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Self-esteem, Sense of Coherence and Attention Deficit Hyperactivity Disorder - A Longitudinal Study from Childhood to Adulthood

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To Karin and Agnes

ABSTRACT

Background: Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common behavioural disorders in school-aged children. The prognosis in adulthood can sometimes be problematic in different aspects related to education, employment, socialization, and overall mental health. The functional impairment of ADHD has been related to the development of a low self-esteem. However, there are reports describing children and adolescents with severe ADHD symptoms that do not report problems such as low self-esteem or problems in school or social competencies.

Aim: Self-esteem and sense of coherence (SOC) are both seen as important factors for health and therefore, the overall aim of this thesis was to examine the longitudinal and concurrent relationship between low self-esteem, SOC and ADHD from childhood to young adulthood.

Method: The data used in all four papers came from the longitudinal Twin study of Child and Adolescent Development (TCHAD). The twins and/or their parents have been contacted in four different waves. Wave 1 was in 1994 (twins were 8-9 years old) and wave 2 was in 1999 (twins were 13-14 years old). In 2001, a clinical study with a sub sample including the twin pairs living in the Stockholm county area (twins were 15-17 years of age) and finally Wave 4 was in 2006 (twins were 20-21 years old). I used DSM III based ADHD criteria in order to study ADHD symptoms in Paper I and II and DSM IV based criteria for ADHD symptoms in Paper III and IV. We used the "I think I am" questionnaire in Paper I, II and III for the purpose to study self-esteem and the SOC scale in Paper IV.

Results: There was a long-term relationship between ADHD-symptoms in childhood and a low self-esteem in adolescence. However, the patterns of findings in ADHD discordant MZ and DZ twins could indicate the association is not causal but instead problems caused by a common factor for example personality traits due to a genetic factor. A low self esteem in adolescence was associated with a high score of ADHD symptoms in early adulthood, especially with the development of the inattentive subtype of ADHD compared with the hyperactive/impulsive subtype.

Children with high scores of ADHD symptoms often seem to have profiles of self-esteem characterized by low scores in the domains "skills and talents" and "psychological well-being." However, more than a few children with high score ADHD had profiles characterized of good self-esteem. In addition, children with the most persistent high scores of ADHD symptoms had relatively good self-esteem profiles.

SOC could be a protective factor for the development and the maintenance of mental and physical health. This hypothesis was supported by the findings of a statistically significant interaction between SOC and ADHD at 16 on the outcome, i.e. ADHD at 21 years. The young persons with high (SOC) at age 16 had a low score of ADHD symptoms at age 21 even if they had a high ADHD score at age 16.

Conclusions: There was a longitudinal relationship between low self-esteem and high scores of ADHD symptoms from childhood to early adulthood. A high SOC seems to be a good predictor for a reduction of ADHD symptoms from adolescence to early adulthood.

Keywords: Self-esteem, Sense of Coherence, ADHD, longitudinal, twins

LIST OF PUBLICATIONS

I.   Edbom T, Lichtenstein P, Granlund M, Larsson J-O. Long-term relationships between symptoms of Attention Deficit Hyperactivity Disorder and self-esteem in a prospective longitudinal study of twins. *Acta Paediatr 2006;95(6):650-7*.

II. Edbom T, Granlund M, Lichtenstein P, Larsson J. ADHD symptoms related to profiles of self-esteem in a longitudinal study of twins a person-oriented approach. *Journal of Child and Adolescent Psychiatric Nursing 2008;21(4):228*.

III. Edbom T, Larsson J-O. Self-esteem in adolescence related to ADHD subtypes in early adulthood. A seven-year follow-up. *manuscript 2009.*

IV. Edbom T, Malmberg K, Granlund M, Lichtenstein P, Larsson J. High sense of coherence in adolescence is a protective factor in the longitudinal development of ADHD symptoms. *Scand J Caring Sci 2009; in press*.

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LIST OF ABBREVIATIONS

ADHD	Attention Deficit - Hyperactivity Disorder
ADD	Attention Deficit Disorder
DSM	Diagnostic And Statistical Manual of Mental Disorders
SOC	Sense of Coherence
ICD	International Statistical Classification of Diseases and Related Health Problems
SE	Self-Esteem
ITIA	I Think I Am
QoL	Quality of Life
GLM	Generalized Linear Model
YSR	Youth Self Report Scale
CBCL	Child Behavior Checklist

1 PROLOGUE

After my graduation as a psychiatric nurse in 1994 I started working in child and adolescent psychiatry in Sundsvall and one year later at the child and adolescent psychiatric clinic at St Görans Children's Hospital, Stockholm. There I came in contact with children with various neuropsychiatric disabilities. During that period I met many children who were surveyed with questions about ADHD. In my work with these children, I noticed that spite similar symptom picture some patients fared relatively well; they could live and manage their symptoms with good functioning in their lives. A few years later on, I began studies at the Social and Caring Sciences at Åbo Akademi University, where the focus was health and salutogenesis. During this period grew my interest in trying to understand how the children I've met still fared managed to stay well despite their sometimes serious symptoms. This thesis has given me the opportunity to go into the issues of children with symptoms of ADHD and concepts important for health, ie. self-esteem and sense of coherence.

2 BACKGROUND

One of the most common behavioural disorders in school age children is Attention Deficit Hyperactivity Disorder (ADHD). The diagnosis is categorized seen as a neuropsychiatric dysfunction with a prevalence of 1-7 percentages of school-aged children depending on which criteria is used. According to DSM-IV (American Psychiatric Association, 2000) ADHD is a disorder consisting of a cluster of symptoms for inattention and hyperactivity/impulsivity were at least 6 out of 9 symptoms in each cluster need to be present during the last 6 months. To successfully diagnose ADHD, a severe impairment must be present in school, either/or at home either/or in social activities.

ADHD is commonly diagnosed during the same period of time as when the child's internalization of self-concept is developed. The diagnosis can affect the development negatively and may lead to an increased risk for low self-esteem that may have both long- and short-term affects on the child's health and well being. Thus, children with ADHD are commonly known to have impairments that are linked to low self-esteem and problems with social relationships that could affect their health (Biederman, 2005).

In spite of this, there are reports describing children and adolescents with severe ADHD symptoms and they do not include problems such as low self-esteem, or problems in school, or social competencies. Other findings indicate that different subtypes of ADHD, such as inattentive type and hyperactivity, are related in a different way to low self-esteem. This could be due to internal or external personal protective or salutogenic factors (Antonovsky, 1987; Russell A. Barkley, 1990;

Biederman, 2005; Biederman *et al.*, 1998; Daley, 2004; S Harter, 1988; S. Harter, 1993). In some studies, children with ADHD-symptoms and other behavioural problems asses their self-esteem as equal as controls. This findings have been discussed by authors as a *positive illusory bias* (Hoza *et al.*, 2002) or as self-protective in order to cope with their daily life experience of failure (Diener & Milich, 1997).

My thesis will discuss the longitudinal relationship between self-esteem and ADHD symptoms. I will consider whether self-esteem issues in adolescence are related to ADHD subtypes in young adulthood, and if ADHD symptoms are related to specific profiles of self-esteem. Finally, I will also discuss if concepts important for the development of effective coping and resilience skills, such as a sense of coherence (SOC), are related to the development of ADHD symptoms.

2.1 HEALTH

A commonly perceived definition of health has evolved over the decades. At first, health, or healthy, was understood to mean the absence of disease. But the term now stands for a multidimensional concept, which includes elements such as well being, function, and participation (WHO, 2001).

The perception of health as it relates to disease, is synonymous with the absence of disease, including injuries, and mental or physical disabilities. For medical purposes, with the pathology and aetiology of diseases in focus, these health concepts seem natural. But even within the medical philosophy, those health concepts are questioned because they only refer to the individual's retained or recovered status in relation to

an entire range of normal physical and mental functioning. Such a concept ignores the large individual variation and compensation opportunities that exist and which, from a broader health perspective, can be seen as significant (Nordenfelt & Tengland, 1996).

Several definitions of health are described in the literature, and the common feature of these definitions is that health and illness are described as being on opposite ends of the same dimension (Suominen, 1993). For a long time, scientific interest was directed towards the identification of factors thought to provoke the onset of illness, or that might have a negative impact on the course of disease. Studies of risk factors and psychosocial stress factors, such as life events, chronic difficulties, work-related distress and coping behaviours, have produced an impressive amount of global literature (Geyer, 1997). But during the last decade, new ways of evaluating the research and a new definition of health has emerged. The best known definition is the WHO's 1958 decree:

"We conceive of health as being a state of complete physical, mental and social well-being, not merely the absence of disease or infirmity." (World Health Organization, 1958)

In addition to further searches for potential pathogenic factors, a lot of interest has been devoted to protecting individuals from becoming ill after a stressful experience (Turner & Marino, 1994; Wheaton, 1985).

2.2 SELF-ESTEEM

Definitions of self-esteem are vague and contradictory. Different authors do not agree on a common definition, and it remains unclear which basic elements must be included in all definitions. Important concepts related to the foundation of self-esteem include: self-identity, self-image, and self-concept (Bailey, 2003).

Simply put, self-esteem is what, and how, you think and feel about yourself, or how much you value yourself. Most people measure themselves along a continuum that might range between the extremes of high or low and good or bad. Self-esteem can also be defined as the degree to which a person is able to achieve their goals and expectations, or the relationship between an individual's performance and that individual's perceived potential (Carlock, 1998; James, 1980; Josephs, 1992).

Self-esteem can be regarded as a multidimensional concept, which is able to portray itself through different dimensions of the self-image in different contexts (S. Harter, 1993; Ouvinen-Birgerstam, 1985; Suonpaa *et al.*, 1989). Self-esteem is also mentioned as an abstract cognitive and emotional concept of an individual's idea and value of him/herself, as well as the level at which the individual accepts and respects his/her idea of his/her self-image (Johnson, 2003; Ouvinen-Birgerstam, 1985). Low self-esteem seems to play an important role in psychological dysfunction, psychopathology, and maladjustment, depression, and anxiety. It is also related to cognitive strategies that lead to poor problem solving, which is an essential problem in children with ADHD (Nurmi *et al.*, 1994).

The notion that self-esteem affects health is not new. High self-esteem has been shown to be associated with better mental health outcomes, such as a better ability to cope, and also to be associated with lower incidence of depression in both adolescence and adulthood (Birndorf *et al.*, 2005). There is little information available to explain which factors contribute to the development and maintenance of high self-esteem for children and for adolescents. Further information on the self-esteem construct would aid our understanding of whether or not communities, families, schools, and clinicians may be able to affect self-esteem, considering its possible mediating effect on mental health outcomes such as emotional distress and depression (Birndorf et al., 2005).

Much of the research on adolescent self-esteem has been cross-sectional. Research that has included longitudinal analyses of self-esteem change over time, has produced inconsistent results (Zimmerman *et al.*, 1997). Research indicates that there are different trajectories and subgroups that are important in the development of self-esteem. This leaves open the possibility that subgroup differences exist.

As to specific differences according to gender, results show that girls tend to have lower self-esteem than boys. Differences are more significant with reference to appearance and athletic performance. As far as the development of self-esteem is concerned, there is no major change, notably when considering global perception. Results of a factor analysis underscore the fact that girls' self-esteem is more global and less differentiated by domain while boys separate the scholastic and behavioural part of their experience from the social. Global self-esteem has more influence on the level of depressive mood in girls than in boys (Bolognini *et al.*, 1996).

As a way to address these concerns, Hirsch (1991) used a cluster analytic approach to identify subgroup variation. They found that youth could be characterized by one of four self-esteem trajectories: consistently high, consistently low, slightly increasing, and steeply decreasing. Their results suggest that self-esteem may be stable over time for some youths, but vary considerably for others (Hirsch & DuBois, 1991).

2.3   SENSE OF COHERENCE

A very influential contribution to this line of research came from Aron Antonovsky and his idea of "salutogenesis", which is strongly connected with "Sense of Coherence" (SOC). SOC is a theoretical construct that is used to explain why some individuals fall ill after the occurrence of stressful situations (Antonovsky, 1987). Beginning with observations of holocaust survivors and their horrible experiences, Antonovsky turned his attention to resistance resources within the individual. This led him to formulate his concept of sense of coherence:

A global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that (1) the stimuli, deriving from ones internal and external environments in the course of living are structured, predictable and explicable; (2) the resources are available for one to meet the demands posed by these stimuli; and (3) these demands are challenges worthy of investment and engagement (Antonovsky, 1987, p. 19).

According to Antonovsky SOC does not determine overt behaviour, but it does determine the perception and interpretation of external events. It consists of three components, derived from analysing data from a number of qualitative interviews:

Comprehensibility is a basic necessity, and has a great deal to do with a person's ability to identify and analyse problems and to evaluate crisis and risk situations. Manageability is the ability to mobilize one's social network to help solve problems. Meaningfulness is the extent of the belief that coping makes sense emotionally (Antonovsky, 1987).

These three aspects of SOC have been found to be highly interrelated (Taru Feldt & Rasku, 1998). They are also closely related to several other conceptualizations of the individual's internal resources such as theories on self-efficacy (A. Bandura, 1977; Albert Bandura, 1997), which underscores the importance of an individual's belief in his/her capabilities to exercise control over environmental events, to welcome challenges or to become fully involved in the many situations of life.

2.3.1 The stability of SOC

On the basis of the theory, an individual's SOC is fully developed and stabilized near 30 years old. Thereafter SOC is thought to have reached a degree of stability (Antonovsky, 1987). SOC is assumed to be relatively stable in adulthood, corresponding to self-efficacy. The few empirical studies that have explored the stability of SOC are in line with this suggestion (Taru Feldt *et al.*, 2000; T. Feldt *et al.*, 2007). As indicated in the most recent review on SOC research, however, further investigations are needed to explore whether SOC and its three components (comprehensibility, manageability, meaningfulness) represent a stable disposition (Geyer, 1997; Kivimäki *et al.*, 2000). Research in adults shows that SOC is comparatively stable after 10 years (Eriksson & Lindstrom, 2005) but longitudinal evidence on the stability of SOC and its impact on health in men and women remains

scarce (Geyer, 1997; Schnyder *et al.*, 2000). Some findings (Smith *et al.*, 2003) also question the long-term stability of SOC with the aim to investigate the stability of SOC over a 4-year-period. The authors suggest that SOC could be more of a state than trait (Smith et al., 2003).

2.3.2 SOC and Health

In the theory, SOC is hypothesized to be a salutogenic resource influencing the aetiology of, and recovery from, disease through effective coping. This coping may include avoidance of habits that directly interfere with health (Antonovsky, 1987). In addition, SOC is thought to decrease the likelihood of perceiving the social environment as stressful. This reduces susceptibility to health damaging effects of chronic stress by lowering the probability of repeated adverse neurophysiologic reactions and negative emotions related to stress perceptions (Antonovsky, 1987). However, it is also assumed that an individual's health may influence their SOC, i.e., the causality between SOC and health may also operate the other way around. Health represents one of the sources responsible for the maintenance of the level of SOC. Persistent or serious health problems may shape a person's daily life in terms of the experiences of consistency, load balance, and participation in socially valued decision making. These experiences, in turn, are likely to influence the development of SOC (Antonovsky, 1987, 1988).

2.4 ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

One of the most common behavioural disorders in school-aged children is Attention Deficit Hyperactivity Disorder (ADHD). There are mainly two diagnostic system used in child and adolescent psychiatry. "Diagnostic and Statistical Manual of Mental

Disorders" (DSM-IV-TR) (American Psychiatric Association, 2000) and the "International Classification of Diseases and Related Health Problems" (ICD 10) (World Health Organization, 1994). The manuals are frequently revised, and regarding ADHD, the symptoms have been transformed from one dimension in DSM-III to the multi-axial model in DSM IV.

2.4.1 Defining Attention Deficit Hyperactivity Disorder

In 1980, the DSM III introduced the concept of ADD (Attention Deficit Disorder). This concept included both symptoms of attention disorder and impulsivity. These two parts could possibly be accompanied by hyperactivity and it was then called ADHD (ADD with Hyperactivity). In DSM III-R from 1987 (American Psychiatric Association, 1987), all three subscales merged together in a rating scale, and if 8 out of 14 criteria were met, it was diagnosed as ADHD (Attention Deficit Hyperactivity Disorder). In 1994, DSM-IV split the criteria into two main subscales; attention disorder and hyperactivity-impulsivity. For diagnosis 6 of 9 symptoms for Attention Deficit Disorder or hyperactivity-impulsivity must be met in order to get the diagnose, according to DSM-IV. In addition to these diagnostic criteria, the problems must have existed before the age of 7. The problems must involve clinically significant impairment. A form of impairment from the symptoms must exist in at least two different social contexts and the symptoms should not depend on, or be better explained by, another mental illness (American Psychiatric Association, 1987, 2000).

The aetiology of ADHD remains unknown, but it is likely multifactorial and encompasses a combination of environmental, genetic, and biologic factors (Spencer *et al.*, 2002). In addition, there are several biological factors that are environmentally

derived that appear to play a role in the aetiology of ADHD (Schubiner & Katragadda, 2008).

Children with ADHD are commonly known to have impairments that are linked to low self-esteem and problems with social relationships, which could affect their health. The disorder does not only affect children but also adults with risk for coexisting problems such as anxiety, depression, social interaction difficulties, relationship difficulties and low self-esteem (Biederman, 2005; Daley, 2004). There have been follow-up studies showing that between 30% and 60% of children with ADHD continue to experience symptoms and impairment in their adult life (R. A. Barkley *et al.*, 2002; H. Larsson *et al.*, 2006; J. O. Larsson *et al.*, 2004).

It is quite clear that ADHD begins in childhood, but often persists into adolescence and adulthood for the majority of individuals. Since the criteria for the diagnosis of ADHD are most applicable to children, making the diagnosis in adolescents requires an understanding of how these symptoms are expressed in this age group. The prognosis of ADHD is variable and depends on several psychosocial factors, with approximately 20% of adolescents who perform well in social, emotional, and educational domains, another 20% who perform poorly in these domains, and the majority who perform somewhere in the middle (Daley, 2004). Although, it is not unusual for children to be more active, livelier, less attentive, and more impulsive than adults, it is hardly surprising that children have more problems than adults in following through on directions and consistently finishing their work. So when parents complain that their child has difficulty paying attention, controlling his or her activity, or resisting impulses, observers may be quick to dismiss these problems

simply as normal behaviour, and reassure parents that they are natural qualities of children, that there is no need for alarm (R. A. Barkley, 1995).

The relationships between self-esteem and ADHD have been studied both as an independent variable and as an outcome measure (Bussing *et al.*, 2000; Gonzalez & Sellers, 2002; S. Harter, 1993; Hoza et al., 2002; Shaw-Zirt *et al.*, 2005; Treuting, 2001), although there are conflicting results discussed by researchers as a positive illusory bias (Hoza et al., 2002) or as self-protective in order to cope with their daily life experience of failure (Diener & Milich, 1997). There are different measures regarding the self-esteem concept, which make it difficult to draw conclusions from the research, and there is also a shortage of longitudinal studies (Aasland & Diseth, 1999).

High self-esteem is seen as an important factor for coping strategies and the ability for children with ADHD symptoms to experience god health. Adolescents with high self-esteem might manage the stress in more constructive ways, instead of blaming themselves and becoming depressed. Low self-esteem, on the other hand, seems to be a major marker for the development of depression (Hoffmann *et al.*, 2003). Another explanation of relatively high self-esteem in children with persistent ADHD may be "positive illusory bias", which means the children tend to overestimate their abilities, for instance, in academic performance (Hoza et al., 2002). However, this has been questioned, and their apparent self-confidence might be a way to hid his/her shortcomings from others and a way of neglecting the individual's lack of skills that he/she does not want others to know about (Asendorpf & Ostendorf, 1998).

Overall, ADHD seems to be related to low self-esteem although there are conflicting results and there has also been a call for studies to reflect upon whether ADHD symptoms cause low self-esteem, and there is a need for longitudinal studies. Furthermore, the concept of self-esteem is complex and multi-dimensional and needs to be further studied to see if different dimensions of self-esteem are related to ADHD symptoms. Some children with ADHD seems to manage well, they have high self-esteem, perform well academically and possess social competencies and experience good health. But there is a need for research regarding salutogentic factors and I want to study the salutogentic effect of SOC in adolescents on the development of ADHD symptoms. This is an important question since teenagers with ADHD often receive a bad prognosis (R. A. Barkley et al., 2002; Cantwell, 1996). Knowledge about the developmental relations between self-esteem, SOC and ADHD can help us to better understand how interventions can be designed to protect individuals from mental illness protect individuals from negative mental illnes (Antonovsky, 1987; Taru Feldt et al., 2000).

3 AIMS

Self-esteem and SOC are both seen as important factors for health and therefore, the overall aim of this thesis, has been to examine the longitudinal and concurrent relationship between low self-esteem, SOC and ADHD from childhood to young adulthood.

Specific aims:

- Is there a concurrent and long-term relationship between parental reported ADHD-symptoms in children and self-reported low self-esteem in adolescence?

- Is it possible for twin siblings to score differently in an ADHD evaluation during childhood, with one twin later showing signs of low self-esteem during adolescence, while the other twin remains relatively free of the illness?

- What types of self-esteem profiles in adolescence are related to high scores of ADHD symptoms?

- Do children with persistent ADHD have specific self-esteem profiles?

- Is low self-esteem more associated to the development of the inattentive subtype of ADHD compared with the hyperactive/impulsive subtype?

- Can SOC, as a salutogenetic factor, change the long-term development of ADHD symptoms?
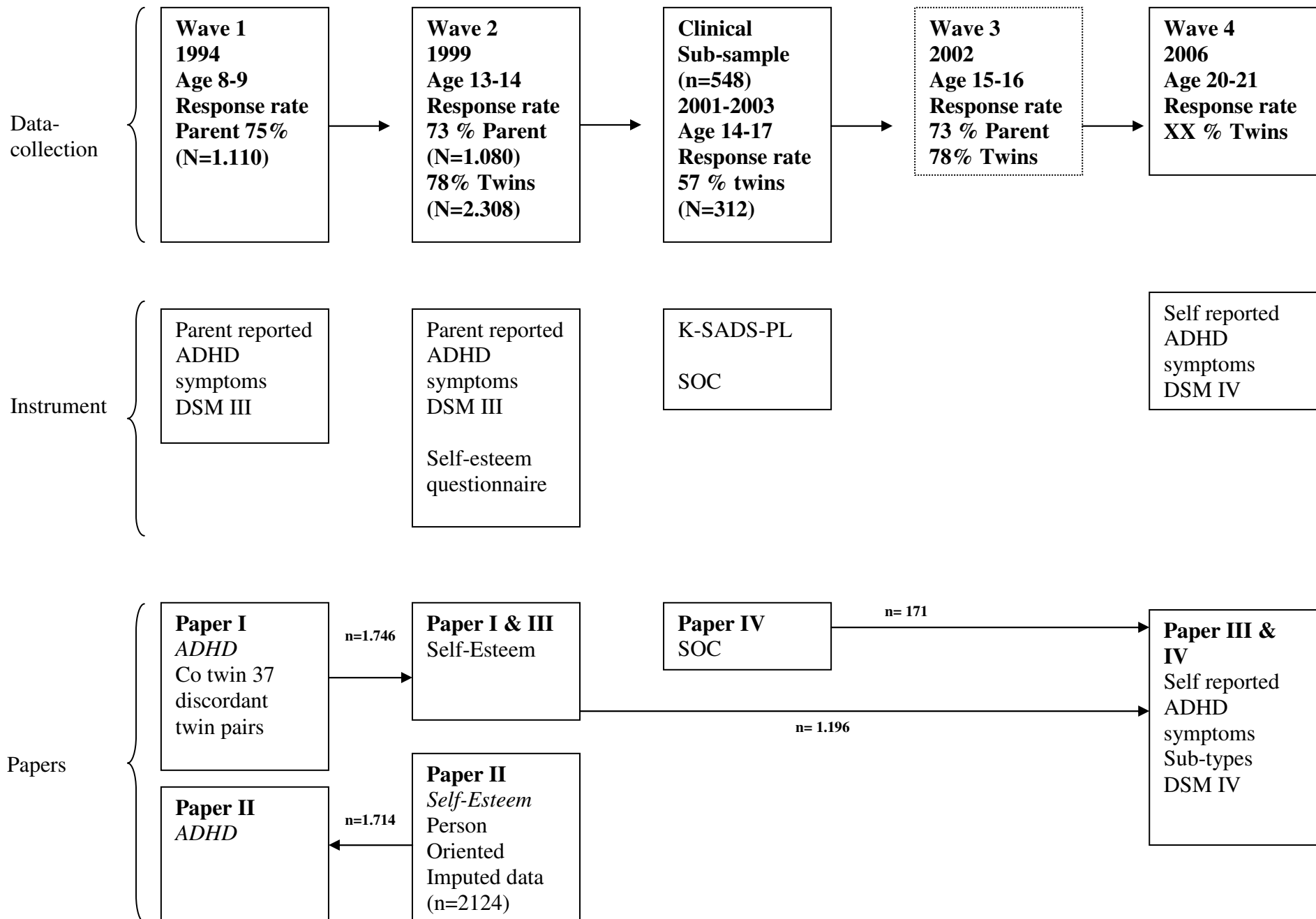
4 METHODS

4.1 DESIGN

This study was conducted to understand the relationship between self-esteem, SOC and ADHD symptoms in a longitudinal context. As the literature shows, conflicting results exist regarding the outcome of ADHD in terms of self-esteem. As the project aims to understand how self-esteem and SOC are related to the development of ADHD symptoms, we used a longitudinal design. The data used in all four papers comes from the Twin study of Child and Adolescent Development (TCHAD). The twins were identified through the Swedish Twin Registry (Lichtenstein *et al.*, 2002). All twins born in Sweden between May 1985 and December 1986, where both twins were alive, and lived in Sweden at the time of the study, comprised the survey population. The twins and/or their parents have been contacted in four different waves. Wave 1 was in 1994 (twins were between 8 to 9 years old) and wave 2 was in 1999 (twins were between 13 to14 years old). In 2001, a clinical study with a sub-sample including the twin pairs living in the Stockholm county area (twins were between 15 to 17 years old) and finally Wave 4 was in 2006 (twins were between 20 to 21 years old).

In Wave 1, the parent questionnaire had a response rate of 75% (N=l,103). In Wave 2, the parental response rate was 73% (N=l,063), and 78% of the twins (N=2,263) responded. In the clinical sub-sample (N=548) 57% (n=312) participated and for Wave 4, 58% of the twins participated (n=1705).

Twin study of Child and Adolescent Development (TCHAD) N=1.480 parent N=2.960 twinns

Data-collection

| **Wave 1** **1994** **Age 8-9** **Response rate** **Parent 75%** **(N=1.110)** | → | **Wave 2** **1999** **Age 13-14** **Response rate** **73 % Parent** **(N=1.080)** **78% Twins** **(N=2.308)** | → | **Clinical** **Sub-sample** **(n=548)** **2001-2003** **Age 14-17** **Response rate** **57 % twins** **(N=312)** | → | **Wave 3** **2002** **Age 15-16** **Response rate** **73 % Parent** **78% Twins** | → | **Wave 4** **2006** **Age 20-21** **Response rate** **XX % Twins** |

Instrument

| Parent reported ADHD symptoms DSM III | Parent reported ADHD symptoms DSM III Self-esteem questionnaire | K-SADS-PL SOC | | Self reported ADHD symptoms DSM IV |

Papers

| **Paper I** *ADHD* Co twin 37 discordant twin pairs | n=1.746 → | **Paper I & III** Self-Esteem | | **Paper IV** SOC | n= 171 → | **Paper III & IV** Self reported ADHD symptoms Sub-types DSM IV |

n= 1.196

| **Paper II** *ADHD* | ← n=1.714 | **Paper II** *Self-Esteem* Person Oriented Imputed data (n=2124) |

4.2 SUBJECTS

As the subjects were derived from a longitudinal study, we used data from four different waves.

Paper I

For paper I, we used data from Wave 1 and Wave 2. Wave 1 took place in 1994, when all of the parents received a mailed questionnaire, including assessments regarding parent-rated ADHD-symptoms, to which 1.106 (75%) of the parents responded. Wave 2 took place in 1999, renewing contact with the 1.450 families still living in Sweden. Questionnaires including the "I Think I Am" self-esteem scale and Youth Self Report Scale (YSR), a behavioural scale, were sent out to the twins and again, parent rated ADHD-symptoms. 2.263 (78%) of the twins responded. There was complete data on self-esteem for 1.811 twins, 2.199 twins had complete data on YSR, and 2.153 twins had complete data on ADHD. A total sample of 1.746 twins had complete data for both ADHD and self-esteem.

Paper II

In the study population of 2124 children, 1050 boys and 1074 girls had complete data on self-rated self-esteem. In Wave 1, 2153 children, 1073 boys and 1080 girls, had complete data on parent-rated ADHD symptoms and for Wave 2, 2105 children, 1022 boys and 1083 girls had complete parent-rated ADHD data in Wave 2. For the analysis in the present study, there was complete information on self-esteem for 1928 children at 13 years old, and parent-rated ADHD symptoms also at 13 years old. Further, there was complete data concerning 1714 children with information about self-esteem at 13 years old and parent-rated ADHD symptoms at 8 years old. In this

study, the analysis is made after reviewing complete data on all subscales. This means that compared to paper one, we lost 32 individuals to missing values.

Paper III

In this study we used data from TCHAD Wave 2 and 4. At 14 years old, the twins (n=2263) and there parents (n=1063) were mailed a questionnaire intended to assess ADHD-symptoms, behaviour problems and the health status of their twins (wave 2 in TCHAD). Moreover, both twins answered a questionnaire covering areas such as health status and self-esteem. ADHD symptoms at 21 years of age were assessed after questionnaires were sent to the young adults in wave 4. Time between baseline, wave 2, and follow-up, wave 4, for this study was 7 years. There was complete data on 1196 individuals between age 14 and 21.

Paper IV

The survey group for this study was derived from an assessment including 156 twin pairs, or 312 individuals, and among them were135 boys and 177 girls. The mean age at baseline was 16 years old, but the age ranged from between 14.6 to 16.7 years old, and at least one parent from each set of twins participated (in the K-SADS interview). Time between baseline and follow-up for this study was 5 years when the twins were 21 years old. At follow up, there was complete on data 171 individuals.

4.3 MEASURES

In order to answer the research question aimed in this study, we used both self and parent-rated questionnaires to measure soc, behaviour problems, self-esteem and ADHD symptoms.

4.3.1 ADHD questionnaires

ADHD symptoms in (Paper I, Paper II)

The parents in wave 1 and 2 completed a binary-scaled checklist with between 21 and 24 items based on DSM III. The parents were asked to check symptoms that had persisted for at least six months. Fourteen of these checklist items from the parent-response at wave 1 and wave 2 were used in Paper I and Paper II to create a dimensional scale that covers the DSM-III-R conceptualization of ADHD (American Psychiatric Association, 1987). Children with missing values for two or more ADHD symptoms were excluded from the analyses The symptoms were scored as 0 if the item was not true and 1 for true, and then summed up in a total score (Steffensson *et al.*, 1999).

ADHD symptoms (Paper III)

ADHD symptoms at wave 4 (21 years old) were assessed using ADHD items in the A-TAC questionnaire (S. L. Hansson *et al.*, 2005) listed in DSM IV (American Psychiatric Association, 2000). It focused on psychiatric symptoms including attention-deficit hyperactivity disorder (ADHD). The Swedish version of A–TAC is reported to be a reliable and valid instrument (S. L. Hansson et al., 2005). The questionnaire contains questions about ADHD symptoms rated on a three-point scale: 0 indicating normality ('no'), 1 some abnormality ('yes, to some extent'), and 2 indicating abnormality ('yes' or 'yes, previously').

ADHD symptoms (Paper IV)

The twins and their parents were invited to an assessment including a structured clinical interview with Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL). The K-SADS-PL is a widely-used semi-structured diagnostic interview designed to assess current and past episodes of psychopathology in children and adolescents according to the Diagnostic and Statistical Manual of Mental Disorders, 3rd revised edition (DSM-III-R) and DSM-IV criteria. K-SADS-PL has been shown to be a reliable and valid diagnostic instrument for child and adolescent psychiatric diagnoses (Kaufman *et al.*, 2000). In this study, the present version of the Swedish K-SADS-PL was used to assess symptoms according to DSM-IV. In the K-SADS-PL interview procedure, the interview was first performed with the child alone and thereafter with at least one parent. The clinical interviewer then summarized the information from the parent (about the child) with the information from the child and classified the symptoms as "not present" (0), "possible" (1) or "certain" (2).

4.3.2   Self-esteem questionnaire (Paper I, II and III)

The "I Think I Am" self-esteem questionnaire is a self-report scale developed and standardized in a Swedish sample of children aged 8–16 years old (Ouvinen-Birgerstam, 1985) and was used to assess self-esteem in the present study. The self-esteem scale includes descriptions of a child's ideas of him/herself, using a 72 item questionnaire with a four point response scale: "Exactly like me", "Almost like me", "Not quite like me", and "Not at all like me". The score can range from +144 and – 144. According to the "I Think I Am" manual (Ouvinen-Birgerstam, 1985) five sub-scales were derived: (I) physical characteristics, (II) skills and talents, (III)

psychological well-being, (IV) relationships with parents and family, and (V) relationships with others. The reliability of the questionnaire was tested with the measurements of internal consistency (reliability coefficients between 0.91 and 0.93), using a split-half method.

4.3.3 Sense of Coherence questionnaire (Paper IV)

The SOC self-report scale was developed by Antonovsky to measure the overall capacity to cope with stressful life situations (Antonovsky, 1987). This study used a shorter format, comprised of 13 of the original 29 items and it considers three components: comprehensibility, manageability and meaningfulness. The scores are summed up, and the total sum ranged from 13 to 91. The higher the score, the stronger the SOC. (Langius *et al.*, 1992). The scale has proved to be psychometrically sound and reliable (T. Feldt et al., 2007). The short form of the SOC questionnaire has shown acceptable results concerning reliability and validity for adolescents (Hagquist & Andrich, 2004). There were no statistically significant differences with respect to SOC scores at baseline between the study group followed-up at age 21 and the drop-outs. The SOC scale has been used in a large number of studies in somatic, psychosomatic medicine, mental and public health, and stress research (Cederfjall *et al.*, 2001; Eriksson & Lindstrom, 2006; Hagquist & Andrich, 2004; K. Hansson *et al.*, 2004; Kristensson & Ohlund, 2005; Myrin & Lagerstrom, 2006; Torsheim *et al.*, 2001). A review of 458 studies shows that the SOC is strongly related to perceived mental health. The stronger the SOC, the better the perceived health in general, at least for those with an initially high SOC. (Eriksson & Lindstrom, 2006; Eriksson *et al.*, 2007; Kivimäki et al., 2000).

4.3.4 Youth Self Report Scale (Paper I)

The Youth Self Report (YSR) protocol, a self-administered survey, was developed by Thomas M. Achenbach and was derived from another widely used standardized measure in child psychology called the Child Behaviour Checklist (CBCL). The YSR was designed to assess the emotional and behavioural problems in adolescents in a standardized format. It assessed internalizing (i.e., anxiety and depression,) and externalizing (i.e., aggressive, hyperactivity and noncompliant) behaviours. (Achenbach & Edelbrock, 1987). In Paper I we used the Internalizing subscale.

4.4 STATISTICAL ANALYSIS

Paper I

As the aim of Paper I was to study the concurrent and long-term relationship between parental-reported ADHD-symptoms in children 8 years old and 13 years old, and self-reported self-esteem at 13 years old we used two types of analyses. First the association between self-esteem total scores and subscales, ADHD-symptoms as a dichotomous variable was examined using generalized linear model (GLM). Standard errors were adjusted for clustering within twin pairs. In order to control for depression/anxiety, the YSR internalizing problem scales, anxiety and sex were used in the model as covariates. We then used co-twin analysis to perform a matched case control study. We extracted 37 pairs discordant for ADHD symptoms at 8-9 years old and using pair-wise t-tests and we tested differences in self-esteem at 13-14 years old between the twins with ADHD and his/her twin.

Paper II

In Paper II we used a "person-oriented approach" to study self-esteem as a multidimensional concept. When using a person-oriented approach, it is important to choose a "sound clustering method" (Lars R. Bergman *et al.*, 2003). I chose the Ward method to perform a cluster analysis. Each individual was characterized by his/her profile of values in the listed five indices: (I) physical characteristics, (II) skills and talents, (III) psychological well-being, (IV) relationships with parents and family, and (V) relationships with others. To analyse how these individual profiles clustered, the following procedure was used:

First, a few outliers being characterized by unique profiles were removed to a residue using the computer program Sleipner© (Lars R. Bergman et al., 2003). This is important for both technical and theoretical reasons as discussed by the author (Lars R. Bergman et al., 2003). The residue, which consisted of eight children, was not analysed in this study.

Then, a hierarchical cluster analysis using Ward's method was undertaken on standardized values. The measure of dissimilarity was the squared Euclidean distance and a 7-cluster solution was chosen based on the homogeneity of the clusters, which was estimated by computing the percentage explained error sum of squares (ESS), which was 70.8 %, whereas 100 % indicates a perfect homogeneity.

The use of a twin population created the opportunity to validate the statistical analysis of the self-esteem concept using a "split-half" method. Testing the material and the cluster solutions stability, two groups were generated. Each twin in every pair of twins was randomly assigned to one of the groups. We confirmed the similarity

between the two group's cluster-solutions using the Centroid method in the Sleipner computer program. The clusters were numbered 1 to 7, with cluster 1 consisting of the highest numbers of individual and then descending to cluster 7. In order to test for sex differences within the clusters, we used two-sided Fisher's exact tests.

I then used generalized linear model (GLM) in order to test the association between self-esteem profiles and ADHD-symptoms as a dimensional scale using clusters of self-esteem. As index variable we used the profile containing the highest number of individuals as the reference cluster (cluster 1). The calculations of standard errors were adjusted for the correlation between co-twins and we used sex as covariate.

"Ordered logistic regression" (ologit) was used to estimate the relationship between the longitudinal ADHD profiles and self-esteem clusters as the independent variable (StataCorp, 2005). The degree of ADHD-persistence was included in the analyses as an ordinal dependent variable ("Low-Low" = 1, "Low-High" and "High-Low" = 2 and "High-High" = 3).

Paper III

In order to study the relationship between self-esteem at 13 years old and ADHD subtypes as the outcome measure, we used both dimensional and categorical measures, as follow-up at 21 years old. Self-esteem subscales and total score at 14 years old were used as independent variables. Descriptive analysis for self-esteem at 14 years old and ADHD subtypes were conducted. We used linear regression in order to calculate the relationship between dimensional measures of ADHD subtypes at 21 years of age and self-esteem at 14 years of age controlling for parent reported ADHD symptoms at 14 years old. We calculated a dichotomized self-esteem total score

variable whereas low self-esteem was defined as lower than the 25 quartile. We then used logistic regression in order to calculate the odds ratios for low self-esteem in adolescence to have one of the three ADHD subtypes in early adulthood. In the study population, the twins in each twin pair are a cluster that violates the assumption in many regression models including linear and logistic regression that the individuals in the sample should be independent. Therefore a method available in Stata was used that increases the estimated standard errors giving robust estimates of the p-values. The method is based on the sandwich or Huber/White variance estimator (StataCorp 2005).

Paper IV

In Paper IV, we used the self-rated ADHD symptom scale at follow-up at 21 years old to discover the outcome measure and SOC and K-SADS-PL ADHD symptoms at baseline at 16 years of age as independent variables controlling for sex and time from baseline to follow-up, and also for clustering within twin-pairs, using the generalized linear model module (GLM) in Stata (StataCorp, 2005). As the aim of this paper was to study whether SOC can serve as a salutogenetic factor modifying the long-term development of ADHD symptoms, we calculated the interaction between SOC and ADHD symptoms at 16 years, which was analysed since one of the aims was to evaluate if SOC at 16 years old moderated the outcome, which is the development of ADHD symptoms at age of 21. In addition to the main effects we report four measures of effects on ADHD symptoms at age 21 for the covariates ADHD at 16 and SOC at 16; the effects of ADHD at 16 for 1) low SOC=40 and 2) high SOC=80 and the effects of SOC for 3) low ADHD=3 and 4) high ADHD=10.

The baseline scales for SOC and ADHD were in supplementary analyses dichotomized in order to further visualize the relationships between these scales and the outcome i.e. ADHD symptoms at follow-up. The SOC scale was dichotomized at the 75th percentile in low and high SOC (van der Hal-van Raalte *et al.*, 2008). In the same way ADHD symptoms measured at 16 years old were dichotomized at the 75th percentile in low scores and high scores. We then calculated the mean value of ADHD symptoms measured at 21 years old in each of the four combinations (high SOC-low ADHD, low SOC-high ADHD and so on).

5 SUMMARY OF RESULTS

5.1 PAPER I

In this study we found a long-term relationship between high scores of parental-reported ADHD-symptoms at 8 and 13 years old, and low scores in measures of self-reported self-esteem at 13 years old. In the co-twin control method, we confirmed that a high score of ADHD-symptoms at age 8 was related to significantly lower scores at age 13 in self-esteem.

5.1.1 Relationship between ADHD-symptom and self-esteem in adolescence in the total sample

In the longitudinal analysis we found that children with high ADHD scores at 8 years old had statistically significant lower self-reported self-esteem scores at 13 years old for the self-esteem subscales "skills and talents" *(p<0.05)*, "psychological well-being"*(p<0.01)* and total self-esteem score *(p<0.05)* when controlling for YSR internalizing problem scale.

In the concurrent analyses we found that children with high ADHD scores at 13 years old had statistically significant lower self-reported self-esteem scores at 13 years for all the self-esteem subscales and total self-esteem score.

5.1.2 Relationship between longitudinal patterns of ADHD-symptom scores and self-esteem in the total sample

We found a statistically significant difference in self-esteem between the Low-Low pattern when comparing it to the other three patterns. When comparing the three

patterns "High-Low", "Low-High" and "High-High" with each other, we only found statistical differences in self-esteem between "High-Low" and "High-High" *(p<0.05)*.

5.1.3 Cotwin analyses of twins discordant for ADHD-symptoms and self-esteem

In the twin, co twin control analyses, statistically significant differences were found between twins discordant for ADHD symptoms in all same sexed twin pairs at 8 years of age on the self-esteem "total score" *(p<0.05)* and "psychological well-being" *(p<0.01)*, even after controlling for gender and YSR internalizing problems scores at 13 years of age. Similar within-pair differences were also found between discordant DZ twins in "total score" *(p<0.05)* and "psychological well-being" *(p<0.05)*. However, the within-twin pair differences were smaller among discordant MZ twins.

5.2 PAPER II

In this study we identified seven different patterns of self-esteem in the total study population at age 13. In the longitudinal analysis we found that two of the patterns were related to ADHD symptoms at age 8-9 and when analysing concurrent relationships between ADHD symptoms (age13-14) and self-esteem patterns (age 13-14), all patterns but one were related to ADHD symptoms.

The cluster analysis including the 2124 individuals generated seven unique self-esteem-typologies or profiles (Table I). The self-esteem profiles included all five self-esteem sub-scales. Children in Cluster 1 scored high on all sub-scales, although within one SD from total mean on all subscales in the total population group. Cluster 1 also had the largest number of individuals. Cluster 3 defines a profile where the individuals scored high on all sub-scales except on "physical characteristics" although

the mean values were within one SD from the standardization group. Cluster 5 scored low on all sub-scales especially on "skills and talents" and "mental well-being." Cluster 4 and 6 varied between the sub-scales within each profile, and scored low on "skills and talents" and "relation to family". Cluster 7 is comprised of individuals scoring more than two standard deviations below the total study group mean value on all self-esteem subscales. There were significantly more girls in cluster 3 (58%, $p<0.001$) and 5 (58%, $p< 0.01$). In Cluster 4, there were significantly more boys (58%, $p < 0.01$).

Table 1

Mean values of self-esteem total score and subscales by cluster membership at 13 years of age

Cluster	n	Physical characteristics		Skills and talents		Mental well-being		Relation to family		Relation to others		Total score	
		m	*sd*	*m*	*sd*	*m*	*sd*	*m*	*sd*	*m*	*sd*	*m*	*sd*
1	692	14.5	3.5	13.0	3.5	15.4	4.5	16.3	3.5	14.7	3.1	73.8	8.1
2	434	18.1	2.2	16.9	2.5	19.8	3.1	19.0	2.1	17.2	2.8	91.0	6.71
3	303	6.6	5.2	10.0	5.0	11.2	4.7	14.5	3.7	8.9	5.6	51.2	10.7
4	285	14.5	2.8	6.0	4.1	10.6	5.1	14.8	4.0	10.5	4.2	56.5	8.4
5	246	4.5	7.1	-.8	6.4	1.1	6.9	8.4	8.4	4.7	6.2	17.9	16.0
6	100	11.5	4.1	10.9	4.9	6.6	7.2	1.4	5.7	11.8	5.1	42.1	13.7
7	64	-17.0	5.7	-14.9	6.6	-16.6	7.9	-18.7	6.2	-15.0	7.5	-82.1	24.5

5.2.2 ADHD symptoms as a dimensional scale

In the analysis between the ADHD dimensional scale at 8 years of age and self-esteem clusters at 13 years of age, using self-esteem cluster 1 as the reference cluster, significantly higher scores of ADHD symptoms were found in cluster 4 *(p<0.05)* and 5 *(p<0.001)*. In the analysis using ADHD symptom dimensional scale at 13 years of age and self-esteem clusters at 13 years of age, all self-esteem clusters except cluster 7 were significantly linked to ADHD symptoms scale when using self-esteem cluster 1 as the reference cluster. We found no significant sex differences with respect to the number of ADHD symptoms within the seven clusters.

5.2.3 ADHD symptoms dichotomized

The largest number of children with high scores of ADHD symptoms was found in cluster 4 and 5 both longitudinally (ADHD at age 8-9) and concurrent (ADHD at age 13-14). However, there were children with high ADHD symptoms scores present in all self-esteem clusters. We found no significant sex differences with respect to ADHD symptoms, dichotomized as high/low within the seven clusters.

5.2.4 Longitudinal patterns of ADHD symptoms related to profiles of self-esteem in adolescence

Data from the longitudinal samples show that cluster 5 has the highest relative frequency of children in "High-Low" (8%) and "Low-High" (6%) combinations of ADHD symptoms scores. Cluster 4 and 5 had the highest relative frequencies for the combination "High-High" (4% and 3% respectively). There were also significantly higher relationships for cluster 4 *(p<0.01)* and 5 *(p<0.001)*.

5.3 PAPER III

We found that self-esteem at 14 years of age was especially related to inattention measured seven years later at age 21.

5.3.1 The relationships between self-esteem in adolescents ADHD subtypes in young adulthood

All self-esteem sub scale and the total score were statistically significant related to inattention subtype for both boys and girls except for boys in the self-esteem subscale "relation to family". For hyperactivity subtype, the self-esteem subscale "psychological well-being" was the only subscale that was significantly statistically related for boys although for girls all subscales except "skills and talents" and "relation with others" were significantly statistically related to hyperactivity.

5.3.2 Odds Ratios for adolescents with low self-esteem to have a high score in an ADHD subtype at age 21

The highest odds ratio for low self-esteem was found for high score subtype inattention (2.69 for boys, 2.86 for girls and 2.47 total group). The odds ratio for hyperactivity was lower (1.91 for girls but and 1.22 for boys), although not significantly for boys. The highest odds ratio for all low self-esteem subscales was found for high score subtype inattention in girls except for "Relation to family" in girls and "Psychological well-being" for boys where odds ratio for hyperactivity was higher.

5.4 PAPER IV

We found support for the salutogenic hypothesis because the findings of a statistically significant interaction between SOC and ADHD at 16 on the outcome ADHD at 21. Higher ADHD scores at 16 years were associated with higher ADHD scores at 21 years. However, this relationship was stronger for lower SOC. A higher SOC at 16 years was associated with lower ADHD at 21 years and this relationship was stronger for higher (worse) ADHD at 16 years.

5.4.1 Relationship between ADHD symptoms and SOC

The correlation between ADHD, according to K-SADS-PL measured at 16 years of age and (self-reported) SOC concurrent was: -0.34 for the total scale, -0.35 for hyperactivity scale, and -0.24 for inattentive scale. The correlation between ADHD, according to K-SADS-PL at 16 and self reported ADHD at 21 years of age, was 0.52. Measures of SOC at 16 years of age, and self reported ADHD at 21 years of age, had a correlation coefficient at -0.51 and for the hyperactivity scale -0.42, and the inattentive scale -0.44.

There was a significant relationship between SOC at 16 years of age, and ADHD measured at 21 years of age *(p<.01)* when controlling for concurrent ADHD symptoms. In our analyses, we found that the interaction term between SOC and ADHD symptoms at 16 years of age was statistically significant *(p<.05)*. In our supplementary analysis of patterns of dichotomized ADHD symptoms and SOC at 16 years of age and outcome ADHD symptoms 5 years later we found that subjects classified with a high ADHD score and a low SOC score at baseline had the highest levels of ADHD symptoms at age 21. The subjects with a high ADHD score and a high SOC score at baseline had relatively low levels of ADHD symptoms at age 21.

5.4.2 Figure 2

Figure 2. Average scores of ADHD symptoms at 21 years of age by profiles of dichotomized ADHD and SOC scores measured at 16 years of age
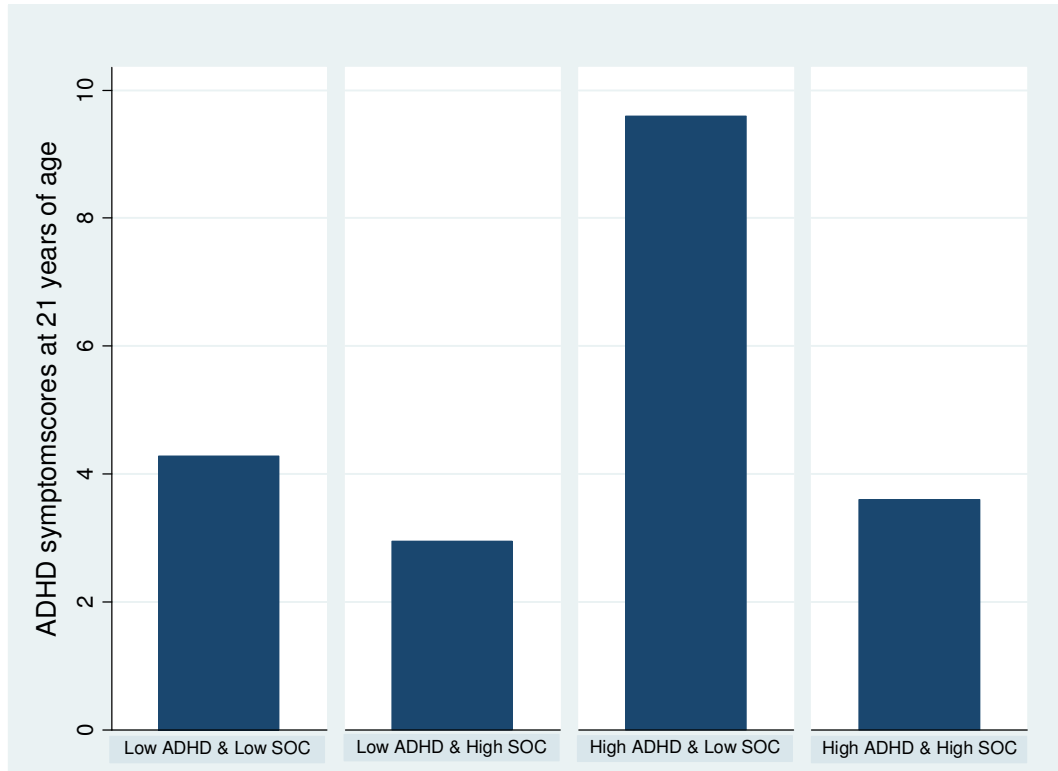
Each group represents a dichotomized profile ADHD and SOC measured at 16 years of age. The bars represent the mean of ADHD symptoms by each group 5 years later, at 21 years of age. The SOC scale was dichotomized at the 75th percentile in low and high SOC. In the same way ADHD symptoms measured at 16 years of age was dichotomized at the 75th percentile in low score and high score.

6 DISCUSSION

Is there a concurrent and long-term relationship between parental reported ADHD symptoms in children, and self-reported low self-esteem in adolescence?

We have found a long-term relationship between self-esteem and ADHD symptoms using different methods and times of measurements. Our findings in Paper I and II support the theory of a long-term relationship between ADHD-symptoms and a low self-esteem which is in line with earlier findings by (Bussing et al., 2000; Hechtman *et al.*, 1980; Shaw-Zirt et al., 2005; Slomkowski *et al.*, 1995; Treuting, 2001). We found a statistically significant relationship in the total study group between high scores of parental-reported ADHD-symptoms at eight years of age, and low scores in measures of self-esteem at 13 years of age. Our results also show that some different subscales are more related to ADHD such as psychological well-being and "skills and talents" which reflects more of internalising symptoms. We know from earlier research that ADHD is related to depression (Cantwell, 1996; Faraone & Biederman, 1997; Treuting, 2001). In order to handle this, we controlled for internalising symptoms in our analysis. There is also support for the theory of children with symptoms of ADHD and there experiences of problems in school and academic performance (R. A. Barkley et al., 2002; Biederman, 2005; Steinhausen, 2003) as we found that the sub scale "skills and talents" were significantly related to ADHD symptoms. This sub-scale is supposed to reflect the adolescents view of himself in, for instance, school environments (Ouvinen-Birgerstam, 1985).

Do twin pairs where one twin have high scores of ADHD symptoms in childhood have lower self-esteem in adolescence compared to their co twin?

In our co-twin analysis we confirmed the earlier analysis because this method enabled us to perform a match case-control where same sex twins discordant for ADHD symptoms. This methodology made it possible to create a matched case control study where as within the twin pairs, one twin had high scores of ADHD symptoms and his/her co twin had low symptoms.

Using a co-twin methodology, the design makes it possible to study the causality of the relationship between ADHD symptoms and self-esteem and if the relationship is due to genetic and environmental influences (George *et al.*, 1999). A somewhat speculative conclusion of the results of the co-twin analyses is that children with ADHD have poor self-esteem due to common factors causing difficulties in the academic, social and behavioural domains mediating other adverse outcomes, such as depression. These factors could be a genetically associated personality trait or endophenotype, a trait that increases the risk for both ADHD-symptoms and a low self-esteem. Due to the rather small number of discordant twin pairs, the analyses have limited power. Nevertheless, the analyses revealed interesting results, and might be of used as hypothesis generating for future large-scale studies.

What types of profiles of self-esteem in adolescence are related to high scores of ADHD symptoms?

Self-esteem is a complex concept and could be regarded as both a global concept or self-esteem could also be regarded as a multidimensional concept and may be portrayed as different dimensions of the self-image in different contexts. (S. Harter,

1993; Ouvinen-Birgerstam, 1985; Suonpaa et al., 1989). In Paper II, self-esteem was looked upon as a multidimensional concept suitable for investigations using a person-oriented approach (L. R. Bergman & Magnusson, 1997). The results from the cluster analysis identified that two "problem clusters" with a generally low self-esteem could have problems related to, for instance, academic performance. This finding is in agreement with previous reports of children with ADHD having problems with academic performance and depression (Bussing et al., 2000; Cantwell, 1996; Daley, 2004; Gadow *et al.*, 2002; Hudziak *et al.*, 1998; Klassen *et al.*, 2004; Spira & Fischel, 2005).

On the other hand, children in these two clusters also portrait relatively high scores on the subscales "relation to family" and "relation to others". This lends strings to the common opinion that children with ADHD often encounter problems in social interactions with peers and are often confronted with peer rejection and social isolation (de Boo & Prins, 2006).

It must be emphasized that, when the concept self-esteem is described in terms of profiles, we found individuals with high scores of ADHD symptoms at both wave 1 and wave 2 present in all seven self-esteem clusters. Thus, on the individual level, children with problems related to ADHD could have very different profiles of self-esteem, which is in line with the common idea of self-esteem as a multidimensional concept (S. Harter, 1993).

Do children with persistent ADHD symptoms have specific self-esteem profiles in adolescence?

When analyzing clusters of self-esteem in relation to longitudinal patterns of ADHD, we found that cluster 4 had the highest relative frequency of children with ADHD persistent pattern ("High-High"). Cluster 5 had the highest relative frequency in the other combinations of longitudinal patterns of non-persistent high scores of ADHD symptoms ("High-Low" and "Low-High"). This was a somewhat unexpected finding since an overall higher score in the self-esteem subscales, compared to cluster 5, characterizes cluster 4. A similar finding of high self-esteem in children with persistent ADHD has been reported (Biederman et al., 1998). One explanation may be that children with long-term ADHD develop strategies for coping and learn to adjust their life according to their symptoms (Seligman & Csikszentmihalyi, 2000; Snyder & Lopez, 2001). This could be similar to the situation for children with physical impairments. Despite common belief that these children have a lower self-esteem, studies indicated that children with physical impairments are not found to assess their self-concept lower than children without impairment (Grue & Heiberg, 2000; Specht *et al.*, 1998).

Another explanation of a relatively good self-esteem in children with persistent ADHD may be "positive illusory bias" that is that children have a tendency to overestimate their abilities, for instance, in academic performance (Hoza et al., 2002). However, this has been questioned and the self-enhancement could be a way of neglecting the individual's lack of skills that he/she does not want others to know about (Asendorpf & Ostendorf, 1998).

The conflicting findings of both low and high self-esteem linked to ADHD may also be related to the lack of a consensus regarding the definition of the self-esteem concept (Coopersmith, 1967; Robson, 1988). Studies regarding how the child's self is affected by and related to ADHD have increased during the last decade. Concepts such as self-esteem, self-perception, self-efficacy, self-worth, and self-concept are often used to describe and analyse different domains of the self.

Is low self- esteem more often associated with the development of the inattentive subtype of ADHD compared with the hyperactive/impulsive subtype?

In Paper I we proved a long-term relationship between ADHD and self-esteem (Edbom *et al.*, 2006). This relationship could not be explained as a causal relationship, but rather that children with ADHD symptoms and low self-esteem share a common genetic factor influencing both ADHD symptoms and low self-esteem. We used *Paper III* to study self-esteem in adolescents and its long-term relationships with symptoms of ADHD in young adulthood and tested the hypothesis that low self-esteem is more commonly associated with the development of the inattentive subtype of ADHD compared with the hyperactive/impulsive subtype. Our main findings show that there is a relationship, especially in boys, between low self-esteem in adolescence and high scores of the ADHD inattention subtype in early adulthood. Our results are similar to the results by (Canu & Carlson, 2007) who studied self-esteem in young adults with ADHD combined and inattentive subtype and found that adult men with ADHD combined type and inattentive type had significant lower self-esteem compared to non-ADHD controls.

Other studies of ADHD subtype and self-esteem have been conducted by, for instance (Hechtman et al., 1980), who studied hyperactive behaviour in young adults and self-esteem and found that hyperactive young adults scored significantly worse on self-esteem compared to controls. This study had only predominantly hyperactive adults and controls in the sample, which make comparison with our study somewhat difficult. A review by (Hechtman, 1999) of outcome studies of hyperactive children shows that hyperactive children experience significant difficulties during adolescence, and that social, emotional, and impulse problems persist into young adulthood for the majority. On the other hand some hyperactive children were found to function well within the normal range as adults.

In our study we found that low self-esteem has a stronger relationship with inattention, when compared to hyperactivity. It could be that inattentive problems from adolescence to adulthood generate, for instance, relationship problems, academic problems, and job problems (Canu & Carlson, 2007). The explanations for why hyperactivity has a weaker relationship with low self-esteem has been discussed by (Smalley *et al.*, 2000) who found that adolescents with higher self-esteem rated themselves as having fewer ADHD symptoms, and were judged by clinicians to have better psychosocial adjustment, in both the hyperactive and control groups. This has also been discussed by (Hoza *et al.*, 1993) who reported that 8- to 13-year-old boys with ADHD did not rate themselves as worse than controls on self-perceived competence and global self-worth, despite academic and social failure. This could be understood in different ways. Relatively good self-esteem in children with ADHD may be "positive illusory bias" that is that the children have a tendency to overestimate their abilities for instance in academic performance (Hoza *et al.*, 2000). The stronger relationship between low self-esteem and ADHD inattention subtype

could also be explained by the reduction of hyperactivity symptoms in adulthood. In contrast, symptoms of inattention are more likely to last into adulthood. As we found in our study, there are a higher proportion of adolescents with inattention compared to hyperactivity, which could give a higher power to find relationships between inattention and self-esteem compared to hyperactivity for instance (Mick *et al.*, 2004) states that most adults with ADHD continue to struggle with a substantial number of ADHD symptoms and high levels of dysfunction and that in-attention is more persistent than hyperactivity or impulsivity as children progress through adolescence and into early adulthood.

Can SOC as a salutogenetic factor change the long-term development of ADHD symptoms?

One of the aims of this project has been to investigate whether SOC can serve as a salutogenetic factor modifying the long-term development of ADHD symptoms. We analysed if there is a statistically significant interaction effect between SOC and ADHD symptoms at 16 years of age and the outcome that is ADHD symptoms five years later at 21 years of age.

Our main findings in Paper IV, support the idea of SOC as a protective factor for the development and the maintenance of mental health related to ADHD symptoms. These results are partly similar with the findings of van der Hal-van Raalte (van der Hal-van Raalte et al., 2008) and colleagues in their study of child Holocaust survivors. A high SOC could mediate and moderate the association of early childhood deprivation due to holocaust persecution and post-traumatic stress. (van der Hal-van Raalte et al., 2008). The idea of SOC as an active protective factor for health is in contradiction with findings from another longitudinal study by Kivimäki, who studied

the stability of SOC and its relation to health. They used sickness absence as outcome variable and found no evidence for a "salutogenic status" of SOC (Antonovsky, 1987; Kivimäki et al., 2000). The main findings support the theory of SOC, according to Antonovsky, as a direct protective factor, decreasing the probability that a person develops and maintains ADHD symptoms.

An alternative explanation may be that higher scores on the SOC measure are indirectly related to some other variable that contributes to mental health at 21 years of age, such as family and peer relationships related both to the development of ADHD symptoms and SOC. Findings by Marsh (Marsh *et al.*, 2007) conducted a study to better understand the factors that are related to SOC levels among youth. He suggests that social support may provide youths with a positive environment and consistent resources increasing SOC. Alternatively, disruptive behaviour and ADHD may create patterns of problematic interactions and drive away helpful social resources, which in turn influence the ability to understand and cope with the environment.

We found a statistically significant negative correlation between the health problems, in this case ADHD symptoms, and the SOC scale measured at 16 years of age. Furthermore, there was a similar relationship between the SOC scale at 16 years of age, and ADHD symptoms at 21 years of age. Thus, a low SOC was related to high score of ADHD symptoms both concurrently and after the five year follow-up.

The findings are similar with the results in studies within the field of somatic care that have shown that high SOC can work as a predictive factor for sustained health (Antonovsky, 1979; Huovinen *et al.*, 2001; Ytterberg *et al.*, 2008). There are also

studies investigating the relationship between SOC and psychopathology. Ritskari (2006) found in a follow-up study of Finnish men that psychopathology, adaptive functioning and SOC scales were associated with a variety of psychiatric disorders and that SOC showed an independent association with symptoms of a wide range of psychiatric disorders at follow-up (Ristkari *et al.*, 2006). A study of schizophrenic patients found that SOC was positively related to mastery, self-esteem and social support but negatively associated to psychopathology. SOC was positively associated to all health related measures and changes in SOC during an 18-month follow-up were positively correlated to changes in overall subjective quality of life, general health, global well-being and global psychosocial functioning (Hart *et al.*, 2006).

The concurrent and longitudinal relationship between SOC and ADHD symptoms could be interpreted as saying that SOC is a good measurement of the mental health state, both present and past. The findings of a relationship between SOC and ADHD are similar with the strong negative correlations observed between the SOC scale and measures of depression and anxiety. This has raised the question of whether the SOC scale inversely measures the other constructs. Konttinen (2008) examined the discriminate validity of the three measures by comparing their associations with health indicators and behaviours. The SOC scale had high inverse correlations with both depression and anxiety. However, confirmatory factor analysis suggested that it was possible to differentiate between SOC, cognitive depressive symptoms and anxiety (Konttinen *et al.*, 2008).

SOC as a salutogenic factor is explained in different ways according to the theory. Individuals with high SOC scores are those likely to perceive stressors as predictable and explicable, have confidence in their capacity to overcome, and judge it

worthwhile to rise to the challenges they face. Low SOC is the relative absence of these beliefs (Myrin & Lagerstrom, 2006). Thus, if the SOC scale is a salutogenic factor, young persons with high SOC at 16 years of age should have a better prognosis with regard to the development of ADHD symptoms.

In Paper IV, we have analysed SOC as a moderator for the development of ADHD. The theory of SOC as a mediator for health has been the focus of other studies of behavioural and external problems. In one study, the relationship of hostility and anger expression to SOC and its role as predictors of health-related quality of life and found that the impact of anger-hostility variables on quality of life seems to be "mediated by SOC" (Julkunen & Ahlstrom, 2006).

According to Antonovsky, (Antonovsky, 1979, 1987) concepts like life experiences and participation in decision-making in childhood and adolescence are the base for a strong SOC in adulthood. In early adulthood the location along the SOC continuum becomes rather fixed, especially after the age of 30 (Antonovsky, 1979). The tes-retest reliability in adults has been shown to be high in earlier studies although there are only a few studies addressing this issue. Although the level of SOC in adults seems to be rather stable (Taru Feldt et al., 2000), in childhood and adolescence it could be possible to improve SOC by an intervention. Hansson and colleagues (2004), who conducted a salutogenic milieu therapy in order to enhance resiliency in an adolescent with conduct disorder during their stay in an inpatient child psychiatric unit. They conducted a long-term follow-up and found that the subjects had improved their lives and have an acceptable life situation (K. Hansson et al., 2004).

6.1 METHODOLOGICAL CONSIDERATIONS

First, since we have studied individual differences in ADHD symptoms in a population-based sample, it is not certain that all results in the present study are generalisable to individuals with a categorical diagnosis of ADHD. The reliance on parental reporting may underestimate hyperactive behaviour in different settings and we had no information concerning functional impact of the ADHD symptoms. We used DSM-III-R instead of DSM-IV and accordingly we do not report results in detail for Hyperactive-Impulsive or Inattentive dimensions. The research on self-esteem is complicated by conflicting descriptions in the definition of self-esteem (Aasland & Diseth, 1999) and important differences between scales regarding self-esteem. In this study we used the self-esteem questionnaire, which is a Swedish questionnaire (Ouvinen-Birgerstam, 1985). The fact that the self-esteem questionnaire is not an international questionnaire makes it more difficult in terms of validation when comparing the results with other questionnaires that are aimed to measure self-esteem, although the instrument has been thoroughly validated and has been used in numerous studies on Swedish children and adolescents (Abd-el-Gawad *et al.*, 2002; von Essen *et al.*, 2000). There are also other important considerations to bear in mind regarding the use of a twin population. In order to study self-esteem in twins, one must consider whether twins report their self-esteem differently than other children or adolescents. However, in our analyses the study population did not differ from Swedish adolescents in SE-scores transformed stanine scores (data not shown) (Ouvinen-Birgerstam, 1985).

7 CONCLUSIONS AND CLINICAL IMPLICATIONS

High self-esteem and SOC are important factors to maintaining good health. Our primary goal of this thesis was to show how low self-esteem is related to ADHD symptoms and that this relationship can follow an individual from childhood to young adulthood. Although there are within group variance regarding ADHD and children with ADHD symptoms also seems to asses there self-esteem no worse than children with low ADHD symptoms. This could be related to various salutogenic factors and resilience, and we have found support for that because, sense of coherence seems to change the development of ADHD symptoms from adolescence to young adulthood.

In Paper I, we discovered a long-term relationship between ADHD-symptoms and low self-esteem. Thus, children with ADHD might be more vulnerable to low self-esteem during their early adolescence. But the pattern of findings in ADHD discordant MZ and DZ twins doesn't exclude the fact that the association, is at least in part, due to common genetic factors.

In Paper II, children with high scores of ADHD symptoms often seem to have profiles of self-esteem characterized by low scores in the domains "skills and talents" and "psychological well-being." But more than a few children with high score ADHD had profiles characterized by high self-esteem. In addition, children with persistent high scores of ADHD symptoms had relatively good self-esteem profiles.

In Paper III, we tested the hypothesis, which claims that low self-esteem is more closely associated with the development of the inattentive subtype of ADHD, than it is with the hyperactive/impulsive subtype.

In Paper IV, the main findings support the idea of SOC as a protective factor for the development and the maintenance of mental health related to ADHD symptoms because we found support for the salutogenic hypothesis since the findings of a statistically significant interaction between SOC and ADHD at 16 on the outcome, i.e. ADHD at 21 years.

This study indicates that academic performance seems to be the one of the most important domain of self-esteem for children. As ADHD is a common diagnose in school-aged children, this study highlights the importance of identifying children with these symptoms to be able to prevent the development of ADHD-symptoms.

Salutogenetic factors also seem to be important to the development of psychological health. In health care the main focus often is the diagnosis and its implication. This study supports a more salutogenetic approach in health care, which promotes the capabilities and coping abilities among children with neuropsychiatric disabilities.

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