (collected from Likert-scales), Spearman's rank correlation, presented as ρ =rho, was used for assessing the strength and direction of association between PSS and GSI (Table 1.2). $P < 0.05$ was used as the significance level.

Paper II

The Student's t-test was used to evaluate the potential difference from the cut-off of five (defining poor sleep) for the PSQI (Table 2.1). When comparing the proportion of girls and boys with a PSQI score above five as well as the proportion of adolescents getting less than eight hours of sleep and the proportion of adolescents having problems staying awake a χ^2 test was used. Spearman's rank correlation, presented as ρ =rho, was used for assessing the strength and direction of association between PSQI and GSI, as well as PSQI and PSS (Table 2.2). $P < 0.05$ was used as the significance level.

Paper III

We used generalised estimation equations (GEE), presented as β , for evaluating the associations between the "Perceived Stress Scale" (PSS) and the "I think I Am"-scale (ITIA) (Table 3.1), including the subscales of the ITIA. β represents the calculated change in PSS score per one increase in ITIA score.

The result was set as "missing", and excluded from the analysis, if more than 50% of the items were lacking. An imputation was made, using the mean of the non-missing items, if a student had less than 50% of the data missing from the ITIA global or any of the subscales. $P < 0.05$ was used as the significance level.

Paper IV

The results from the PSS are presented as means, with standard deviations (SDs) in brackets (Table 4.1). The Swedish adolescents had more missing values on PSS than the Bulgarian adolescents, and boys had more missing values than girls in both

countries. The result from the whole scale was set as “missing”, and excluded from the analysis, if seven or more items (>50%) were lacking. An imputation, using the mean of the non-missing items for that individual student, was made if less than (or equal to) 50% was missing, resulting in slightly lower total PSS scores compared with the students completing all the questions. To investigate possible implications of this proceeding we stratified complete cases, imputed cases and missing cases, giving similar results that did not change our conclusions.

The comparison of results from PSS and health outcomes between girls and boys was made using T-test and Chi² and/or Fisher’s exact test. Spearman’s rank correlation, presented as ρ =rho, was used for assessing the strength and direction of association between PSS and the health outcomes. To observe the possible effects of clustered observations in the classes we performed a sensitivity analysis using generalised estimating equations (GEE), giving similar results that did not change our conclusions

Linear regression, adding an interaction term: health outcome*sex, was used when calculating the p-values for comparisons between boys and girls in the associations between perceived stress and health outcomes. Linear regression with the interaction term health outcome*country was used when comparing associations in Sweden with Bulgaria. $P < 0.05$ was used as the significance level.

Ethical considerations

Papers I and II

A registration at www.clinicaltrials.gov was made before the study started (reference no. NCT 01 457 222). The local ethics committee (Etikprövningsnämnden) in Lund, Sweden, provided permission for the study (reference no. 2011/345). Written informed consent was provided by each participant and all data were collected anonymously.

Papers III and IV

For the first data-collection, we acquired the legally required permission for the study from the local ethics committee (Etikprövningsnämnden) in Lund, Sweden (reference no. LU 60-1989). The Bulgarian Academy of Science provided ethical permission for the Bulgarian part of the study. For the second data-collection, an additional permission was acquired from the local ethics committee (Etikprövningsnämnden) in Lund, Sweden (reference no. 2014/429). All data were collected anonymously.

Results

Paper I

In comparison with the reference population from 1996, the adolescents of both sexes reported significantly higher results on the PSS in 2011. Additionally, the girls reported a slightly higher value than the boys but this difference was, however, not statistically significant (Table 1.1).

TABLE 1.1 PSS in relation to sex and in comparison with Swedish norms from 1996.

Variable	Total	Female	Male	Female vs. Male
n, 2011	179	127	45	
PSS, median (IQR), 2011	28 (11)	28.5 (10)	26.5 (12.5)	$p=0.12$
PSS, mean (SD), 2011	28.3 (8.2)	28.9 (8.1)	26.2 (8.2)	
PSS Norm, mean (SD), 1996	24.4 (8.0)	24.4 (7.2)	24.4 (8.7)	
Comparison PSS mean 1996 and 2011:	$p<0.0001$	$p<0.0001$	$p=0.0086$	
Comparison PSS, mean, between 1996 and 2011:				

Note: Swedish norms from (Eskin & Parr, 1996).

The adolescents in 2011 also reported significantly higher scores on the GSI (from SCL-90) than the reference population from 1998. The girls had significantly higher results for both total GSI and the subscales *Somatization*, *Interpersonal sensitivity*, *Depression*, *Anxiety*, *Phobic anxiety*, and *Paranoid Ideation* than the boys, but in the subscales *Obsessive Compulsivity*, *Hostility* and *Psychoticism* there were no significant differences between the sexes. Additionally, a clear correlation between PSS and GSI was observed (Table 1.2).

A more comprehensive display of the results is shown in Paper I at the end of this thesis.

TABLE 1.2. Correlations between perceived stress and GSI in the 2011 study population.

Variable	PSS, Total	PSS, Female	PSS, Male
GSI, n	177	127	46
GSI, ρ (rho)	0.67	0.69	0.60
GSI, p-value	$p<0.0001$	$p<0.0001$	$p<0.0001$

Note: ρ (rho) = Spearman's rank correlation coefficient

Paper II

Poor sleep, i.e. the score of PSQI being significantly higher than the cut-off level of 5, was indicated in a large proportion of both girls and boys (76% and 71%, respectively). The small difference in the mean score between girls and boys was not statistically significant (Table 2.1).

TABLE 2.1: The results of Pittsburgh Sleep Quality Index (PSQI) in 185 Swedish adolescents by sex. Significant p-values in bold.

PSQI	Total*	Female**	Male**	Missing data on sex	p-value between sexes
n	185	130	45	10	
Mean score	6.70	6.72	6.31		<i>p</i> =0.20
CI 95%	(6.30-7.20)	(6.23-7.21)	(5.41-7.21)		
n > score 5	140	99	32		
% > score 5	76%	76%	71%		
p-value mean score > score 5	p<0.0001	p<0.0001	p=0.0026		

* The total PSQI can only be calculated if the answers are complete and no answer is missing.

** All participants did not share their data on sex and/or school.

There was a clear correlation between overall sleep quality (PSQI) and the occurrence of psychiatric symptoms (GSI) in both girls and boys. Furthermore, an apparent correlation between overall sleep quality (PSQI) and levels of perceived stress (PSS) was also found in both sexes (Table 2.2).

TABLE 2.2. Spearman correlations between overall sleep quality (Pittsburgh Sleep Quality Index (PSQI)) and general mental health (Global Severity Index from Symptoms Checklist 90 (GSI)) as well as perceived stress (Perceived Stress Scale (PSS)), by sex. Significant p-values in bold.

Scales	All			Female			Male		
	Rho	n	p-value	Rho	n	p-value	Rho	n	p-value
PSQI - GSI	0.4393	179	<0.0001	0.4137	129	<0.0001	0.4375	44	0.0030
PSQI - PSS	0.4802	166	<0.0001	0.4437	122	<0.0001	0.6032	40	<0.0001

Adolescent girls reported more sleep disturbances than the boys ($p=0.002$), but no other significant differences between the sexes were found when analysing the sub-scales from the PSQI. A more comprehensive display of the results is shown in Paper II at the end of this thesis.

Paper III

In both countries, the girls had significantly higher levels of perceived stress, as well as slightly lower scores in self-esteem, than the boys. They also had lower scores on the subscale *Psychological well-being*.

Adolescents in Sweden reported significantly higher levels of perceived stress than Bulgarian adolescents. There was a trend towards Swedish students having marginally higher self-esteem than the Bulgarian adolescents, although this small difference was not significant.

A more comprehensive display of the results is shown in Paper III at the end of this thesis.

In both countries, there was an association between levels of perceived stress and levels of self-esteem, but this was clearly more distinct in Bulgaria than in Sweden (Figure 3.1).

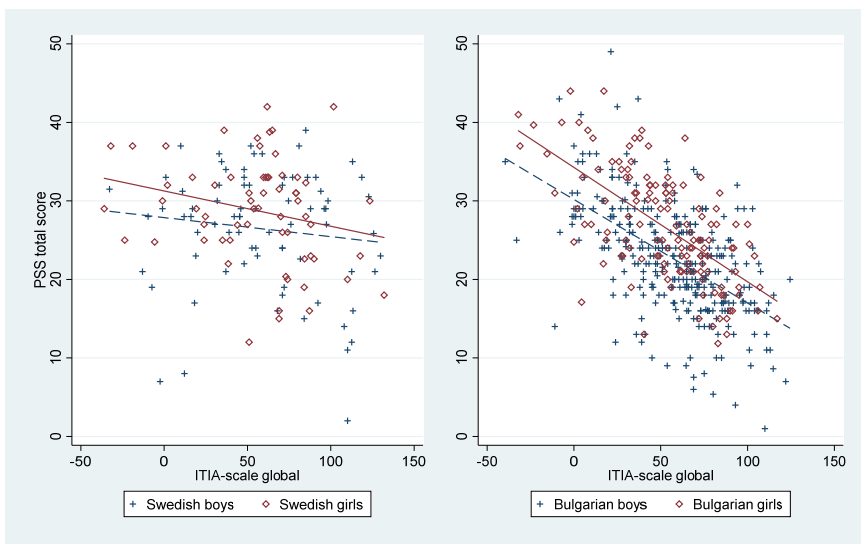


FIGURE 3.1. Scatter plot with a linear fit to show the association between the "Perceived Stress Scale" (PSS) and the global "I Think I Am"-scale (ITIA) separated by country and sex.

The more obvious association between perceived stress and self-esteem observed in Bulgaria was confirmed by a significant interaction between the countries. No significant interaction between girls and boys was found (Table 3.1).

TABLE 3.1. Association between the “Perceived Stress Scale” (PSS) and the “I Think I Am”-scale (ITIA) separated by country and sex using generalised estimation equations.

Variable	β^a	95% CI	p-value
All (n = 603)	-0.11	-0.12; -0.09	< 0.0001
Sweden (n = 141)	-0.03	-0.07; -0.003	0.03
Bulgaria (n = 462)	-0.14	-0.16; -0.12	< 0.0001
Interaction between Sweden and Bulgaria	-0.11	-0.14; -0.07	< 0.0001
Boys (n = 401)	-0.10	-0.12; -0.08	< 0.0001
Girls (n = 194)	-0.11	-0.13; -0.08	< 0.0001
Interaction between boys and girls	-0.008	-0.04; 0.03	0.65
Swedish boys (n = 77)	-0.02	-0.07; 0.02	0.30
Swedish girls (n = 63)	-0.05	-0.09; -0.005	0.03
Interaction between Swedish boys and Swedish girls	-0.02	-0.09; 0.04	0.51
Bulgarian boys (n = 324)	-0.13	-0.15; -0.11	< 0.0001
Bulgarian girls (n = 131)	-0.15	-0.18; -0.12	< 0.0001
Interaction between Bulgarian boys and Bulgarian girls	-0.01	-0.05; 0.02	0.45

^a β denotes the change in PSS score per one increase in ITIA score.

Paper IV

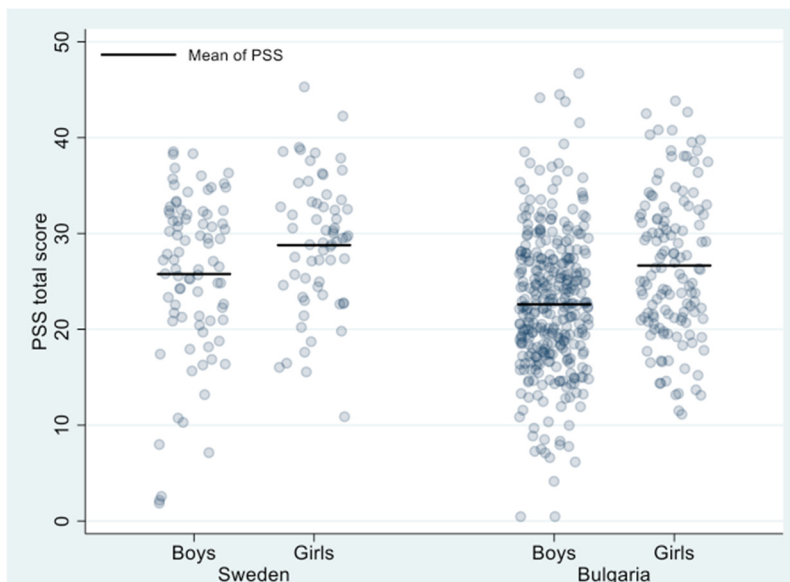


FIGURE 4.1. PSS total score for boys and girls in Sweden and Bulgaria ($n_s = 147$, $n_b = 462$)

The Swedish students reported higher mean scores on the PSS than the Bulgarian students. Additionally, a larger percentage of the Swedish students reported perceived stress levels in the two upper quartiles of the PSS-scale (the total score from PSS divided into quartiles, 0-13, 14-27, 28-41, 42-56) (Figure 4.1, and Table 4.1).

In both countries, the girls reported significantly higher levels of perceived stress than the boys (Figure 4.1, and Table 4.1). The girls also more often reported *feeling stressed by schoolwork*, as well as *feeling low*, *being irritated*, *being anxious*, *feeling dizzy*, *having stomach ache*, and *having headache*.

TABLE 4.1: PSS total score in Sweden and Bulgaria, separated and compared between boys and girls

	Sweden (n =162)		p-value ^c	Bulgaria (n = 465)		p-value ^c
	Boys (n = 95)	Girls (n = 67)		Boys (n = 333)	Girls (n = 132)	
PSS total score, imputed^a						
Number (%)	84 (57)	63 (43)		330 (71)	132 (29)	
Mean (SD)	25.8 (8.4)	28.8 (6.7)	0.02	22.6 (6.9)	26.7 (7.1)	< 0.0001
Range	2; 39	12; 42		2; 50	12; 44	
Quartiles ^b (%)	8/39/52/13	2/38/57/10		8/68/22/2	2/57/39/2	

^aIf more than 50% missing, the scale was set to missing. If less than or equal to 50% missing, the missing items were imputed with the mean of the non-missing items

^bPSS total score divided into quartiles, 0-13, 14-27, 28-41, 42-56

^cP-value for test (t-test or chi-square test/fisher exact test) between boys and girls

Levels of perceived stress were associated with *feeling low*, *being irritated*, *being anxious*, *feeling dizzy* and *feeling stressed by schoolwork* in all groups, with no significant difference in association between the girls and the boys.

The association between perceived stress and most of the health outcomes leaned towards being generally stronger among the Bulgarian students.

A more comprehensive display of the results is shown in Paper IV at the end of this thesis.

Discussion

Levels of perceived stress (PSS) and overall psychiatric symptoms (GSI) have increased when comparing Swedish adolescents in 2011 with reference populations 15 to 17 years earlier. The adolescents showed higher values specifically on the subscales *Obsessive compulsivity*, *Depression*, *Anxiety*, and *Psychoticism* on the SCL-90, whereas only the girls showed higher values on the subscale *Phobic anxiety*. In addition, perceived stress (PSS) and overall psychiatric symptoms (GSI) showed a clear correlation ($\rho=0.67$).

The girls in 2011 reported more psychiatric symptoms than boys and had a significantly higher GSI. They had particularly higher values on the subscales *Somatization*, *Interpersonal sensitivity*, *Depression*, *Anxiety*, *Phobic anxiety*, and *Paranoid Ideation* in the SCL-90, whereas no gender difference was observed for the remaining three subscales (*Obsessive compulsivity*, *Hostility*, *Psychoticism*). There was a tendency towards a gender difference in perceived stress (although not statistically significant, $p=0.12$) where girls reported a mean value of 28.9 and boys 26.2.

Parallel to the rise in self-reported symptoms, an increase in the prescription of antidepressants in this age group has been observed (Socialstyrelsen, 2019b). Furthermore, the consumption of psychiatric care due to internal symptoms, such as depression or anxiety, has also increased (Socialstyrelsen, 2019b). All in all, the findings indicate that a true rise in psychiatric symptoms among Swedish adolescents has occurred. This pattern, with a gradual increase in psychiatric symptoms among adolescents in affluent countries, seems to be observable at least since the end of World War II (Birmaher et al., 1996; Bremberg, 2006; Weissman & Klerman, 1992).

When Rutter and Smith investigated several possible theories back in 1995 they found support for two suggested explanations; an increase in alcohol consumption, and an increasing gap between expectations and actual possibilities in life (Rutter & Smith, 1995). As Swedish adolescents nowadays have instead reported a decrease in alcohol intake (Centralförbundet för alkohol- och narkotikaupplysning, 2020), this explanation does not seem to be valid. The other suggested hypothesis might, however, still be of explanatory value as it might help to understand the somewhat paradoxical situation where improved living conditions have resulted in rather increased psychiatric symptoms. Expectations of reality, which are rising faster with every generation and

most likely augmented by the use of the internet and social media, in combination with a failure to accurately estimate the investments needed for implementing the expectations, creates a sense of defeat, despite the fact that current living conditions have indeed improved.

Around the beginning of the new millennium, several researchers suggested that living in highly individualistic, secularised cultures increased the risk for experiencing psychiatric symptoms as Western societies tend to promote almost impossible expectations related to the individuals' ability to freely choose, and act, and often fail to offer sufficient alternatives of social identity and connectedness (Eckersley & Dear, 2002; Maercker, 2001; Neeleman & Lewis, 1999). However, in all societies of the world, psychiatric disorders are responsible for a large proportion of the disease burden in adolescents (Patel, Flisher, Hetrick, & McGorry, 2007), and unipolar depressive disorder is the main cause of YLDs in adolescents in all regions, including not only high-income countries but also the eastern Mediterranean and Africa (Gore et al., 2011).

The phenomenon with girls reporting more psychiatric symptoms than boys of the same age seems to be consistent (Bremberg, 2006; C. Hagquist & Forsberg, 2007) (S Petersen, 2007; Socialstyrelsen, 2019b; M. A. Wiklund et al., 2012). The suspicion that a gender-difference in reporting psychiatric symptoms may exist has resulted in the recommendation to include both internalising and externalising symptoms in future studies (C. Hagquist, 2010). From this aspect, the fact that in Paper I the girls reported more psychiatric symptoms than boys on all the subscales, including the subscale Hostility (although this difference was not statistically significant), is worth noting. The same pattern was also seen in the reference population from 1998. Additionally, in both girls and boys, only internalising symptoms, as measured in the subscales *Obsessive Compulsivity*, *Depression*, and *Anxiety* of the SCL-90, were found to be higher in 2011 compared with the reference population from 1998.

The uncertainty of a more modern lifestyle, where your destiny is not necessarily as stereotyped and predictable as it was for the generations before us, in combination with the high levels of individualisation in industrialised countries was proposed as possible contributors to the observed increase in psychiatric symptoms among Swedish adolescents by Bremberg et al. in 2006 (Bremberg, 2006). The cause is, however, still not determined, and the lack of studies is apparent. As the increase in psychiatric symptoms is seen in all groups of adolescents, regardless of their psychosocial status, this has been interpreted as that the underlying causes should be searched for in environments that are common to the age-group, such as the school environment (Socialstyrelsen, 2019b). Another possible explanation could be that although the actual, specific stressors might vary considerably between both groups as well as

individuals, levels of perceived stress have generally increased among adolescents and are clearly correlated with the occurrence of psychiatric symptoms, as shown in Paper I.

As all the data in Paper I are based on internationally recognised, well validated questionnaires, the findings serve as an important support for the idea that levels of psychiatric symptoms have indeed increased among Swedish adolescents, both girls and boys, as earlier indicated from larger national studies with single, separate questions used for screening the population (Calling et al., 2017; Folkhälsomyndigheten, 2018b; S Petersen, 2007).

Sleep is highly essential to promote resilience. In Paper II, sleep quality was indeed significantly correlated with both the occurrence of psychiatric symptoms and higher levels of perceived stress. Alarmingly, a majority, 76% of the girls and 71% of the boys in the study, reported poor sleep quality.

Poor sleep quality is negatively associated with regulating emotions, attention and behavioural control (S. Bauducco, I. Flink, M. Jansson-Fröjmark, & S. Linton, 2016; Dahl & Lewin, 2002). Depressive symptoms are not only associated with poor sleep quality among adolescents but, more importantly, have been shown to improve significantly when implementing strategies to improve sleep quality such as gradual sleep extension and sleep hygiene advice (Blunden, 2014; Dahl & Lewin, 2002; Dewald-Kaufmann, Oort, & Meijer, 2014). Poor sleep quality is also negatively associated with overall cognitive performance, as well as specific cognitive abilities, such as verbal, numeric and reasoning capacities (Ortega et al., 2010). Thus not very surprisingly, poor sleep quality is negatively affecting both learning and memory processes and is associated with worse academic achievement (Curcio, Ferrara, & De Gennaro, 2006; Dewald, Meijer, Oort, Kerkhof, & Bogels, 2010; Fallone, Owens, & Deane, 2002; Titova et al., 2015).

In 2015, the US sleep foundation changed its recommendations to eight to 10 hours of sleep per night, introducing a wider acceptable span to allow for more individual differences (Hirshkowitz et al., 2015). Earlier (before 2015), at least nine hours per night was recommended for this age-group (Hirshkowitz et al., 2015). Interestingly, both age-specific recommended sleep duration and actual sleep duration have continuously decreased from 1897 to 2009, at an almost identical rate of -0.71 min per year and -0.73 min per year respectively. Recommended sleep has been approximately 37 minutes greater than actual sleep and has been relatively consistent throughout this time-period (Matricciani, Olds, Williams, Blunden, & Rigney, 2012). The implication of this observation is unclear, but possibly the recommendations are indeed revised to meet the current expectations. In Paper II, the mean sleep duration was 8 hours 12

min, corresponding well with earlier data reporting a mean total sleep duration of eight hours per night among European adolescents (Garaulet et al., 2011). 25% of the girls and 35% of the boys in Paper II slept less than the lowest recommended duration of eight hours/night. Very few adolescents reach the upper span of the current recommendation of 8-10 hours of sleep per night. In a large study from Uppsala with data from 2011, only about 8% of adolescents (12-17 years of age) slept at least nine hours per night (Titova et al., 2015). Excessive sleep duration, i.e. sleeping more than 10 hours per night in this age-group, has also been linked to various health complaints, but this, however, seems to be quite rare, only affecting 0.2% of the younger adolescents and 0.8% of the older, respectively (S. V. Bauducco et al., 2016).

Adolescents who sleep above nine hours/night have lower levels of perceived stress than those who only sleep for 7.5 hours/night (Colrain & Baker, 2011). Experiencing stress has also been associated with sleeping less than seven hours/night in a Swedish study where older adolescents report an association between stress at school and sleeping less (S. Bauducco et al., 2016). Whether the perceived stress intrinsically causes less sleep or is merely a result of stressed adolescents prioritising fewer hours to sleep, or, probably both, is however not clear. Familiar to many, stress has been shown to be a common source of insomnia (Morin, Rodrigue, & Ivers, 2003). Stress negatively affects sleep quality, with an increased fragmentation as well as a reduction in both deep sleep and sleep duration, as shown by objective sleep recordings. Poor sleep quality, in turn, creates a biological stress response (Garaulet et al., 2011).

In Paper II, the girls reported a higher frequency of sleep disturbances than boys, with significantly higher scores on *Nightly waking*, *Toilet visits*, *Feeling cold*, *Feeling hot*, *Unpleasant dreams*, and *Ache*, corresponding well with findings from Titova et al (Titova et al., 2015). The girls slept on average 12 min more per night than boys, possibly to compensate for the higher frequency of sleep disturbances. Olds et al. also found that girls slept 11 min more than boys on weekdays (Olds, Blunden, Petkov, & Forchino, 2010), whereas Bauducco et al., on the other hand, reported that girls sleep slightly less than boys (S. V. Bauducco et al., 2016). Regardless, this uncertain possible difference of approximately plus-minus 10 minutes per night in sleep duration between girls and boys seems to be of limited clinical importance.

Younger adolescents report an association between stress in the family environment and sleeping less (S. Bauducco et al., 2016). Parenting style has indeed been shown to have an important impact on sleep quality, where adolescents raised by supportive, encouraging parents report less daytime sleepiness, better concentration and better mood (Brand, Hatzinger, Beck, & Holsboer-Trachsler, 2009). A more negative family environment, with many restrictions, blame, and particularly inconsistency, is in turn

highly correlated to low sleep quality, with increased daytime sleepiness and more depressive symptoms (Bartel, Gradisar, & Williamson, 2015; Brand et al., 2009).

Around the age of 13, adolescents across different cultures show a shift towards a preference for evening activities independent of environmental factors, reaching their maximum “eveningness” around the age of 20 (girls at 19.5 years, boys at 20.9 years of age). Their preferred later bedtime is accompanied by a later intrinsic circadian phase (Colrain & Baker, 2011). As their daytime obligations still tend to start quite early in the morning, the result is often a lack of sleep.

Interventional studies where school start times were delayed by about one hour showed an increase in sleep duration and a decrease in daytime sleepiness (Colrain & Baker, 2011; Hirshkowitz et al., 2015), as well as fewer depressive symptoms (Minges & Redeker, 2016). In Paper II, 94.3% of the girls and 89.8% of the boys reported that lack of sleep affected their functioning in daily activities. The existing intrinsic “eveningness” accentuates even further as the adolescent brain already struggles with making wise long-term decisions as frontal networks, which are responsible for resisting short-term gains in favour of long-term goals, develop very slowly (Jetha & Segalowitz, 2012). Adding sleep deprivation to this equation is disastrous, as this further reduces these fundamental executive capacities, for example making it even harder to prioritise sleep instead of scrolling on screens.

The use of screens before bedtime is often suggested as one possible explanation for the modern phenomenon of lack of sleep (Reza, Negar, & Zahra, 2019; Šmotek, Fárková, Manková, & Kopřivová, 2020). Screen-light, both short wave-length and high light-intensity, has been shown to negatively affect sleep (Green, Cohen-Zion, Haim, & Dagan, 2017). Additionally, for many, late evening is the only time when they can indulge in whatever they feel like, delusively seemingly not competing with the many tasks on the ever present daily “to do-list”. Consequently, as the number of hours in a day remains constant, this results in the loss of valuable sleep. As well recognised by book enthusiasts throughout the times, high evening arousal, both emotional and cognitive, has been correlated to shorter duration of sleep (Bartel et al., 2015). The use of screens further provides us with access to unlimited activity around-the-clock, adding to the expanded availability of activities during late evenings, which may also represent a possible explanation (S. Bauducco et al., 2016; Shochat, Cohen-Zion, & Tzischinsky, 2014). Allowing some free, un-booked time during the day may reduce this phenomenon and help restore a healthy sleep pattern.

The findings from Paper II, using only validated questionnaires for measure, adds to previous research supporting that poor sleep quality is undeniably very common among Swedish adolescents (Gradisar et al., 2011; Statistiska Centralbyrån, 2016; Titova et

al., 2015). Addressing and improving sleep quality may reduce both depressive symptoms and perceived stress in adolescents. How to sleep well is thus an important life-skill to master, and to teach our children the importance of sleep and strategies to deal with common sleep problems seems increasingly important.

High self-esteem has likewise been shown to support mental health and shield against the perception of stress (Baumeister et al., 2003; Birgerstam, 2013; Birndorf et al., 2005; Kling et al., 1999; Major et al., 1999; Rector & Roger, 1997; William & Donna, 1992). This is well in accordance with the main findings of Paper III, thus showing a distinct association between self-esteem and perceived stress in both Swedish and Bulgarian adolescents. Individuals with healthy high self-esteem seem to be less prone to negative ruminating thoughts, saving both precious time and their energy. They don't see the inevitable failures in life as indications of something intrinsically wrong with them as persons, but rather view defeats as a result of different circumstances, some within the control of the individual and thus possible to positively affect with hard work, and some circumstances outside the control of the individual, hence not being the individuals' responsibility, or fault.

Intriguingly, the Swedish adolescents reported both higher levels of self-esteem, as well as higher levels of perceived stress than the Bulgarian adolescents, resulting in the association between self-esteem and perceived stress being significantly stronger in Bulgaria than in Sweden. Hypothetically, high self-esteem may be protective against perceived stress only up to a certain level. The concept of self-esteem, based on the evaluation of the capacity of the self in comparison with others, might be problematic as "being average", which, logically and mathematically, is fairly close to what most of us are, is generally not considered good enough.

High self-esteem may lead to very high expectations. Strongly and genuinely believing that everything is possible if you only work hard enough may be crucial for taking on really hard tasks, but as that "hard enough" is defined only by the results, not taking any other consequences into consideration, it might actually lead to higher levels of perceived stress, particularly if failing to realise that some goals undoubtedly compete with each other (e.g. career and family). Even if you are very capable in many areas, your total capacity still has a limit, particularly over time. Having too much confidence in one's capacity might lead to taking on too many challenges, as well as the (false) presumption that all time-consuming activities that are necessary for maintaining resilience, such as eating or sleeping, are optional and may be skipped, thus delusively creating more available time for work and getting ahead.

Leading an active life, ideally combining peak school performance with a selection of profitable leisure activities and having a rich social life is considered high status in

Sweden, to the extent that being fully booked in itself is viewed as something highly desirable. Sleep, rest, and relaxation are viewed rather as unnecessary activities for the weak. Previous measurements, where e.g. bragging about how few hours you need to sleep, is not only fully acceptable but also admirable, further encouraging leading a life with high levels of perceived stress.

It was hypothesised that differences in self-esteem between girls and boys may help explain why girls throughout most studies present with higher levels of stress and both more somatic and psychiatric symptoms (Bremberg, 2006; Schraml, Perski, Grossi, & Simonsson-Sarnecki, 2011; Thorsén et al., 2016). However, in Paper III, there was no significant difference in self-esteem between the girls and boys. Furthermore, no gender difference in the association between self-esteem and perceived stress was found. Differences in self-esteem could thus not explain why girls from both Sweden and Bulgaria showed more perceived stress, as well as less psychological well-being, than boys in the same country.

In Paper IV, when combining the Perceived Stress Scale with questions commonly used for evaluating public health in larger studies, the girls in both Sweden and Bulgaria persistently reported both more psychiatric as well as somatic symptoms than boys. The main finding was, however, the clear association between perceived stress and *feeling irritated*, *feeling low* and *feeling anxious* present in both girls and boys, in both Sweden and Bulgaria. Since school is an obvious major stressor for most adolescents, regardless of high or low performance, it is perhaps not too surprising that all groups in this study also had a significant association between perceived stress and *feeling stressed from schoolwork*. It has earlier been proposed that a decline in school performance (compared with previous measurements, as well as with other countries), might contribute to the observed increase in psychiatric symptoms among Swedish adolescents (Bremberg, 2015). Notably, the opposite (an increase in psychiatric symptoms results in decreased school performance), may just as well be true. Among the different somatic symptoms, only *feeling dizzy* had an apparent association with levels of perceived stress in all groups. The Bulgarian adolescents showed an association between perceived stress and *stomach ache* and *headache*, but among the Swedish adolescents no such associations were found.

Girls in Bulgaria tended to have slightly stronger associations between perceived stress and different health outcomes than boys, but no statistically significant difference was found. In Sweden, no difference in associations between perceived stress and essentially any of the health outcomes was found. The only exception was the Swedish girls showing their strongest (inverse) association between perceived stress and *How often have you felt happy?*, whereas the Swedish boys showed no such association at all. The implication of this finding is currently unclear.

In summary, all groups showed significant associations between perceived stress and particularly psychiatric symptoms. Further, the Swedish adolescents consistently reported higher levels of perceived stress than the Bulgarian adolescents. Consequently, higher levels of perceived stress may possibly help explain why the observed increase in self-reported psychiatric symptoms is greater in Swedish adolescents than in many other European countries (Fridh et al., 2016) and also why girls report more psychiatric symptoms than boys.

Overall perspectives of the findings

The overall findings of this thesis support the idea that perceived stress and occurrence of internalising psychiatric symptoms among Swedish adolescents are associated and have increased over time. In accordance with earlier studies (Bremberg, 2006; Folkhälsomyndigheten, 2018b, 2020; Solveig Petersen, 2010; Shennan, Payne, & Fenlon, 2011; Statistics Sweden, 2015) adolescent girls consistently report higher levels of perceived stress and more psychiatric and somatic symptoms than boys. In Paper I, using internationally recognised and validated questionnaires gave similar results as the larger national studies, which have been conducted since the 1980s, using single questions (Bremberg, 2006; Folkhälsomyndigheten, 2010, 2018b; C. Hagquist & Forsberg, 2007; S Petersen, 2007; WHO, 2013/14).

As shown in Paper II, there is a significant association between insufficient sleep, perceived stress and the occurrence of psychiatric symptoms, and insufficient sleep is common among Swedish adolescents. However, the tendency with adolescent girls reporting higher levels of perceived stress than boys cannot be explained by differences in self-esteem between the sexes, and moreover, the association between self-esteem and perceived stress seems to be stronger in Bulgaria than in Sweden, rather suggesting a cultural difference, as shown in Paper III. Finally, the results from Paper IV show that perceived stress is indeed associated with primarily psychiatric symptoms as measured with single questions in larger national studies.

Psychiatric symptoms and psychiatric disorders

The field of mental disorders has undeniably expanded. The first edition of The American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders, the DSM-IV (American Psychiatric Association, 1994) contained 106 different diagnoses. With the passing of time, diagnoses were added such as social phobia, smoking and alcohol dependence, and by 2003 it contained 357 different conditions (Rapley, McHoul, & Hansen, 2003). This may highlight the need to define

the purpose of using the system with diagnosis at all, which, naturally, will vary for different individuals, conditions, and situations.

In the 2000s, paediatric and adolescent psychiatric care consumption has increased significantly more than the self-reported psychiatric symptoms in Sweden (Bremberg & Dalman, 2015), possibly reflecting the more recent public expectation that issues such as also milder psychiatric symptoms are something that needs to be addressed. These potential changes in seeking behaviour has led to a debate where some doctors are putting forward that some kinds of psychiatric symptoms should be expected when living a normal life. It has been argued that no good will come from pathologising the occurrence of certain symptoms, that medication does not seem to help anyway, and expression of worries that vulnerable patients who really need psychiatric care may risk not getting the attention they need when competing with a large, loud and demanding group in society (Rück, 2020).

We also do know, however, that complaints of stress, symptoms of depression, anxiety, sleeping difficulties, and functional somatic symptoms during adolescence often can be serious enough to be addressed in their own right (Stansfield, 2006), and that the occurrence of such symptoms in adolescence is undeniably related to psychiatric disorders in adulthood (Bohman et al., 2012; Clark, Rodgers, Caldwell, Power, & Stansfeld, 2007; Fergusson, Horwood, Ridder, & Beautrais, 2005; Hiyoshi et al., 2015). Perhaps most importantly, it has been predicted that psychiatric suffering throughout life to a large extent can be prevented if affected adolescents receive proper guidance and care (WHO, 2014).

It is indeed extremely important to note that the increased occurrence of psychiatric symptoms does not necessarily correspond to more serious psychiatric conditions meeting the criteria for psychiatric disorders and demanding proper medical treatment, such as manifest depression. Yet, this clarification does not automatically transfer to not having to address the phenomena with increased psychiatric symptoms. The distinction is, however, particularly crucial when discussing possible efforts to act on the reported psychiatric symptoms among adolescents, especially when considering the level of care, the adequacy of medication, the allocation of resources and the suffering of the individual.

Expectations, comparison, and magical voluntarism as possible mechanisms

A potential explanation for the observed levels of psychiatric symptoms in adolescents could be the contemporarily implicitly accepted concept of “magical voluntarism”, basically meaning the idea that, if we just work hard enough, we can have whatever we want, and that individual choice is always possible (Fisher, 2011; Smail, 2004). This idea puts all the responsibility of working hard and making the “right choices” on the individual, most likely starting to impact us as soon as the brain is mature enough to perform such reasoning. Simultaneously, as the idea that individual choice is always possible has become widely accepted, a pressure to “live”, as opposed to simply “exist” has occurred (Rapley et al., 2003). Not even the sky is the limit anymore; the possibilities seem to be endless and are restricted only by our imagination.

Unfortunately, to actually materialise these ideas usually demands a lot of work and capability. We tend to gravely underestimate the amount of work needed to maintain even a fairly ordinary life, as in having somewhere to live, getting (and keeping) a job, eat, sleep, exercise, maybe having a pet or even a child (or two). We now live in a culture where exercising three times per week is not deemed to be enough. As exercise is really good for us, more of it must be even better goes the logic. Running a marathon is now not only for athletes but something pretty much anyone could, would, and should do. Being married is expected to be far more exciting than merely sharing everyday life and being reasonably nice to each other, being a parent far more demanding than making sure your children are safe, have clothes and something to eat. We notoriously tend to forget, or maybe do not even realise, that even if we would be able to do anything, we set our minds to, this does definitely not equal being able to do everything, particularly not at the same time.

We thus seem to be quite poor at performing an analysis of the whole, more complex picture. We notoriously misjudge the consequences when we try to achieve many different goals at the same, scarce amount of time. Cognitively or not, failing to realise that many of our different goals are competing with each other in terms of limited resources, is far too common.

As a species, our, by all means, unique and invaluable capacity to anticipate future events turn out to have some serious limitations, particularly when adding the amount of information made possible with access to the internet and the impact of a globalised world. Trying to perform the impossible task of foreseeing all the possible consequences of an action likely contributes to perceived stress and a lot of worrying. Not making a choice does not work either, as this turns out to be an action by itself, and

procrastination has downsides of its own. The equation seems to be a lot more complex than we realise.

Decrease of resilience factors

When life eventually does not turn out as expected, a logical solution, if believing that everything is possible if you work hard enough, is to increase your efforts. In the short run, cutting back on sleep, rest, social contacts, exercise and nutritious food adds a few extra hours to the day and is a tempting alternative. By working hard and reducing recovery we tend to get more and more into survival mode, losing our long-term perspective. This often makes us confuse being busy with actually achieving something, but just putting in a lot of hours is not necessarily the same thing as getting the results you want. It creates a heavy load on the allostatic balance, with high expenses and reduced recovery, resulting in a vicious circle with increased efforts giving worse and worse results. In the long run, such a strategy is deleterious, as if this situation continues for a long enough time (or if the burden gets even heavier), allostatic overload with corresponding psychopathology, such as milder psychiatric symptoms and, eventually, burnout will follow.

This might also be a part of the explanation for why girls consistently report higher levels of stress and more psychiatric symptoms than boys. Women today are not only allowed in areas earlier reserved for men only, but often expected to participate in them as well, such as providing financially for their family, having demanding careers, performing in sports and more creative self-development. They now have to perform in all these areas in addition to keeping up with their “old responsibilities” of being attractive, raising a family, providing emotional support and maintaining the home and social contacts. If she chooses not to participate in any of these areas, she still often relates cognitively to the consequences of her choices, often hard decisions that come at a great energy expenditure in itself. These complex demands, and the fact that adolescent girls, and women, more often build their self-worth upon achievements, with the belief that they need to “deserve” their existence (Hallsten, Josephson, & Torgén, 2005), and at the same time care more about the opinion of others (Lawler & Nixon, 2011; Rudolph, 2002) likely exposes them to a “double whammy” of both higher levels of stress, as well as reduced recovery.

Remarkably, in Paper II, 76% of the girls and 71% of the boys reported insufficient sleep. As it is now well known that good sleep quality is very important for essentially all imaginable health outcomes in adolescents, mental as well as somatic (Brand & Kirov, 2011; Dewald et al., 2010; Lang et al., 2016; Moore & Meltzer, 2008; Olds et

al., 2010; Wolfson & Carskadon, 1998), these numbers definitely deserve attention. Simply fitting in enough hours of sleep in an adolescent's busy daily schedule can, admittedly, be challenging enough. Parents continuing to take responsibility for their adolescents' sleep by setting earlier bed-times and creating a positive and supportive family environment seem to be on to something (Bartel et al., 2015; Brand et al., 2009), and delaying the start of the school day has shown some promising results (Richardson, Gradisar, Short, & Lang, 2017; Shochat et al., 2014). As some individuals even tend to get upset with the suggestion that insufficient sleep may partly cause or at least worsen their psychiatric symptoms (somehow by this feeling less validated and that their symptoms are not taken seriously), more information and education about the importance of sleep, and its potential to increase psychiatric health seems to be needed. To prevent a development of psychiatric and stress-related symptoms, methods to improve sleep, ranging from encouraging moderate physical activity to providing sleep hygiene advice and addressing different types of arousal (such as ruminating thoughts) (Bartel et al., 2015; Brand et al., 2010) should also be prioritised in public health policies.

In Papers III and IV, it is obvious that, in comparison, a larger percentage (67% of the girls and 65% of the boys) of the Swedish adolescents reported perceived stress in the upper two quartiles (>28) compared to the Bulgarian adolescents (41% of the girls and 24% of the boys). Interestingly, our findings in Paper III do not support the idea that differences in self-esteem between the sexes could contribute to the higher levels of stress and psychiatric symptoms reported by girls. Rather, a cultural difference seems to be present, with Bulgarian adolescents having a significantly stronger association between self-esteem and perceived stress than the Swedish adolescents. Notably, in Paper IV, the Bulgarian adolescents also show stronger (inverse) associations between perceived stress and the items that evaluate psychological well-being (such as *general well-being, feeling content, feeling happy*).

The Swedish adolescents thus reported higher levels of perceived stress, but it is less associated with psychological well-being. Possibly this reflects a cultural assumption that "being stressed" equals "being successful", as earlier shown in advanced economies (Bellezza, Paharia, & Keinan, 2017), but at the expense of an increase in psychiatric symptoms (such as *being irritated, feeling anxious, feeling low*). Appropriately, these items were indeed significantly associated with levels of perceived stress for both girls and boys in both countries.

All adolescents, regardless of sex, reporting perceived stress in the upper two quartiles could thus be considered as high-risk individuals when it comes to developing stress-related psychiatric symptoms over time. To be clear, this applies to approximately two out of three Swedish adolescents.

Strengths and limitations

Common for all four Papers

The cross-sectional design of the studies does not allow for any conclusions on causality. Regrettably, no analysis of the non-responders was possible to perform, and it is very likely that adolescents not being present in school differ in properties compared to the attending ones. All instruments for measuring stress, sleep, self-esteem and psychosomatic symptoms were based on self-report questionnaires, and even if self-reporting and general health seem to correlate well in Nordic adolescents (Bleidablik, Meland, & Lydersen, 2009), the objectivity of the findings could be questioned. However, both perceived stress and measures of psychiatric symptoms are highly dependent on, and defined from, the individual's experience, and more objective methods are still lacking. In this context, measures of perceived stress have higher ecological validity than, e.g., measures of physiological response (Lavoie & Douglas, 2012).

Most importantly, these studies expanding our knowledge with data on adolescents from validated and reliable questionnaires are a significant addition to the larger population studies based on various single questions.

Strengths and limitations in Papers I and II

The major limitation with Papers I and II is to what extent the findings are representative of the general population. Two different schools, diverging in the aspects of academic achievement, socioeconomic status and location were selected aiming to collect data from a representative population, as has been suggested in earlier studies (Schraml, Perski, Grossi, & Makower, 2012; Suldo et al., 2008). Most of the adolescents in Papers I and II were in programmes preparing the students for university studies; a population where higher levels of perceived stress have been detected earlier (Bremberg, 2006). Nonetheless, when comparing the participating schools with diverging urbanicity and academic achievement, no difference in perceived stress could be found (C. Antonson, Thorsén, Sundquist, & Sundquist, 2014).

Although a higher participation rate would indeed be desired, this population has earlier proved hard to examine as in, for example, the "Malmö students Life and Drug habits" with a drop-out rate between 77% and 96% (S Petersen, 2007), but where the results still have been found useful in governmental reports. Both the assumption that the participating adolescents were more motivated to participate because of high stress

levels, and that the adolescents with the highest stress levels chose not to participate because of lack of time, might as well be true. Nevertheless, the participating students in themselves represent 12 to 14% of the total number of students which, under the assumption that they only can represent this sub-group, is still concerning enough.

The reference population used for comparison over time was slightly older than the adolescents participating in the new data collection. However, PSS values seem to be fairly consistent when repeatedly assessing the same individuals between 15-20 years of age (Schmeelk-Cone & Zimmerman, 2003).

As opposed to perceived stress and psychiatric symptoms, sleep quality is possible to measure more objectively with e.g. polysomnography. There is, however, a good correlation between polysomnography and the PSQI (Backhaus et al., 2002). When comparing data on sleep duration collected with polysomnography versus self-report questionnaires, individuals tend throughout to overrate their sleep duration by about 10% (Tremaine, Dorrian, & Blunden, 2010). Hence, data from self-report questionnaires risk missing individuals with too short sleep duration rather than exaggerating the problem.

Strengths and limitations in Papers III and IV

Comparing adolescents from Sweden and Bulgaria, in the light of the similarities and differences of the two countries, provides valuable insights suggesting a cultural difference rather than a difference between girls and boys. The data were collected using well-validated, reliable questionnaires that have been used before when examining different countries. The participation rate of 70-77% can, particularly in this age-group, be considered high. The schools were chosen from different socioeconomic locations in both Sweden and Bulgaria, trying to compensate for the limitation of comparing populations from cities of different sizes.

Self-esteem as measured in the ITIA-scale overlaps with the terms of self-image and self-concept. The implication of this overlap in this study is, however, unclear. When compared with other psychometric scales and face-to-face interviews, the ITIA-scale has been shown to have good validity (Birgerstam, 2013). It was also the second most used questionnaire in Stockholm County Council (the largest health care provider in Sweden) (Dunerfeldt, Elmund, & Söderström, 2010), thus considered to be a valuable tool in clinical practice.

The major limitation of Papers III and IV is the known multidirectional interrelations between perceived stress, self-esteem and psychiatric and somatic symptoms, limiting the value of statistical evidence calculated with bivariate correlations. In the study, however, a sensitivity analysis was performed to account for clustered observations

within classes using generalised estimating equations (GEE), resulting in similar results and not changing the conclusions. The clinical value lies mainly in noting where there are (and are not) both statistically and clinically significant associations present, whereas the actual numerical representation may be less useful.

Future research

The results from this thesis can be utilised by policymakers, health care personnel and teachers in addition to parents and their adolescents. Evaluating methods for teaching, planning and prioritising in order to reduce the number of stressors, as well as investigating mindfulness interventions and other possible methods reducing the perception of stress as both preventative measures and part of treatment should be considered. Furthermore, interventions aiming at improving sleep in adolescents, and importantly, how to successfully implement such methods in this group should be of high priority.

Further studies are needed to examine how preventative measures early in life possibly affect the progression of symptoms later on, and if focusing on factors creating resilience can turn progression of symptoms and avoid them from developing into disorders. Additionally, when addressing topics of this kind of complexity, with multidirectional associations and interactions that, to complicate things even further, whose magnitude tends to highly differ also between individuals, other methods of research are needed to reach any meaningful conclusions. Rather than evaluating each monotherapeutic measure on its own, more of an algorithm-based therapeutic program should be considered, as has been shown to have promising results when treating other multifactorial conditions such as cognitive decline (Bredesen, 2014).

Conclusions

The topic of this thesis is undeniably quite complex. The findings from this thesis may support the hypothesis that increased levels of perceived stress, with insufficient recovery further accumulating the allostatic load, may partly explain the high frequency of reported psychiatric symptoms in society today and why girls report more symptoms than boys. Furthermore, spending too many resources on arguing whether these symptoms really are more frequently occurring than before does not seem worthwhile, as studies that would definitively determine the question are unlikely to be produced, at least within the reasonable future.

We do know, however, that psychiatric symptoms occur frequently, and as well as addressing the suffering they cause intrinsically, we have good reasons to explore how preventative measures early in life possibly affect the future progression of symptoms. Investigating methods reducing both stressors and the perception of stress, in addition to increasing factors of resilience, seem to be needed when trying to prevent, and treat, psychiatric symptoms in adolescents. The goal should wisely be to find and evaluate strategies that aim to get as large a part of the population as possible to achieve mental health, as defined by the WHO (World Health Organization, 2007). That is, more than the absence of mental illness, but rather a state of mental well-being, including the individuals' capacity to cope with everyday stress, to work productively, to fulfil his or her potential abilities, and to contribute to our society.

Populärvetenskaplig sammanfattning

Bakgrund

Ökning av psykisk ohälsa hos ungdomar

Psykisk ohälsa ökar i alla ålderskategorier, och bedöms nu vara den näst största globala orsaken till hälsoproblem. Hos ungdomar bedöms ca 30% av all sjukdomsburda, mätt med DALYs (Disability Adjusted Life Years), bero på psykiska besvär. I Sverige har sjukhusinläggningarna för psykiska besvär ökat i åldersgruppen 16-24 år, och till skillnad från i andra åldersgrupper ses ingen minskning av självmordstalen. Stora nationella studier har också visat på en ökning av självrapporterade psykosomatiska symtom. Flickor rapporterar genomgående mer symtom än pojkar, men en ökning har setts hos båda könen. Det är dock mycket viktigt att poängtera att självrapporterade psykiska symtom inte nödvändigtvis är det samma som att ha en psykiatrisk diagnos.

De flesta stora nationella studier inom området har använt frågeformulär med många enskilda, tämligen ospecifika frågor. Avsaknaden av data insamlad via högkvalitativa enkäter med bra vetenskaplig tillförlitlighet gör att resultaten kan vara svårtolkade.

Adolescensen är den utvecklingsperiod som pågår från puberteten till vuxenlivet. Hjärnans kapacitet för hypotetiskt och abstrakt tänkande utvecklas. Psykiska besvär som utvecklas under adolescensen riskerar att finnas kvar under vuxenlivet. Det är bland annat av den anledningen WHO, såväl som EU och Sverige, bedömer att ungdomar är en särskilt viktig målgrupp för folkhälsoprojekt inom psykisk hälsa.

Ökningen av den psykiska ohälsan kan upplevas kontraintuitiv, då barn och ungdomar i Sverige idag har bland den bästa fysiska hälsan i världen och samhällsutvecklingen med en generellt sett ökad levnadsstandard borde ha lett till förbättrad psykisk hälsa. Detta har dock uppenbarligen inte skett. När man ber ungdomar att själva att reflektera över ökningen av psykosomatiska symtom föreslår de bland annat exponering för stress, bestående av t.ex. höga prestandakrav i samhället, valfrihet (med motsvarande individuellt ansvar), mediaexponering och skolarbete, som möjliga mekanismer. Brister i skolsystemet och ökad risk för framtida arbetslöshet har också föreslagits.

Även om en ökning av upplevd stress är en sannolik, och ofta föreslagen, förklaring till den observerade ökningen av psykiska och somatiska symtom hos ungdomar, så är det fortfarande ont om forskning som kopplar samman upplevd stress och förekomsten av psykiska och somatiska symtom.

Stress

Den medicinska termen stress definieras som en generell kroppslig reaktion, som är likadan oavsett vilken belastning (stressor), som utlöste den. Även tanken på möjliga kommande hot, och utmanande situationer som har inträffat tidigare i livet, ger ett fysiologiskt stress-svar. Stress, och ett välbalanserat fysiologiskt svar, är helt nödvändigt för såväl vår överlevnad som vårt välmående. En lagom stressnivå hjälper oss att åstadkomma saker och att utveckla vår fulla potential. Upplevd stress är summan av den stress individen utsätts för plus hur individen tolkar sin förmåga att hantera situationen. Det säger ingenting om hur mycket stress individen rent objektivt utsätts för, och inte heller något om individens objektiva förmåga att klara av utmaningen.

Allostas innebär en vidareutveckling av stressbegreppet. Det är ett samlingsbegrepp för den komplexa process där en organism aktivt anpassar sig för att bibehålla sitt normaltillstånd när den utsätts för belastning. Den allostatiska belastningen är summan av kroppens reaktioner, "kostnaderna", för dessa anpassningar över tid. En kortvarig allostatisk belastning är ofta oproblematiske, medan en längre tids allostatisk belastning kan ge patofysiologiska förändringar i kroppen, och därmed sjukdom, på sikt. Detta kallas då allostatisk överbelastning.

Resiliens är kroppens förmåga till flexibilitet genom att adekvat svara på förändringar i omgivningen och därmed fortsätta att upprätthålla sin normala funktion när den utsätts för belastning, såväl psykiskt som fysiskt. Om allostas förenklat kan beskrivas som summan av kostnaderna för kroppens reaktioner på belastning, så kan resiliens förenklat beskrivas som dess hållfasthet. Olika individer har olika förmåga till resiliens, men den kan också vara högre eller lägre hos samma individ, beroende bland annat på möjlighet till återhämtning.

Könsskillnader

Psykisk ohälsa och psykiatrisk vårdkonsumtion är vanligare bland flickor än bland pojkar, i synnerhet rörande internaliserande symptom såsom depression och ångest. Flickor rapporterar också oftare psykosomatiska symptom och könsskillnaden tycks uppstå i de tidiga tonåren, det vill säga mellan 13 och 15 års ålder. Många förklaringsmodeller till dessa könsskillnader har föreslagits, bland annat könsskillnader

i hur personer uppmärksammar, definierar och reagerar på psykiska symtom, biologiska skillnader och sociala konstruktioner av genus.

Sömn

God sömn är viktigt för såväl psykisk som somatisk hälsa hos ungdomar. Parallellt med utvecklingen av ökning i ångest, depressiva symtom och somatisering har även sömnbrist ökat de senaste 20 åren. Det finns en stor överlappning, med orsakssamband åt båda hållen, mellan sömnstörningar och ångest samt depression. För tonåringar rekommenderas 8 till 10 timmars sömn. Det är viktigt att notera att den totala tiden för sömn i princip alltid blir kortare än den tid individen har legat i sin säng. Flickor sover generellt sett något längre än pojkar, men det är ingen större könsskillnad.

Sambandet mellan stress och dålig sömnkvalitet är väl belagd bland vuxna, men mindre undersökt hos ungdomar. En svensk studie har visat att mindre än sju timmars sömn var associerat med stress i hemmet hos yngre tonåringar och stress i skolan hos äldre tonåringar. Stress under skolexaminationer har visat sig ge försämrad sömn och som följd därav sämre akademiska resultat.

Självkänsla

Självkänsla definieras som en individs subjektiva bedömning av sitt eget värde, där en hög självkänsla refererar till en positiv generell uppfattning om en själv. Låg självkänsla korrelerar med förekomst av depression och ångest hos ungdomar. Flickor tenderar att skatta sin självkänsla något lägre än pojkar, och skillnaden verkar uppkomma vid 11-13 års ålder. Skillnaderna i självkänsla är som störst i de sena tonåren. En förklaringsmodell till detta kan vara att puberteten förstärker önskade manliga kroppsideal, där pojkarna växer i längd och muskelmassa, medan den motarbetar flickors ofta smala kroppsideal då även friska flickor under puberteten ökar sin muskelmassa och även sina fettdepåer. Stereotypa könsroller, skillnader i interaktion med vuxna och våld mot kvinnor har också lagts fram som hypotetiska förklaringar.

Hög självkänsla har tidigare föreslagits vara en skyddsfaktor mot utveckling av stressrelaterade symtom och psykiska problem. Till exempel har hög självkänsla associerats med lägre förekomst av depression hos både vuxna och ungdomar. Människor med hög självkänsla verkar ha mer positiva känslor inför sig själva, och är i allmänhet lyckligare och mindre deprimerade. De lider mindre, och är också mer benägna att snabbt återhämta sig efter utmaningar, medan människor med låg självkänsla oftare saknar denna förmåga och är mer känsliga.

Målsättning

Målsättningen med denna avhandling var att analysera förekomsten av, och eventuella associationer mellan, upplevd stress, dålig sömn, självkänsla och psykiska symptom hos ungdomar med vetenskapligt välvaliderade skattningsskalor. Hypotesen var att ungdomars upplevda stress och psykiska symptom hade ökat över tid, att otillräcklig sömn var associerat med upplevd stress och psykiska symptom, att självkänsla är associerat med upplevd stress och att upplevd stress är associerat med förekomst av psykiska symptom, så som de mäts i stora nationella studier.

Material och Metod

Avhandlingen är uppdelad i två projekt: CHAMPS (Cognition and Health in Adolescent, Mindfulness as Prevention of Stress) och Statsskicksprojektet.

Samtliga delstudier baseras på välvaliderade, psykometriska skattningsskalor. För upplevd stress användes Perceived Stress Scale (PSS), för psykiska symptom Symptoms Checklist-90 (SCL-90), för sömn Pittsburgh Sleep Quality Index (PSQI), för självkänsla Jag Tycker Jag Är (ITIA) och för hälsoutfall Folkhälsoenkäten i Region Skåne (FHE).

I CHAMPS, som utfördes 2011, inkluderades 283 svensktalande gymnasielever (15-19 år) från en skola med en hög akademisk nivå i Lund och en skola med en genomsnittlig akademisk nivå från bruksorten Finspång. Beroende på svarsfrekvensen i de olika skalorna är antalet svaranden olika för de olika frågeställningarna, men 194 personer besvarade enkäten PSS (138 flickor, 48 pojkar, 8 angav ej kön).

I Statsskicksprojektet, där den del av datainsamlingen som inkluderats i denna avhandling utfördes 2015-16, inkluderades 636 ungdomar i åldern 15-16 år från Sofia, Bulgarien (331 pojkar och 133 flickor, 472 totalt) och Västerås, Sverige (95 pojkar och 67 flickor, 164 totalt).

Resultat

Högre upplevd stress (PSS) och mer psykiska symptom (SCL-90) uppmättes 2011 hos båda könen i jämförelse med svenska referensgrupper från 1996-98. Upplevd stress korrelerade väl till psykiska symptom.

Flickor rapporterade mer psykiska symtom än pojkar.

Mer än 70 % av ungdomarna i studien hade dålig sömnkvalitet. Det fanns en tydlig korrelation mellan sömn (PSQI) och psykiska symtom (SCL-90) och upplevd stress (PSS). Flickorna rapporterade mer sömnstörningar än pojkarna.

Vidare fanns det ett samband mellan upplevd stress (PSS) och självkänsla (ITIA) i båda länderna, men sambandet var tydligare i Bulgarien än i Sverige. Flickorna i båda länderna rapporterade något lägre självkänsla än pojkarna i samma land, men i alldeles för låg grad för att kunna förklara skillnaderna i upplevd stress.

Det fanns även samband mellan upplevd stress (PSS) och psykiska symtom (FHE) i alla grupper. Även här var sambandet tydligare i Bulgarien. Flickorna i både Sverige och Bulgarien rapporterade högre upplevd stress och mer psykiska och somatiska symtom än pojkarna.

Konklusion

Resultaten i den här avhandlingen stöder hypotesen att psykiska symtom hos ungdomar har ökat sedan slutet av 1990-talet, och även att upplevelsen av stress samt otillräcklig återhämtning kan vara möjliga bidragande förklaringar till denna utveckling. Man bör utvärdera om förebyggande åtgärder av psykiska symtom tidigt i livet kan ha effekt på framtida utveckling av psykisk ohälsa. Vidare finns det behov av att utvärdera metoder för att minska upplevelsen av stress, både genom att minska den faktiska stressbördan (om möjligt), stärka individens strategier för att hantera stress samt faktorer för ökad resiliens.

Målsättningen bör vara att hitta och utvärdera strategier som syftar till att en så stor del av befolkningen som möjligt ska kunna uppnå god psykisk hälsa, vilket innebär betydligt mer än endast frånvaro av psykisk sjukdom. Snarare bör ett tillstånd av psykiskt välbefinnande eftersträvas, inkluderande individens förmåga att hantera den stress som vardagen innebär, att arbeta produktivt, att uppfylla sina potentiella förmågor samt att bidra till vårt samhälle.

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Perceived Stress

This thesis examines the prevalence of, associations between, and sex differences in, perceived stress and psychiatric symptoms, sleep quality, self-esteem and self-rated health outcomes in adolescents. The findings support the idea that psychiatric symptoms in adolescents have increased over time, and that perception of stress and insufficient recovery may partly explain this development.



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