

The social determinants of self-reported mental health among adolescents in Sweden and the Nordic countries

- focusing on socioeconomic inequalities

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To my dear family
Anders, Vera and Sigrid

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ABSTRACT

Mental health problems have increased among children and adolescents in the Nordic countries during the last decades. Such problems may have both short- and long-term negative consequences for both the individual and society at large. Knowledge of the determinants and distribution of mental health problems is essential for prevention and treatment of such problems.

This thesis examined the social determinants and distribution of subjective health complaints (SHCs), self-reported stress and life satisfaction among adolescents in Sweden and the other Nordic countries. It comprises four studies, which are based on cross-sectional data from two studies: the Health Behaviour in School-aged Children (HBSC) study and the Study of Adolescence Resilience and Stress (STARS), along with register data and official statistics.

The results showed persistent social inequalities in adolescent mental health related to gender, country of birth, family structure and socioeconomic conditions in Sweden. Socioeconomic conditions, as well as the at-risk-of-poverty rate, were related to adolescent mental health in all Nordic countries. Furthermore, the results showed that SHCs were strongly associated with stress. Various school experiences, such as school satisfaction, schoolwork pressure and bullying, were also shown to be associated with SHCs. The thesis also includes a validation of the Family Affluence Scale using Swedish register

data, showing that the scale may be used in surveys using self-reported socioeconomic status among children and adolescents.

The studies in this thesis demonstrate the need of policy measures at several levels of society to improve, and reduce social inequalities in, adolescents' mental health and well-being.

Keywords: adolescents, mental health, socioeconomic inequalities, Nordic countries

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SAMMANFATTNING PÅ SVENSKA

Självrapporterade hälsobesvär har ökat bland barn och ungdomar i Norden under de senaste decennierna. Sådana besvär kan ha både kort- och långsiktiga negativa konsekvenser för både individen och samhället i stort. Kunskap om faktorerna bakom, samt fördelningen av, självrapporterade hälsobesvär är nödvändig för att kunna förebygga och behandla sådana problem.

Denna avhandling analyserade bestämningsfaktorer och fördelning av självrapporterade hälsobesvär, självrapporterad stress och livstillfredsställelse bland ungdomar i Sverige och övriga Norden. Den innehåller fyra studier som baseras på tvärsnittsdata från två studier: Study of Adolescence Resilience and Stress (STARS) och Health Behaviour in School-aged Children (HBSC), i Sverige kallad Skolbarns hälsovanor. Även registerdata och officiell statistik användes.

Resultaten visade på sociala ojämlikheter i ungdomars psykiska hälsa relaterade till kön, födelseland, familjestruktur och socioekonomiska villkor i Sverige. Socioekonomiska villkor, liksom andelen av befolkningen som lever i relativ fattigdom, var relaterade till ungdomars psykiska hälsa i alla nordiska länder. Vidare visade resultaten att självrapporterade hälsobesvär var starkt korrelerade med stress. Flera skolfaktorer, såsom skoltrivsel, skolstress och mobbning, visades också ha samband med självrapporterade hälsobesvär. Avhandlingen innehåller även en validering av Family Affluence Scale med hjälp av svenska registerdata, och som visade att skalan kan användas i enkätstudier som använder självrapporterad socioekonomisk status bland barn och ungdomar.

Studierna i avhandlingen visar på behovet av policyåtgärder på flera nivåer i samhället för att förbättra, och minska sociala ojämlikheter i, ungdomars psykiska hälsa och välbefinnande.

LIST OF PAPERS

This thesis is based on the following studies, referred to in the text by their Roman numerals.

- I. Corell M, Friberg P, Löfstedt P, Petzold M, Chen Y. Subjective health complaints in early adolescence reflect stress: A study among adolescents in Western Sweden. *Scand J Public Health*. 2022 Jun;50(4):516-523.
- II. Corell, M., Chen, Y., Friberg, P., Petzold, M., Löfstedt, P. Does the family affluence scale reflect actual parental earned income, level of education and occupational status? A validation study using register data in Sweden. *BMC Public Health* 21, 1995 (2021).
- III. Corell, M., Friberg, P., Petzold, M., Löfstedt, P. Socioeconomic inequalities in adolescent mental health in the Nordic countries in the 2000s - A study using cross-sectional data from the Health Behaviour in School-aged Children study. *Arch Public Health* 82, 20 (2024).
- IV. Corell, M., Eriksson, C., Friberg, P., Petzold, M., Löfstedt, P. Regional differences in subjective health complaints among adolescents in Sweden and the role of socioeconomic conditions and school experiences. A multilevel study using cross-sectional data from the Health Behaviour in School-aged Children study 2021/22. *Manuscript*.

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ABBREVIATIONS

FAS	The Family Affluence Scale
HBSC	The Health Behaviour in School-Aged Children Study
HBSC-SCL	The Health Behaviour in School-Aged Children Study Symptoms Checklist
ICD	International Classification of Diseases
LS	Life satisfaction
MHCs	Multiple health complaints
MHPs	Mental health problems
NBHW	The National Board of Health and Welfare
NCM	The Nordic Council of Ministers
PFW	Perceived Family Wealth
PHAS	The Public Health Agency of Sweden
PSP	The Psychosomatic Problems Scale
PSS	The Perceived Stress Scale
SHCs	Subjective Health Complaints
STARS	The Study of Adolescence Resilience and Stress
WHO	The World Health Organization

DEFINITIONS IN SHORT

Adolescence	The phase of life between childhood and adulthood, from ages 10 to 19 (WHO, 2024a).
Health	A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (WHO, 1946).
Mental health	A state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community (WHO, 2005).
Mental ill-health	Mental ill-health is an umbrella term that includes both mental health problems and mental disorders (National Board of Health and Welfare et al., 2024).
Mental health problems	Health problems or complaints that may be mild or severe and may impact an individual's everyday life and functioning, but do not comply with the diagnostic criteria of mental disorders (National Board of Health and Welfare et al., 2024).
Subjective health complaints	A synonym for mental health problems.
Mental disorder	A mental disorder is characterized by a clinically significant disturbance in an individual's cognition, emotional regulation, or behaviour. It is usually associated with distress or impairment in important areas of functioning (WHO, 2024b).

The social determinants of health	The conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life (WHO, 2024d).
Equity in health	Equity in health means that everyone has fair opportunity to attain their full health potential (WHO, 2024c).
Social inequities in health	Unfair and unjust differences in health across groups to the extent that they are unavoidable.
Social inequalities	The unequal distribution of, and unequal access to, highly valued and desired material and nonmaterial social goods. Social inequalities imply systematic advantages and disadvantages in life chances, living conditions, opportunity structures, and life outcomes of individuals and social groups (Suter, 2020).
Objective socioeconomic status	Focuses on material factors and is usually measured by educational attainment, occupational status and income.
Subjective socioeconomic status	Focuses on psychosocial factors and is usually measured by an individual's self-perceived socioeconomic status or social standing in his or her community or society.
The social gradient	A situation wherein the association between the social position of an individual and their risk of illness crosses the entire population (Diderichsen et al., 2012).
Income inequality	Refers to how unevenly income is distributed throughout a population. The less

equal the distribution, the greater the income inequality.

At-risk-of-poverty rate

The rate is the percentage of persons living in households where the equivalised total disposable household income is below 60 percent of the median equivalised disposable income of all households.

Gini coefficient

It measures inequality on a scale from 0 to 1, where higher values indicate higher inequality. It is often based on earned income including or excluding capital gains.

BACKGROUND TO THIS THESIS

Thirteen years ago, I began working as an analyst, and mainly with the Swedish part of the Health Behaviour in School-aged Children (HBSC) study together with my colleague Petra Löfstedt (who was later to become one of my supervisors for this thesis), at the Public Health Agency in Sweden. The starting point of this thesis was the gradual increase of self-reported mental health problems seen among children and adolescents in Sweden during the last decades according to data from the HBSC study. When we published the national HBSC report in December 2014, showing the results from the 2013/14 data collection along with the time trends (Public Health Agency of Sweden, 2014), one of the most common questions we received from media and different stakeholders was why there has been such an increase of multiple health complaints among children and adolescents in Sweden. We were unable to answer the question. Consequently, we decided to try to find explanations to this increase.

We decided to arrange a seminar series in 2015 and 2016, where invited researchers from universities and analysts from other governmental agencies presented their research or studies on different topics. The aim of the first seminar was to determine the trends in mental ill health among children and adolescents in Sweden. In the following seminars, we sought explanations to the trend within the school environment, socioeconomic conditions, the family context and social media use. In the final seminar, representatives from the Nordic countries discussed possible explanations to the Swedish trends from a Nordic perspective.

After completing the six seminars, the Public Health Agency decided to continue the task of finding explanations to the increase of multiple health complaints among children and adolescents in Sweden. A group of analysts were engaged in the work, led by myself, Petra Löfstedt and Lina Wiklander. In spring 2018, the report “Why have multiple health complaints increased among children and adolescents in Sweden? The development between 1985 and 2014.” was published. The main conclusions in the report (Public Health Agency of Sweden, 2018) were that the functioning of the Swedish school system had deteriorated and that there was an increased awareness of the higher demands in the labour market among adolescents. Both these factors had probably contributed to the increase in multiple health complaints.

In parallel with the work on the report, we also organized the 9th HBSC data collection in Sweden, the 2017/18 survey round. In January 2019, the findings of the 2017/18 data collection along with the time trends were published and disseminated (Public Health Agency of Sweden, 2019). The results showed that multiple health complaints had continued to increase among 13- and 15-year-olds compared to 2013/14. For the first time, multiple health complaints also increased among 11-year-olds. We understood that we had to pursue our work looking for explanations to the increase.

At the end of 2019, agreements between the Public Health Agency and researchers at five different universities in Sweden had been completed. All researchers were to provide the agency with new knowledge on mental health among children and adolescents from different viewpoints: the school context (Stockholm University), bullying and disabilities (Jönköping University and Linköping University), stress and socioeconomic inequalities (University of Gothenburg) and Nordic comparisons (Karolinska Institute).

I was admitted as a doctoral student at the School of Public Health and Community Medicine, Sahlgrenska Academy, University of Gothenburg, in April 2020. In the following years, I combined my work with the HBSC study at the Public Health Agency with my doctoral studies in public health. I became part of the research group behind the STARS study in the region of Västra Götaland, led by Professor Peter Friberg and Associate Professor Yun Chen. Together with the STARS research group and my supervisors Max Petzold, Peter Friberg and Petra Löfstedt, I worked with the project financed by the Public Health Agency 2019–2021, examining the role of stress and socioeconomic inequalities for adolescents' mental health. The work resulted in multiple reports to the agency and scientific papers that are now part of this thesis.

RATIONALE FOR THIS THESIS

Based on the results from the Swedish HBSC study and previous literature, this thesis aims to fill four knowledge gaps. They are briefly described below.

As mentioned above, several explanations to the increase of multiple health complaints among children and adolescents in Sweden have been put forward. Less is known about the underlying mechanisms of health complaints among adolescents. They are sometimes referred to as “stress-related”, but few studies

have actually explored the links between general stress and health complaints among adolescents.

Adequate measures of both objective and subjective socioeconomic conditions are a prerequisite for measuring and tackling social inequalities in health. The Family Affluence Scale has served as a measure of families' socioeconomic conditions since the HBSC 1993/94. The scale has undergone several revisions and been validated nationally as well as cross-nationally. However, it has not been validated in Sweden, nor by using register data.

The Nordic countries share common political, historical and cultural heritage and all belong to the "social democratic welfare regime" (Esping-Andersen, 1990). They have been characterized by redistributive tax systems, generous social transfers and in-kind education and health care systems and low income inequality from an international perspective. However, income inequality has risen in recent years, especially in Sweden (Nordic Council of Ministers, 2018; The Lancet Regional Health – Europe, 2023). Socioeconomic inequalities in, and the role of income inequality for, adolescent mental health in the Nordic countries have not been explored recently.

Sweden is a large country and the conditions for those living in densely and sparsely populated areas differ, including socioeconomic conditions such as education level, income and income inequality. It was not until 2021/22 that regionally comparable data of children's and adolescents' self-reported mental health and well-being in Sweden was available, through the extension of the sample in the HBSC study. Until then, comparisons of children's and adolescents' self-reported health status across regions, and the causes behind regional differences, were not possible to examine. The distribution of mental health problems and regional factors behind, have not been explored previously.

INTRODUCTION

ADOLESCENCE

Adolescence is the phase of life between childhood and adulthood. The World Health Organization (WHO) defines an adolescent as any person aged 10–19 years, which means that one in six people worldwide is an adolescent (WHO, 2024a). Adolescence can be divided into three phases: early adolescence defined as ages 10–13 years, middle adolescence as ages 14–17 years and late adolescence as age 18 to the early 20s. In this thesis, focus is on early and middle adolescence.

Rapid physical, cognitive, emotional and social development take place during adolescence. Puberty affects health and well-being in several ways, for instance many mental disorders have their onset in puberty (Patton & Viner, 2007). Cognitive skills, such as coping, problem-solving and emotional regulation are developed. Adolescence is also characterized by increasing autonomy from parents and increasing importance of peers and romantic relationships (Patton et al., 2016; Steinberg, 2022; WHO, 2024a).

Various health behaviours are formed during this phase of life, such as eating behaviours, physical activity, sleep patterns, substance use and sexual activity and together lay ground for adolescents' current and future health and health behaviours (Inchley et al., 2023). Promoting their socio-emotional learning and psychological well-being and ensuring access to mental health care are critical for their health and well-being (WHO, 2024a).

DEFINING MENTAL HEALTH

The definition of *health*, and particularly the definition of *mental health*, provided by the World Health Organization (WHO) are important starting points in this thesis. The WHO defines *health* as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1946). Furthermore, *mental health* is defined as “a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully and is able to make a contribution to his or her community” (WHO, 2005).

The core components of the definition of mental health by the WHO can be labelled *emotional well-being* (feelings of happiness and satisfaction with life), *psychological well-being* (positive individual functioning in terms of self-realization) and *social well-being* (positive societal functioning in terms of being of social value). Psychological well-being and social well-being are both included in *eudaimonic well-being*. Emotional well-being is synonymous to *hedonic well-being* (Westerhof & Keyes, 2010).

Mental ill health is an umbrella term that comprises both *mental health problems* and *mental disorders* (National Board of Health and Welfare et al., 2024).

Mental health problems are often normal reactions to stressors in life and may be mild or severe, may last for shorter or longer periods and may impact an individual's functioning in everyday life, such as work, education or leisure activities (National Board of Health and Welfare et al., 2024; Svedberg et al., 2013). Examples of mental health problems are concentration difficulties, feeling low, sleeping difficulties and suicidal thoughts. Mental health problems may manifest as somatic symptoms such as headache, stomach ache, back ache or dizziness (Dalman et al., 2021; National Board of Health and Welfare et al., 2024). Somatic health complaints may have also other causes, such as period pain, growing pain etc.

A *mental disorder* or illness is characterized by a clinically significant disturbance in an individual's cognition, emotional regulation, or behaviour. It is usually associated with distress or impairment in important areas of functioning (National Board of Health and Welfare et al., 2024; WHO, 2024b). Mental disorders are described by the International Classification of Diseases 11th Revision (ICD-11).

In this thesis, focus is on hedonic or emotional-well-being, more specifically on life satisfaction, and on mental health problems.

Another important starting point of this thesis is the *two continua model* or the *dual factor model*. This model states that mental illness and mental health are related but distinct dimensions (Westerhof & Keyes, 2010). This means that an individual may experience mental illness (disorder) and mental health at the same time. One continuum in the model indicates the presence or absence of mental health, the other continuum the presence or absence of mental illness. The two continua model may be used to identify four potential states of mental

health. They are *flourishing*, *struggling*, *languishing* and *floundering* (Keyes, 2005; Keyes, 2002). The dual continua model has been shown to be valid for children (Greenspoon & Saklofske, 2001).

DEFINING STRESSORS AND STRESS

Various stressors and self-reported stress as such will be explored in this thesis. Therefore, it is important to define these two concepts. *Stress* was traditionally defined either as a stimulus (stressor) or as a response (physical and psychological) (Folkman, 2013). However, the definition of stress varies between disciplines. The *biological tradition* focuses on the physiological responses to stress, the *psychological tradition* focuses on cognitive processes and the *sociological tradition* focuses on the social environment and its effects.

The *biological tradition* was founded by Hans Selye (Selye, 1936). Selye introduced the *General Adaption Syndrome (GAS)*, which describes the physiological changes that follow a stressor. The first stage is a general alarm reaction, the second stage is a resistance phase where the organs practically return to normal and the third stage is a phase of exhaustion where the symptoms are the same as in the first stage (Selye, 1936; Selye, 1950).

The *Stress and Coping Theory* belongs to the *psychological tradition* and defines stress as a relationship between the person and the environment. It was founded by Richard Lazarus (Lazarus, 1966). The theory consists of four elements: an internal or external stressor, an appraisal of the stressor, a coping strategy and a stress reaction (psychological and physical) (Lazarus & Folkman, 1984). Stress arises when a person appraises a situation as threatening or otherwise demanding and does not have an appropriate coping response (Lazarus, 1966; Lazarus & Launier, 1978).

Leonard Pearlin et al developed the *Stress Process Model* (Pearlin et al., 1981), which is part of the *sociological tradition*. In their model, they show how three major components of stress (its *sources*, *mediators* and *outcomes*) are related. Sources of stress are life events, chronic life strains and self-concepts (self-esteem and mastery/sense of control). Mediators of stress are social support and coping. Manifestations of stress may be various: from responses in the single cell to responses at a level of systems, such as the endocrine, immunological, metabolic or cardiovascular systems, or physical or psychological diseases. In this thesis, both the Stress and Coping theory and

the Stress Process Model are used to illustrate the mechanisms from stress to SHCs.

THE SOCIAL DETERMINANTS OF HEALTH

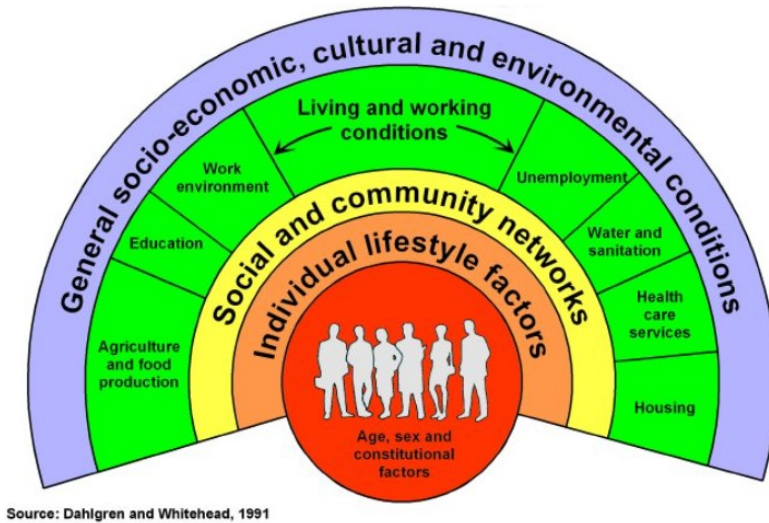
This thesis uses the framework of the *social determinants of health*, which are defined by the WHO as “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life.” (WHO, 2024d). *Inequalities in health* arise because of inequalities in society – in the conditions in which people are born, grow, live, work, and age (Marmot et al, 2010). *The social gradient* is found across the whole of society. “With each step one moves up on the social ladder, the better one’s health” (Siegrist & Marmot, 2006).

A well-known model that illustrates the social determinants of health is the Rainbow model (Dahlgren & Whitehead, 1991; Dahlgren & Whitehead, 2007; Dahlgren & Whitehead, 2021), see figure 1. The Rainbow model shows how an individual’s health is influenced by age, sex and constitutional factors, individual lifestyle factors, social and community networks, living and working conditions and structural conditions (Dahlgren & Whitehead, 2007). The social determinants of health can be health promoting, protective or risk factors. The model can be, and has been, adopted for children and adolescents.

The Rainbow model is not intended to be a model of the determinants of inequalities in health (Dahlgren & Whitehead, 2021). However, the unequal distribution of social determinants of health lead to health inequalities (Marmot et al., 2010). The history and practice of the Rainbow model have been extensively described (Dyar et al., 2022).

The *life course perspective* is central in the Marmot Review (Marmot et al., 2010) where strategies to reduce health inequalities were proposed. This perspective describes how social and biological factors operating at different stages of the life course and across generations contribute to the development of inequalities in adult health and disease. Conditions even before birth shape future inequalities in social development, education, employment and adult health.

Figure 1 The Rainbow model of the social determinants of health



In contrast to the Rainbow model, *Diderichsen's model* focuses on inequalities in health: how they are generated and maintained (Diderichsen et al., 2001). The model shows the pathways from social context to health outcomes and where policy interventions reducing health inequalities may take place.

The *ecological systems theory*, developed by Bronfenbrenner in the late 1970s, states that an individual's development is influenced by different systems (Bronfenbrenner, 1979). These include the micro-, meso-, exo-, macro- and chronosystems. All systems influence an individual's growth and behaviour. The microsystem is the most important for a child's development, and comprises the family and school.

Both the social determinants of child health and the pathways to child health inequalities are demonstrated by Pearce et al 2019, who adopted the Rainbow model and Diderichsen's model (Pearce et al., 2019). In their adapted model, the innermost layer comprises parenting along with health behaviours and lifestyle factors, and the second layer includes parents' own health and health behaviours. In the adopted model, "household resources" and "community" are different layers, in contrast to the original Rainbow model where "social and community networks" are one single layer. The outer layers are similar in Pearce's model and the Rainbow model.

Pearce et al 2019 also describe the four main pathways that link socioeconomic conditions to child and adolescent health and cause health inequalities: *material*, *psychosocial*, *behavioural* and *structural*. The pathways are not mutually exclusive, instead they are inter-related. They are briefly described below.

The *material pathway* focuses on material living conditions and resources. Even in high-income countries, child poverty is prevalent and there are families struggling to afford food and appropriate clothing. Also, the size and quality of housing and access to a garden or green space vary across socioeconomic groups (Pearce et al., 2019).

The *psychosocial pathway* consists of two complementary pathways. The first one is feelings of inferiority, subordination or lack of control among those less advantaged. The second one is stressors associated with living in social disadvantage. For children, the feelings and behaviours of their parents or caregivers manifest the first pathway. Adolescents however, start to develop a sense of social position and therefore their perceptions of social status or family wealth relative to peers is related to their health. Poverty and living in financial strain are stressors associated with living in social disadvantage (Pearce et al., 2019).

The *behavioural pathway* proposes that health inequalities result from inequalities in health behaviours, such as eating behaviours, physical activity, alcohol consumption and tobacco use. Unhealthy behaviours are more prevalent in disadvantaged groups and therefore contribute to health inequalities. This pathway includes both parents' or caregivers' and children's own health behaviours, as well as siblings' and peers' health behaviours (Pearce et al., 2019).

The *structural pathway* comprises socioeconomic, political, cultural and commercial factors that influence the distribution of resources, power and services across different groups. Childcare, schools, housing, health services and the welfare system are all examples of structural factors that influence children's and adolescents' health both directly and indirectly, through material, psychosocial and behavioral pathways. This pathway also comprises working environments which affect parents' material and psychological well-being and parenting capacity, and thereby child and adolescent health and well-being (Pearce et al., 2019).

The framework of the social determinants of health, especially the Rainbow model, is the basis of this thesis.

TRENDS IN MENTAL HEALTH

Mental health problems (MHPs) have increased among children, adolescents and young adults in high-income countries in the West (Boer et al., 2023; Bor et al., 2014; Collishaw, 2015; Cosma et al., 2020). They have increased in Northern Europe (Potrebny et al., 2017), across the Nordic countries (Hagquist et al., 2019) and in Norway (Potrebny et al., 2024; Potrebny et al., 2019). Several studies report a greater increase among girls than boys (Boer et al., 2023; Bor et al., 2014; Potrebny et al., 2024; Potrebny et al., 2019).

In Sweden, MHPs have become more common among adolescents and young adults since the end of World War II or even before that (Swedish Government Official Reports 2006:77). In 2010, an independent expert panel concluded that there has been a real increase in self-reported mental ill health in adolescents from the mid-1980s to the mid-2000s (Royal Academy of Sciences, 2010). The increase was confirmed in later reports (Hagquist, 2011; Public Health Agency of Sweden, 2014, 2019, 2023a) and studies (Blomqvist et al., 2019; Eriksson & Stattin, 2023; Högberg et al., 2020; Högberg et al., 2023; van Geelen & Hagquist, 2016). Several studies have reported a larger increase of MHPs among adolescent girls than adolescent boys in Sweden (Blomqvist et al., 2019; Högberg et al., 2020; Public Health Agency of Sweden, 2023a).

TRENDS IN MENTAL HEALTH PROBLEMS IN SWEDEN AND THE NORDIC COUNTRIES

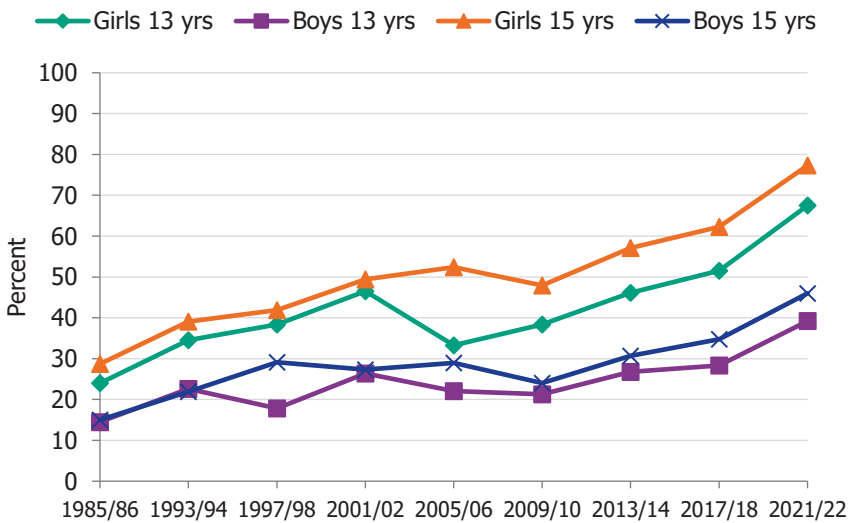
Long national and cross-national time trends in health and its determinants among children and adolescents are provided by the Health Behaviour in School-aged Children (HBSC) study. It is based on a nationally representative sample of children and adolescents in over 50 countries, carried out every four years (Inchley et al., 2023). All the Nordic countries except Iceland have participated since 1985/86 (Iceland joined in 2005/06).

The HBSC study has included the HBSC-Symptoms Checklist (HBSC-SCL) since the start in 1985/86. The adolescents were asked how often they have experienced the following symptoms in the last six months: headache; stomach ache; back ache; feeling low; feeling irritable or bad tempered; feeling nervous; difficulties in getting to sleep; and feeling dizzy. Response options for each

symptom ranged from *about every day* to *rarely or never*. The proportion reporting multiple health complaints (MHCs) more than once a week or about every day in the last six months is reported here (figure 2 and 3). Data for 1989/90 is missing due to different response options.

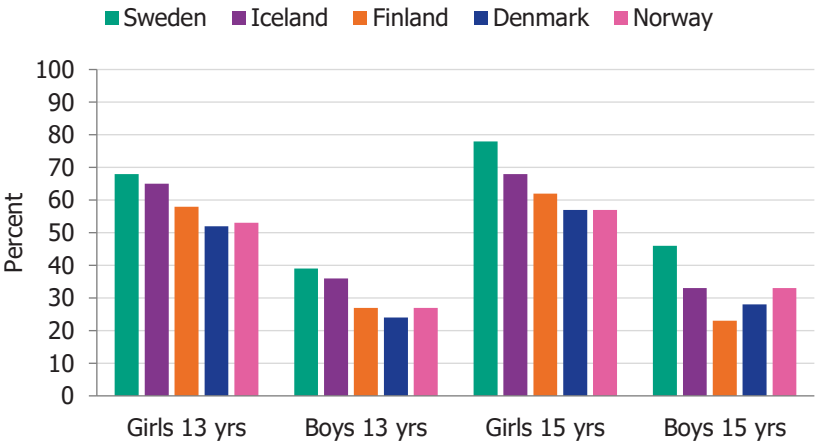
The most recent (2021/22) results for Sweden showed that the proportion of adolescents reporting MHCs had more than doubled since 1985/86 (Public Health Agency of Sweden, 2023a). The results also showed a clear gender gap, where MHCs were more prevalent among girls than boys. Among 13-year-olds, 68 percent of girls and 39 percent of boys reported MHCs. Among 15-year-olds, the proportion was 77 percent among girls and 46 percent among boys (see figure 2). Of the 44 countries that participated in the HBSC 2021/22, Sweden was ranked 6 among 13-year-olds and 3 among 15-year-olds (Cosma, Abdrakhmanova, et al., 2023). All the other Nordic countries reported lower rates of MHCs (see figure 3).

Figure 2 Multiple health complaints in Sweden 1985/86-2021/22, by gender and age



Source: Public Health Agency of Sweden, 2023a.

Figure 3 Multiple health complaints in the Nordic countries 2021/22, by gender and age



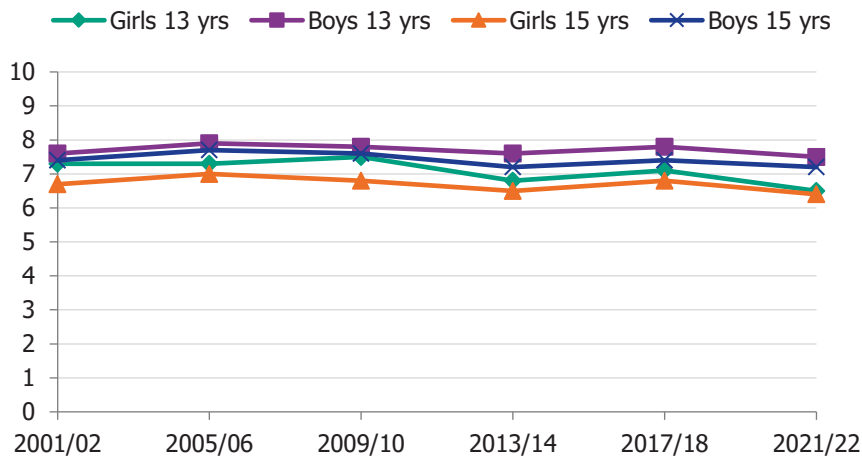
Source: Cosma et al, 2023.

TRENDS IN LIFE SATISFACTION IN SWEDEN AND THE NORDIC COUNTRIES

The HBSC study has included Cantril’s ladder as a measure of life satisfaction (LS) since 2001/02. The ladder has 11 steps: the top indicates the best possible life and the bottom the worst. Children were asked to indicate the ladder step at which they would place their lives at present (from 0 to 10). Here, mean values are presented (figure 4 and 5).

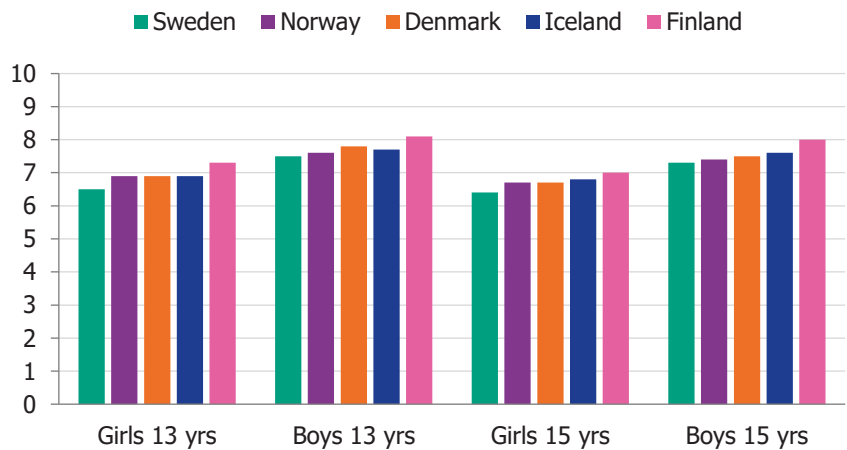
The average LS largely remained stable among 13- and 15-year-old girls and boys in Sweden in the 2000s (see figure 4). The results also showed that the mean LS was higher among boys than girls. In 2021/22, the mean LS was 6.5 among 13-year-old girls, compared to 7.5 among 13-year-old boys. It was 6.4 among 15-year-old girls and 7.2 among 15-year-old boys (Public Health Agency of Sweden, 2023a). Of the 44 countries that participated in the HBSC 2021/22, Sweden was ranked 39 among 13-year-olds and 31 among 15-year-olds (Cosma, Abdrakhmanova, et al., 2023). All the other Nordic countries reported higher mean values of LS (see figure 5).

Figure 4 Mean life satisfaction in Sweden 2001/02-2021/22, by gender and age



Source: Public Health Agency of Sweden, 2023a.

Figure 5 Mean life satisfaction in the Nordic countries 2021/22, by gender and age



Source: Cosma et al, 2023.

TRENDS IN MENTAL DISORDERS AND MEDICATION IN SWEDEN

Not only has there been an increase of MHPs among Swedish children and adolescents, there has also been an increase of mental disorders during the last two decades (National Board of Health and Welfare, 2017, 2019, 2020, 2024). The most recent official report shows that the proportion of children aged 10–17 years with a diagnosed mental disorder, or receiving medication for a mental disorder, was 13 percent among boys and 12 percent among girls in 2023 (National Board of Health and Welfare, 2024). That is an increase from 4 percent among both girls and boys in 2006 (National Board of Health and Welfare, 2020).

Internalizing mental disorders are more common among girls and externalizing mental disorders are more common among boys (Kovess-Masfety et al., 2021). More specifically, depression and anxiety are more common among girls and ADHD is more common among boys in Sweden (National Board of Health and Welfare, 2019).

The increase in mental disorders among children and adolescents is mainly attributable to depression and anxiety (National Board of Health and Welfare, 2020). However, ADHD has also increased since 2006, and in 2022, approximately 10.5 percent of boys and 6 percent girls aged 10–17 years had been diagnosed with ADHD or ADD (National Board of Health and Welfare, 2023).

MENTAL HEALTH ACROSS REGIONS IN SWEDEN

Comparable data of children's and adolescents' self-reported mental health across municipalities and regions have been scarce in Sweden. Many Swedish regions regularly monitor children's and adolescents' health status via surveys. Some examples are *Liv och hälsa ung* in Uppsala, Örebro, Västmanland and Södermanland regions, *Om mig* in Östergötland region, *Barns och ungdomars hälsa och levnadsvanor* in Kronoberg region, *Folkhälsoenkät Ung* in Jönköping region and *Folkhälsoenkät barn och unga* in Skåne region. Similarly, most schools and municipalities in Sweden use surveys in the student health's monitoring of individual students' health status over time.

Although age groups are similar across the regional surveys well as the surveys used by the student health, the use of different questions and instruments to measure mental health and well-being make comparisons across regions and

municipalities difficult to make. However, in 2009, a national census (Kartläggning av barns och ungas psykiska hälsa) was carried out among all students in grades 6 and 9, and the results were reported for schools, municipalities and regions (Statens folkhälsoinstitut, 2011). The results showed that the majority of the students felt well, but health problems increased between grade 6 and 9, and girls reported more mental ill health than boys. There were small, or no, differences in mental ill health related to country of birth or type of municipality. It was not until 2021/22, that another nationwide survey collected data that could be presented across regions: the sample in the Swedish HBSC study was extended to enable presentation of the results for each of the 21 regions (Public Health Agency of Sweden, 2023a).

Regional differences in mental disorders among children and adolescents have also been reported (National Board of Health and Welfare, 2017; Swedish Association of Local Authorities and Regions, 2024). In 2022, 6.4 percent of all children 0-17 years were in contact with children's and adolescents' psychiatry (BUP). That was an increase from 5.5 percent in 2017. It was also reported that regional differences in psychiatric care, such as diagnoses and medication, were large (Swedish Association of Local Authorities and Regions, 2024).

WHY HAVE MENTAL HEALTH PROBLEMS INCREASED?

Several attempts to identify factors behind the increase of MHPs among children and adolescents have taken place recent years (Collishaw, 2015; Nordic Council of Ministers, 2021; Public Health Agency of Sweden, 2018). Here, the most common explanations are described.

SCHOOL FACTORS

The importance of school experiences for children and adolescents' health is undebated. The school environment, school performance and mental health and well-being are mutually related. A good social environment in school can affect children's and adolescents' mental health and well-being positively and a poor social environment can have the opposite effect (Nordic Council of Ministers, 2021).

Early difficulties in school, especially difficulties reading and writing may cause internalizing and externalizing mental health problems, especially

internalizing problems among girls in adolescence. The direction of the association may also be the opposite: internalizing and externalizing mental health problems have negative effects on school performance (Gustafsson J E et al., 2010).

School has been appointed as one of the main drivers of stress according to Swedish adolescents for a long time (Hiltunen, 2017; Swedish Agency for Youth and Civil Society, 2015; Swedish Government Official Reports 2006:77; Tim Bergling Foundation et al., 2024).

A systematic review has shown a positive association between academic pressure and mental health problems (Stearse et al., 2023). An international study showed that an increase in schoolwork pressure over time partly explained the increase of psychosomatic complaints during the period 2002–2018 in high-income countries (Cosma et al., 2020). Similarly, the increase of national-level schoolwork pressure was associated with increases in national-level psychological complaints in the years 2002–2018 across Europe (Boer et al., 2023). In Sweden, increased school stress since 1993, especially among girls, explained a small share of the total increase of psychosomatic health complaints during 1993–2017, and about half of the increasing gender gap in health complaints (Högberg et al., 2020).

The education reform in Sweden in 2011 increased school-related stress and reduced the academic self-esteem of pupils in the 7th school year. This resulted in more psychosomatic symptoms and lower life satisfaction for these pupils, especially among girls (Högberg et al., 2021). School stress has increased more in grade 6 than in year 9 and more among girls than boys in recent cohorts. Also, low school grades and school difficulties have become stronger risk factors for school stress (Högberg & Strandh, 2024). Girls experienced higher levels of stress and worry and higher increases in stress, worry and academic demands between grades 6 and 9 than boys in Sweden (Giota & Gustafsson, 2021).

According to the PHAS, the fact that school performance has deteriorated according to PISA and TIMSS and that school pressure is widespread indicates that the functioning of the Swedish school system has deteriorated, which probably has contributed to the increase in MHCs among children and adolescents (Public Health Agency of Sweden, 2018).

Being bullied was associated with psychosomatic problems (Due et al., 2005; Gini & Pozzoli, 2013; Hjern et al., 2008). Psychosomatic complaints were more common among students involved in bullying (as a bully, victim or both) (Modin et al., 2015). Likewise, involvement in in-person bullying or cyber-bullying, either as a perpetrator or victim, were associated with higher levels of psychological symptoms (Kim et al., 2022). Physical violence, sexual assault, bullying and sexual harassment were shown to be strong risk factors for mental health problems in young people in Sweden (Landstedt, 2010). Harassment in the class (Modin & Östberg, 2009), teacher- or peer-bullying in the class (Modin et al., 2015) and sexual jokes in the class (Brolin Låftman et al., 2021) were associated with psychosomatic health complaints.

MACROECONOMIC FACTORS

Macroeconomic factors such as national wealth and income inequality were associated with MHPs among children and adolescents. For instance, national income inequality was associated with a higher national prevalence of health complaints (Dierckens et al., 2020; Elgar et al., 2015; Holstein et al., 2009).

The economic recession in Sweden in the beginning of the 1990s led to lower employment rates, especially among youth. Employment rates among them never recovered, instead many were forced to study even though they may have preferred to work (Swedish Government Official Reports 2006:77). Worry about family finances partly explained the increase of psychosomatic complaints among adolescents during the mid-1990s (Kim & Hagquist, 2018). Financial stress among parents was associated to an increased risk of MHPs among children in all Nordic countries in early 2010s, following the recession 2008-2009 (Gunnarsdóttir et al., 2016).

The labour market is more insecure and has higher educational demands than before. It is feasible that also adolescents are aware of these changes and that they feel pressures to complete secondary school with good grades to be able to continue to higher education. Therefore, the changes in the labour market have probably contributed to the increase of mental health problems among youth (Public Health Agency of Sweden, 2018).

CULTURAL FACTORS

The increase in time spent on internet use was associated with increases national-level psychological complaints among adolescents 2002-2018 (Boer et al., 2023). The rise of electronic media communication (EMC), along with

declines in sleep duration, may have contributed to the increase of mood disorders (depression) among adolescents and young adults since the mid-2000s (in the generation of adolescents referred to as “iGen”, born in the late 1990s) (Twenge et al., 2019). Since 2010, “iGen” adolescents have spent more time on new media screen activities and less time on nonscreen activities, which may account for the increases in depression and suicide (Twenge, Joiner, et al., 2018). The rapid adoption of smartphones and the shift in adolescents’ time use that followed may partly explain the decrease in psychological well-being (self-esteem, life satisfaction and happiness) among American adolescents after 2012 (Twenge, Martin, et al., 2018).

Increased screen time and internet use, such as social media and gaming, may expose adolescents’ to adversities and affect their mental health (Nordic Council of Ministers, 2021). For instance, a systematic review has shown that cyberbullying was associated with moderate to severe depressive symptoms, substance use, ideation and suicide attempts (Bottino et al., 2015). A Nordic study has shown that those subjected to cyberbullying had lower life satisfaction than those who were not bullied (Arnarsson et al., 2020).

The transition to independent adults with own income, own housing and possibilities to create a family, may be more difficult compared to earlier generations (Swedish Agency for Youth and Civil Society, 2015). This creates stress, not only among youth that are on their way of leaving home, but also among younger adolescents. A lot of school pressure among adolescents can be contributed to their thoughts about their future.

Increased *individualization* in society has also been proposed as an explanation to the increase of MHPs in Sweden (Swedish Government Official Reports 2006:77). It has brought new opportunities and makes life less predictable, but also requires youth to choose their own way of living. The capacity to handle this situation does not seem to have evolved in the same way as new opportunities have evolved.

According to Hiltunen, 2017, ill health is related to adolescents’ striving for *perfection* in everyday life. Norms related to social competition, social relations and school work are especially important for girls’ ill health (Hiltunen, 2017).

GLOBAL FACTORS

There have also been a number of events in more recent years that probably have affected adolescents' mental health and well-being. That includes the *covid-19-pandemic* and *Russia's invasion of Ukraine*.

Cosma et al 2023 examined the impact of the covid-19-pandemic on adolescents' school performance, social relations and mental health. They found that 37 percent of adolescents reported no impact on their mental health, 33 percent a positive impact and 30 percent a negative impact. Those who reported a negative impact on their school performance and their social relations were more likely to report low life satisfaction and health complaints, but variations across genders and ages, as well as countries, were found (Cosma, Bersia, et al., 2023).

In Sweden, the PHAS investigated the covid-19-pandemics' consequences for children and adolescents in Sweden (Public Health Agency of Sweden, 2024). In summary, small changes in living conditions, lifestyle and health were seen, but health inequalities increased. In contrast, Chen et al 2022 performed a longitudinal study of adolescents (at ages 13 and 15) and found that Swedish adolescents who were exposed to covid-19 in 2020 did not show worse mental health, relations with parents and peers or health behaviours at age 15 compared to adolescents not exposed to covid-19 (Chen et al., 2022). However, the data was collected during the first year of the pandemic (until November 2020), which may have affected the results.

CONTROVERSIES

There are researchers who question the increase of MHPs among children and adolescents. Some argue that there has been a *medicalization* of normal life events and less acceptance of mental ill health (Collishaw, 2015; Swedish Government Official Reports 2006:77). Increased *openness* and *reporting* about mental ill health have also been put forward as contributing factors to the increase. However, data from other informants than children and adolescents themselves, such as parents, victims and the police, follow broadly similar trends (Collishaw, 2015). Increased help-seeking, improved screening and clinical recognition in schools and primary care and broader diagnostic classifications have been put forward as explanations to the increase of mental disorders (Collishaw, 2015).

In Sweden, Wickström & Kvist Lindholm 2020 argued that the reporting and interpretation of the results of the health complaints checklist (HBSC-SCL) in the HBSC study is not correct. They have interviewed adolescents and concluded that some adolescents referred to the health complaints as “deep-seated problems” and others to “everyday problems”. The researchers therefore argued that caution must be taken when reporting the results from symptom scales to avoid the pathologizing of “everyday problems” (Wickström & Kvist Lindholm, 2020). However, Högberg et al 2023 showed that the distribution of complaints was not bimodal and that there were no clusters of respondents as suggested by Wickström & Kvist Lindholm 2020 (Högberg et al., 2023). Högberg et al 2023 also showed that the increase in complaints 1985-2017 was greatest among students who reported multiple and frequent complaints. They therefore argued that the increase of MHPs was not due to a greater tendency to report trivial complaints.

Kvist Lindholm & Wickström have also argued that today’s adolescents have a different view of common psychiatric diagnoses, such as anxiety and depression, and give new meaning to them, nuance them and also devalue them. Adolescents thereby transform them into cultural, rather than diagnostic, categories (Kvist Lindholm & Wickström, 2020). However, it is unclear how this change would be reflected in adolescents’ responses to symptoms-checklists in questionnaires and consequently, the trends in MHPs.

CONSEQUENCES OF MENTAL ILL HEALTH IN ADOLESCENCE

MENTAL DISORDERS

Mental disorders are becoming one of the dominant health problems of adolescents globally and substantial investment in prevention and the health-care system is required (Patel et al., 2007; Patton et al., 2016). Mental disorders, including stress-related disorders, today account for a significant part of the burden of disease among children in Sweden (Institute for Health Metrics and Evaluation).

Mental disorders usually begin in late childhood and adolescence, and because many persist into adulthood, adolescent mental disorders also make a greater contribution to adult disease than ever before (Kessler et al., 2005; Patton et al., 2014).

MENTAL HEALTH PROBLEMS

Psychosomatic complaints in adolescence are associated to later mental health outcomes. Adolescents with high levels of psychosomatic complaints at baseline (age 13 or 15 years) had higher odds of high levels of depressive symptoms after three years and after six years. Psychosomatic symptoms at baseline also predicted high levels of anxiety symptoms and diagnoses of anxiety disorders six years later (Giannotta et al., 2022). The frequency, number, and persistence of psychosomatic complaints (stomach ache, headache and difficulties falling asleep) during adolescence (at age 15–16 and/or 17–18) were associated with symptoms of depression and anxiety in young adulthood (20–21 years) (Grigorian et al., 2023). Adolescents who had many psychosomatic symptoms at age 14 were more likely to have anxiety symptoms and suffer from somatization ten years later (Kinnunen et al., 2010). Worry and anxiety in late adolescence and early adulthood increased the risk of suicide attempts, suicide and mental disorders later in life (National Board of Health and Welfare, 2013).

Somatic complaints in adolescence are also associated to later mental health outcomes. Somatic symptoms, especially abdominal pain, at age 16–17, predicted depression and other mental health disorders 15 years later, regardless of adolescent depression (Bohman et al., 2012). Somatic symptoms at age 16–17 also predicted severe adult (age 18–35) hospital-based mental health care in a dose-response relationship, also when controlling for depression and anxiety at start (Bohman et al., 2018). Frequent and recurring stomach aches, headaches, and muscle aches at some point(s) during childhood (ages 9 to 16) predicted depression and generalized anxiety disorder in adulthood (19 to 26 years) after accounting for childhood psychiatric and physical health status and psychosocial adversity (Shanahan et al., 2015). Musculoskeletal pain in at least two body locations at both age 16 and 18 was associated with psychological distress (GHQ-12) and symptoms of anxiety at age 18 (Auvinen et al., 2017).

Health complaints are also associated with other adverse outcomes in adulthood. Several individual health complaints (both somatic and psychological), the number of health complaints and self-rated health at age 15–16 were associated with an increased use of long-term social welfare benefits 6–11 years later (Homlong et al., 2015). Worry and anxiety in late adolescence and early adulthood were associated with accidents and injuries, lower educational attainment, a weaker position on the labour market and

lower chances of having a family later in life (National Board of Health and Welfare, 2013).

A GOOD AND EQUITABLE HEALTH FOR ALL CHILDREN AND ADOLESCENTS

The UN Convention on the Rights of the Child (United Nations, 1989), especially article 24 which, somewhat simplified, states that every child has the right to the highest attainable standard of health and access to health care services, and the Sustainable Development Goal (SDG) number three to ensure healthy lives and promote well-being for all at all ages (United Nations, 2015) are important starting points for this thesis.

The Swedish goal of public health, a good and equitable health for all and with an overarching objective of eliminating avoidable health inequalities within one generation (The Swedish Government Bill 2017/18:249), is also important. Two target areas concern children and adolescents specifically: 1) Conditions in early life and 2) Knowledge, skills and education/training.

KNOWLEDGE GAPS

Both the increase and high prevalence of MHPs among children and adolescents in Sweden and the Nordic countries have attracted the attention of researchers and policy makers during the last decades, and numerous scientific articles on the trends and its causes have been published. Not least by the vast network of HBSC researchers, with access to nearly 40 years of cross-national data on health and its determinants among children and adolescents (Currie & Morgan, 2020). However, some knowledge gaps remain.

First, as already mentioned, several explanations to the increase of MHPs among children and adolescents have been suggested. Less is known about the underlying mechanisms of SHCs among adolescents. They are sometimes referred to as “stress-related”, but few studies have actually explored the links between general stress and SHCs among adolescents.

Second, the Family Affluence Scale has served as a measure of families’ socioeconomic conditions since the HBSC 1993/94 and is highly appreciated among researchers and policy makers (Currie et al., 2023). The scale has undergone several revisions and been validated nationally as well as cross-

nationally. However, it has not been validated in Sweden, nor by using register data.

Third, the Nordic countries have been characterized by redistributive tax systems, generous social transfers and in-kind education and health care systems and low income inequality from an international perspective. However, income inequality has risen in recent years, especially in Sweden (Nordic Council of Ministers, 2018; The Lancet Regional Health – Europe, 2023). Socioeconomic inequalities in, and the role of income inequality for, adolescent mental health in the Nordic countries have not been explored recently.

Finally, it was not until 2021/22 that regionally comparable data of children's and adolescents' self-reported mental health and well-being in Sweden was available, through the extension of the sample in the HBSC study. Until then, comparisons of children's and adolescents' self-reported health status across regions, and the causes behind regional differences, were not possible to examine. The distribution of MHPs across Sweden and regional factors behind, have not been explored previously.

There were four hypotheses in this thesis:

- i) *Subjective health complaints among adolescents are related to stress*
- ii) *The Family Affluence Scale serves as a measure of families' socioeconomic status in Sweden*
- iii) *Income inequality is associated to mental health and well-being among adolescents in the Nordic countries*
- iv) *There are regional differences in subjective health complaints among adolescents across regions in Sweden and regional factors play a role*

AIM

The overall aim of the thesis was to analyze the social determinants and distribution of subjective health complaints, self-reported stress and life satisfaction among adolescents in Sweden and the other Nordic countries, focusing on socioeconomic inequalities. A specific aim was to validate the Family Affluence Scale, used as a measure of families' socioeconomic status in surveys. The aims of each study are stated below.

STUDY I

The overall aims of the study were to do an analysis of subjective health complaints (SHCs) and perceived general stress among adolescents in Sweden and analyse their prevalence and association.

STUDY II

The overall aim of the study was to examine the external validity of the Family Affluence Scale (FAS) among adolescents in Sweden by using register data for parental earned income, level of education and occupational status.

STUDY III

The aims of the study were to examine individual-level socioeconomic inequalities in SHCs and LS among adolescents in the Nordic countries during 2002 – 2018 and to explore whether SHCs and LS were related to income inequality in terms of the at-risk-of-poverty rate at the country level.

STUDY IV

The aims of the study were to examine the variation of SHCs among 15-year-old boys and girls across regions, schools and individuals in Sweden and to examine the role of socioeconomic conditions and school experiences at the individual-, school- and regional-level for SHCs among boys and girls.

Previous research has found clear gender differences in SHCs. Therefore, special attention is given to the role of gender in studies I and IV.

METHODS

OVERVIEW OF THE STUDIES

Table 1 Overview of studies in this thesis

Study	I	II	III	IV
Design and population	Quantitative, 2,283 13-year-olds from the STARS baseline 2015–2019.	Quantitative, 2,283 13-year-olds from the STARS baseline 2015–2019 and register data for 2,280 parents from Statistics Sweden (2,258 mothers and 2,204 fathers).	Quantitative, 41,148 15-year-olds from HBSC 2002–2018. Sweden: 9,196 Norway: 6,142 Finland: 8,577 Denmark: 6,176 and Iceland: 11,057. Official statistics regarding income inequality.	Quantitative, 10,701 15-year-olds from HBSC Sweden in 2022 and official statistics regarding income inequality and education in each region.
Outcomes	SHCs, self-reported stress	FAS	SHCs, life satisfaction	SHCs
Covariates	Gender, migration background, family structure, FAS, MacArthur Scale	Parental occupation, education and earned income	Gender, FAS, PFW, at-risk-of-poverty rate	Gender, migration background, FAS, PFW, school satisfaction, schoolwork pressure, bullying, at-risk-of-poverty rate
Analysis	Descriptive, Pearson's r , multiple linear and logistic regression analysis	Descriptive, Spearman's r , Principal Component Analysis	Descriptive and multilevel linear regression analysis	Descriptive and multilevel linear regression analysis

DATA

Cross-sectional data from two different studies were used in this thesis: regional data from the Swedish STudy of Adolescence Resilience and Stress (STARS), University of Gothenburg, and Swedish and Nordic data from the Health Behaviour in School-aged Children (HBSC) study, named Skolbarns hälsovanor in Sweden. Register data from Statistics Sweden were added to the STARS data. Official statistics were also used. Each study is described below.

THE HEALTH BEHAVIOUR IN SCHOOL-AGED CHILDREN (HBSC) STUDY

The HBSC study is a repeated cross-sectional study, consisting of a questionnaire on living conditions, social relations, school, health and risk behaviours and health to a nationally representative sample of 11-, 13- and 15-year-olds. It has been carried out in all Nordic countries since 1985/86 (except Iceland that joined in 2006) and is currently carried out in over 50 countries across Europe and in Canada.

HBSC focuses on understanding young people's health in their social context – at home, school, and with family and friends. It aims to improve understanding of how these factors, individually and collectively, influence young people's health throughout adolescence (Inchley et al., 2023).

The study is carried out every four years in accordance with a common research protocol (Inchley et al., 2023). The sampling in the HBSC study is done in a two-stage cluster manner. First, a nationally representative sample of schools is selected. Second, one class per school is selected. All students in the sampled class are invited to take part in the survey.

The Public Health Agency of Sweden (PHAS) is responsible for the Swedish part of the HBSC study. In 2021/22, the HBSC survey in Sweden had an extended sample, allowing for a regional presentation and analysis of the results (Public Health Agency of Sweden, 2023b).

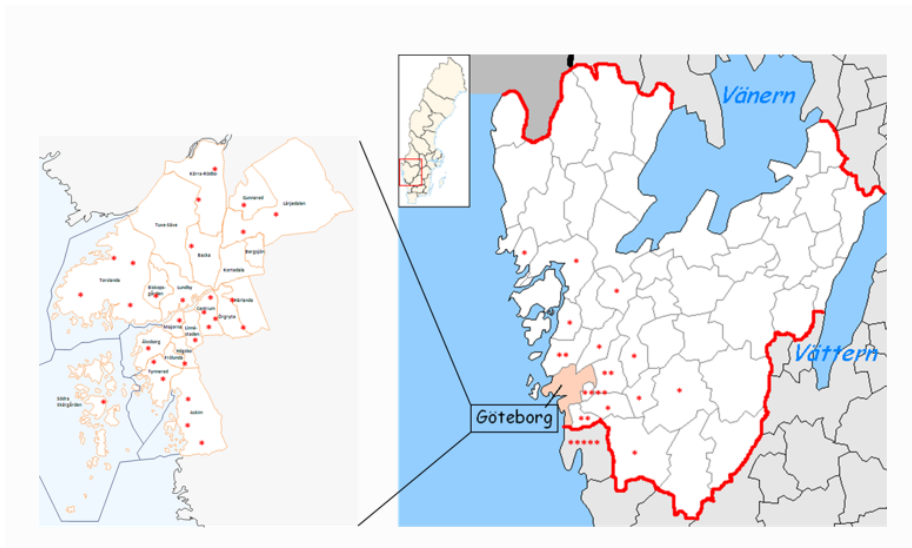
THE STUDY OF ADOLESCENCE RESILIENCE AND STRESS (STARS)

The STARS started in 2015 at the Sahlgrenska Academy at the University of Gothenburg, and combines questionnaires with clinical tests (height, weight,

waist circumference, blood pressure, hair cortisol etc.) and data from registers, e.g. regarding school results and the socioeconomic conditions of the family.

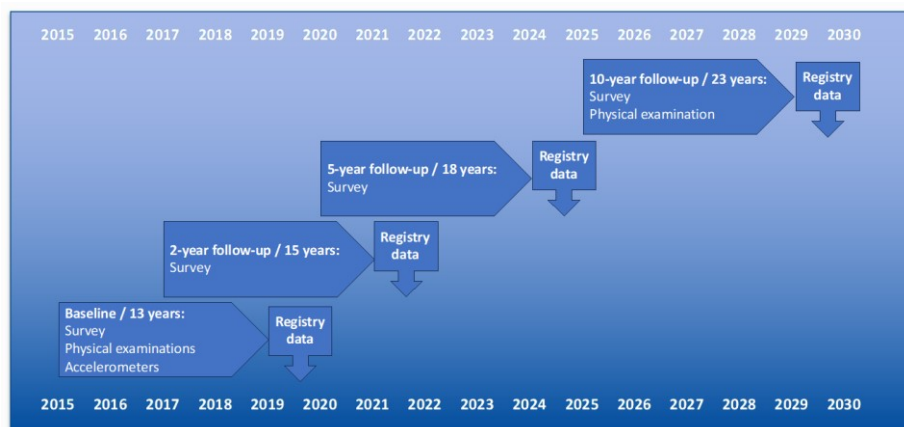
At baseline, data from 2,283 13-year-olds from 54 schools in 16 municipalities in Western Sweden (Västra Götaland) were collected (see figure 6). Schools were selected from areas with various socioeconomic contexts. After obtaining consent from the principals, researchers visited 7th grade classes to inform teachers and students about the study. Next, information letters and consent forms were sent to students and their parents or guardians. The response rate was 45 per cent.

Figure 6 Municipalities and schools that participated in STARS



The STARS study has monitored adolescents over several years, starting at the age of 13 (see figure 7). The baseline data were collected 2015–2019 and the 2-year-follow-up data were collected 2017–2021. The 5-year-follow-up was carried out 2020–2024.

Figure 7 Timeline for the STARS study



REGISTER DATA

Register data regarding earned income, educational level and occupational status from Statistics Sweden (2014–2018) were linked to the adolescents in STARS. In total, survey data were available for 2 280 adolescents, and register data were available for 2 258 mothers and 2 204 fathers.

OFFICIAL STATISTICS

Data from Eurostat regarding the national at-risk-of-poverty rate 2001–2018 in the Nordic countries were used. Official statistics from Statistics Sweden and the Public Health Agency of Sweden (2021–2022) regarding income inequality (the Gini coefficient and the at-risk-of-poverty rate), eligibility to secondary school and post-secondary education among adults in each Swedish region were used.

MEASURES

SUBJECTIVE HEALTH COMPLAINTS

Subjective Health Complaints (SHCs) were measured with the Psychosomatic Problems Scale (PSP) in the STARS and the HBSC Symptoms Checklist (HBSC-SCL) in the HBSC study.

In the HBSC, adolescents were asked how often they had experienced the following eight symptoms in the last six months: headache; stomach ache;

backache; feeling low; irritability or bad temper; feeling nervous; difficulties in getting to sleep; and feeling dizzy (see Table 2). Response options for each symptom were “about every day”, “more than once a week”, “about every week”, “about every month” and “rarely or never”.

Table 2. Individual health complaints included in the HBSC-SCL and the PSP-scale

Health complaint	HBSC-SCL (HBSC)	PSP-scale (STARS)
Headache	Yes	Yes
Stomach ache	Yes	Yes
Backache	Yes	No
Felt dizzy	Yes	Yes
Feeling low	Yes	No
Felt sad	No	Yes
Feeling nervous	Yes	No
Felt tense	No	Yes
Had a bad appetite	No	Yes
Difficulties in getting to sleep	Yes	Yes
Difficulties concentrating	No	Yes
Irritability or bad temper	Yes	No

The coding guidelines from the HBSC Internal Protocol (Inchley et al., 2023) state that the HBSC-SCL can be coded as a continuous variable (a sum score or a mean score) or as a dichotomous variable (for example those who report multiple health complaints more than once a week or every day). Also, the scale can be divided into two subscales (a somatic and a psychological).

The PSP-scale is introduced with “Your well-being and your health (if you think of the last 6 months. . .) Have you had difficulties concentrating, difficulties in getting to sleep, headache, stomach ache, felt tense, had a bad

appetite, felt sad or felt dizzy?” (See Table 2). The response options were “never”, “seldom”, “sometimes”, “often” and “always”.

The HBSC-SCL has been validated among school-aged children several times in different countries (Dey et al., 2015; Garipey et al., 2016; Haugland & Wold, 2001; Hetland et al., 2002; Lyyra et al., 2018; Potrebny et al., 2019) and across countries (Haugland et al., 2001; Ravens-Sieberer et al., 2008). Most of the studies found that the HBSC-SCL scale is two-dimensional, i.e. consists of a psychological and a somatic factor that are correlated (Dey et al., 2015; Garipey et al., 2016; Haugland et al., 2001; Hetland et al., 2002; Lyyra et al., 2018; Potrebny et al., 2019). In contrast, Ravens-Sieberer et al 2008 found that the scale is unidimensional.

Haugland & Wold 2001 found that health complaints negatively influenced subjective well-being and functioning in daily life among adolescents. Similar results were found by Svedberg et al 2013, who found that psychosomatic symptoms were associated to children’s and adolescents’ health-related quality of life, including their daily functioning (Svedberg et al., 2013).

The PSP-scale has been validated among adolescents in Sweden (Hagquist, 2008). The study showed that the PSP-scale has high reliability, works invariantly over time and similarly for both boys and girls.

SELF-REPORTED STRESS

Self-reported stress was measured by Cohen’s Perceived Stress Scale (PSS-10) in the STARS. Items were designed to measure how unpredictable, uncontrollable and overloaded respondents find their lives. The scale also includes one item about current levels of experienced nervousness and stress. The questions concern the respondent’s feelings and thoughts during the last month. The response options were “never”, “almost never”, “sometimes”, “fairly often” and “very often”. The four positively stated items (items 4, 5, 7 and 8) need to be reversed before a sum score is calculated (see Table 3).

Table 3. *The Perceived Stress Scale (PSS-10).*

In the last month, how often have you...	
1.	been upset because of something that happened unexpectedly?
2.	felt that you were unable to control the important things in your life?
3.	felt nervous and "stressed"?
4.	felt confident about your ability to handle your personal problems?
5.	felt that things were going your way?
6.	found that you could not cope with all the things that you had to do?
7.	been able to control irritations in your life?
8.	felt that you were on top of things?
9.	been angered because of things that were outside of your control?
10.	felt difficulties were piling up so high that you could not overcome them?

The PSS-10 has been validated using a sample of 7th grade students (Kechter et al., 2019). They found that a two-factor model (*perceived coping* and *perceived stress*) fitted the data better than a uni-dimensional model. They also found that PSS scores were inversely associated with executive function (measured with the Behavior Rating Inventory of Executive Function, BRIEF).

LIFE SATISFACTION

Life satisfaction (LS) was measured with Cantril's ladder (Cantril, 1965) in the HBSC study. The adolescents were asked to rate their life satisfaction using a visual analogue scale with 11 steps: the top indicates the best possible life, and the bottom the worst. The scale was slightly adopted before it was included in the HBSC study in 2001/02 (Currie et al., 2001).

The item has good convergent validity with other mental health and well-being measures among adolescents (Andersen et al., 2016; Levin & Currie, 2014; Mazur et al., 2018). Levin & Currie found good convergent validity with emotional well-being measures, perceived health and subjective health as well

as acceptable test-retest agreement. Good convergent validity with Kidscreen was reported among Polish adolescents (Mazur et al., 2018) and Norwegian adolescents (Andersen et al., 2016).

SOCIOECONOMIC CONDITIONS

The family's socioeconomic conditions were assessed with three different instruments: the Family Affluence Scale in the STARS and the HBSC study, the Perceived Family Wealth item in the HBSC and the MacArthur Scale of Subjective Social Status in the STARS. Official statistics regarding education and income inequality were also collected.

The *Family Affluence Scale II*, used in the years 2002–2010, consisted of four items regarding the family's material assets. They were the number of cars (0, 1, 2 or more), number of computers (0, 1, 2, > 2), unshared bedroom (no/yes), and the number of holidays during the last 12 months (0, 1, 2, 3 or more). The sum score of the FAS II is 0–9.

The *Family Affluence Scale III*, used in the years 2014–2022, consisted of six items regarding the family's material assets. They were: the number of cars (0, 1, 2 or more), number of bathrooms (0, 1, 2, 3 or more), number of computers (0, 1, 2, > 2), unshared bedroom (no/yes), dishwasher (no/yes) and the number of holidays abroad during the last 12 months (0, 1, 2, 3 or more). The sum score of the FAS III is 0–13.

Perceived family wealth (PFW) was assessed with the question “How well off do you think your family is?”, with the response options “very well off”, “quite well off”, “average”, “not so well off”, and “not at all well off”.

Subjective social status (SSS) was measured by the MacArthur Scale of Subjective Social Status – Youth Version (Goodman et al., 2001). The respondents view a drawing of a ladder with 10 rungs. Students were asked to mark the rung that best represents where their family would be on a ladder picturing how Swedish society is set up.

Eligibility to secondary school showed the proportion (%) of children in grade 9 in each region who were eligible for at least a vocational programme at secondary school (passed (E) in Swedish, English and Mathematics and at least five other subjects), in 2022.

Post-secondary education showed the proportion (%) of adults aged 25–64 years with a post-secondary education in each region, in 2021.

The *at-risk-of-poverty rate* was the proportion (%) of the population (of all ages) whose equivalised (adjusted to household composition) disposable income (including capital income) was below 60 percent of the national median equivalised disposable income after social transfers (in study III). In study IV, the proportion of children (0–19 years) living in families whose equivalised disposable income was below 60% of the national median equivalised disposable income after social transfers was used.

The *Gini coefficient* ranged from 0 to 1, where higher values indicate higher inequality. The Gini is based on equivalised (adjusted to household composition) disposable income (earned and capital income) in the population (all ages), in 2021.

SCHOOL EXPERIENCES

School satisfaction was assessed with the question “How do you feel about school at present?”. Response options ranged from “I like it a lot” to “I don’t like it at all”. *School satisfaction in the school* was aggregated from school satisfaction.

Schoolwork pressure was assessed with the question “How pressured do you feel by the schoolwork you have to do?” Response options ranged from “not at all” to “a lot”. *Schoolwork pressure in the school* was aggregated from school pressure.

Bullied was derived from the question “How often have you been bullied by (an) other person(s) at school in the past couple of months?”. A definition of bullying was provided before the question. Response options ranged from “I have not been bullied at school the last months” to “several times a week”. *Bullied in the school* was aggregated from bullied.

STATISTICAL METHODS

COMPARISONS BETWEEN GROUPS

When the outcome variable was symmetrically distributed, mean values were calculated to compare values between groups. Student t-tests were performed to determine if there were statistically significant differences in mean values

between two groups. ANOVAs with Bonferroni correction were performed to determine if there were statistically significant differences in mean values between multiple groups. Confidence Intervals were calculated and compared to determine if there were statistically significant differences in mean values between larger number of groups.

When the outcome variable was not symmetrically distributed, median values and interquartile ranges (IQRs) were calculated to compare values between multiple groups. Kruskal-Wallis tests were performed to determine whether differences in medians across multiple groups were statistically significant.

CORRELATIONS BETWEEN VARIABLES

The linear correlation between continuous variables was estimated with Pearson's correlation coefficient r . The correlation between categorical variables was estimated with Spearman's correlation coefficients r . Correlation coefficients were interpreted as follows: 0–0.29 as low, 0.30–0.49 as moderate and 0.5–1.0 as high correlation. Fisher's r -to- z transformation was used to determine if there were statistically significant differences in correlations between subgroups.

THE INTERNAL RELIABILITY AND DIMENSIONALITY OF INSTRUMENTS

Cronbach's alpha was calculated for several instruments to determine the internal reliability. Principal Component Analyses was performed to examine if scales were unidimensional or not.

ASSOCIATIONS BETWEEN VARIABLES

To examine associations between independent and dependent variables, various forms of regression analyses were performed. Simple regressions if there was only one independent variable, multiple regressions if there were multiple independent variables. If the outcome was continuous, linear regressions were performed. If the outcome was dichotomous, logistic regressions were performed. To examine associations using hierarchical data, multilevel regression analyses were performed.

All statistical analyses were performed in IBM SPSS.

ETHICAL CONSIDERATIONS

ETHICAL APPROVAL

In the STARS study, adolescents were not anonymous and shared sensitive personal data about their health status. Further, register data regarding their school performance and their parent's occupational status, education level and income were added to STARS. Ethical approval for the STARS study was obtained by the Regional Ethics Board in Gothenburg in August 2015 (Dnr 578–15). An ethical application was obtained from the Swedish Ethical Review Authority before register data was linked to the STARS data (Dnr 2019-06035).

In the Swedish HBSC study, children participated anonymously and also answered a limited number of background questions (mainly multiple choice, except for height, weight and for girls, exact age for menarche). Therefore, the risk of backwards identification of a specific child in the data set is minimal. Consequently, the data have not been classified as personal data by the PHAS (responsible for the data collection). However, the regional extended data collected in 2021/22 were classified as personal data, due to the elevated risk for backward identification of individual students.

There is no ethical approval for the HBSC study in Sweden. The PHAS has the right to collect the data according to articles 6.1 e (processing is necessary for the performance of a task carried out in the public interest) and 9.2 j (processing is necessary for [...] statistical purposes) in the General Data Protection Regulation (GDPR). Ethical approval for the HBSC study was obtained in some Nordic countries (Norway, Finland and Iceland some years), but not in Denmark.

However, an ethical application was submitted and granted from the Swedish Ethical Review Board “Etikprövningsmyndigheten” before study IV (based on the extended sample 2021/22) was conducted (Dnr 2023-05117-01).

PARENTAL CONSENT

Parental consent is necessary due to the age of the children participating in the studies (13 years in STARS, and 11, 13 & 15 years in HBSC). However, informed consent is used in STARS and passive consent has been used in the Swedish HBSC. Passive parental consent was obtained before children's participation in the HBSC study in all Nordic countries, 2002–2018, with the

exception of Norway, where informed parental consent was introduced in 2018.

THE HELSINKI DECLARATION

This thesis includes studies that involve human subjects. Therefore, the principles of the Declaration of Helsinki (World Medical Association) should be followed. One such principle is nr 16, “Medical research involving human subjects may only be conducted if the importance of the objective outweighs the risks and burdens to the research subjects.”. The risks for the children participating in the HBSC are minor as they only filled in a questionnaire anonymously. The risks are also limited in the STARS study, where the children filled in a questionnaire and also participated in clinical examinations of e.g. blood pressure and waist circumference and provided researchers with blood and hair samples.

THE UN CONVENTION ON THE RIGHTS OF THE CHILD

Two articles in the UN Convention on the Rights of the Child are of special importance for the studies in this thesis. The Convention was ratified by Sweden in 1990 and in 2020, the Convention was incorporated into Swedish law (The Swedish Government Bill 2017/18:186). The first, article 24, states that “States Parties recognize the right of the child to the enjoyment of the highest attainable standard of health and to facilities for the treatment of illness and rehabilitation of health. States Parties shall strive to ensure that no child is deprived of his or her right of access to such health care services.” The studies in this thesis address adolescent health inequalities in Sweden and the other Nordic countries and provide policy makers with knowledge that enable policy measures that improve their living conditions and health.

The second is article 12, “States Parties shall assure to the child who is capable of forming his or her own views the right to express those views freely in all matters affecting the child, the views of the child being given due weight in accordance with the age and maturity of the child”. By participating in the surveys, the children and adolescents were given the opportunity to express their view on their living conditions, social relations, school experiences and health. Their views on these matters are used in research that highlights their situation and hopefully leads to policy measures that improve their living conditions and health.

RESULTS

This thesis has provided new knowledge on the distribution of self-reported mental health and its social determinants among adolescents in Sweden and the other Nordic countries, during the 21st century. It has also provided unique validation work on the FAS by using register data.

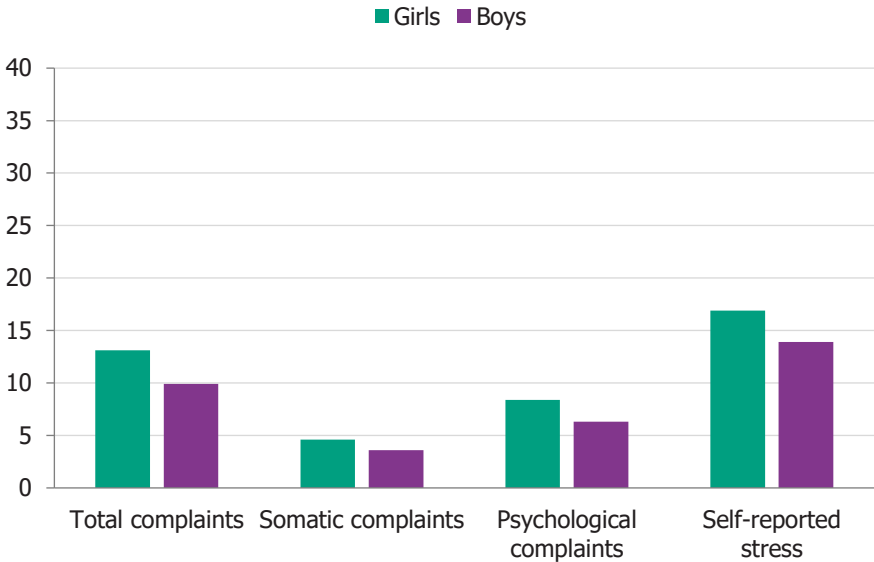
The thesis has examined the distribution of self-reported stress, SHCs and LS among adolescents after gender, country of birth as well as objective and subjective socioeconomic conditions. One study also examined the distribution across family structure, another across the Swedish regions and one across the Nordic countries. It was not possible to examine the distribution of self-reported stress, SHCs or LS across gender identity or gender expression, ethnicity, cultural or religious background or sexual orientation, because such questions were not included in the STARS or HBSC questionnaires to children and adolescents. Together, the studies provide a comprehensive understanding of the distribution of self-reported mental health among adolescents in the Sweden.

Several important social determinants of self-reported mental health have been examined in the thesis, especially socioeconomic conditions at different levels (in the family, at school, at the regional level and the national level) as well as school experiences (school satisfaction, school pressure and bullying) at the individual level and the school level.

MENTAL HEALTH INEQUALITIES RELATED TO GENDER AND COUNTRY OF BIRTH

Clear gender differences in mental health were found in the studies. The results regarding SHCs and self-reported stress among 13-year-old girls and boys in Western Sweden (study I), are presented in figure 8. Levels of total complaints, as well as somatic and psychological complaints, were higher among girls than boys. Similarly, levels of self-reported stress were higher among girls than boys.

Figure 8 Total complaints (0-32), somatic complaints (0-12), psychological complaints (0-20) and self-reported stress (0-40) among 13-year-olds in Western Sweden, 2015-2019

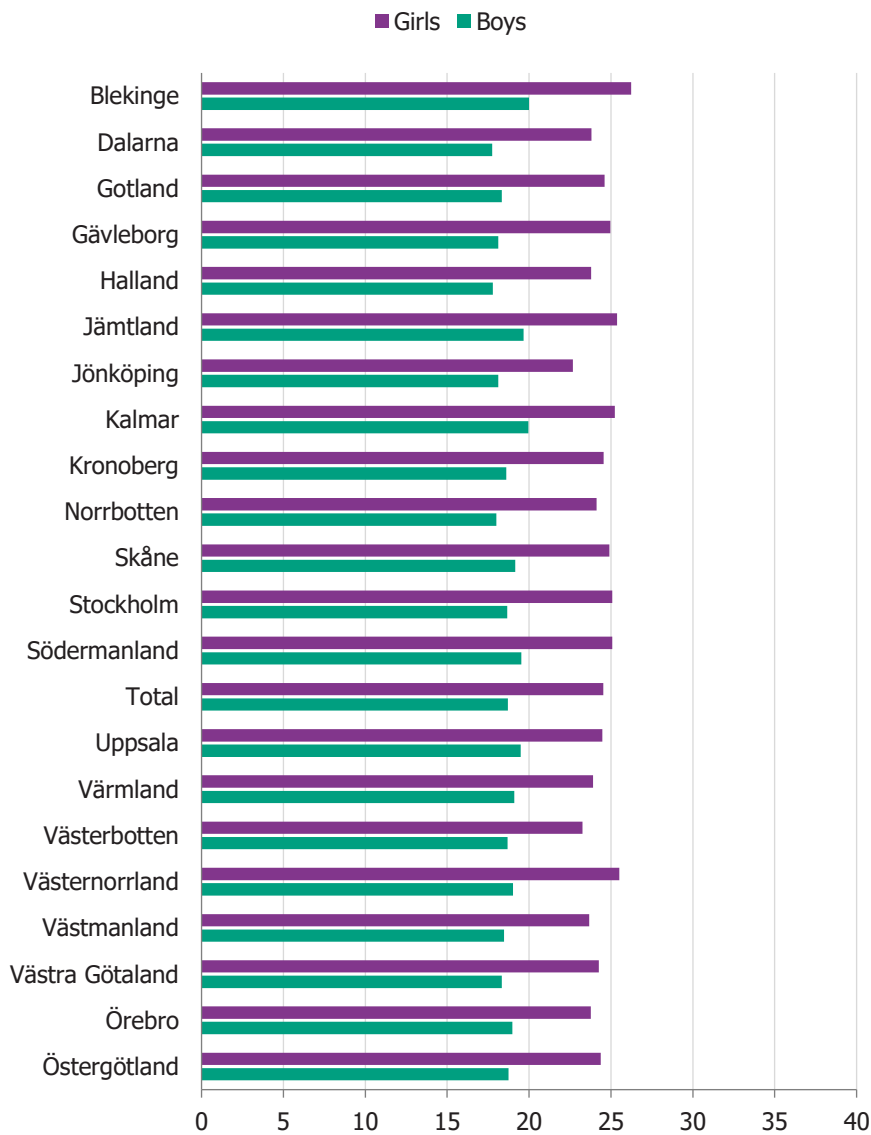


Source: Study I, Corell M, Friberg P et al 2021. Table 1.

Gender differences in mental health were also evident in study IV, where regional differences in SHCs among 15-year-olds were analyzed. SHCs were more common among girls than boys in all 21 Swedish regions (see figure 9).

The prevalence of SHCs and self-reported stress among 13-year-old adolescents with Swedish background and foreign background in Western Sweden were also analyzed, but no consistent differences were found. On the one hand, adolescents with foreign background had slightly higher levels of somatic complaints and self-reported stress. On the other hand, they had lower levels of psychological complaints. Study IV found that 15-year-old adolescents born abroad had a somewhat lower prevalence of SHCs compared to adolescents born in Sweden.

Figure 9 SHCs (8-40) among 15-year-olds in each Swedish region, 2021/22

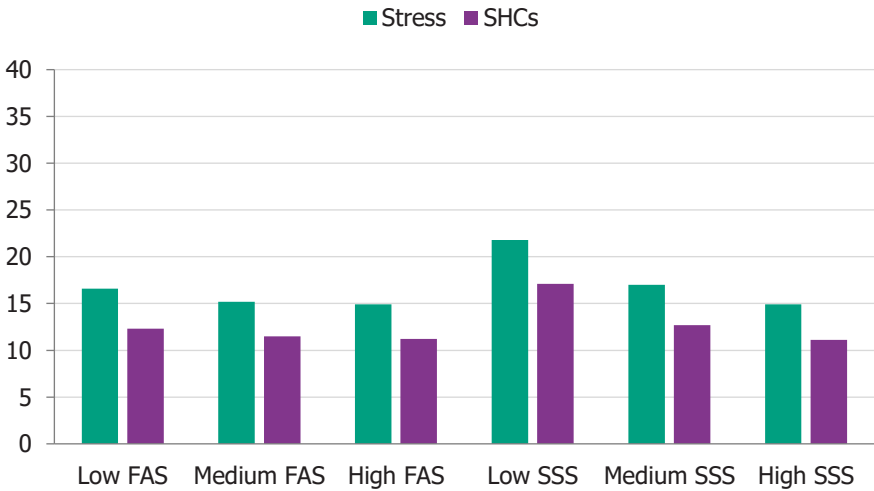


Source: Study IV, Corell M, Eriksson C et al 2024 (Manuscript).

SOCIOECONOMIC INEQUALITIES IN MENTAL HEALTH

Socioeconomic inequalities in mental health were found in all the studies where it was examined. Socioeconomic inequalities were found in SHCs and self-reported stress among 13-year-olds in Western Sweden (study I). A social gradient was observed in both health outcomes when subjective social status was used as a measure of socioeconomic status, meaning that sum scores of self-reported stress and SHCs gradually decreased as subjective social status increased. When objective socioeconomic status was used, the low FAS group reported higher levels of both SHCs and stress compared to the medium and high FAS groups (see figure 10), but no social gradient was found, as no difference was observed between the medium and the high FAS groups.

Figure 10 Self-reported stress (0-40) and subjective health complaints (0-32) among 13-year-olds in Western Sweden 2015-2019, by objective and subjective social status



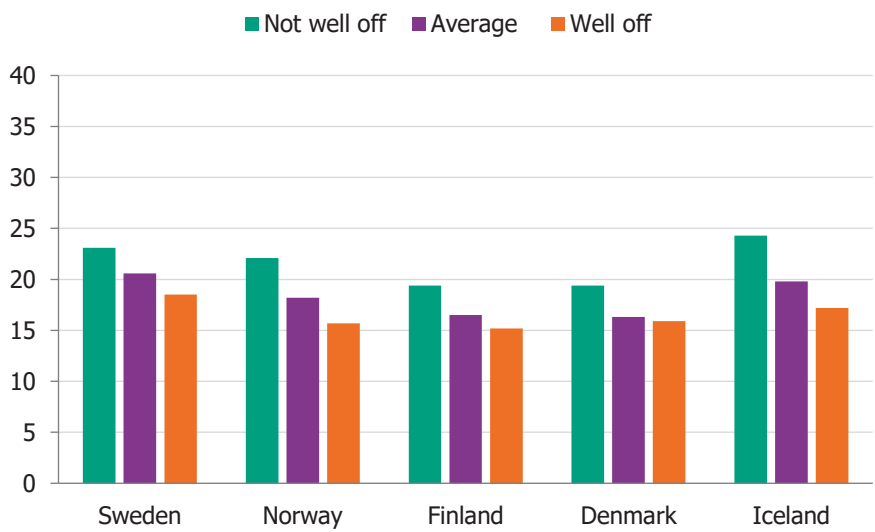
Source: Study I, Corell M, Friberg P et al 2021 Table 1.

Socioeconomic inequalities were also found in SHCs and LS among 15-year-old adolescents in the Nordic countries throughout the period 2002–2018 (study III). There was a social gradient in both SHCs and LS in all countries when PFW was used as a measure of socioeconomic status (see figure 11 and 12), meaning that mean levels of SHCs gradually decreased and LS gradually

increased as PFW increased. Socioeconomic inequalities in SHCs and LS were less evident when the FAS was used as a measure of socioeconomic status (results presented in study III).

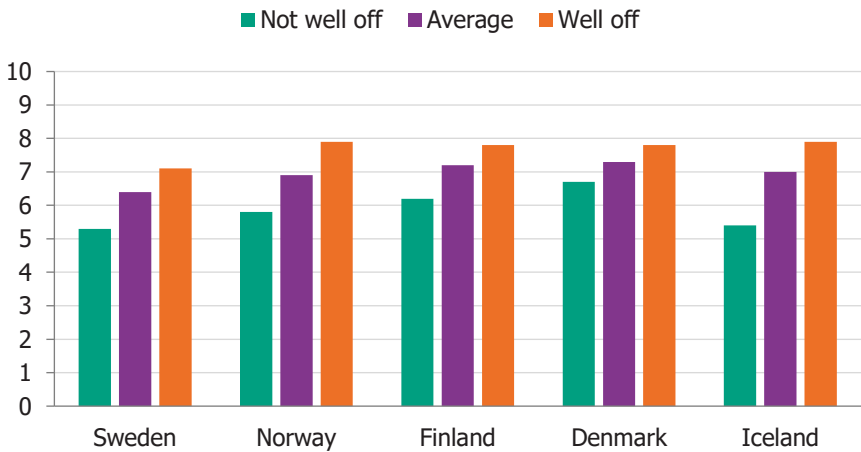
The slope of the social gradient in SHCs and LS when PFW was used was examined with regression analysis in study III. The slope (measured as B) varied across countries: it was steepest in Iceland and flattest in Denmark and Finland. The slope of the social gradient was of average magnitude in Sweden.

Figure 11 Subjective health complaints (7-40) among 15-year-olds in the Nordic countries 2014, by perceived family wealth



Source: Study III, Corell M, Friberg P et al 2024. Table 2. 2014 was chosen because Iceland and Denmark did not include PFW in 2018.

Figure 12 Life satisfaction (0-10) among 15-year-olds in the Nordic countries 2014, by perceived family wealth

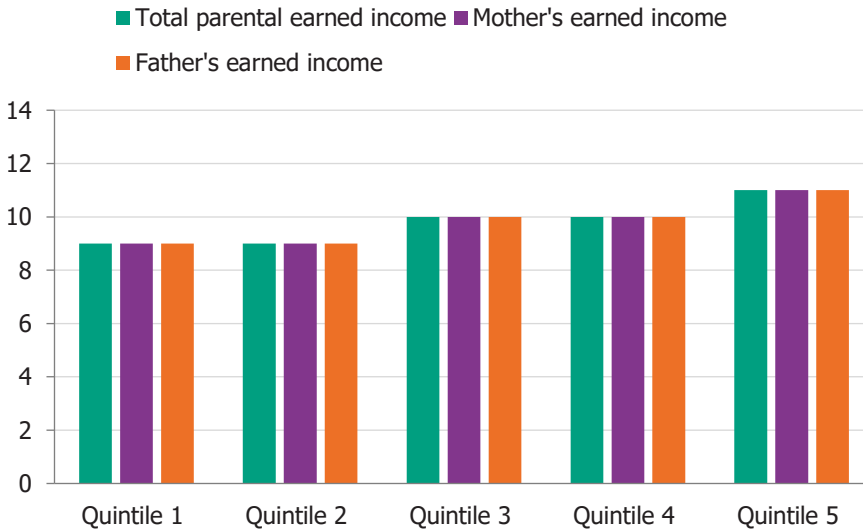


Source: Study III, Corell M, Friberg P et al 2024. Table 4. 2014 was chosen because Iceland and Denmark did not include PFW in 2018.

Study IV showed that the higher the PFW (both at the individual-level and the school-level), the lower the levels of SHCs among 15-year-old boys and girls in Sweden in 2022. In contrast to studies I and III, the higher FAS at the individual-level, the higher the levels of SHCs. However, the association between FAS and SHCs in study IV was weak.

In summary, the studies showed that subjective social status was a stronger tool in identifying socioeconomic inequalities in mental health among adolescents in the Nordic countries during the last 20 years (2001/02–2021/22) compared to the FAS. This may raise questions about the reliability and validity of the scale. The validity of the FAS was examined in study II by combining adolescents’ responses to the scale with their parents’ earned income, level of education and occupational status according to registers. As figure 13 shows, median values of FAS gradually increased as parents’ earned income increased. Depending on examination year, the Pearson’s correlation coefficients were $0.28 \leq r \leq 0.46$ for fathers’ earned income and FAS and $0.26 \leq r \leq 0.41$ for mothers’ earned income and FAS. For total parental earned income and FAS, the correlation coefficients were $0.31 \leq r \leq 0.48$.

Figure 13 Median values of FAS (0-13) in each parental earned income quintile, 2015-2019

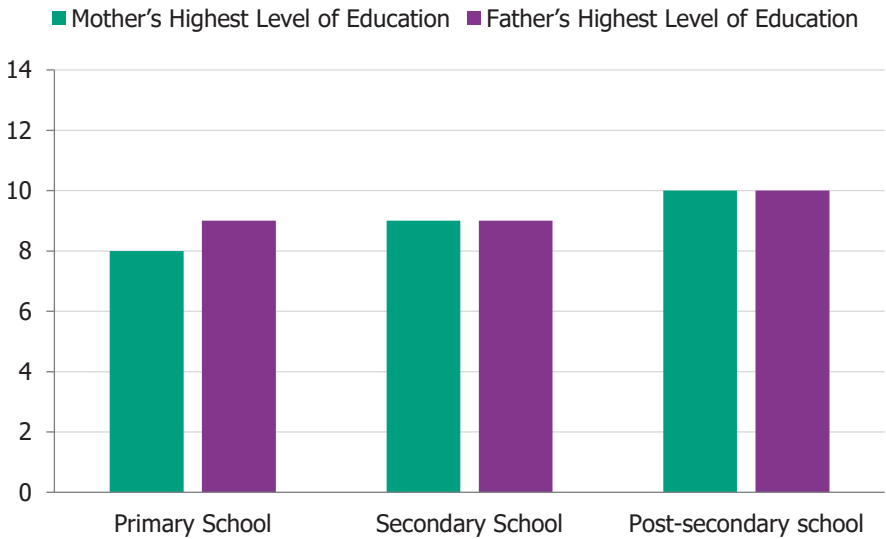


Source: Study II, Corell M, Chen Y et al 2021. Table 3.

As figure 14 shows, median values of FAS also gradually increased as parents' level of education increased. The Spearman's correlation coefficient for fathers' education level and FAS was 0.21 and for mothers' education and FAS 0.19. Median values of FAS were higher in families with both parents working, but the Spearman's correlation coefficient for parents' occupational status and FAS was low ($r=0.22$).

Finally, the results showed that the low FAS group consisted mainly of adolescents with parents belonging to the two lower income quintiles (73.1%). Accordingly, the high FAS group consisted mainly of adolescents with parents belonging to the two higher income quintiles (65.8%).

Figure 14 Median FAS values (0-13) in each parental education level, 2015-2019



Source: Study II, Corell M, Chen Y et al 2021. Table 3.

The role of income inequality for SHCs and LS among 15-year-olds was examined through multilevel analyses of the Nordic countries (study III) and the Swedish regions (study IV) respectively. The at-risk-of-poverty rate was used for this purpose. The results showed that the higher the at-risk-of-poverty rate at the national level, the higher the national prevalence of SHCs and the lower the rates of LS among adolescents in the Nordic countries (study III). However, when the role of the at-risk-of-poverty rate at the regional level for SHCs among Swedish adolescents was examined, a weak association was found only for boys (study IV). The Gini coefficient at the regional level was also included in that study, but showed no significant association with SHCs among adolescents.

Family structure is also related to socioeconomic conditions. Study I examined the distribution of SHCs and self-reported stress across family structures and found significantly higher levels among 13-year-olds living with one parent, compared to those living in a nuclear family.

STRESS AND MENTAL HEALTH

Although school experiences are central as adolescents spend considerable time either at school or doing homework, schoolwork pressure may not be the only source of stress in adolescents' lives. In one study, the role of general stress for SHCs was examined (study I). Stress was found to be strongly associated with health complaints among adolescents. The association was stronger between self-reported stress and psychological complaints than the association between self-reported stress and somatic complaints. Stress was particularly associated to some of the individual health complaints: felt sad, difficulties concentrating and felt tense. The associations were weaker between stress and headache, stomach ache, felt dizzy and difficulties in getting to sleep.

THE SCHOOL CONTEXT AND MENTAL HEALTH

The importance of school, both as a working environment and a social environment for adolescents' mental health, was also examined (study IV). Although very little of the variance in SHCs among girls, and especially boys, was attributable to the school level in Sweden, several of the school variables at the individual-level were strongly associated to SHCs among both boys and girls. Schoolwork pressure and being bullied were associated with higher levels of SHCs, meanwhile school satisfaction was associated with lower levels of SHCs. None of the school-level experiences (school satisfaction, schoolwork pressure or bullying in the school) were significantly associated with SHCs.

THE REGIONAL CONTEXT AND MENTAL HEALTH

The role of regional-level factors for adolescents' mental health was examined in study IV. The distribution of SHCs across regions was shown in figure 9. Significant differences in levels were found between regions, but no evident geographical patterns were observed, such as differences between the northern and southern parts of Sweden, densely and sparsely populated regions or between larger and smaller regions. In fact, the results from the MLRA showed that very little of the variation of SHCs among boys and girls was attributable

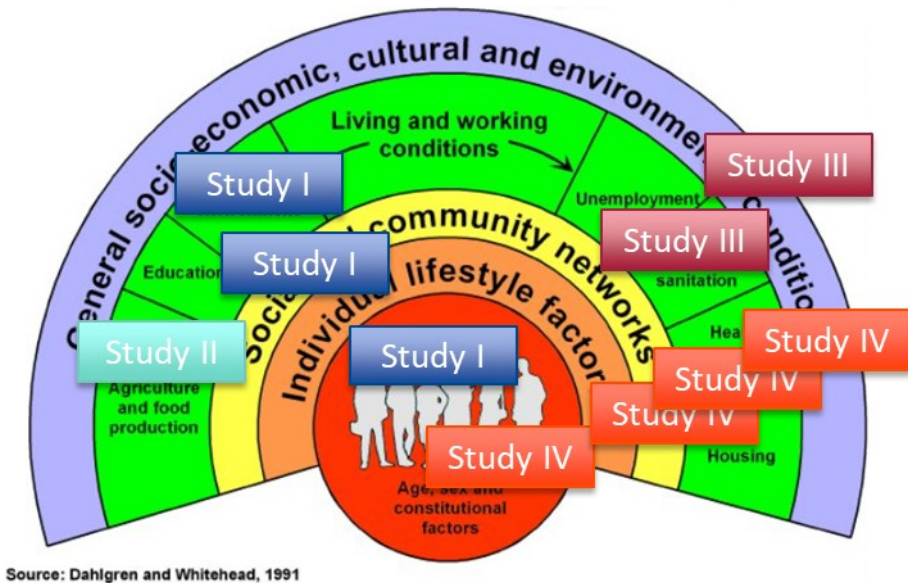
to the regional level. The regional-level variables regarding eligibility to secondary school as well as the education level among adults, were not associated to SHCs among adolescents. The role of income inequality at the regional level was previously described. Other important conditions that influence health may however vary across regions, such as the proportion living in urban and rural areas, access to higher education, health care, housing etc. and these were not included in the study.

DISCUSSION

This thesis aimed to analyze the distribution of self-reported mental health and its social determinants among adolescents in Sweden and the other Nordic countries. Cross-sectional data from two studies along with register data and official statistics were used. The distribution of, and association between, self-reported stress and SHCs were examined in study I. The validity of the FAS in Sweden was examined in study II. Socioeconomic inequalities in SHCs and LS among Nordic adolescents and the role of income inequality was examined in study III. Study IV examined the variation of SHCs among Swedish adolescents across regions, schools and individuals as well as the role of socioeconomic conditions and school experiences.

The aim of this chapter is to synthesize and discuss the findings from each study, within the social determinants of health framework and the Rainbow model. For this purpose, figure 15 shows which layers of the model that have been covered in the studies in this thesis. As the figure shows, all layers except “individual lifestyle factors” were examined.

Figure 15 Placing the studies in the thesis in the Rainbow model



GENDER INEQUALITIES IN MENTAL HEALTH

One main finding in this thesis was clear gender inequalities in self-reported stress and SHCs among Swedish 13-year-olds and 15-year-olds, where girls reported worse mental health than boys. The findings complied with previous research (Ottová-Jordan et al., 2015; Ottova et al., 2012) as well as the most recent international results from the HBSC study, showing persistent gender differences in all indicators of mental health and well-being to the disadvantage of girls and increasing gender differences with age (Cosma, Abdrakhmanova, et al., 2023). Several explanations to the gender inequalities in mental health among adolescents have been put forward, including individual factors (such as biological factors, the onset of puberty and differences in coping) and societal factors (such as gender norms and expectations).

Clear gender differences in adolescent mental health and well-being have previously been reported and analyzed in Sweden (Hiltunen, 2017; Landstedt, 2010; Public Health Agency of Sweden, 2023a). Perceived demands and responsibilities regarding schoolwork, future plans, relationships, appearance and financial issues were strongly associated with MHPs, especially among girls (Landstedt, 2010). Ill health among adolescents was associated with their striving for perfection in their everyday lives (Hiltunen, 2017). Girls adhered to behavioural norms regarding social competition, social relations and schoolwork to a higher extent than boys. Hiltunen 2017 argued that this “gender regime” partly explained the gender difference in mental ill health.

There is also research showing that women and men have different coping strategies when exposed to various stressors. Women tend to seek support among family and friends, meanwhile men tend to seek distraction from alcohol, drugs and sports. The same pattern seems to appear among girls and boys (National Institute of Public Health, 2009; Swedish Government Official Reports 2006:77).

The fact that the size of the gender differences (the gender gap) in health varies across countries (Cosma, Abdrakhmanova, et al., 2023) suggests that contextual factors matter. One such factor is societal gender inequality. The role of gender inequality for adolescent health and health behaviours has been examined in several studies based on cross-national HBSC data (de Looze et al., 2019; de Looze et al., 2018; Heinz et al., 2020; Torsheim et al., 2006). Torsheim et al 2006 found consistent gender difference in SHCs across countries in the late 1990s, increasing with age, but the magnitude of the

gender difference varied across countries. They found that gender differences in SHCs were larger in countries with higher gender inequality, assessed with the Gender Development Index (GDI).

Higher gender equality (assessed with the Gender Empowerment Measure) at the national level was associated with higher life satisfaction among both boys and girls in 2009/10 (de Looze et al., 2018). The association remained significant when controlling for national wealth and income inequality, and was partly explained by social support in the family, from peers and in the school. Another study found that gender inequality at the national level (measured with the GII) was associated with gender differences in typically masculine health behaviours: physical fighting, physical activity and injuries in 2009/10 (de Looze et al., 2019). All three behaviours were more common among boys than girls in all countries, but gender differences were larger in countries with higher gender inequality. According to the authors, adolescents adhere to social norms, including gender norms. In countries with traditional gender norms, boys are more prone to fight and engage in physical activity. In more gender equal societies, girls are freer to engage in risky behaviours which may result in injuries.

The correlation between gender inequalities in adolescent health and the Gender Inequality Index (GII) in the late 2010s was examined by Heinz et al 2020. In contrast to previous literature (listed above), the results showed that the higher the gender equality, the higher the gender difference in multiple health complaints, school work pressure, feeling fat and life satisfaction, to the disadvantage of girls. However, in more gender equal societies, the smaller the gender inequalities in physical activity, smoking, alcohol use and overweight (behaviours and health outcomes that are generally more prevalent among boys). The cluster analysis revealed that geographically and historically linked countries had similar health risks for boys and girls. Sweden appeared in a cluster with Denmark, Finland, Canada, Scotland, the Netherlands and some Eastern European countries. Norway and Iceland appeared in a cluster with mainly Eastern European countries.

THE ROLE OF SOCIOECONOMIC CONDITIONS FOR MENTAL HEALTH

This thesis has also shown socioeconomic inequalities in adolescent mental health and that the FAS may be used as a measure of families' socioeconomic conditions. The use of both objective measures (such as income, education and occupation) and subjective measures (an individual's perception of his or her standing in society) of socioeconomic status are crucial in public health. Both the STARS and HBSC studies have included such measures. The FAS was included in both STARS and HBSC, the PFW item only in the HBSC, and the MacArthur Scale in STARS.

The results showed that self-reported stress, SHCs and LS related more closely to subjective social status than objective social status in the Nordic countries. The results aligned with previous research: subjective socioeconomic conditions have been shown to be more important than objective socioeconomic conditions (Ahlborg et al., 2017; Elgar et al., 2016; Svedberg et al., 2016; Weinberg et al., 2021).

Elgar et al 2016 found that inequalities in life satisfaction were largest when subjective social status (the MacArthur Scale) was used. Their results suggested that objective and subjective measures of SES relate differently to adolescent health and are not interchangeable. Instead, Elgar et al 2016 argued that psychosocial processes matter more than material inequality for adolescents' health. Similar results were shown by Ahlborg et al 2017, who examined socioeconomic inequalities in MHC, LS and self-rated health. They showed that PFW was more strongly related to the health outcomes than the FAS and concluded that subjective social status was more important than objective social status when examining inequalities in adolescent health. Similar conclusions were drawn by Svedberg et al 2016, who compared FAS, PFW and parental occupation and found that they were weakly correlated. They also found that PFW, but not FAS, was significantly associated to health-related quality of life (HRQOL).

A social gradient in psychosomatic complaints was observed by Weinberg et al 2021 across 30 countries when PFW was used. But, for family affluence, the social gradient varied across countries. In some countries there was a social gradient, but in some countries, it was absent or reversed. Weinberg et al 2020 therefore concluded that status perceptions and social comparisons are

important for mental health among adolescents, particularly in countries with relatively high standards of living.

The results in study II showed that the Family Affluence Scale III was successful in capturing objective socioeconomic conditions of families in Sweden. Although the scale had been included in the HBSC study for 25 years, it had never been properly validated in Sweden before. One may argue that the findings in study II have limited value because the FAS is revised on a regular basis and within short the FAS IV will be introduced to the HBSC study (2025/26 or 2029/30). On the other hand, study II was a validation of the FAS III, which was included in several survey rounds (2013/14, 2017/18 and 2021/22). Data from these three survey rounds will be used in future HBSC studies, especially studies examining trends in socioeconomic inequalities in various health behaviours and health outcomes. Validation studies need to be performed for each version of the scale. Additionally, study II was the first validation of the FAS using register data for parental education, occupational status and earned income. The methods in the study may therefore inspire other HBSC researchers in their future validation work.

Since study II was published in 2021, at least three new studies on the FAS have been published by researchers in the HBSC network (Boer et al., 2024; Brook et al., 2024; Currie et al., 2023). Currie et al 2023 described the development of the FAS, empirical work using the scale as well as its policy impact on adolescent health inequalities. Boer et al 2024 examined whether the covid-19-pandemic effected the FAS, by using data before and after the pandemic. The study showed that the internal consistency of the FAS decreased during the pandemic, but was still acceptable in all countries. The item thresholds of the computer and holiday items changed during the pandemic, effecting mean scores of the scale before and after the pandemic. However, Boer et al 2023 concluded, the scale is still suitable for examining socioeconomic inequalities in adolescent health. Brook et al 2024 examined whether the FAS II was suitable for time trend analyses of Norwegian HBSC data 2002–2018. Although the results showed an overall good model fit in the different survey years, they also showed measurement non-invariance across survey years, sex and age groups. The results showed that the FAS II can be used for ranking affluence and comparing health outcomes in individual years, but FAS II scores across years are not comparable.

THE ROLE OF STRESS FOR MENTAL HEALTH

Another important finding in this thesis was that SHCs, especially psychological complaints, were strongly associated with stress. There has been little research on the links between general stress and SHCs among adolescents. Instead, a lot of research has focused on school demands or schoolwork pressure and health complaints (Boer et al., 2023; Brodin Låftman et al., 2023; Cosma et al., 2020; Currie & Morgan, 2020; Hjern et al., 2008; Högborg, 2021; Högborg et al., 2021). Previous studies on general stress and health complaints (Brodin Låftman & Östberg, 2023; Brodin Låftman & Östberg, 2024; Moksnes & Espnes, 2020; Moksnes & Lazarewicz, 2019) were based on older adolescents.

In Sweden, Anniko 2018 showed that stressors related to school were the most prevalent sources to stress among adolescents, but also that social stressors were more strongly associated with increases in MHPs. Furthermore, adolescents with higher levels of stressors and distress engaged more in cognitive avoidance (i.e. efforts to suppress or not think about a stressful situation) and repetitive negative thinking (RNT), which led to further increases of MHPs. Anniko concluded that cognitive avoidance and RNT may be important mechanisms behind stress-related MHPs among adolescents. The findings in this thesis highlight the importance of examining the total burden of stress in children and adolescents' lives, not only experiences of stress related to school (Anniko, 2018).

The use of cross-sectional data to examine the association between self-reported stress and SHCs in study I can be questioned. If longitudinal data from the STARS study had been available at the time of the study, inferences about causality had been drawn more easily. However, the results align with the theoretical framework presented in the study. Additionally, a review of the research on stress and health by O'Connor et al, published in 2021, describes how stress influences health, both directly and indirectly (Connor et al., 2021). The results also align with previous research on the association between stress and health complaints among adolescents, based both on cross-sectional data (Brodin Låftman & Östberg, 2023; Brodin Låftman & Östberg, 2024; Moksnes & Espnes, 2020; Moksnes & Lazarewicz, 2019; Wiklund et al., 2012) as well as longitudinal data (Brodin Låftman & Östberg, 2023; Brodin Låftman & Östberg, 2024).

THE ROLE OF THE SCHOOL CONTEXT FOR MENTAL HEALTH

The results in study IV showed that individual-level school satisfaction, schoolwork pressure and being bullied were strongly associated with SHCs. However, the school-level school satisfaction, schoolwork pressure or bullying were in general not significantly associated with SHCs. The former results were in line with previous research (Boer et al., 2023; Hjern et al., 2008; Ottova et al., 2012), but the latter results were not. For instance, harassment, bullying and sexual jokes in the class have all been shown to be associated with health complaints (Brolin Låftman et al., 2021; Modin et al., 2015; Modin & Östberg, 2009).

School-level data regarding the socioeconomic and demographic characteristics of the students and their families, students' school performance and schools' financial and organizational characteristics would have been helpful in the study. Such data are available from the Swedish National Agency for Education and The Swedish Schools Inspectorate. However, because of legal and ethical issues, the Swedish HBSC study does not include school identifiers or personal identifiers and thus makes it impossible to link such data to the HBSC data. Instead, the only option to capture school-level characteristics is by aggregating individual students' data to school-level data. This was done in study IV. However, as only one class per school is sampled in the HBSC study, it is unclear to what extent aggregation of one class's school experiences actually reflect all students' school experiences.

THE ROLE OF REGIONAL AND NATIONAL SOCIOECONOMIC CONDITIONS FOR MENTAL HEALTH

The role of regional and national socioeconomic conditions, in terms of education and income inequality, were examined in studies III and IV. The use of at-risk-of-poverty rate as a measure of income inequality in the studies differed from most previous studies. Although highly correlated (Morelli et al., 2015), the at-risk-of-poverty rate is a different concept and measure than the Gini, which has previously been used as a measure of income inequality in several studies examining the role of income inequality on adolescents' mental health (Dierckens et al., 2020; Elgar et al., 2015; Ottová-Jordan et al., 2015).

The association between child wellbeing (measured with the UNICEF index of child well-being, comprising a range of indicators including mental health) and the proportion of children living in relative poverty was indeed examined (Pickett & Wilkinson, 2007). The main difference between the two measures is that the at-risk-of-poverty rate shows the proportion of the population that fall beneath a certain threshold of income (60 percent of the equivalised disposable national median income) meanwhile the Gini shows the magnitude of income inequality across the whole population. In other words, the former focuses on the prevalence of relative deprivation and the latter focuses on income inequality per se. In study III, it was concluded that the at-risk-of-poverty rate may be used as a measure of income inequality instead of the Gini coefficient. It may be particularly helpful when the effects of income inequality on health is to be studied in countries with very similar rates of Gini (such as the Nordic countries). It is however, important to acknowledge that the two measures are not identical and interchangeable.

In study III, socioeconomic inequalities in both SHCs and LS across the Nordic countries were presented using mainly descriptive statistics (mean values of SHCs and LS for each socioeconomic group, as well as the size (n) of each group). Linear regressions were also performed to show the slope of the social gradient (B) in SHCs and LS. The presentation of inequality was in line with Nielsen et al (2015) recommendations on how to present inequality (Nielsen et al., 2015). They argued that the prevalence of the health outcome(s), the size of the socioeconomic groups and the regression line representing the summary indices of health inequality should be included.

However, socioeconomic inequalities in health can be assessed and described in various ways. The choice is related to the type of data and measurements available. Absolute differences or inequalities in health may for instance be described with Prevalence Differences or Slope Index of Inequality (SII). Relative differences or inequalities may be described with Odds Ratios or Relative Index of Inequality. Previous research using HBSC data and more specifically the FAS has calculated both SII and RII (Elgar et al., 2015; Nielsen et al., 2015). Another method to assess socioeconomic inequalities is the Yitzhaki Index (Elgar et al., 2013), which has also been used in research using HBSC data.

The fact that survey data of children's and adolescents' self-reported mental health have not been comparable across Swedish regions until the HBSC sample was heavily extended in 2021/22, make the results of study IV unique

in a Swedish context. Therefore, study IV has contributed to the research field by showing that most of the variation in SHCs occur between individuals and schools, and not regions.

STRENGTHS AND LIMITATIONS

There are four major limitations in the studies in this thesis that need to be addressed. Two are related to the use of cross-sectional survey data and concern *casual inference* and the *generalizability* of the results. The third limitation is that only *internalizing problems* are assessed. Finally, a limitation concerns the choice of *multilevel regression analysis* despite data for a limited number of countries.

There are three major strengths of this thesis. The first is the use of *high-quality survey data and register data*, the second is the use of *well-validated instruments* and the third is the use of *well-established statistical methods* in the public health and epidemiology research field. The major limitations and strengths are described below.

LIMITATIONS

All four studies in this thesis are based on cross-sectional survey data. The STARS study is nowadays a longitudinal study, with three measurement points, targeting adolescents at the ages 13, 15 and 18. However, when the first two studies in this thesis were conducted, only baseline data (2015–2019) from the STARS had been collected and were available for research. The baseline data from STARS are therefore comparable to any cross-sectional data. The HBSC study is a repeated cross-sectional study, targeting different children and adolescents each time.

CAUSAL INFERENCE

Cross-sectional survey data means that all data, both on exposures and outcomes, are collected at the same time. Cross-sectional data are useful for measuring the prevalence of health outcomes, and examining associations between exposures and outcomes, in a population. Also, repeated cross-sectional studies may be used for analyzing population changes over time. The use of cross-sectional data in this thesis does not allow for conclusions about causality to be drawn, solely based on the results from the analyses. However, all studies in the thesis are based on well-established theoretical or conceptual frameworks as well as on previous literature and empirical findings in the

public health research field. This facilitates conclusions about causality to be drawn, e.g. regarding the association between stress and SHCs or the association between school experiences and SHCs.

GENERALIZABILITY

There may be different forms of *selection bias* in the survey data from the STARS and the HBSC study. Selection bias occurs when the samples drawn are not representative of the target population. *Nonresponse bias* is a common type of selection bias and means that the characteristics of the responders and the non-responders differ. In the case of both the STARS and HBSC studies, there is a risk of non-response bias both among schools and students.

As described in the Methods chapter, the sampling in the HBSC study is done in a two-stage cluster manner. First, a nationally representative sample of schools is selected. Second, one class per school is selected. Therefore, two response rates are of interest: the response rate among the selected schools and the response rate among the students in the selected classes. The proportion of sampled schools that chose to participate in the Swedish HBSC study has gradually decreased, from over 80 percent 1985/86–2009/10, to 77 percent in 2013/14, 47 percent 2017/18 and 55 percent in 2021/22 (Public Health Agency of Sweden, 2023a). However, Statistics Sweden’s comparison of participating and non-participating schools 2021/22 showed no differences with regards to public/private schools, school size or the education level among parents to students attending the schools (Statistics Sweden, 2022). Therefore, the risk of *non-response bias among schools* in the HBSC seems low.

The proportion of students in the selected classes who chose to participate in the HBSC has been surprisingly stable 1985/86–2017/18, between 85 and 90 percent. In the last data collection, the participation rate fell to 80 percent. One reason may be the covid-19-pandemic. Despite the high response rate among students, there is still a risk of nonresponse bias at the student-level. Children and adolescents with less favorable socioeconomic conditions, lower attachment to school and worse health may be underrepresented due to less willingness to participate or absence on the day(s) data were collected in the schools. The extent of this problem is difficult to determine, as no comparison of participating and non-participating students has been made.

However, when comparing the background variables of the students participating in the Swedish HBSC study 2017/18 and STARS 2015–2019 with population data from Statistics Sweden, only minor differences with

regard to migration background and family structure were shown. Further, parents to adolescents in the STARS were only slightly more well-educated than adults of the same age in the population (see study II). Collectively, there seems to be little risk of *selection bias* in both studies.

In the STARS, active (written) consent is required from parents, which may lead to *selection bias* because of underrepresentation of children with migrant background, lower socioeconomic status and children living with one parent or without parents. It is difficult to determine the extent of this problem, as there is little information about the students that did not participate in the study.

It is important to acknowledge that the results in this thesis are not generalizable to adolescents of all ages (10–19 years). Only data for specific ages (13-year-olds in study I and II, 15-year-olds in study III and IV) were used. Caution must be taken to avoid *extrapolation*, i.e. drawing conclusions about the population outside the range of the data (adolescents younger than 11 and older than 15).

ONLY INTERNALIZING PROBLEMS WERE ASSESSED

The studies in this thesis only included measures of internalizing problems (the PSP-scale and the HBSC-SCL) and not any externalizing problems. As mentioned in the introductory chapter, internalizing problems are more common among girls and externalizing problems more common among boys. Both the HBSC and STARS studies have very limited questions that may be regarded as externalizing problems: physical fights and bullying. The lack of measures of externalizing problems means that we may have overestimated the gender difference in self-reported mental health among adolescents in Sweden and the other Nordic countries. It also means that the social determinants of externalizing problems are not examined.

MULTILEVEL ANALYSIS WITH A LIMITED NUMBER OF COUNTRIES

The small number of countries included in study III may be questioned. The power of the data used in the multilevel regression analysis with the at-risk-of-poverty rate was low, and some of the results lacked statistical significance at the 0.05 level (but were statistically significant at the 0.10 level). This means that the estimators may have been biased (Bryan & Jenkins, 2015; Maas & Hox, 2004). To some extent this limitation is compensated for by having a long time series (five data points per country except Iceland which had four) and a

large number of students (41,148). However, the estimates from the multilevel analyses have to be interpreted with some caution.

STRENGTHS

HIGH-QUALITY SURVEY DATA AND REGISTER DATA

The use of HBSC data, STARS data, register data and official statistics was a major strength in all of the studies. Regarding the STARS study, researchers recruited the students and were present at schools during the data collection. Regarding the HBSC, the Public Health Agency of Sweden has been responsible for the study since the early 1990s and Statistics Sweden was responsible for the data collection during the last four survey rounds (2009/10–2021/22). Most importantly, the HBSC research protocol covers all steps of the data collection in all participating countries, ensuring high quality of the data (Inchley et al, 2023).

WELL-VALIDATED INSTRUMENTS

Both the HBSC and STARS studies use well-validated and well-used instruments to measure health (such as the HBSC-SCL, Cantril's ladder and Cohen's PSS-10) and socioeconomic conditions (the FAS, PFW and MacArthur Scale). See the Methods chapter for a description of the instruments used in the studies and associated validation studies.

WELL-ESTABLISHED STATISTICAL METHODS

Only well-established statistical methods have been applied in the four studies (see the Methods chapter). Among the methods used are Cronbach's alpha to assess the internal reliability of the scales used, calculation of Pearson's and Spearman's correlation coefficients to determine correlations between variables and performance of simple and multiple linear regression analyses and multilevel linear regression to examine associations between variables.

CONCLUSION

This thesis has shown that socioeconomic inequalities in SHCs, self-reported stress and LS persisted among adolescents in Sweden and the other Nordic countries in the 2000s. Subjective socioeconomic status related more closely to adolescents' mental health than objective socioeconomic status. Additionally, a social gradient was observed in adolescent mental health when perceived family wealth or subjective social status, but not FAS, was used as a measure of socioeconomic status. This despite the fact that the validation of the FAS showed that it was moderately correlated with parental earned income and thus may be used in surveys to children and adolescents using self-reported socioeconomic status. Also, the results showed that the higher the at-risk-of-poverty rate, the higher the prevalence of SHCs and the lower the LS among adolescents. The thesis has also shown that SHCs are closely related to general stress and stressors in the school: low school satisfaction, schoolwork pressure and being bullied.

CONTRIBUTIONS TO THE LITERATURE

- This thesis has validated the *Family Affluence Scale* by using register data for parental earned income, level of education and occupation status. The results showed that total parental earned income was moderately correlated with adolescents' scoring on the FAS and may be used in surveys using self-reported socioeconomic status among children and adolescents.
- This thesis has found that the *at-risk-of-poverty rate* was associated with higher levels of SHCs and lower levels of LS among adolescents in the Nordic countries. It has also found that SHCs can be referred to as stress-related. Therefore, both *increased income inequality* and *increased stress* may have contributed to the increase of SHCs among Swedish adolescents during the last decades.
- This thesis has found that regional differences in SHCs across Sweden mainly were attributable to *individual-level factors* such as gender, socioeconomic conditions and school experiences. Very little of the differences were attributable to school-level or regional-level factors.

POLICY IMPLICATIONS

Finding contributing factors behind the continued increase of health complaints among children and adolescents in Sweden is important. Such problems may persist into adulthood and hinder education, employment and family formation. Failing to address this urgent public health challenge will bring great costs for the Swedish society. The need for health promoting and disease prevention measures within the mental health field cannot be exaggerated.

POLICY MEASURES REDUCING SOCIOECONOMIC INEQUALITIES

Sweden and the other Nordic countries have seen a gradual increase of families living in at-risk-of-poverty and an increase of the Gini. A major reason is that the tax and benefit system has become less redistributive and benefits have not risen at the same rate as wages. The findings in this thesis show that families' socioeconomic conditions, especially perceived family wealth, and the at-risk-of-poverty rate at the national level are associated with adolescents' mental health and well-being. Thus, there results support policy measures aimed at improving families' socioeconomic conditions as well as a reduction in socioeconomic inequalities at a societal level to improve mental health in adolescents. Such measures are needed to reach the Swedish goal of public health (a good and equitable health for all) and help secure every child's right to the highest attainable standard of health (according to the UN Convention on the Rights of the Child).

POLICY MEASURES IN SCHOOL

The findings also support policy measures that make the school less stressful for children and adolescents in Sweden. Schoolwork pressure has gradually increased since it first was measured in the HBSC study 1997/98, but it has increased dramatically since the Swedish school reform in 2011, introducing more tests, earlier grades and a new grading system. The findings highlight the continued importance of promoting children's and adolescents' school satisfaction and creating a positive school climate, without bullying. As rates of school satisfaction have dropped during the last decade and bullying has increased in Sweden in the last two HBSC survey rounds (2017/18 and

2021/22), there is an urgent need for measures in school aiming at reversing these trends.

FUTURE PERSPECTIVES

In future research, examining the association between general stress and health complaints among children (not adolescents) would be of interest. If possible, the association between general stress and health complaints over time, using longitudinal data, would be of interest. An important issue when examining general stress among children 0-10 years is to find an appropriate and valid measure. The HBSC network recommends the use of PSS-4 only to 13- and 15-year-olds (not 11-year-olds) (Inchley et al., 2023). Further, the Danish HBSC team has conducted a pilot study on the PSS-4 in Denmark, confirming that items in the scale were difficult for 11-year-olds (Rich Madsen, 2022). The inclusion of the PSS-4 (Cohen's Perceived Stress Scale with only four items) in the 2021/22 HBSC study enables further research on general stress and health complaints as well as other mental health outcomes among 13- and 15-year-olds.

Future research will need to examine the functioning of the next version of the FAS. However, there is also a need for other types of validation studies, such as the functioning of the scale for children who have alternating residence (live half of the time with each parent) or alternate between their parents to less extent. In addition, there is a need to validate the scale in countries where living conditions vary greatly across the country. In Sweden for instance, living conditions may vary between urban and sparsely populated areas, possibly effecting items such as own bedroom and number of cars.

In future research, examining the role of absolute and relative deprivation at the country-level with child and adolescent mental health outcomes across several countries would be beneficial. There are studies which have combined national income and national income inequality with mental health outcomes (Dierckens et al., 2020; Elgar et al., 2015; Levin et al., 2011; Ottová-Jordan et al., 2015; Rathmann et al., 2015). The at-risk-of-poverty rate could be one such measure of relative deprivation, but there are also other measures as well as measures of absolute deprivation available from the EU.

The results in study IV implied that regional level did not seem to be a relevant explanatory level when examining geographical differences in children's and adolescents' mental health and well-being. It is probably more relevant to examine the clustering of students at the neighborhood or municipality level, and include such variables, in future research.

There are other important aspects of children and adolescents' lives that have not been highlighted or controlled for in any of the three studies examining the distribution of health complaints. One such aspect is the increased use of internet, such as social media use and gaming, which also have been enabled by the increased access to smartphones from 2010 and forward. Children spend a considerable amount of time each day online. The internet activity may have different impact on adolescents' health and well-being. On the one hand, the content itself on social media or in internet games may be harmful, on the other hand, the internet use may hinder healthy behaviours such as physical activity, regular and healthy meals and sufficient sleep.

Other major events have taken place in the world, probably affecting children and adolescents' mental health and well-being. The covid-19-pandemic struck the whole world in early 2020 and heavily impacted children and adolescents' lives for almost two years. When the pandemic came to its end, Russia invaded Ukraine, and started a war in the European region. The war has already had several implications for Swedish national security policy and the nation has recently joined the NATO. On top of the pandemic and the war, climate change has become even more urgent.

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