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Psychiatric problems, protective factors and outcomes in adolescents with ADHD

The role of self-perceptions

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Psykiske tilleggsvansker, beskyttende faktorer og utfall blant ungdom med ADHD: En studie basert på selvoppfattelse

ADHD er en vanlig, nevropsykiatrisk lidelse og kjennetegnes av oppmerksomhetsvansker, hyperaktivitet og impulsivitet som gir nedsatt funksjon i hverdagen. Den kliniske presentasjonen endres med alderen, og innvirkningen på hverdagsfunksjon påvirkes i stor grad av forløpet. Tilleggsvansker er vanlig i forløpet, og forverrer utfallet. Ungdom med ADHD og emosjonelle- og atferdsvansker har økt risiko for psykiske lidelser, funksjonsvansker og redusert livskvalitet. Selv om ADHD regnes som en arvelig lidelse, kan miljøfaktorer være viktige faktorer for utviklingen av lidelsen og videre forløp. Beskyttende faktorer antas å fremme resiliens, og inkluderer både individuelle- og miljøfaktorer. Det mangler studier som undersøker risiko- og beskyttende faktorer som er viktige for utfallet blant ungdom med ADHD.

Hovedmålet i denne studien var å undersøke faktorer som kan påvirke bedre utfall blant ungdom med ADHD. Studiene er basert på data fra Hel-BUP studien, en klinisk studie i BUP klinikk. De to første er tverrsnittstudier i alderen 13-18, mens tredje studie er en 3-årig oppfølgingsstudie. Alle studiene inkluderer omtrent 190 ungdommer med ADHD.

I den første studien undersøkte vi ungdommenes opplevelse av familiefunksjon og livskvalitet avhengig av nivå av emosjonelle- og atferdsvansker. Vi sammenlignet selvrapport med foreldrerapport, og inkluderte derved ungdommenes og deres foreldres perspektiv. Ungdommer med både emosjonelle- og atferdsvansker opplevde verst familiefunksjon og livskvalitet. Foreldre rapporterte derimot at tilleggsvansker påvirket ungdommens livskvalitet, men ikke familiefunksjon.

I den andre studien undersøkte vi om beskyttende faktorer påvirker forholdet mellom risikofaktorer og livskvalitet (mediator- eller moderatoreffekt). Vi fant ingen moderatoreffekt. Se under for forklaring av mediator. Individuelle egenskaper, som inkluderer selvtillit, strukturerte egenskaper og sosial kompetanse, medierer forholdet mellom emosjonelle vansker og livskvalitet. Vi fant også at sosial støtte medierer forholdet mellom atferdsvansker og livskvalitet.

I den tredje studien undersøkte vi om selvtillit, strukturerte egenskaper og sosial kompetanse blant ungdom med ADHD predikerer mer gunstig utfall. Vi målte psykososial fungering og diagnosene angst, depresjon og ADHD i ung voksen alder. Bedre selvtillit i ungdomstiden predikerte bedre psykososial fungering. Mer strukturerte egenskaper og bedre sosial kompetanse var også assosiert med dette utfallet. Videre var bedre selvtillit assosiert med mindre depresjon, mens bedre sosial kompetanse var assosiert med mindre angst.

Konklusjon: Emosjonelle vansker og atferdsvansker er viktige risikofaktorer for ungdom med ADHD og selvoppfattelsen blant ungdom med ADHD gir nyttig informasjon som kan optimalisere klinisk undersøkelse. Ved å måle beskyttende faktorer i tillegg til risikofaktorer, identifiseres mulige behandlingsmål. Individuelle egenskaper er viktige beskyttende faktorer i ungdomsalderen. Selvtillit, strukturerte egenskaper og sosial kompetanse bør undersøkes videre som mulige behandlingsmål for pasienter med ADHD i overgangen mellom ungdom og ung voksen.

Eksempel på mediator (Forholdet mellom tilleggsvansker og livskvalitet går gjennom beskyttende faktorer):
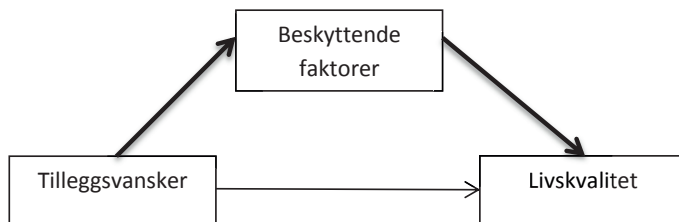
Beskyttende faktorer

Tilleggsvansker

Livskvalitet

Overnevnte avhandling er funnet verdig til å forsvares offentlig
For graden PhD i nevrovitenskap
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Abbreviations and definitions

ADHD: Attention Deficit Hyperactivity Disorders

APA: American Psychiatric Association

CAP: Child and Adolescent Psychiatry

CGAS: Children´s global assessment scale

DSM-V: Diagnostic and Statistical Manual of Mental Disorders, 5th edition

DSM-V-TR   Diagnostic and Statistical Manual of Mental Disorders, 4th edition, text revision

ICD-10:   International Classification of Disease, 10th version

IQ: Intelligence Quotient

MRI: Magnetic Resonance Imaging

QoL: Quality of Life, defined as an individual's subjective perception of their well-being in several domains

WHO: World Health Organization

WHOQOL: World Health Organization Quality of Life

Psychiatric problems: Emotional and/or behavioral problems coexisting with ADHD and based on dimensional ratings.

Protective factor: A factor that is thought to promote resilience

Outcomes: Diagnoses of Anxiety, Depression and ADHD, psychosocial functioning and QoL.

Summary

ADHD is a common, neurodevelopmental disorder characterized by symptoms of inattention, hyperactivity, and impulsivity which affect functioning in academic, social, and family contexts. Its clinical presentation evolves across the lifespan, and the developmental course largely determines the disorder's impact on everyday functioning. Coexisting problems or disorders are common across development, and worsen the outcomes. Adolescents with ADHD and co-existing emotional and conduct problems have increased risk of psychiatric disorders, functional impairment and QoL. Although ADHD is considered a strongly hereditary disorder, environmental factors may also be important risk factors for the development and course of this condition. Protective factors are thought to promote resilience, and include both individual and environmental factors. Risk and protective factors important for outcomes among adolescents with ADHD should be investigated.

The main objective of this thesis was to assess factors that may be of importance in achieving better outcomes in adolescents with ADHD.

In the first study we assessed the adolescents' perceptions of family functioning and QoL according to level of coexisting emotional and conduct problems. We added parent reports to compare with the self-report, and included perspectives of both informant. To investigate these aims, we used a sample obtained from a cross-sectional survey of clinical adolescents with ADHD, aged 13-18 years. The sample of 194 adolescent with ADHD were divided into four groups; 1. Without additional emotional and conduct problems; 2. With additional emotional problems; 3. With additional conduct problems; 4. With additional emotional and conduct problems. The findings showed that adolescents with both emotional and conduct problems reported lower QoL and family functioning. On the other hand, parents reported a significant impact of coexisting problems on adolescents' QoL, but not on family functioning. The findings of the study suggest that the self-perceptions of adolescents with ADHD generate useful information that may help to optimize clinical assessment.

In the second study we assessed the mediating and moderating effects of personal and environmental protective factors on the relationship between coexisting emotional and conduct problems and QoL. Individual competencies, which include self-esteem, structured style, and social competence, were the strongest mediator between coexisting emotional

problems and QoL among adolescents with ADHD, including those who were prescribed psychostimulants. Social resources mediated the relationship between conduct problems and QoL. These findings indicate that assessment of protective factors, in addition to risk factors, may identify potential treatment goals.

In the third study, using a longitudinal design, we investigated whether the personal protective factors; self-esteem, structured style and social competence, were predictors of more favorable outcomes. Outcomes were psychosocial functioning, anxiety, depression and ADHD diagnoses three years later. Better self-esteem in adolescence was a predictor of better psychosocial functioning in young adulthood. A more structured style and better social competence were also associated with this outcome. Furthermore, better self-esteem in adolescence was associated with fewer depressive disorders, while social competence in adolescence was associated with fewer anxiety disorders in young adulthood. Further knowledge of protective factors might be useful in the development of support and clinical interventions for ADHD patients in the transition period from adolescence to emerging adulthood.

Introduction

Topic of the thesis

Based on both cross-sectional and longitudinal studies, this thesis examines the possible associations between coexisting problems and protective factors and outcomes among adolescents with attention deficit hyperactivity disorder (ADHD). The protective factors investigated in these studies are self-esteem, structured style and social competence, social support and family cohesion. Quality of life (QoL), family functioning, psychosocial functioning and the diagnoses of anxiety disorders, depressive disorders and persistent ADHD are included as outcomes.

ADHD is considered a neurodevelopmental disorder where gene-environmental interactions are recognized as important for the expression of the disorder. The literature has shown that ADHD is a risk factor for long-term psychosocial impairment, coexisting problems and QoL. Furthermore, coexisting emotional and conduct problems are acknowledged as strong and negative predictors in children with ADHD. On the other hand, protective factors might improve the outcomes of ADHD. Figure 1 illustrates the possible mechanisms of a desirable outcome where treatment of risk and protective factors may contribute to a positive gene-environmental interaction creating a better outcome for the ADHD patient. This thesis is based on the theoretical framework that the ADHD phenotype is influenced by environmental factors, and that addressing risk and protective factors may reveal important treatment goals.

Environment
Improvement of risk factors:
-ADHD
-Coexisting emotional and conduct problems

Genetics
 -ADHD
-Structured Style
-Social competence
-Self-esteem

Gene-environment interactions

Phenotype
-few symptoms
-high functioning
-good QoL

Environment
Improved protective factors:
-Structured Style
-Social Competence
-Self-esteem
-Social support
-Family Cohesion

Figure 1. Illustration of possible mechanisms of successful ADHD outcome

A historical view of ADHD

The first published description of ADHD symptoms in the medical literature was as early as 1812 (Taylor, 2011). By the early 20th century, the diagnosis "Minimal Brain Damage" emerged, and was described in terms of cognitive processes and physical causes. In the mid-20th century "Minimal Brain Dysfunction" (MBD) was described as a condition with normal IQ, problems with motor control, language, memory, and impulse control, with assumed neurobiological etiology (Clements, 1966). Dykman (Dykman, 1971) was the first to formulate MBD as a disorder of attention, including poor performance, increased reaction time, and decreased physiological reactivity with and without hyperactivity. MBD was still thought to comprise organically based deficits. The DSM-III was the first diagnostic manual to describe attention deficit disorder; thus, etiological formulations were replaced with descriptions of observable behaviors (APA, 1980). At the same time, motor control problems were removed from the ADHD criteria to the diagnostic category "Developmental Coordination Disorder", although recent research now indicates associations between motor control problems and ADHD (Kaiser, Schoemaker, Albaret, & Geuze, 2014). DSM-IV introduced three subtypes; predominantly attentive type, hyperactive-impulsive type and combined type (APA, 1994). Subsequent research found these groups unstable, so the DSM-V downgraded them to indicators (APA, 2013). It has become clear that ADHD often persists into adulthood (Biederman et al., 2012). The DSM-V adjusted for unstable symptom profiles with age, and therefore the diagnostic criteria for ADHD over the age of 17 includes fewer symptoms.

An amphetamine-like stimulant (Benzedrine) was described as calming, and improved school functioning for hyperkinetic children as early as the 1930s (Strohl, 2011). The American Food and Drug Administration approved Ritalin in the early 1960s. Its controversial use started in the 1970s, with a subsequent rise in prescriptions for children until the present time. Of the treatments investigated to date, medical treatment has the strongest and most direct effect on ADHD symptoms, in both the short and long-term. Unfortunately, we have no therapies that have better documented effects on the mechanisms of the disorder.

In 1932 in Europe, Kramer and Pollnow indicated that severe and chaotic hyperactivity in children was often associated with seizures, learning difficulties, anxiety and early onset (Taylor, 2011). Their work seemed to influence the World Health Organization's (WHO)

International Classification of Disease (ICD). Hyperkinetic disorder developed from MBD, and was introduced in the ICD-8, and maintained in the ICD-9 and ICD-10 (WHO, 1992).

Self-perceptions

Self-perceptions of children with ADHD have been shown to be overinflated in comparison to the perceptions of other informants (parents and teachers), that reflect actual competence (Hoza et al., 2004). This phenomenon has been termed the positive illusory bias. A recent study showed that self-perceptions of academic competence of children with ADHD in the 11th grade, positively predicted academic achievements in the 12th grade (Scholtens, Rydell, & Yang-Wallentin, 2013); thus, the positive illusory bias was less obvious in this sample. One of the possible explanations for the positive illusory bias is cognitive immaturity. Young children are known to have optimistic beliefs about their own success, and children with ADHD are characterized as being behaviorally and cognitively immature (Owens, Goldfine, Evangelista, Hoza, & Kaiser, 2007). If so, this implies that children with ADHD will outgrow this bias in cognitions, but to date this relationship has not been assessed in a follow-up study (Owens et al., 2007). Adults with ADHD were aware of problems in cognitive functioning shown by considerable perceived neuropsychological impairments (Fuermaier et al., 2014). Adolescent girls with ADHD reported that the scholastic competencies were similar as performed achievement tests, and self-reported social acceptance ratings were not significantly different from peer-rated positive nominations (Swanson, Owens, & Hinshaw, 2012). However, with respect to teacher and parent reports, there were significantly higher self-appraisals among girls with ADHD (Swanson et al., 2012). The same study investigated the correspondence between test scores and self-reports in girls without ADHD, but they significantly underrated their own competence in relation to adult informants (Swanson et al., 2012).

During adolescence it is normal that parents are less involved in several domains of their child's life. In the general population, parents evaluated their child's well-being and QoL more highly than did the children themselves on most life domains (Ellert, Ravens-Sieberer, Erhart, & Kurth, 2011; Jozefiak, Larsson, Wichstrom, Mattejat, & Ravens-Sieberer, 2008). In patients with internalizing disorders, differences between informants typically become greater with age (van der Ende, Verhulst, & Tiemeier, 2012), with parents reporting fewer problems.

Further, parents' and adolescents' well-being have been shown to be weakly correlated, in spite of socialization, common material welfare and genetic influences (Casas, 2012). Externalizing disorders have been shown to be more burdensome for parents than anxiety and depressive disorders, and parental burden associated with child psychiatric disorders is related to the use of specialist mental health services (Angold et al., 1998). Furthermore, maternal depression is associated with maternal reports of worse child behavior (Müller, Achtergarde, & Furniss, 2011).

Discrepancies between self-reports and parent reports have been repeatedly acknowledged in the literature (Rescorla et al., 2013), and both types of reports may be biased. By attending to both perspectives, the adolescent will supply an insight into their own situation, while parents may supply an understanding of the broader impact of the adolescent's health (Coghill, Danckaerts, Sonuga-Barke, Sergeant, & Group, 2009).

Adolescence and emerging adulthood

Adolescence has been described as the second decade of life (Arnett, 2000). It usually starts with puberty and ends at the age of 18. Until that age, young people commonly live with their parents and are part of a school-based peer culture. Intimacy with parents may be supportive, but may be less important than friendships during adolescence (Paikoff & Brooks-Gunn, 1991).

The transition into young adulthood represents a particularly challenging period, as parental support declines and environmental demands increase. Arnett described the phase of emerging adulthood, as people aged 18-25 seeing themselves gradually making their way into adulthood (Arnett 2000). This age group is characterized by instability, as most people are obtaining an education or rapidly changing jobs, moving away from family, managing finances independently and navigating friendships and romantic relationships. Young adults, on the other hand, have settled into a more stable occupational path, are married and have children. For individuals with ADHD, this period could be particularly demanding as many individuals with ADHD tend to have poorer social and organizational skills (Fleming & McMahon, 2012). In addition, adolescents with ADHD are transitioning between child services and adult mental health services during this period (Young, Murphy, & Coghill, 2011).

Diagnostic criteria and prevalence of ADHD

The DSM-IV category of ADHD is more broadly defined, and is more prevalent than the ICD-10 hyperkinetic disorder, even though the symptoms listed are similar. Thus, all cases diagnosed with ICD-10 should be included within the DSM-IV. In the ICD-10, all core symptoms, inattention, hyperactivity and impulsivity, should be present as well as a more stringent criteria for functional impairment across several areas (academic, social, family life, personal etc.). Many clinicians in Europe, including Norway, use the wider definition of the DSM-IV and DSM-V in addition to the ICD-10, and are able to treat troubled patients with disorders not included in the ICD-10 criteria, such as ADHD with predominantly symptoms of inattention (ADD) (Norwegian Directorate of Health, 2007; Taylor et al., 2004). Clinicians are then challenged to distinguish pathology from normality, and to identify other causes for ADHD symptoms.

The rate of ADHD is generally agreed to be in the range of 3% to 7% in children and adolescents, and ADHD prevalence rates based on the DSM-IV are expected to be higher than those based on the ICD-10 (Polanczyk, Salum, Sugaya, Caye, & Rohde, 2015; Thomas, Sanders, Doust, Beller, & Glasziou, 2015). Although less studied, reported estimates for the prevalence of ADHD in adult populations range from 3% to 4% (Biederman, Petty, Clarke, Lomedico, & Faraone, 2011; Kessler et al., 2006). A Norwegian registry study found an ADHD prevalence rate of about 3% in 11-year-old children (Suren et al., 2012). However, about 5% fulfilled the DSM-IV criteria in a large Norwegian epidemiological study (Ullebo, Posserud, Heiervang, Obel, & Gillberg, 2012).

Categorical versus dimensional approach

Psychiatric disorders described in diagnostic manuals are organized categorically (APA, 2000; WHO ICD-10, 2009). In contrast to a leg fracture, for example, which is either present or not, most psychiatric disorders are extremes on a continuum of symptoms. Level of symptoms and impairment should be used to distinguish pathology from normality, and to indicate diagnostic cutoffs. Categories are practical, and carry meaning that is convenient for communication with, for example, parents. Further, most research and clinical work is based on a categorical approach, and is fundamental for many treatment options, such as. medical treatment for ADHD. However, diagnostic thinking challenges clinicians' planning of care for

individual cases, as many individuals have dimensions of multiple symptoms and dysfunctions that must be taken into account (Rutter, 2008). Statistically, a dimensional approach has benefits because it provides a better fit with the data. For example evidence of substantial heritability of attention problems in a general population of twins was found (Gjone, Stevenson, & Sundet, 1996). Importantly though, the degree of heritability was similar for those with low, moderate and high levels of attention problems, supporting a dimensional rather than a categorical model of ADHD (Gjone et al., 1996). A recent review discussed categories versus dimensions, and concluded that ADHD is best modelled as a continuum of symptoms in both children and adolescents (Coghill & Sonuga-Barke, 2012). Recent reviews of subthreshold depression found that risk factors and outcome were similar for major depressive disorder, indicating that early detection and prevention is needed (Bertha & Balazs, 2013; Wesselhoeft, Sorensen, Heiervang, & Bilenberg, 2013). Genetic and nonshared environmental influences have an etiological overlap between dimensions of attention problems and anxiety subtypes (Michelini, Eley, Gregory, & McAdams, 2015). There were no associations with hyperactivity/impulsivity and anxiety, thus investigating dimensions of ADHD symptoms answered new questions in this study (Michelini et al., 2015). Nevertheless, there is a degree of consistency between the taxon and the DSM structure of the depression and anxiety disorders (Coghill & Sonuga-Barke, 2012). Importantly though, the presence of a categorical latent structure for a disorder does not indicate homogenous causality (Coghill & Sonuga-Barke, 2012). Thus, researchers should consider both categorical and dimensional approaches.

Etiology

Twin and family studies indicate that ADHD is strongly hereditary, with estimates of 70-80% (S. A. Burt, 2009; Faraone, Bonvicini, & Scassellati, 2014; Gjone et al., 1996). However, most of the genetic part of the phenotype variance remains unexplained (Akutagava-Martins, Salatino-Oliveira, Kieling, Rohde, & Hutz, 2013). ADHD could be biologically heterogeneous, and thus subjects based on the clinical phenotype in genetic studies may limit the ability to identify genetics (Matthews, Nigg, & Fair, 2014). Genetic risk factors may have shared effects on risk loci between several neuropsychiatric disorders (Consortium, 2013; Michelini et al., 2015), consistent with findings of comorbidity in clinical samples. Neurobiological theories of ADHD include executive (top-down) (Barkley, 1997) and sensory/reward (bottom-up) systems (Sagvolden, Johansen, Aase, & Russell, 2005), and integrated models of ADHD indicate that consideration of both is required to understand the

clinical picture (Barkley, 2009). Executive functions are neuroanatomically linked to prefrontal cortical regions that hypothetically interact with posterior and subcortical regions, and individuals with ADHD often show impairments on tasks that measure executive processes (Matthews et al., 2014), although these impairments are shown to be heterogeneous (Lambek et al., 2011). The bottom-up theory includes reward, motivation, and emotional regulation theories. The reward system relies on ascending dopamine circuits, while neural systems involved in processing emotions and motivation include the limbic system (J. T. Nigg & Casey, 2005). The reward system constitutes the ability to choose larger delayed rewards over smaller immediate rewards. Motivation is involved with approach-avoidance behavior, which is linked to emotional processes. Emotional regulation reflects the ability to adjust the initial emotional response to create an appropriate behavior, while emotional self-regulation is closely connected to working memory systems and emotional inhibition is associated with the skill of suppressing inappropriate emotional reactions (Barkley, 2009). Neuroimaging studies suggest that the neurobiology of ADHD involves dysfunctions in the abovementioned areas (Glaser et al., 2006; Kasparek, Theiner, & Filova, 2013; Purper-Ouakil, Ramoz, Lepagnol-Bestel, Gorwood, & Simonneau, 2011). In relation to neurotransmitter systems, findings have suggested that disruptions in white matter microstructure may play a key role in the early pathophysiology of ADHD (Nagel et al., 2011). Diagnostic values of EEG are uncertain, however, based on several studies in a meta-analysis, excessive theta waves and theta/beta ratios have been found in a substantial subgroup of ADHD patients (Arns, Conners, & Kraemer, 2013).

Environmental factors may have an effect on brain development and the outcome of psychiatric disorders (Tomalski & Johnson, 2010). Prenatal factors associated with ADHD include maternal use of alcohol and cigarette smoking, perinatal factors include hypoxia during birth and low birth weight, and postnatal factors include parenting and family conflicts (Nigg, 2006). For example, to be born with a very low birth weight has been shown to increase the risk of ADHD in adulthood (Halmoy, Klungsoyr, Skjaerven, & Haavik, 2012; Lund, Vik, Skranes, Brubakk, & Indredavik, 2011). Gene-environment interactions may help to explain the etiology of ADHD. Most of these factors could represent an aggregation of multiple processes and mechanisms, which could be the reason why they have more effect than results from genetic analysis. Gene-environment interaction occurs when genetic risk factors are moderated by environmental risk factors (Petrill, Bartlett, & Blair, 2013), while

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gene-environment correlations occurs when genetic risk factors are mediated by environmental risk factors (Plomin, DeFries, & Loehlin, 1977). Research on gene-environment interactions has recognized that environmental factors, or experiences in life, might alter the gene expression, and thus the phenotype, a phenomenon called epigenetics (Manuck & McCaffery, 2014). The human brain has rapid periods of growth during early infancy and adolescence, which might cause increased plasticity (Cramer et al., 2011). Thus, risk and protective factors may be particularly important in these periods (Giedd, 2008). Inattention has been recognized as a mediator of the relationship between intelligence and academic performance (Costa Dde et al., 2014). A recent meta-analysis indicated interaction effects between multiple psychosocial adversities and the genotypes for dopamine (DAT1) and serotonin (5-HTT) transporters (Nigg, Nikolas, & Burt, 2010). How these factors relate to ADHD, and whether they overlap with other environmental factors are presently unexplained (Nigg et al., 2010).

Coexisting problems

The literature distinguishes between coexisting disorders, based on defined and well-validated diagnoses, and coexisting problems, where assessments are based on dimensional ratings of associated problems. Large epidemiological and clinical studies have shown that coexisting problems or disorders are frequent among children with ADHD (Angold, Costello, & Erkanli, 1999; Jensen et al., 2001; Kadesjo & Gillberg, 2001). Adolescents with ADHD and coexisting emotional and conduct problems have increased risk of criminality (Dalsgaard, Mortensen, Frydenberg, & Thomsen, 2013), psychiatric admission (Dalsgaard, Mortensen, Frydenberg, & Thomsen, 2002) and premature death (Dalsgaard, Ostergaard, Leckman, Mortensen, & Pedersen, 2015), and psychosocial impairment (Steinhausen et al., 2006) and QoL (Danckaerts et al., 2010). Over 85% of children with ADHD have at least one coexisting psychiatric disorder and approximately 60% of patients have at least two coexisting disorders (Angold et al., 1999; Kadesjo & Gillberg, 2001). Similar results are found in adult populations (Barkley, 2008). Thus, in clinical practice coexisting psychiatric problems are the rule rather than the exception. Frequency and types of coexisting problems have been shown to change with age. A recent Swedish registry study of ADHD found a general increase in comorbidities with age (Giacobini, Medin, Ahnemark, Russo, & Carlqvist, 2014). Coexisting autism spectrum disorders were most common at preschool age, while in adulthood substance use disorders, anxiety and personality disorders were most frequent. In a large European study of children aged 6-18 years, the most common coexisting problems were oppositional defiant

disorder (ODD), anxiety, depression, tics and co-ordination problems (Steinhausen et al., 2006). Follow-up studies of boys concluded that the period of increased risk for the onset of new disorders was limited to adolescence (Biederman et al., 2012). Follow-up studies of female samples with ADHD into early adulthood showed an increased risk of conduct disorders (CD), depression and anxiety disorders among others (Hinshaw et al., 2012). How long these risks persist remains unknown.

Measuring outcomes

Outcomes of disease and treatment may include level of symptoms, functional impairment and QoL (Coghill et al., 2009). Although all three dimensions are related, research indicates several distinctions between the concepts as assessments of outcome. Measuring symptom reduction is a well-established evaluation of an improved outcome, and will be discussed no further. Outcome measures other than symptoms, psychosocial functioning and QoL may include social skills, neuropsychological deficits, academic outcomes and brain structure (Cortese et al., 2015; Gardner & Gerdes, 2013; Spencer et al., 2013). Psychosocial functioning is usually measured across several domains, including academic, social, personal and family. Thus, it is a measure of the impact of the symptoms in important life domains, and functional impairment is a diagnostic criterion in most mental health disorders. Lower rates of ADHD have been found in studies when functional impairment is added to symptoms, compared with studies of ADHD based on symptoms alone (Faraone, Sergeant, Gillberg, & Biederman, 2003).

It has been shown that it is possible to improve QoL without reducing psychiatric symptoms, indicating that QoL is an important outcome measure in chronic disorders (Bastiaansen, Koot, & Ferdinand, 2005). Sawyer and colleagues (Sawyer et al., 2002) suggested multiple distinctions between QoL and psychosocial functioning as measured by CGAS. First, psychosocial functioning is assessed by clinicians, and is therefore an objective deviation from the mean. QoL is assessed by the child or the child's parent, and represents a subjective deviation from the child's own experiences. Second, psychosocial functioning is integrated with the illness, while QoL provides a broader, multidimensional assessment of the impact of the illness. Further, it has been indicated that a child's view is important in understanding treatment goals (Eiser & Morse, 2001).

The QoL concept focuses on subjective feelings, and physical and mental health providers are increasingly regarding QoL as one of the main aspects of health (WHOQOL, 1995). The WHO QoL group's definition of QoL from 1995 is "the individual's subjective perception of their position in life, in the context of culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns" (WHOQOL, 1995).

Important domains of well-being during adolescence may include how they feel about managing school, how they feel together with their family, how they get along with friends, how they feel when they are by themselves, and what they feel about their physical and mental health (Jozefiak, 2012).

We have indicated that QoL describes an individual's subjective perception of their well-being in several domains, and thus, self-reported outcome seems essential (Matza, Swensen, Flood, Secnik, & Leidy, 2004). In addition to addressing feelings in aspects of situations that are best answered by self-reports, adolescents are allowed to express their opinions and take a more active role in their assessment and treatment in a clinical setting. However, QoL instruments should use language and contexts that are understandable and relevant to the age groups questioned (Matza et al., 2004).

A large body of research based on parent reports has documented reduced QoL among children with ADHD. Although less studied among patients with ADHD, children's self-reports of QoL are closer to the norm (Danckaerts et al., 2010). On the other hand, a recent study found that children with ADHD aged 8-12 agreed with their parents that their QoL was significantly lower than that of healthy controls (Marques et al., 2013).

A large European study found that parent-reported QoL outcomes for adolescents with ADHD were negatively associated with emotional and conduct problems, problems with peers, physical health problems, coordination problems, and maternal and paternal mental health problems (Riley et al., 2006). Another study, which included self-reports, found worse QoL among adolescents with ADHD and conduct problems (Becker, Roessner, Breuer, Dopfner, & Rothenberger, 2011). Treatment studies of children with ADHD reveal inconsistent findings of improved QoL over time (Danckaerts et al., 2010).

Treatment

Psychostimulants treats the dysregulation of attention, cognitive control and emotion, and multiple studies have documented a positive effect of medical treatment on core symptoms,

psychosocial functioning and QoL (Fridman, Hodgkins, Kahle, & Erder, 2015; Hodgkins, Shaw, Coghill, & Hechtman, 2012; Savill et al., 2015). Nevertheless, although findings are in need of replication, medical treatment may be limited by a low ratio of normalization (Banaschewski et al., 2006), long-term effectiveness is yet to be determined (van de Loo-Neus, Rommelse, & Buitelaar, 2011), and adverse effects on sleep, appetite and growth are common, although rarely serious (Graham et al., 2011). Sonuga-Barke and colleagues (Sonuga-Barke et al., 2013) focused exclusively on ADHD outcomes in a recent meta-analysis, using more stringent entry criteria than other recent studies. Thus, the more peripheral outcomes usually considered important for patients with ADHD were not considered in this meta-analysis. When analyses were restricted to trials with blinded assessments, the standardized mean differences for all psychological interventions dropped to non-significant levels (Sonuga-Barke et al., 2013). Behavioral interventions improved parenting and decreased children's coexisting conduct problems, and children's academic performance and social skills improved (nonblinded ratings) (Daley et al., 2014). Another study found that the evidence was somewhat stronger for the benefits of cognitive training as supplementary rather than a frontline ADHD treatment in reducing neuropsychological impairment (Cortese et al., 2015). There were improvements on objective tests of both visual and verbal working memory, although there were no effects on inhibition or inattention, and adolescents were included. Neurofeedback has been shown to specifically improve attention (Arns, de Ridder, Strehl, Breteler, & Coenen, 2009), although effect sizes were lower than those found in medical trials. Notably, most of the studies assessed included children below the age of 13 (Daley et al., 2014; Sonuga-Barke et al., 2013).

Factors related to outcomes

Examining relationships gives us insight into the ways in which factors combine to moderate the influence of one another. When referring to beneficial outcomes under high-risk circumstances, the second factor is called protective, and when referring to negative outcomes it is called a risk factor (Michael Rutter, 2008). ADHD symptoms in childhood have been found to be related to functional impairment in adulthood, including adults who had ADHD symptoms below the level of diagnostic criteria (Mannuzza et al., 2011). ADHD has been associated with working disability at surprisingly high levels in multiple Norwegian studies, which indicates the severity of the disease in terms of functional impairment (Gjervan,

Torgersen, Nordahl, & Rasmussen, 2012; Halmoy, Fasmer, Gillberg, & Haavik, 2009; Torgersen, Krokstad, & Vaaler, 2014). ADHD and psychosocial impairment in childhood were associated with working disability in adulthood, while emotional and conduct disorders in childhood were not significantly associated with working disability (Mordre, Groholt, Sandstad, & Myhre, 2012). The continued presence of impairment into adulthood is not surprising given that ADHD is a persistent disorder. However, the impairment could be explained by factors that are critical for functioning, and could potentially be treated. Key features of the developmental progression of ADHD have been indicated, and predictors of school age and long-term outcome were symptom severity, cognitive function, and family factors in preschool years (Cherkasova, Sulla, Dalena, Ponde, & Hechtman, 2013). Comorbidity also emerged as a long-term predictor at school age (Cherkasova et al., 2013). Higher IQ has been shown to have a compensatory role among children with ADHD (Costello & Maughan, 2015). Comorbid conduct disorder and substance use disorder increased the mortality rates of children, adolescents and adults with ADHD (Dalsgaard et al., 2015). Children with ADHD and comorbid conduct disorder (Mordre et al., 2012), as well as emotional problems (Halmoy et al., 2009) were at higher risk of working disability than children with ADHD alone. Furthermore, peer rejection of children with ADHD was associated with delinquency, smoking, anxiety and global impairment from childhood to adolescence (Mrug et al., 2012). On the other hand, recent research showed that stimulant therapy during childhood was a predictor of being employed as an adult, independent from comorbidity and current treatment (Gjervan et al., 2012; Halmoy et al., 2009). It has been indicated that the relationship between ADHD symptoms and occupational outcome is mediated by task-related performance and social functioning (Gjervan, Hjemdal, & Nordahl, 2013). More knowledge of protective factors in adolescents with ADHD is called for (Modesto-Lowe, Yelunina, & Hanjan, 2011).

Resilience and protective factors

The original meaning of the English word *resilience* is "to bounce or spring back" (Simpson, 2005). In a social context, this could refer to the ability of a person to "bounce back" after facing adversity. Smith and colleagues (Smith, 2013) referred to resilience as resistance to illness and the ability to adapt positively. Resilience has also been referred to as a stable coping style, adaptation, or response to stress (Luthar, Cicchetti, & Becker, 2000). Rutter

(Rutter, 2008) used the term resilience to refer only to persons who adapted well to high levels of environmental adversity. IQ is one of the individual competencies that has been found to predict outcomes in individuals with ADHD. As expected, a higher IQ predicts a better educational outcome (Barkley, Murphy, & Fischer, 2008), although findings indicate that lower IQ may also predict antisocial behavior, poorer occupational functioning and substance use (Weiss, 1993). In previous research, measures of resilience have not specifically described the ability to "bounce back," but rather have incorporated protective factors that are thought to promote resilience (Friborg, Hjemdal, Rosenvinge, & Martinussen, 2003). Protective factors include both individual and environmental factors, and can be measured (von Soest, Mossige, Stefansen, & Hjemdal, 2010). These factors lessen child maladjustment after life events (Rutter, 2000). Individual competencies include self-esteem, structured style and social competence. Self-esteem includes self-belief and self-efficacy, addressing belief in one's self and belief in one's capability to organize and execute tasks, respectively. Structured style relates to executive functioning skills such as planning, organization, and goal orientation. Environmental factors include social resources and family cohesion. Social resources address social support, such as having supportive friends, neighbors or teachers.

Family cohesion/functioning. The evaluation of family functioning often focuses on the different types of interactions among family members in a number of areas, including the rules of behavior, family members' roles, and affective concerns within the family (Epstein, 1983). There are several instruments that measure related aspects of family processes, including cohesion, parenting, general functioning and family conflicts. Poor family functioning may indicate problems caused by the child's symptoms (Cussen, Sciberras, Ukoumunne, & Efron, 2012). ADHD affects children's functioning in all areas not only because of ADHD core symptoms, but also because of secondary problems associated with an ADHD diagnosis, such as problems with self-esteem or behavior. However, it is important to also consider parental factors (Faraone, Kunwar, Adamson, & Biederman, 2009). A recent review explored studies assessing parental factors and ADHD outcomes, and suggested that parental psychopathology and family conflicts are associated with oppositional and conduct problems, rather than ADHD symptoms (Deault, 2010).

An association between early parenting and development of emotional symptoms in 6-15-year-olds with ADHD has been found (Park et al., 2014). Thus, studies indicate that poor

family functioning is a risk factor for comorbidity among ADHD patients. In addition, research indicates that better family functioning might be a protector from poor outcomes. The influence of positive foster care on improvement in ADHD symptomatology in children was mediated by higher levels family cohesion (Crea, Chan, & Barth, 2013). Parental support was associated with QoL among college students with ADHD (Grenwald-Mayes, 2002; Wilmshurst, Peele, & Wilmshurst, 2011). Furthermore, positive development of executive functions, social competence, and peer outcomes has been associated with higher levels of family cohesion, family functioning and/or parent-child attachment during childhood (Crea et al., 2013; Hurt, Hoza, & Pelham, 2007). Research indicates that parental training may have a positive effect on ADHD behavior (Zwi, Jones, Thorgaard, York, & Dennis, 2011), and therefore assessments of family processes are important in the clinical practice. There is a gap in the assessment of self-perceptions of family functioning in adolescents with ADHD and coexisting emotional problems (Deault, 2010).

Social resources. Social resources are related to the level of social support outside the family, and include characteristics of the neighborhood and school, and the availability of social support and positive role models (von Soest, Mossige, Stefansen, Hjemdal, 2010). Such resources include encouragement, cohesion, support, help and the feeling of being appreciated by others, which have been shown to be positively related to adolescent resilience (Olsson, Bond, Burns, Vella-Brodrick, & Sawyer, 2003). Negative interactions between children with ADHD and other children occur so often that the child with ADHD is rejected by their peer group (Hodgens, Cole, & Boldizar, 2000). Ostrander and colleagues (2006) found that others' reports of social competence had a direct relationship on depression in both older and younger children with ADHD. Furthermore, coexisting conduct problems have been shown to worsen relationships with peers in Norwegian school-aged children (Paap et al., 2013), while Mrug and colleagues (2012) found that peer rejection in childhood made independent contributions to the assessment of poor global functioning in adolescence. Further knowledge of the significance of social resources compared with individual competencies and family cohesion for the outcome of adolescents with ADHD is needed.

Self-esteem. Self-esteem is an important cognition about the self. Self-esteem is the feeling of being valued by, and valuable to, other people, while self-efficacy is a belief in one's capability to accomplish tasks. A twin study of adolescents indicated a heritability of self-esteem of 30–60% (Kamakura, Ando, & Ono, 2007). Stability in self-esteem was due to

genetic and non-shared environmental effects (i.e., an environment unique to individuals within the family), whereas change in self-esteem was explained by non-shared environmental influences (Kamakura et al., 2007). Individuals at risk with better self-efficacy have been shown to adapt better to past and present life events (Buckner, Mezzacappa, & Beardslee, 2009). Children with ADHD are functionally impaired because of inattention, impulsivity and hyperactivity that mat lead to failure in some settings (e.g., social and academic settings). Although many of their cognitive functions might be good, they often grow up with negative messages about their abilities and may experience failure in performing tasks throughout their childhood (Young, Bramham, Gray, & Rose, 2008). A recent review indicates that ADHD is associated with lower self-esteem in adulthood compared with comparison groups (Cook, Knight, Hume, & Qureshi, 2014). On the other hand, Hoza and colleagues found that self-esteem reports of children with ADHD were similar to those of healthy controls (Hoza 1993, McQuade, 2011). This phenomenon is called "positive illusory bias." Moreover, when children's self-reports were compared with reports of teachers or parents, children with ADHD tended to overestimate their own competence in various areas, despite actual histories of marked failures in numerous domains reported by significant others (Hoza 2012). Children with ADHD and coexisting conduct problems were found to overestimate competencies, while those with coexisting emotional problems have been shown to attenuate this tendency (Hoza 2002). Intervention studies of adults with ADHD indicate improvement in self-esteem, although further studies are recommended (Bramham et al., 2009; Stevenson, Whitmont, Bornholt, Livesey, & Stevenson, 2002). More knowledge about self-esteem as a protective factor for adolescents with ADHD is needed.

Structured style. Structured style relates to the parts of executive function skills that are complex higher order cognitive processes and are responsible for self-regulation, decision-making, and goal-directed behaviors. Executive functions are higher-level cognitive operations that encompass prolonged, planned, goal-directed behaviors by resisting distractions and inhibiting inappropriate responses (Friedman et al., 2006). Executive functions have been shown to predict global functioning among girls independent of IQ (Miller & Hinshaw, 2010). It has been shown that promotion of inhibitory control, emotion regulation and planning skills in children decreased internalizing and externalizing problems, and increased social and emotional competence (Greenberg, 2006). A substantial proportion of ADHD patients have executive function deficits (Nigg, Willcutt, Doyle, & Sonuga-Barke, 2005; Roberts, Martel, & Nigg, 2013), which have been shown to be heterogeneous (Lambek

et al., 2011). A recent study suggested that planning and working memory skills predicted the presence of internalizing comorbidity, and that these skills together with ADHD combined type were additive in predicting adolescent psychopathology (Rinsky & Hinshaw, 2011). Executive function impairment may persist into young adulthood (Biederman et al., 2009) and may be associated with poor behavioral and social outcomes independent of the course of the ADHD (Biederman et al., 2006). The role of structured style in outcomes among adolescents with ADHD requires further exploration.

Social competence. Social competence has been defined as the possession of skills and behaviors that allow for successful interaction in social situations (Vaughn et al., 2009), and has been measured by such constructs as social adeptness, ability to initiate activities and flexibility in social matters. Social incompetence is a serious condition, as it is an important predictor of poor long-term outcomes in adolescence (Greene, Biederman, Faraone, Sienna, & Garcia-Jetton, 1997). The social competence of children with ADHD might be affected by their ADHD symptoms. Hyperactivity and impulsivity might seem aggressive to peers, and restless and intrusive behavior that is inappropriate in the given context and resistant to correction may interrupt other children's play (Barkley, 1997). Inattention manifests itself in poor listening abilities, being distracted and having trouble switching roles (Landau & Milich, 1988). Thus, social incompetence might be part of the diagnostic criteria.

ADHD and social difficulties in childhood predict an increased risk of depression and anxiety in early adolescence (Greene et al., 1997; McQuade et al., 2014; Mikami & Hinshaw, 2006; Roy, Hartman, Veenstra, & Oldehinkel, 2014). Girls, but not boys, with low peer status in childhood had an increased risk of anxiety and/or depression disorders in adulthood (Modin, Ostberg, & Almquist, 2011). A better understanding of the possible protective role of social competence among adolescents with ADHD in a longitudinal study is called for (Becker, Luebbe, & Langberg, 2012; Nijmeijer et al., 2008).

Contributions of this thesis

ADHD is a common, highly impairing and strongly heritable neurodevelopmental disorder that originates in childhood and persists into adulthood. As described above, serious social, familial and academic consequences, and increased risk of comorbid conditions, unemployment, delinquency and accidental death are associated with ADHD; thus, the need

for effective treatment is pressing (Hinshaw, Scheffler, RM, 2014). Despite a growing body of literature, more knowledge is needed about risk- and protective factors that are important in terms of outcomes among adolescents with ADHD (Hinshaw et al., 2015). Furthermore, Costello and Maughan (Costello & Maughan, 2015) recently indicated that psychosocial factors have received little attention as predictors of persistence and remission in ADHD. The associations between coexisting emotional and conduct problems and family functioning and QoL among children with ADHD have mainly been assessed by parent reports (Danckaerts et al., 2010; Deault, 2010; Hinshaw et al., 2000). We wanted to extend our knowledge of these associations by assessing self-reports. Further, only a few studies in a recent review have assessed adolescents' perceptions of family functioning, as most studies have focused on parent reports of children under the age of 11 (Deault, 2010).

Previous research has focused on direct relationships between psychopathology and QoL (Danckaerts et al., 2010; Riley et al., 2006). However, it is still unclear whether protective factors mediate and/or moderate the relationship between coexisting emotional and conduct problems and QoL, including in individuals receiving psychopharmacological treatment. Therefore, this topic was further investigated in the present thesis. Protective factors that attenuate the risk of coexisting emotional and conduct problems may be one of the major treatments goals for children and adolescents with ADHD. Self-esteem may play an important role for children with ADHD, as they repeatedly experience failure and negative messages from their surroundings (Young et al., 2008). The predictive roles of high self-esteem, structured style and social competence in adolescents with ADHD for outcomes in emerging adulthood needs further exploration, and are addressed in this thesis. Executive functions are known to persist into emerging adulthood (Biederman et al., 2009), although the role of the structured style of adolescents with ADHD in outcomes in emerging adulthood is still somewhat unclear. Furthermore, according to a recent review, few studies have specifically assessed whether social competence is related to anxiety and depression in young adults with ADHD (Becker et al., 2012), and whether this relationship might be stronger for girls than for boys during adolescence (Becker, McBurnett, Hinshaw, & Pfiffner, 2013).

Aims of the study

The overall aim of the thesis was to assess factors that may be of importance in achieving better outcomes for adolescents with ADHD. Relationships assessed in this thesis are illustrated in Figure 2.

Study 1: By applying a categorical approach, we divided the ADHD group according to emotional and conduct problems. We aimed to investigate whether the level of coexisting emotional and conduct problems had an impact on family functioning and QoL according to adolescent self-report. We used parent reports as a comparison group.

Study 2: We aimed to assess the mediating and moderating effects of individual competencies, family cohesion and social resources on the relationship between coexisting emotional and conduct problems and QoL. We hypothesized that the direct effect between emotional and conduct problems and QoL would be mediated by individual competencies, family cohesion and social resources; implying that better protective factors attenuated the negative effect of risk factors on QoL. Our second hypothesis was that adolescents receiving medication would have fewer emotional and conduct problems and better QoL in the sample. Our third hypothesis was that protective factors would moderate the effect of coexisting problems and ADHD symptom level on QoL.

Study 3: Using a longitudinal study, we investigated whether self-esteem, structured style and social competence were predictors of a more favorable outcome, with better psychosocial functioning, and less anxiety and depression three years later. We hypothesized that: (1) Better self-esteem among adolescents with ADHD would predict better psychosocial functioning, and less depression and anxiety three years later; (2) A more structured style among adolescents with ADHD would predict better psychosocial functioning and fewer ADHD symptoms and less depression and anxiety three years later; (3) Better social competence among adolescents with ADHD would predict better psychosocial functioning, and less depression and anxiety three years later; and (4) The relationship between protective factors and depression, anxiety and psychosocial functioning three years later would be stronger for girls than for boys.
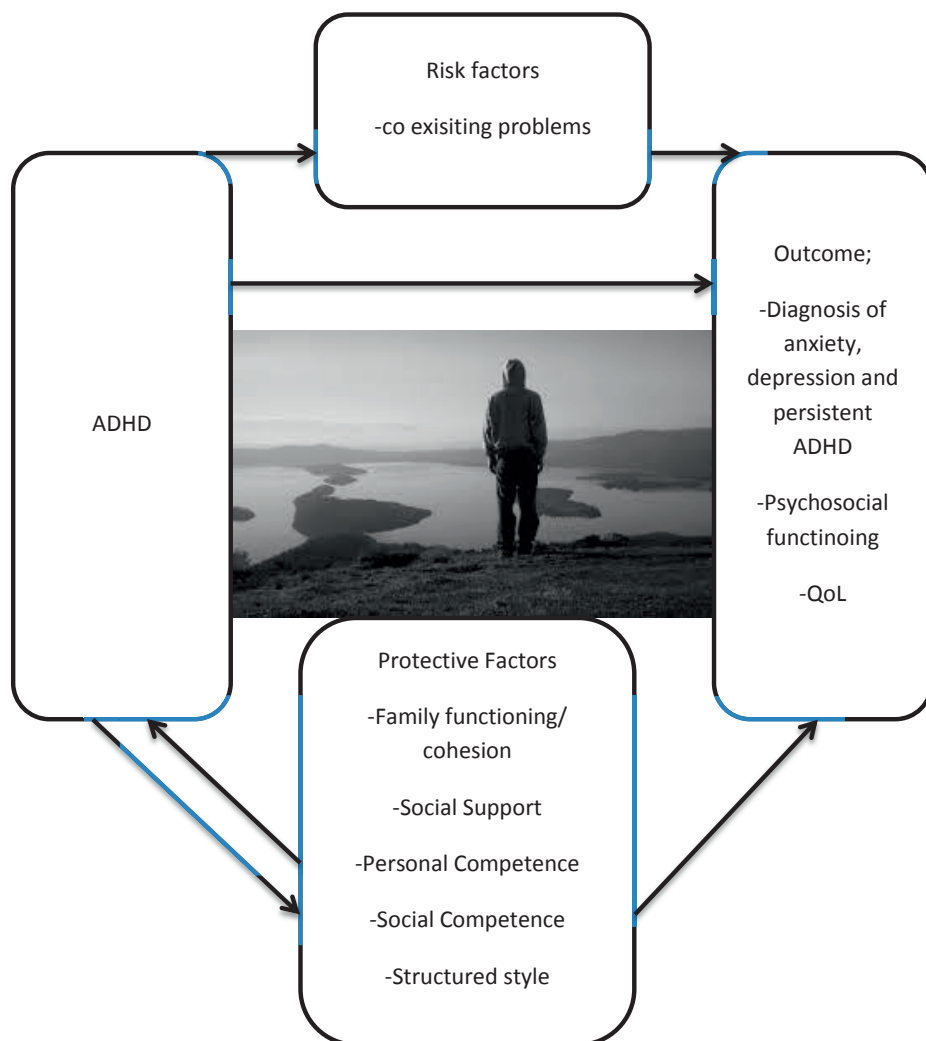
Figure 2. Illustration of relationships between concepts assessed in this thesis.

Method

Design of the clinical sample

The study was part of The Health Survey in the Department of Child and Adolescent Psychiatry (CAP) at St- Olav's University Hospital in Norway. The baseline study was of a defined clinical population. The catchment area is a county in Norway with 303,664 inhabitants, and includes urban and rural areas. The Department of CAP at the University Hospital covers all inhabitants in the county. Inclusion criteria were: referred adolescents, aged 13-18 years, who had at least one personal attendance at the clinic between 15 February, 2009 and 15February, 2011. Exclusion criteria were: major difficulties in answering the questionnaire due to their psychiatric state, cognitive function, visual impairments or lack of sufficient language skills. Emergency patients were invited to take part once they entered a stable phase.

During the study period, 2,032 adolescent patients had at least one attendance at the CAP clinic. Of these, 289 were excluded on the basis of the exclusion criteria. Additionally, 95 were lost in the registration process (i.e., missing). Hence, 1,648 (81.1%) were eligible and were invited to participate. Of these, a total of 717 (43.5%) participated in the CAP survey baseline: 393 girls (54.8%) and 324 boys (45.2%). The sample was re-examined after three years. Of the 684 who had consented to be invited for follow-up, 575 (84.1%) participated and 550 (80.4%) took part in the diagnostic interview (Figure 3).

To explore the representativeness of the study sample, anonymous information about the reference population was collected from the 2009-2011annual reports from St. Olav's University Hospital. All adolescents in the study period ($n = 2,032$) minus those excluded ($n = 289$) were defined as the reference population ($n = 1,743$). In accordance with the permission given by the Norwegian Social Science Data Services, the data protection official for research, we compared age, sex, and the main reason for referral between participants ($n = 717$) and non-participants ($n = 1,026$) in the reference population. Participants were 0.27 years (95% CI [0.10, 0.45]) older than non-participants, ($M = 15.66$, $SD = 1.65$) vs. ($M = 15.39$, $SD = 1.95$, $p < 0.001$). There were more girls in the study group than in the non-participating group: ($n = 393$; 54.8%) vs. ($n = 509$; 49.6%, $p = 0.032$). The main reason for referral did not

differ between participants and non-participants (data not shown, Pearson Exact Chi-Square test; $p = 0.11$).

Procedure at baseline

Newly referred patients and patients already enrolled at the CAP clinic received verbal and written invitations to participate in the study at their first attendance after the project commenced. Written informed consent was obtained from adolescents and parents prior to inclusion, in accordance with the CAP survey procedures. The participating adolescents responded to an electronic questionnaire and data were collected from clinical charts. Parents also responded to a questionnaire.

Procedure at follow-up

Diagnoses were based on telephone interviews with the participants. The interviewers were blind to the participants' baseline assessment. They had a graduate degree in medicine or psychology, and were experienced in child and adolescent psychiatric assessment. The interviewers were extensively trained and supervised, and a blinded experienced child and adolescent psychiatrist, supervised them throughout the study. The inter-rater reliability measure was designed as follows: Seven of the interviewers were used as second opinion raters of audiotaped telephone interviews. Each of the seven interviewers re-scored four interviews performed by four of the other six interviewers. Hence, the number of re-scored patients was $7 \times 4 = 28$. We excluded bipolar disorder from the analysis, as the agreement for bipolar disorder was very poor. The median Cohen's kappa coefficient was 0.786, which is regarded as very good agreement. Kappa coefficients for individual diagnoses were; ADHD $= 0.825$, depression $= 1.000$ and anxiety $= 0.435$. The variance between the raters for the Children's Global Assessment Scale (CGAS) scores was not statistically significant (Likelihood ratio test p $= 0.19$).

Participants

Of the 717 participants in the baseline CAP survey, 243 adolescents were diagnosed with ADHD, of whom 104 were female. Of the ADHD patients from the baseline survey, 190 took part in the diagnostic interview (78.5%), of whom 79 were female (Figure 3).

Sociodemographics

In the first study, the ADHD group was subdivided into four groups according to coexisting problems. Using the Strengths and Difficulties Questionnaire (SDQ), adolescents with ADHD were divided into subgroups according to emotional problems, conduct problems, both, or none. All other diagnostic groups and undiagnosed cases were excluded ($n = 455$). Adolescents diagnosed with autism spectrum disorders (ASD) and co-occurring ADHD were excluded because of the dominant features of autism ($n = 19$). ADHD patients with a missing SDQ questionnaire ($n = 49$) were also excluded from the first study. The second and third studies used a dimensional design, and thus all participants with ADHD were included. The third study used the follow-up data, which included 190 participants with ADHD.

Participants completed a demographic form with information about age, sex and gender.

Baseline Measures

Clinical diagnosis

Diagnoses were collected from clinical charts at baseline and followed ICD-10 multi-axial diagnostic system (i.e., axes I- VI) (WHO, 1992). All diagnoses were made by a clinical psychologist or a child and adolescent psychiatrist based on all clinical information. The CAP clinic's standardized procedure for the assessment and diagnosis of hyperkinetic disorders is based on the National Guideline for Assessment and Treatment of ADHD (Norwegian Directorate of Health, 2007). This guideline, similar to other established ADHD guidelines (Subcommittee on Attention-Deficit/Hyperactivity Disorder, 2011), requires a clinical diagnostic interview based on the ADHD symptoms described in the ICD-10, and possible coexisting disorders, and a somatic assessment. It recommends the use of questionnaires filled

out by the adolescent, their parent, and a teacher to obtain an ADHD symptom score (ADHD rating scale). The ICD-10 diagnosis of hyperkinetic disorder is referred to as ADHD in this study. The diagnostic criteria for hyperkinetic disorder are nearly identical to the DSM-IV-TR criteria for ADHD combined; however, specifiers such as mainly attention problems or mainly hyperactivity/impulsivity problems are not used in the ICD-10. The Norwegian Health Authorities permit the use of *DSM-IV* criteria for ADHD, and patients who fulfill the criteria for one of the ADHD subtypes may be diagnosed with one of the categories within the ICD-10 hyperkinetic disorders.

Strengths and Difficulties Questionnaire (SDQ)

Emotional and conduct problems were measured using the Norwegian version (Van Roy, Groholt, Heyerdahl, & Clench-Aas, 2006) of the SDQ (Goodman, 1997). The clinical and research instrument contains 25 items for both self-report and parent report, addressing behavioral problems, emotional problems, aggressive behavior and inattention problems. (Goodman, 1997). The SDQ adolescent self-report exhibited satisfactory construct validity and internal consistency in a study performed by the original author; the Cronbach alphas of the self-report were as follows: total difficulties, 0.80; emotional problems, 0.66; conduct problems, 0.60; and hyperactivity/inattention, 0.67 (Goodman, 2001). Another study performed by the same authors divided the sample according to the following age groups: 10–13 (preadolescent), 13–16 (early adolescent), and 16–19 (late adolescent) years. The early and late adolescent groups had the following Cronbach alphas, respectively: emotional problems, .71 and .70; conduct problems, .59 and .54; and hyperactivity, .65 and .66 (Van Roy, Veenstra, & Clench-Aas, 2008). Our first study used the Norwegian cut-off points of borderline level (80th percentile) for subscale scores according to self-report (Van Roy et al., 2006). Thus, the ADHD group was divided into four groups according to emotional and conduct problems: ADHD without self-reported emotional or conduct problems (ADHD Only), ADHD with emotional problems (ADHD+EMO), ADHD with conduct problems (ADHD+CD), and ADHD with both emotional and conduct problems (ADHD+EMO+CD). The second and third studies used a dimensional approach.

General Functioning Scale (GFS)

Family functioning was measured using the GFS from the Norwegian version (Reigstad, Jorgensen, Sund, & Wichstrom, 2010) of the McMaster Family Assessment Device (FAD; (Epstein, 1983). The 12-item parent proxy report and self-report inventories measure family functioning in several different areas on rating scales (1-4), yielding an overall family functioning score of 12-48 (Epstein, 1983). Unhealthy functioning is indicated by scores of 24 or higher (Ryan C. E., 2005). The reliability of the GFS is good, with a Cronbach's alpha of 0.92 (Epstein, 1983). The construct validity of the GFS was supported in a large epidemiological study (Byles, Byrne, Boyle, & Offord, 1988).

Inventory of Life quality of Children and adolescents (ILC)

QoL was measured using the Norwegian version (Jozefiak, 2012) of the ILC (Jozefiak et al., 2008; Mattejat F., 2006). The seven-item parent proxy report and self-report inventories include one item for global evaluation of QoL and six items addressing the child's physical and mental health, perception of activities when the child is alone, perceived relationships with friends and family, and functioning in school. The ILC yields a score on a 0-100 scale (0 = Very low QoL, 100 = Very high QoL). Reliability testing of the Norwegian version indicates satisfactory internal consistency (Chronbach's α for parents report: 0.78; adolescent report: 0.80-0.81) and a two-week test-retest reliability of 0.86. Construct validity is also satisfactory (Jozefiak T., 2012).

Resilience scale for adolescents (READ)

Protective factors were measured by a 23-item self-report questionnaire using a five-point Likert scale, with higher scores reflecting lower degrees of resilience. The construct and convergent validity was assessed and the original 28-item questionnaire was modified by taking into account results from a factor analysis, which yielded acceptable psychometric properties (von Soest et al., 2010). The READ is based on the Resilience Scale for Adults (Friborg et al., 2003), and consists of the same five subscales: (1) self-esteem, (2) social competence, (3) structured style, (4) family cohesion, and (5) social resources. The present study used the three dimensions assessing individual characteristics: (1) self-esteem measured self-esteem, self-efficacy, self-liking, hope and determination and a realistic orientation to

life; (2) structured style measured the ability to uphold daily routines and to plan and organize; and (3) social competence measured extraversion, social adeptness, humor, good communication skills and flexibility in social matters.

ADHD Rating Scale IV (ADHD-RS)

ADHD symptoms were measured using the ADHD-RS parent version (Dupaul, 1998). The instrument contains 18 items based on the DSM-IV criteria addressing ADHD symptoms. The items are measured on a five-point scale where higher scores reflect higher frequencies of symptoms. The scale is organized into two sections, each with its own sum score. One reflects symptoms of inattention, while the other reflects hyperactivity and impulsivity.

Follow-up measures

Kiddie Schedule for Affective Disorders and Schizophrenia (Present and Lifetime version) (K-SADS-PL)

The KSADS-PL (Kaufman et al., 1997) (Translated to Norwegian by Sund, NTNU, Trondheim) is a well-established, semi-structured diagnostic interview designed to assess present and past episodes of psychopathology among children and adolescents on Axis I of the DSM-IV-TR. Diagnoses were based on interviews with the participants. Diagnoses of depression included major depressive episodes, dysthymia and depression INA at present and during the last three years. Diagnoses of anxiety included panic disorder, separation anxiety, specific phobia, social phobia, agoraphobia, general anxiety and anxiety disorder INA at present and during the last three years. Diagnoses of ADHD included ADHD inattentive and hyperactive/impulsive type and ADHD INA. Young adults currently taking medication prescribed for ADHD were classified with a diagnosis of ADHD regardless of whether they fulfilled symptom criteria.

Children's Global Assessment Scale (CGAS)

As a measure of overall functioning, we used the CGAS (Shaffer et al., 1983; Schorre & Vandvik, 2004), a summary score assigned by the interviewers based on information gathered during the diagnostic structured interview. The instrument yields a score on a 1-100 scale, in

which 1 indicates the most severely disordered child and 100 indicates the superior functioning in all areas (at home, in school and with friends). Scores above 70 indicate normal functioning (Bird et al., 1990). The CGAS has been validated against many different psychiatric assessment scales (Winters, Collett, & Myers, 2005), and has been shown to distinguish cases from noncases (Bird et al., 1990).
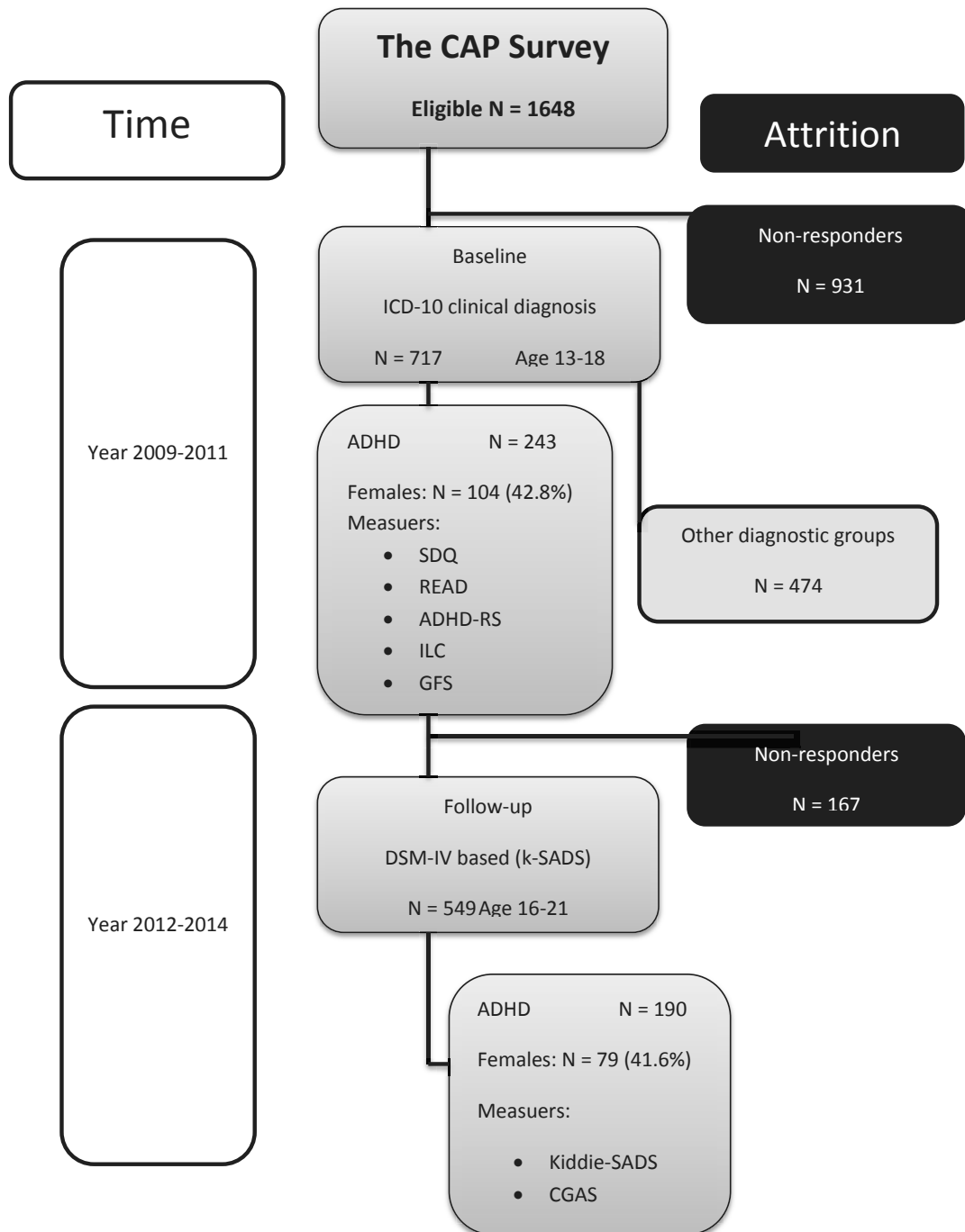
Figure 3. Flow-chart of sample.

Ethics

Written informed consent was obtained from adolescents and their parents prior to inclusion, in accordance with the study procedures in the CAP survey. Study approval was given by the Regional Committees for Medical and Health Research Ethics (Reference No. CAP survey: 4.2008.1393, present study Reference No.: 2011/1772, and by the Norwegian Social Science Data Services (Reference No. CAP survey: 19976).

Statistics

Statistical analyses were conducted using SPSS versions 18-20 and Mplus version 7 (Muthén, 1998-2012). Two-sided p-value tests with $p < 0.05$ were taken to indicate statistical significance. Where relevant, 95% confidence intervals (Cis) were reported. Adjustment for SES in the cases with SES data on (145 cases out of 194) gave substantially similar results (results not shown). Therefore, SES was excluded from the analyses to maintain the sample size and hence statistical power.

In paper 1, differences between the means of the four ADHD groups divided according to coexisting emotional and conduct problems were examined by one-way analysis of variance (ANOVA) and by analysis of covariance (ANCOVA) to adjust for age and gender. Post hoc tests were carried out according to the Sidak procedure.

In paper 2 we used a SEM analyses to assess whether protective factors were mediating factors in the association between coexisting emotional and conduct problems and QoL. In addition, we tested for interactions. The following indexes were used to assess the goodness of fit of the models (Raykov, 2006): the chi-squared test, the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the root mean square error of approximation (RMSEA). For CFI and TFI, values above 0.95 are considered indicators of good fit; for RMSEA, values below 0.06 are considered indicators of good fit (Yu, 2002).

In paper 3, binary regression was used to calculate the odds of being diagnosed with ADHD, depression or anxiety disorder at the three-year follow-up assessment depending on protective factors.

Linear regression analysis was used to assess the association between ADHD at baseline and psychosocial functioning at the 3-year follow-up assessment. To include the effects of protective factors and to control for potential confounders, adolescent age, gender, level of

ADHD symptoms at baseline (ADHD-RS) and protective factors were included separately in the regression analyses.

Descriptions of how we handled missing data are given in each paper.

Results

The overall results from the three studies indicate a good QoL among adolescents with ADHD without additional emotional and conduct problems, and declining QoL when problems co-occurred. Adolescents self-reported worse family functioning when problems co-occurred, while parents reported the same level of family functioning despite coexisting problems. Protective factors had mediating effects on the link between coexisting problems and QoL, and personal distributions, which may be especially important during adolescence, were investigated further. In a longitudinal perspective, better self-esteem, structured style and social competence indicated better outcomes. Descriptive data of sample 1 and 2, and 3 are presented in Tables 1 and 2, respectively.

Table 1. Descriptive data of the sample of study 1 and 2; 194 adolescents with ADHD

	Mean (SD)	N (%)
Age	15.48 (1.71)	
SES	4.78 (1.82)	
SDQ Emotional problem scale	4.23 (2.76)	
SDQ Conduct problem scale	3.01 (1.88)	
SDQ hyperactive/ inattention scale	6.29 (2.15)	
ADHD-RS Inattention scale	18.73 (5.67)	
ADHD-RS Hyperactivity/ impulsivity scale	12.90 (7.11)	
ADHD-RS Total Scale	31.62 (10.42)	
Medicated		148 (76.3)

Note. SES: Highest educational level of parents.
SDQ: Strength and Difficulties Questionnaire.
ADHD-RS: ADHD rating scale

Summary of papers

Study 1

The impact of coexisting emotional and conduct problems on family functioning and quality of life among adolescents with ADHD

Family functioning among adolescents with ADHD Only was significantly better than for adolescents with ADHD+EMO+COND and ADHD+COND (Figure 4). Adolescents with ADHD+EMO reported significantly better family functioning than adolescents with ADHD+EMO+COND. Adolescents with ADHD+EMO+COND reported significantly lower QoL than all the other ADHD groups after adjusting for age and gender (Figure 5).

Parents reported no significant differences in family functioning between the groups in either the unadjusted or the adjusted analysis (Figure 4). They reported lower QoL for adolescents with ADHD+EMO+CD than for the ADHD Only group (Figure 5).

A paired t-test showed that compared to parents, adolescents with ADHD and additional problems reported significantly worse family functioning than their parents (Figure 4). Adolescents from the ADHD Only group reported significantly better QoL than their parents, while parents and adolescents from all ADHD groups with additional problems reported similar levels of QoL (Figure 5).
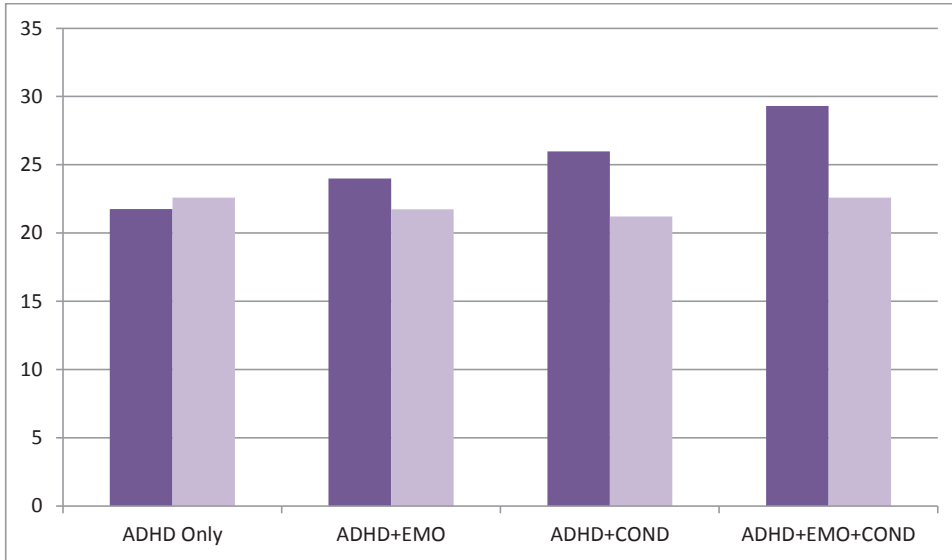
Figure 4. Family functioning (GFS) of adolescents with ADHD. Dark shading represents self-reports. Bright shading represents parent-reports.
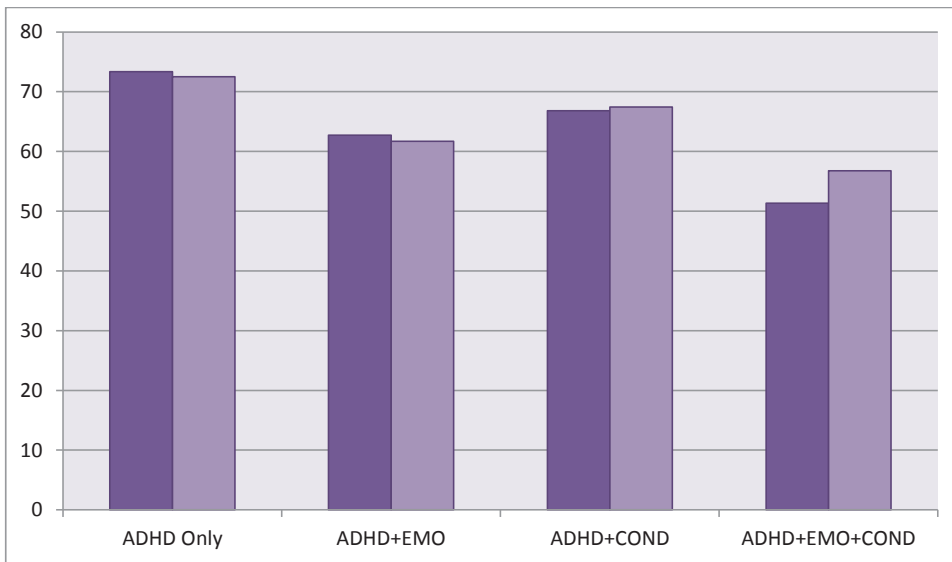
Figure 5. QoL of adolescents with ADHD. Dark shading represents self-reports. Bright shading represents parent-reports.

Study 2

Improved Quality of Life among adolescents with ADHD is mediated by protective factors
A model analyzing the direct effect of coexisting problems on QoL was used (see Figure 6).

In this model, more emotional problems, more conduct Problems and increasing age

decreased QoL.

Note. * p < .05, ** p < .01, *** p < .001. SDQ – Strength and Difficulties Questionnaire
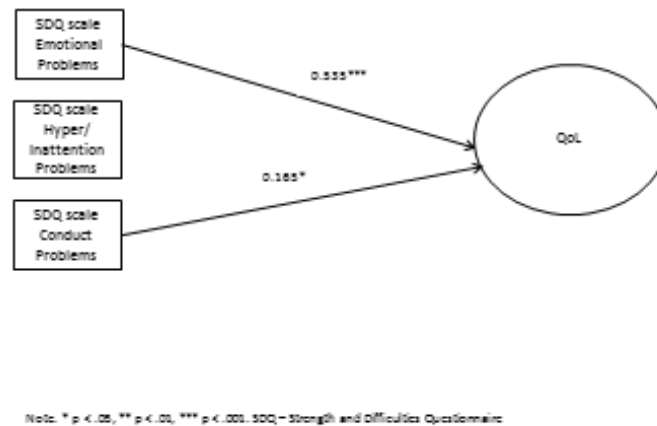
Figure 6. Path model with standardized estimates for direct effects without protective factors,

adjusted for age and gender.

The final path model, also including indirect effects of protective factors and

medicated/unmedicated adolescents, is shown in Figure 7. Emotional problems were

mediated by individual competencies; thus, the direct effect on QoL was reduced, although

still significant, in the final path model. Likewise, conduct problems was mediated by social

resources, thus diminishing the direct effect on QoL.

More conduct problems were associated with lower family cohesion, social resources and not

receiving psychopharmacological treatment. More emotional problems were associated with

lower Individual Competencies, Family Cohesion, and Social Resources. Lower Individual

Competencies and Social Resources were associated with decreased QoL. Medical treatment was almost significantly associated with better QoL (p = 0.062). More hyperactivity/inattention was associated with decreased QoL when adjusted for all variables included in the final path model. Increased age was associated with decreased QoL, similar to the direct effect model.
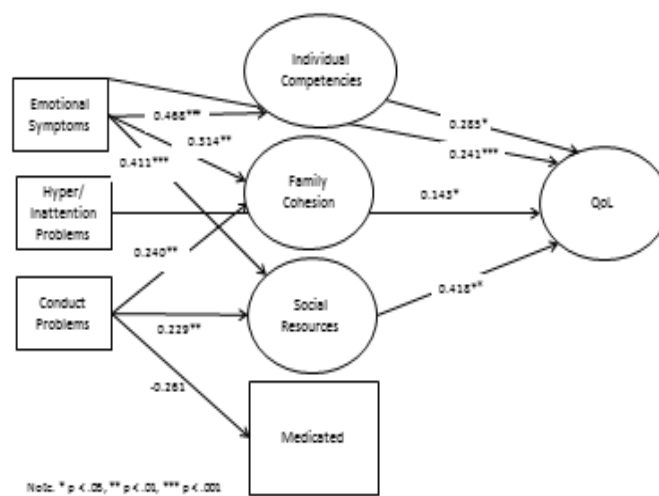
Figure 7. Final path model with standardized estimates adjusted for age and sex.

Our analyses showed no interaction between coexisting problems (i.e., emotional problems, conduct problems, and inattention/hyperactivity) and protective factors (i.e., individual competencies, family cohesion, and social resources), and the effect on QoL. For example; Individual Competencies were not a moderator of Conduct Problems on QoL, or emotional problems on QoL, or of hyperactivity/inattention.

Study 3

What predicts a good adolescent to adult transition in ADHD? The role of self-perceptions as personal resilience

Table 2 shows the differences between participants and non-responders at follow-up. SDQ was assessed at baseline. Table 3 shows the characteristics of the study population at baseline and follow-up. The mean scores of the ADHD-RS are in the same range as other studies, including Norwegian clinical samples of adolescents with ADHD (Dopfner et al., 2006; Egeland, Johansen, & Ueland, 2010). During the three-year follow-up period, 41.6% had psychotherapy; on average eight times; 46.3% had family therapy or consultations, on average 4 times, and 31.6% had environmental interventions (mainly school interventions), on average 2.5 times. During the period between baseline and follow-up, 66.8% of patients in the sample received drug treatment for ADHD, on average for 15 months. Table 4 shows the level of anxiety and depression at follow-up in cases with emotional problems above and below the 80th percentile. Table 5 show correlations between independent and dependent variables assessed in studies 2 and 3.

Table 2. ANOVA of differences between participants and non-responders at follow-up, based on baseline data.

	Participants at follow-up		Non-responders at follow-up		Differences
N	190	(78.2%)	53	(21.8%)	
Age		15.41		15.36	n.s.
Female ratio		0.42		0.47	n.s.
SDQ Emotional problems		4.14		4.54	n.s.
SDQ Conduct problems		3.05		2.87	n.s.
SDQ Hyperactivity/ inattention		6.40		5.93	n.s.
SDQ Impact score		1.53		1.63	n.s.

Table 3. Descriptive data of the sample of study 3 (190 adolescents with ADHD)

	Mean	SD	N	%
Age at baseline	15.41	1.7		
Female gender			79	41.6
ADHD-RS Inattention	18.70	5.8		
ADHD-RS Hyperactivity	12.71	7.1		
SDQ emotional problems at baseline			80	42.1
Psychotherapy			79	41.6
Family-oriented interventions			88	46.3
Environmental interventions (schools etc.)			60	31.6
Medicated during follow-up (nr of months)			127	66.8
Medicated at follow-up			85	44.7
CGAS at follow-up	72.42	13.4		
Persistent ADHD at follow-up			118	62.1
Females with persistent ADHD diagnosis			55	46.6

ADHD diagnosis using DSM-IV criteria. SDQ: Strengths and Difficulties Questionnaire; emotional problems when above 80%. CGAS: Children's Global Assessment Scale.

Table 4. Presence of emotional problems at baseline and anxiety or depression at the three-year follow-up.

	N (%)	N (%) of anxiety disorder at follow-up	N (%) of depressesion at follow-up
Emotional problems at baseline	80 (42.1%)	28 (35%)	35 (39%)
No emotional problems at baseline	110 (57.9%)	18 (16.4%)	19 (17.3%)
Total	190 (100%)	46 (24.3%)	54 (28.4%)

Table 5. Correlations between variables used in study 2 and 3.

	Emo	Self-est	Str.style	Soc.comp	Soc.sup	Fam.coh	Depr	Anx	ADHD	CGAS
Emo	1	0.590**	0.407**	0.334**	0.398**	0.404*	0.412**	0.306**	0.177*	-0.565**
Self-esteem	0.590**	1	0.705**	0.668**	0.685**	0.634*	0.259**	0.263**	0.122	-0.313
Str. Style	0.407**	0.705**	1	0.452**	0.512**	0.578*	0.153*	0.177*	0.166*	-0.245**
Soc. competence	0.334**	0.668**	0.452**	1	0.673**	0.468*	0.081	0.207**	0.104	-0.164
Soc. support	0.398**	0.685**	0.512**	0.673**	1	0.685*	0.116	0.131	0.011	-0.175
Fam.coh	0.404**	0.634**	0.578**	0.468**	0.685**	1	0.160*	0.227**	-0.012	-0.267**
Depression	0.412**	0.259**	0.153*	0.081	0.116	0.160	1	0.379**	0.177*	-0.565**
Anxiety	0.306**	0.263**	0.177*	0.207**	0.131	0.227*	0.379**	1	0.043	-0.407**
ADHD	0.174*	0.122	0.166*	0.104	0.011	-0.012	0.177*	0.043	1	-0.221**
CGAS	-0.565**	-0.313**	-0.245**	-.164*	-0.175*	0.267*	-0.565**	-0.407**	-0.221**	1

Note. *P<0.05. **p<0.01
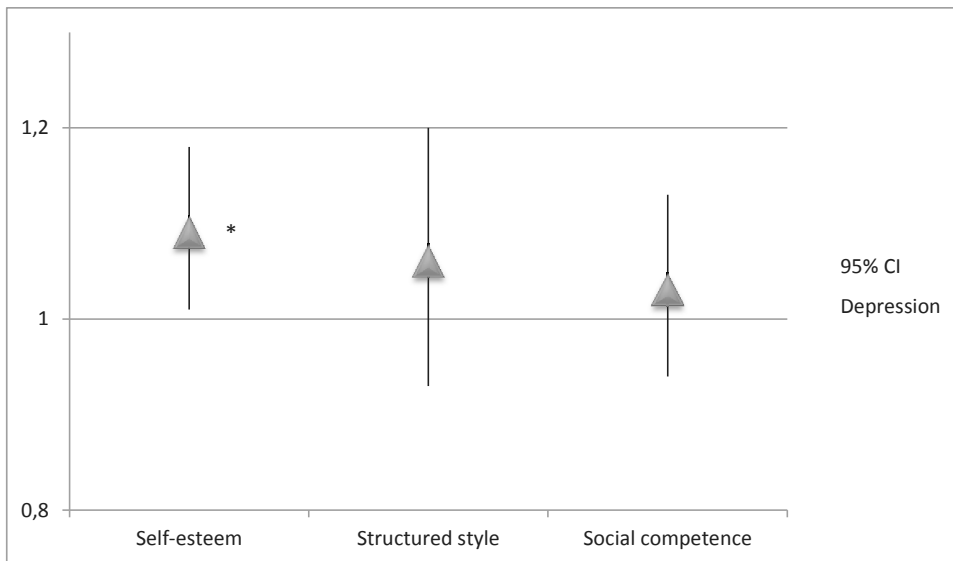
Note. *Significant (p = 0.036)
Figure 9. Odds ratios for depression among ADHD patients at three-year follow-up, adjusted for age, gender, hyperactivity and inattention measured at baseline.
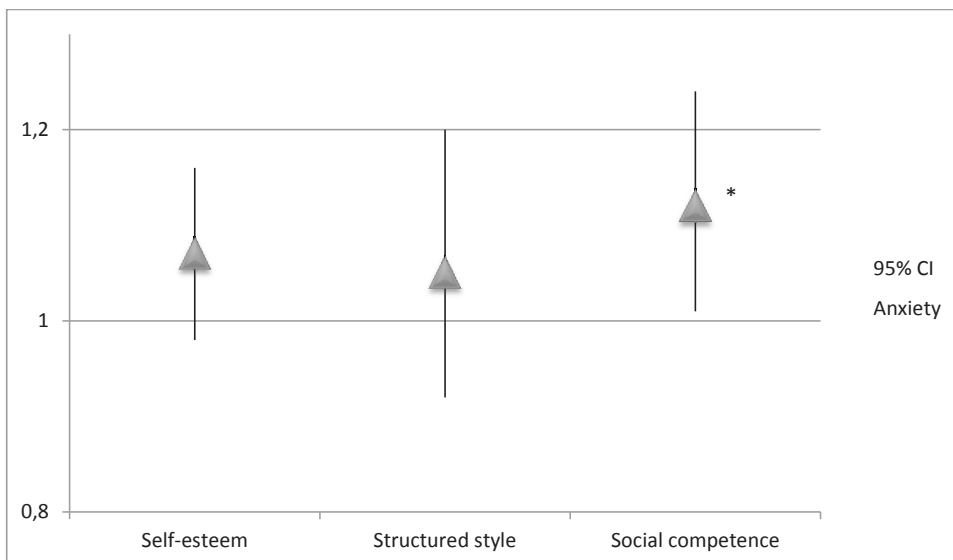
Note. *Significant (p = 0.032)
Figure 10. OR of anxiety among ADHD patients on a 3-year follow-up. Adjusted for age, gender, hyperactivity and inattention measured at baseline.

Table 6. Unstandardized beta coefficients of linear regression analysis with psychosocial functioning during follow-up as a dependent variable among adolescents with ADHD, adjusted for age, gender, hyperactivity and inattention.

Independent variables	N	B	95% CI	p
Self-esteem	190	−0.74	−1.25–0.22	0.005
Structured style	190	−0.82	−1.63–0.01	0.048
Social competence	190	−0.54	−1.16–0.08	0.090
Age	190	−1.85	−3.15–0.55	0.005
Female gender	190	6.30	1.99–10.74	0.005
ADHD-RS Hyperactivity	190	−0.01	−0.41–0.39	0.612
ADHD-RS Inattention	190	−0.13	−0.61–0.36	0.953

Diagnoses of depression and anxiety at follow-up. Adolescents with ADHD and lower self-esteem (higher scores) had higher odds for depressive disorders during the follow-up period (Figure 9), while those with lower social competence (higher scores) had higher odds for anxiety disorders (Figure 10).

Lower psychosocial functioning. Adolescents with ADHD and lower self-esteem and lower structured style (higher scores) had the most severe psychosocial functioning during the three-year follow-up period.

Older age at baseline was associated with higher odds for anxiety disorders and lower psychosocial functioning (Table 6). Female gender was associated with lower psychosocial functioning (Table 6), and higher odds for depressive disorders and anxiety disorders.

Diagnoses of ADHD at follow-up. Adjusted nominal regression analysis showed that adolescents with higher levels of inattention at baseline had higher odds ratios (ORs) for persistent ADHD at three-year follow-up (results not shown). There were no associations between protective factors and persistence of ADHD.

Gender interactions. No interactions between female gender and protective factors were found (results not shown).

Discussion

Main findings

In this study, we found that coexisting problems worsened the self-reported family functioning and QoL of adolescents with ADHD. Thus, adolescents with both emotional and conduct problems reported lower QoL and family functioning. While the parents reported similar levels of QoL as the adolescents, the parents' family functioning reports revealed no effect of coexisting problems. These results suggest that there might be differences in perspectives that should be considered in the assessment, diagnosis, and treatment of adolescents with ADHD.

Protective factors mediated the association between emotional and conduct problems and QoL using dimensional scales in the assessment. Individual competencies, which include structured style, social competence, and self-esteem, were shown to be the strongest mediator between coexisting emotional problems and QoL among adolescents with ADHD. In our three-year follow-up study, better self-esteem in adolescence was a predictor of better psychosocial functioning in young adulthood. A more structured style and better social competence were also associated with this outcome. Further, better self-esteem in adolescence was associated with fewer depressive disorders, while social competence in adolescence was associated with fewer anxiety disorders in young adulthood. Our results support the protective role of self-esteem, structured style and social competence in a critical developmental period.

Main finding in relation to other research

Study 1

A major finding of study 1 was that self-reported family functioning worsened in accordance with coexisting problems among adolescents with ADHD. Former studies of children with ADHD and additional emotional and conduct problems have revealed worse psychosocial functioning, more severe symptoms, and an increased risk of other psychiatric disorders (Biederman et al., 2009; Peyre, Speranza, Cortese, Wohl, & Purper-Ouakil, 2012), indicating that this is a high-risk group. Parents of children and adolescents with ADHD experienced challenges with family routines, homework and the parent-child relationship among others

daily, which was partially revealed by medical treatment (Coghill et al., 2008). The cross-sectional design of our study prevents us from addressing causal inferences, but the existing literature suggests that a child with ADHD has a negative effect on family functioning and vice versa (Crea et al., 2013; Deault, 2010). Supporting the existing literature, we found that families of children with ADHD and coexisting conduct problems were associated with poor family functioning (Edwards, Barkley, Laneri, Fletcher, & Metevia, 2001). However, coexisting emotional problems and family functioning have been less described (Deault, 2010). We found that adolescents with ADHD and coexisting emotional problems had similar family functioning as adolescents with ADHD without coexisting emotional and conduct problems. A recent study, published after our first study, found that parenting in early life predicted the development of childhood emotional symptoms of children with ADHD (Park et al., 2014). It is possible that associations between emotional problems and family functioning are only evident in developmental assessments. The impact of poor family functioning during adolescence on patients with ADHD may affect emotional problems later in life, as the brain has shown increased plasticity during the period of adolescence (Giedd, 2008). The presence of emotional problems during adolescence could be difficult to associate with present family functioning. Emotional problems have also been shown to be less burdensome for the family, as reported by parents (Angold et al., 1998). However, clinical practices and future research should consider our finding of combined coexisting emotional problems and conduct problems, which significantly worsened the family functioning in comparison with all other groups, including adolescents with ADHD and coexisting conduct problems. Patients with ADHD and emotional and conduct problems have also been shown to be a high-risk group also in previous studies (Althoff, Verhulst, Rettew, Hudziak, & van der Ende, 2010).

In our sample, parents reported no significant differences in family functioning between the groups, revealing no impact of coexisting problems. This result is in contrast to the report of the adolescents and shows that self-reports added important information to the assessment. To the best of our knowledge, our study is the first to investigate self-reports of family functioning among adolescents with ADHD and coexisting emotional and conduct problems. The adolescents' psychiatric disorders could have limited their ability to assess themselves and thereby biased their reports. However, importantly, by excluding informants, particular aspects of disorders may be missed (van der Ende & Verhulst, 2005). For patients with internalizing disorders, differences typically become greater with age (van der Ende et al., 2012), with parents reporting fewer problems. By including self-reports, awareness of

internalizing problems may have been increased (Skogli, Teicher, Andersen, Hovik, & Oie, 2013). On the other hand, conduct problems may be underreported by self-reports (Barkley, 2006). Conduct problems have been shown to be more burdensome for the parents than anxiety and depressive disorders, and the parental burden associated with child psychiatric disorders is related to the use of specialist mental health services (Angold et al., 1998). Further, maternal depression is associated with maternal reports of worse child behavior (Müller et al., 2011). Because parental reports can be biased, it is important to include children's self-reports for more accurate assessments of well-being and functioning, especially during adolescence. Family functioning and QoL are measures of the individuals' perceptions of their families or QoL (Jozefiak, Larsson, Wichstrom, Wallander, & Mattejat, 2010; Ryan, 2005). Thus, in this study, the value of self-reports was considered important and was used to categorize the ADHD group according to emotional and conduct problems, and to assess family functioning and QoL. By including adolescent and parental perspectives on outcome measures, clinical work and research is well orientated, and strengths and weaknesses are more evident. In addition, clinicians can improve the foundation for therapeutic discussion with the adolescents and their families.

The higher level of coexisting psychiatric problems with ADHD in our sample had a significant impact on the QoL reports, consistent with the results of a large study of ADHD and coexisting psychiatric problems (Steinhausen et al., 2006). Adding to the literature, we assessed self-reports in addition to parent reports. Our findings showed that adolescents' self-reports and their parents' reports regarding coexisting problems had a similar perception of QoL. It has previously been reported that most adolescents with chronic conditions and their parents agreed on adolescents' QoL, and as adolescents are expected to become partners in their own health care, the perceptions of their own QoL are important (Sattoe, van Staa, & Moll, 2012).

Study 2

The major finding of study 2 was that individual competencies, which include structured style, social competence, and self-esteem, were the strongest mediators of the relationship between emotional problems and QoL among adolescents with ADHD, even after adjusting for prescribed medication. These results suggest that adolescents with ADHD and better

structured style, social competence, and self-esteem have fewer coexisting emotional problems, and that these protective factors are associated with better QoL. Our results may indicate that individual competencies are more important than family cohesion and social resources during adolescence. Adolescence is known to be a period in which psychological independence is achieved, thus, individual competencies are important for perceptions of well-being. Executive function impairments among children with ADHD are heterogeneous (Lambek et al., 2011; Roberts et al., 2013). The present study assessed organizational and planning skills which might be particularly important for adolescents with ADHD. Recent research indicated that planning and organizational abilities predicted academic functioning for middle-school-aged youth and college students with ADHD (Dvorsky & Langberg, 2014; Langberg, Dvorsky, & Evans, 2013). Furthermore, Dvorsky and Langberg (Dvorsky & Langberg, 2014) found no effect of medical treatment on academic functioning, supporting our results, which were adjusted for medication. Self-esteem, which includes self-esteem and self-efficacy, may be an influential factor in everyday life, as it was found to mediate the relationship between ADHD symptoms and test anxiety (Dan & Raz, 2012), and to partially mediate the relationship between ADHD symptoms and adjustment to college (Shaw-Zirt, Popali-Lehane, Chaplin, & Bergman, 2005). Well-being in school is one of the domains of the QoL construct, thus our finding may support the existing literature and underline the importance of good self-esteem. A crucial element for improving self-esteem is to break the vicious cycle of negative appraisals and to adopt positive strategies (Bramham et al., 2009). One method may be to become aware of resources, and to learn to use them in everyday life (Newark, Elsasser, & Stieglitz, 2012), thus improving both coexisting problems and QoL. The social competence of children with ADHD might be affected by their ADHD symptoms, as inattention, hyperactivity and impulsivity may affect behaviors that allow for successful interaction in social situations. As part of the individual competencies, we found that better social competence is associated with fewer emotional problems and better QoL. Social incompetence has been shown to predict emotional problems in younger children (K. B. Burt & Roisman, 2010), supporting our findings. Thus, the important role of individual competencies in adolescents with ADHD adds to the existing literature.

We also found that social resources mediated the relationship between both emotional and conduct problems and QoL, indicating that adolescents with ADHD with better social resources outside the family may be protected from coexisting emotional and conduct problems. Further, better social resources were associated with greater QoL. Our results

support findings from longitudinal studies that suggest that peer rejection predicts later emotional and conduct problems (Mrug 2012, Murray-close 2010). Heiman (2005) found that children with ADHD define friendship differently than children without ADHD. They tend to value certain characteristics in friendships that may conflict with those valued by their peer group, such as having fun compared with receiving emotional support; this can lead to a decreased likelihood of developing mutually satisfying friendships (Gardner 2013). Further, findings indicate that children with ADHD are likely to be actively rejected, neglected and socially isolated (Hodgens, Cole, & Boldizar, 2000). Our results may indicate that social resources including support, encouragement and cohesion outside the family are more important for the adolescent than family cohesion, as social resources diminished the direct effect of conduct problems on QoL. The adolescents reported no significant associations between family cohesion and QoL. Thus, their well-being across several domains is independent of the level of cohesion within the family. On the other hand, individual competencies and social resources were associated with QoL. This could be explained by the age group of our sample. Developmentally, adolescents are transitioning between childhood and adulthood, and friendships with peers may be more important than relationships with parents (Collins, 2004). Research has shown that teachers and peers are important to adolescents for motivation at school (Jagenow, Raufelder, & Eid, 2015). Nevertheless, improvement of social resources may reduce both emotional and conduct problems and improve QoL. Therefore, this may be an important treatment goal.

These results should be interpreted with caution. Because our design was cross sectional, the causality of the factors indluded in the analyses cannot be determined.

Study 3

The major finding of study 3 was that self-esteem was associated with outcomes relating to psychosocial functioning and depressive disorders in young adulthood. Psychosocial impairment and depression in young adulthood might have developed because of ADHD symptomatology, rather than being an independent phenomenon. Several studies have indicated that ADHD symptoms affect the development of self-esteem and self-efficacy, which are core elements of self-esteem, suggesting that underachievement and negative experiences about one's abilities are often experienced by patients with ADHD (Cook et al., 2014; S. Young et al., 2008). These children tend to present a more negative self-concept, as

well as a lesser ability to see new opportunities for self-improvement (Clarke, 2000). Importantly, the work of Hoza and colleagues must also be considered. Self-perceptions of boys and girls with ADHD tend to be characterized by positive illusions (Hoza et al., 2004). Further, these children tended to inflate their self-perception most in the domains of greatest deficit, such as conduct problems (Hoza et al., 2004). On the other hand, in children with coexisting emotional problems, self-perceptions were comparable with those of children without ADHD (Hoza et al., 2004). In our sample, the mean of emotional problems is relatively high compared with the mean of conduct problems, suggesting that the positive illusory bias may be less prominent in our study. Negative cognitions may enhance negative emotions and lead to dysfunctional behavior, highlighting the importance of improving self-esteem as a treatment goal (Young, Bramham, J. , 2012). Although further interventional studies are needed, the existing literature on cognitive behavior therapy in adults with ADHD has shown a treatment effect on ADHD symptoms and functioning (Bramham et al., 2009; Emilsson et al., 2011). A change in our understanding of personal difficulties related to ADHD may constitute the basis for a change in self-esteem, and prove to be of importance for favorable long-term outcomes. Our results add to the existing literature showing that self-esteem is an important and relevant measure during adolescence, and indicating that ADHD patients with better self-esteem manage better in the long term. Thus, self-esteem should be assessed in clinical practice and be considered as a treatment priority.

Our findings suggest that adolescents with ADHD and a more structured style had better psychosocial functioning at three-year follow-up. Consistent with our finding, college students with ADHD reported that organizational skills predicted academic functioning and overall impairment (Dvorsky & Langberg, 2014). As poor structured style among ADHD patients is common, further studies of these relationships are recommended. Available evidence-based services for poor structured style have found cognitive training to be beneficial for individuals with ADHD (Cortese et al., 2015; Evans, Owens, & Bunford, 2013; Mitchell et al., 2013; Thompson et al., 2009). We also hypothesized that structured style would predict less depression and anxiety, but this was not verified. Rinsky and Hinshaw (Rinsky & Hinshaw, 2011) assessed girls with ADHD and found an association between childhood planning and emotional and conduct disorders in early adolescence. It may be that structured style impairments are more related to emotional problems in younger age groups. Recent research assessed specific executive profiles for different groups of children with ADHD, including a group with ADHD without comorbidity and a group with ADHD with

oppositional defiant disorder (Crippa et al., 2014). Unfortunately, emotional disorders were not included in the study. They found that children with ADHD only showed a specific deficit in the planning factor of the executive functions, while children with ADHD and oppositional defiant disorder had deficits in the executive factor. Thus, our findings related to structured style may only represent some of the adolescents with planning impairments within the sample.

With regard to better social competence in adolescents with ADHD, we found less anxiety in young adulthood. A recent study demonstrated cross-domain effects from early externalizing problems through to effects on social and school competence, and later emotional problems (Burt & Roisman, 2010). Inattention manifests as being distracted, not listening and having trouble switching roles. It has been suggested that ADHD symptoms may have a bigger impact on girls' social status than on that of boys (Carlson, Tamm, & Gaub, 1997; S. P. Hinshaw, 2002). Nevertheless, in a study of boys with ADHD, social disability predicted more anxiety in early adolescence (Greene et al., 1997). Our results are in agreement with these findings, and indicate that good social competence in adolescents with ADHD may protect them from developing anxiety disorders three years later.

We also hypothesized that the relationship between protective factors and depression, anxiety and psychosocial functioning was moderated by gender, such that low levels of the protective factors were more strongly associated with depression, anxiety and psychosocial functioning three years later among girls. No significant findings were found. Becker and colleagues (Becker et al., 2013) found that the relationship between negative social preference and internalizing symptoms was stronger among girls than boys. Social preference is an objective estimate of the ratio of peers who like/dislike the child, while social competence is a subjective estimate of social abilities. Our estimate may be biased by "positive illusory bias," as discussed above. Further, the participants in our sample were adolescents and not children (mean age 15.41 years compared with 8.67 years). Although our results are in need of replication, they may indicate that the link between low levels of protective factors and poor outcomes are equal among both genders during adolescence. Nevertheless, as a cofactor, female gender severely increased the risk of developing an anxiety disorder, which is in accordance with the literature (Skrove, Romundstad, & Indredavik, 2013).

Of our sample 41.6 % were girls, which is a higher percentage than in previous work (Gershon, 2002). Gender ratios in referred ADHD samples differ between countries with higher female to male ratios in Scandinavian countries (Novik et al., 2006). Large community-based studies assessing ADHD had a higher female ratio than clinical-based studies (Ramtekkar, Reiersen, Todorov, & Todd, 2010; Willcutt, 2012). Referral is usually based on the recognition of ADHD symptoms by parents, teachers and general practitioners, and on the availability of services (Zwaanswijk, van der Ende, Verhaak, Bensing, & Verhulst, 2005). A recent study indicated that a referral bias is normal, as girls are less likely to be referred for treatment than boys (Rucklidge, 2010). Kopp and colleagues (Kopp, Kelly, & Gillberg, 2010) found that hyperactive symptoms in girls were present but less obvious. Teachers and parents did not recognize their symptoms as ADHD symptoms. In addition, half of the sample had previously been referred to a child psychiatric unit without receiving the appropriate diagnosis (Kopp et al., 2010). Another study of adolescents found that the male mean of ADHD symptoms was closer to the diagnostic threshold than the female mean, and more males fell into the extreme tails (i.e., they showed greater variance than the females) (Arnett, Pennington, Willcutt, DeFries, & Olson, 2014). The levels of parent-reported inattention and hyperactivity were similar for boys and girls in our sample, which is in line with recent research (Arnett et al., 2014; Derks, Dolan, Hudziak, Neale, & Boomsma, 2007; Rucklidge, 2010). The ratio might be partially explained by the age of the sample, as girls are usually referred later than boys (Berry, Shaywitz, & Shaywitz, 1985). Follow-up studies of ADHD patients that begin during the years of childhood may have an underrepresentation of girls in their samples. At follow-up in our study, more girls than boys had a persistent ADHD diagnosis. Female gender did not quite reach statistical significance for persistent ADHD, which might have been due to statistical power limitations, although female gender severely increased the risk for depression, anxiety and psychosocial impairment. In support of our findings, follow-up studies of girls with ADHD found poor outcomes in early adulthood (Hinshaw et al., 2012), while it is speculated that comorbidity may emerge in early adulthood among boys with ADHD (Biederman et al., 2012). It is well known that females in the general population have an increased risk of anxiety and depression, and females with ADHD have a 2.5 times higher risk for major depressive disorder than their female peers (Biederman et al., 2008).

Limitations

The findings of the present study could be limited by selection bias. The low response rate of the baseline sample could have led to imprecise results. However, the reason for referral did not differ from the population of patients treated in the clinic during the study period. Children and adolescents must be referred to the CAP department by a medical doctor and most have been assessed by the school based psychological and pedagogic service (PP-T Psykologisk Pedagogisk Tjeneste) before referral. Children and adolescents with ADHD symptoms with less impairment were not included in the present study. Thus, to avoid the Berkson's bias (Berkson, 2014), these findings are generalizable to individuals with ADHD, but not to the general population.

Another bias that could be present is information bias. The study questionnaires (SDQ and READ) were based on self-report, only. Previous studies have found that children with ADHD have positive illusory bias and perceive their level of competence inaccurately (Emeh & Mikami, 2012). One explanation for this phenomenon is that it protects the individual from awareness of their deficiencies. Hoza and colleagues (Hoza, Pelham, Dobbs, Owens, & Pillow, 2002) found that children with conduct problems overestimated their competencies in several areas, whereas emotional problems attenuated this tendency. Our sample had a relatively high level of emotional problems compared with conduct problems. Further, samples investigated by the abovementioned authors included children under the age of 13 years, and illusory bias may become less evident as these children grow up. It has been shown that adolescents' capabilities are not overinflated in their self-reports compared with clinician's ratings (Slomkowski, Klein, & Mannuzza, 1995). Furthermore, self-report scales may increase awareness of internalizing problems (Skogli et al., 2013).

Generally, all the questionnaires used in this study have been validated. Nevertheless, importantly, we must be certain that the questionnaire measures what we expect it to measure. READ measures five protective factors. Self-perceptions could be inflated as discussed above, or suppressed if the adolescent is depressed. We analyzed correlations (see Table 5) for protective factors and emotional and conduct problems, and for anxiety and depressive disorders to ensure that the questionnaires measured distinct behavior and competencies.

We wanted to adjust for baseline levels of depression and anxiety in the analyses of our third study. Because this was an observational study and the factor of emotional problems could be a mediator, this adjustment could have been critical to the causal chain from the study factor to the study outcome (Christenfeld, Sloan, Carroll, & Greenland, 2004). Other problems arose because of the use of different measures of anxiety and depression in the study; at baseline, there is a self-reported emotional problems scale, while at follow-up structured psychiatric interviews were assessed, yielding categorical diagnoses. We could also have adjusted for other essential factors known to predict outcomes among individuals with ADHD, e.g. IQ (Costello & Maughan, 2015). Unfortunately, IQ was not available in the CAP survey. Nevertheless, previous research has found the predictive role of executive functions to be independent of IQ adjustments (Miller & Hinshaw, 2010; Rohrer-Baumgartner et al., 2014). A clinical interview with parents was not conducted and the family structure was not assessed. Therefore, we could not adjust for parental ADHD or other chronic conditions in the analyses.

Finally, the ADHD diagnosis at baseline was based on clinical ICD-10 diagnoses; however, all diagnoses were made by an experienced child and adolescent psychiatrist or a clinical psychologist, and were based on standard national and international guidelines. In addition we used parent reported inattention, hyperactivity and impulsive symptoms (ADHD-RS). Our results show similar mean scores as another Norwegian study assessing an ADHD samples (Dopfner et al., 2006; Egeland et al., 2010), and a clinical ADHD sample in a Danish validity study of ADHD-RS, which is assumed to be representative for the Scandinavian countries (Szomlaiski et al., 2009). At the three-year follow-up, standardized semi-structured child psychiatric interviews were conducted, and the degree of persisting ADHD in our sample matched that of former studies (Barkley, Fischer, Smallish, & Fletcher, 2002; Biederman et al., 2011).

Conclusions

This thesis investigated associations between self-perceptions of coexisting problems and protective factors and outcomes among adolescents with ADHD. Protective factors investigated in the present studies were self-esteem, structured style and social competence, and social support and family cohesion. We included QoL, family functioning, psychosocial functioning and the diagnoses of anxiety disorders, depressive disorders and persistent ADHD as outcomes.

A higher level of coexisting psychiatric problems had a significant impact on the QoL and family functioning reported by adolescents with ADHD. On the other hand, parents reported a significant impact of coexisting problems on QoL, but surprisingly, not on family functioning. A large percentage of the adolescents treated in the child and adolescent psychiatric clinics are diagnosed with ADHD, and as patients, their perspectives should be acknowledged. The findings of the present study suggest that the self-perceptions of adolescents with ADHD generate useful information that may help to optimize clinical assessment.

This thesis also provides new information regarding the role of resilience in the relationship between ADHD and coexisting emotional and conduct problems, and the impact of protective factors on QoL. Although the causality between assessed factors must be interpreted with cautions, our results suggest that individual competencies and social resources may reduce emotional problems and behavioral problems, and improve QoL among adolescents with ADHD, including those who were prescribed psychostimulants. Family cohesion was not associated with QoL, suggesting that individual competencies and social resources may be more important during adolescence. Assessment of protective factors, in addition to risk factors, may identify potential treatment goals.

This thesis expands the current information about self-perceptions of individual competencies in adolescents with ADHD, which may be protective and provide for a more favorable longitudinal outcome in emerging adulthood. Better self-esteem in adolescence, younger age and male gender were associated with better psychosocial functioning in early adulthood. Although further research is clearly needed, our study indicates that self-perceptions of better self-esteem may protect the individual from developing depression, better social competence may protect them from developing anxiety, and better social competence and structured style

may be of importance for psychosocial functioning. Knowledge of possible protective factors would be useful in the development of support and clinical interventions for ADHD patients in the transition period from adolescence to emerging adulthood.

Our sample had a high ratio of girls. Thus, these findings are representative for both boys and girls with ADHD.

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Appendix

Appendix 1. Overview of instruments used in this thesis.

Instrument	Description	Age	Use	Scores	Psychometric propertied	References
Strengths and Difficulties Questionnaire (SDQ)	Rating of emotional and behavioral problems, and personal strengths	10-19 years	Self-report questionnaire for children/ adolescents and proxy version for caregivers and teachers	25 items organized in five subscales; Emotional problems, conduct problems, hyperactivity/ inattention problems, peer relationship problems and prosocial behavior. High scores indicate more problems	Satisfactory construct validity and internal consistency. Self-report total difficulties; α = 0.80; emotional, 0.66; conduct, 0.60, hyperactivity, 0.67	Goodman, 1997, 2001 Van Roy et al., 2006, 2008
General functioning Scale of the McMaster Assessment Device (GFS)	Rating of family functioning in different areas	12-18 years	Self-report questionnaire for children/ adolescents and proxy version for caregivers	12 items on a 1-4 scale, yielding an overall family functioning score of 12-48. Scores above 24 indicates unhealthy functioning	Good reliability and construct validity. α = 0.92	Epstein, 1983 Reigstad et al., 2010 Byles et al., 2005
Inventory of life Quality of children and adolescents (ILC)	Rating of well-being in physical and mental health, alone, with friends, family, school and globally.	7-18 (20) years	Self-report questionnaire for children/ adolescents and proxy version for caregivers	7 items on a 1-5 scale transformed to a 1-100 scale, 100 indicating very high QoL	Satisfactory reliability and construct validity. Parent-report, α =0.78; self-report (adolescent), α = 0.80	Mattejat et al., 2006 Jozefiak et al, 2012
Resilience Scale for Adolescents (READ)	Rating of 5 protective factors; self-esteem, structured style, social competence, social resources, family cohesion	14-18 (20) years	Self-report questionnaire for adolescents	23 items on a 1-5 scale. Higher scores reflect lower degrees of resilience	Factor analyses yielded acceptable psychometric properties	Von Soest et al., 2010 Friborg et al., 2003
ADHD rating scale (ADHD-RS)	Rating of inattention and hyperactivity/ impulsivity symptoms	5-18 years	Questionnaire for caregivers and teachers	18 items on a 1-4 scale. Higher score indicates more symptoms	High internal validity rating. Internal cinsistency of at least 0.83	DuPaul, 1998 Szomlaiski et al., 2009
Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS-PL) Revised version 2009	Psychiatric DSM-IV diagnoses (present and life-time)	6-18 years	Semi-structured interview (child/ adolescent and parent). Trained interviewer	Diagnoses are scored as definite, probable or not present. In this study only definite and not present were used.	Inter-rater reliability: 93-100% agreement, High concurrent validity when compared with questionaires on depression, anxiety, ADHD and behavioral problems	Kaufman et al., 1997 Miller et al., 2008 Axelson et. al. 2009
Children's Global Assessment Scale	Index of psychosocial functioning	4-16 years	Lowest level for a specified time period	Scoring 1-100: Lowest 1-10(needs 24-hour care) to 91-100 (superior functioning)	Inter-rater reliability (ICC): 0.84, test-retest stability: (ICC): 0.69-0.95. Distinguish cases from non-cases	Schaffer et al., 1983 Bird et al., 1987 Schorre & Vandvik, 2004

Paper I

The Impact of Coexisting Emotional and Conduct Problems on Family Functioning and Quality of Life Among Adolescents With ADHD

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Abstract

Objective: The aim of this study was to assess the impact of self-reported emotional and conduct problems on family functioning and quality of life (QoL) among adolescents with ADHD. **Method:** The ADHD group (*N* = 194) was divided into the following groups: without additional emotional or conduct problems, with emotional problems, with conduct problems, and with both problem types. The cross-sectional study included parent and adolescent reports. **Results:** Adolescents with ADHD and both problem types reported significantly lower QoL and family functioning than all other ADHD groups. Parents reported better QoL for the ADHD group without additional problems, but similar family functioning for all groups. **Conclusion:** A higher level of coexisting psychiatric problems had a significant impact on adolescents' reports of family functioning and QoL. However, coexisting problems showed no association with parent reports of family functioning. Adolescents with ADHD might add important information in clinical assessment. *(J. of Att. Dis. XXXX; XX(X) XX-XX).*

Keywords

ADHD, coexisting problems, family functioning, QoL, multi-informant

Patients with hyperkinetic disorders (hereafter named ADHD) have diagnostic features such as attention problems, hyperactivity, and impulsivity. In addition to these core symptoms, coexisting disorders or problems are frequent, increasing the complexity of the symptomatic picture (Gillberg, 2010). ADHD is a heterogeneous disorder and studies have shown that the addition of coexisting problems, including emotional and conduct problems, substantially increase its impairment (Steinhausen et al., 2006), and risk of an unfavorable long-term outcome (Althoff, Verhulst, Rettew, Hudziak, & van der Ende, 2010; Biederman et al., 2009). Current evidence indicates that ADHD is a heritable disorder (Nigg, Nikolas, & Burt, 2010). In addition to genetic risk factors, adverse family and environmental risk factors are frequent among children and adolescents with ADHD (Biederman et al., 1995), and family problems have particularly been associated with coexisting externalizing problems. Recent studies have found a greater risk for psychopathology in parents of children with ADHD and additional externalizing problems (Chronis et al., 2003; Pfiffner, McBurnett, Rathouz, & Judice, 2005).

The evaluation of family functioning often focuses on the different types of interaction among family members in a number of areas, including the rules of behavior, family members' roles, and affective concerns within the family (Epstein, Baldwin, & Bishop, 1983). To date, most studies have assessed the family functioning of children with ADHD and coexisting externalizing problems, while few have assessed family functioning in children with ADHD and internalizing problems (Deault, 2010).

The multidimensional concept of QoL has various definitions (Coghill, Danckaerts, Sonuga-Barke, Sergeant, & A. E. G. Group, 2009), but is commonly referred to as subjectively perceived well-being and satisfaction within several life domains (Mattejat & Remschmidt, 1998), such as physical and mental health, friends, family, school, and time alone. It has been shown that it is possible to improve QoL without reducing symptoms, which demonstrates the importance of assessing QoL (Bastiaansen, Koot, & Ferdinand, 2005). Nevertheless, treatment studies of children with ADHD reveal inconsistent findings of improved QoL over time (Danckaerts et al., 2010). A large European study

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found that QoL outcomes for adolescents with ADHD were negatively associated with emotional and conduct problems, physical health problems, coordination problems, and maternal and paternal mental health problems (Riley et al., 2006). However, an important limitation of the study was the lack of adolescent self-reports. Another study, which included self-reports, found worse QoL among adolescents with ADHD and conduct problems (Becker, Roessner, Breuer, Dopfner, & Rothenberger, 2011); however, this study did not include adolescents with ADHD and both emotional and conduct problems.

The use of multiple informant assessment is widely accepted in science and clinical practice (Achenbach & Rescorla, 2001). By including self-reports, the adolescents' perspective and perceptions are acknowledged in the decision-making process (Coghill et al., 2009). A recent review demonstrated inflated perception of self-competence among children with ADHD (Owens, Goldfine, Evangelista, Hoza, & Kaiser, 2007). Even though the studies in the Owens et al. review were in the age group below 13 years, the findings suggest the importance of adding reports from parents and adolescents when assessing family functioning and QoL in adolescents with ADHD. Thus, although each informant provides a unique perspective that may be of great relevance in the assessment of the adolescents and the family, most ADHD studies to date have included only parent reports of family stress or functioning and QoL, and not self-reports of adolescents (Danckaerts et al., 2010; Deault, 2010). In addition, only a few studies in a recent review have assessed adolescents perceptions of family functioning; as most studies have focused on parent reports of children below the age of 11 (Deault, 2010).

To our best knowledge, no studies to date have assessed family functioning and QoL in adolescents with ADHD and coexisting emotional and conduct problems in a multi-informant perspective. Therefore, the present study was aimed at the following:

1. To compare the levels of self-reported family functioning and QoL among subgroups of adolescents with ADHD.
2. To compare the levels of parent-reported family functioning and QoL among subgroups of adolescents with ADHD.
3. To compare reports of adolescents with ADHD and their parents with regard to family functioning and QoL.

Method

The Clinical Sample

The study is part of The Health Survey in the Department of Child and Adolescent Psychiatry (CAP) in a hospital in Norway. This was a cross-sectional study of a defined clinical population. The catchment area is a county in Norway with 303,664 inhabitants, which includes urban and rural areas. The Department of CAP at the University Hospital covers all inhabitants in the county. Inclusion criteria were referred adolescents, aged 13 to 18 (20) years, who had at least one personal attendance at the clinic between February 15, 2009, and February 15, 2011. Exclusion criteria were major difficulties in answering the questionnaire due to their psychiatric state, cognitive function, visual impairments or lack of sufficient language skills. Emergency patients were invited to take part once they entered a stable phase.

In the study period, 2,032 adolescent patients had at least one attendance at the CAP clinic. Of these, 289 were excluded on the basis of the exclusion criteria. In addition, 95 were lost in the registration process (i.e., missing). Hence, 1,648 (81.1 %) were eligible and were invited to participate. Of these, a total of 717 (43.5%) participated in the CAP survey: 393 girls (54.8%) and 324 boys (45.2%).

To explore the representativeness of the study sample, anonymous information about the reference population was collected from annual reports from St. Olav's University Hospital, 2009 to 2011. All adolescents in the study period ($n = 2,032$) minus those excluded ($n = 289$) were defined as the reference population ($n = 1,743$). In accordance with the permission given by the Norwegian Social Science Data Services, The Data Protection Official for Research, we compared age, sex, and main reason for referral between participants ($n = 717$) and nonparticipants ($n = 1,026$) of the reference population. Participants were 0.27 years (95% CI [0.10, 0.45]) older than nonparticipants, ($M = 15.66$, $SD = 1.65$) vs. ($M = 15.39$, $SD = 1.95$), $p < .001$. There were more girls in the study group than in the nonparticipating group: ($n = 393$; 54.8%) vs. ($n = 509$; 49.6%), $p = .032$. The main reason for referral did not differ between participants and nonparticipants (data not shown, Pearson Exact Chi-Square test; $p = .11$).

The adolescents diagnosed with ADHD ($N = 194$) were included in the present study (see Figure 1). By using the Strength and Difficulties Questionnaire (SDQ), the adolescents with ADHD were further divided into the following subgroups: no additional problems (ADHD Only), additional emotional problems (ADHD + EMO), conduct problems (ADHD + COND) or emotional and conduct problems (ADHD + EMO + COND) All other diagnostic groups and undiagnosed cases in the CAP survey were excluded from the present study ($n = 474$). ADHD patients with a missing SDQ questionnaire ($n = 49$) were also excluded.

Procedure

Newly referred patients and patients already enrolled at the CAP clinic received oral and written invitations to
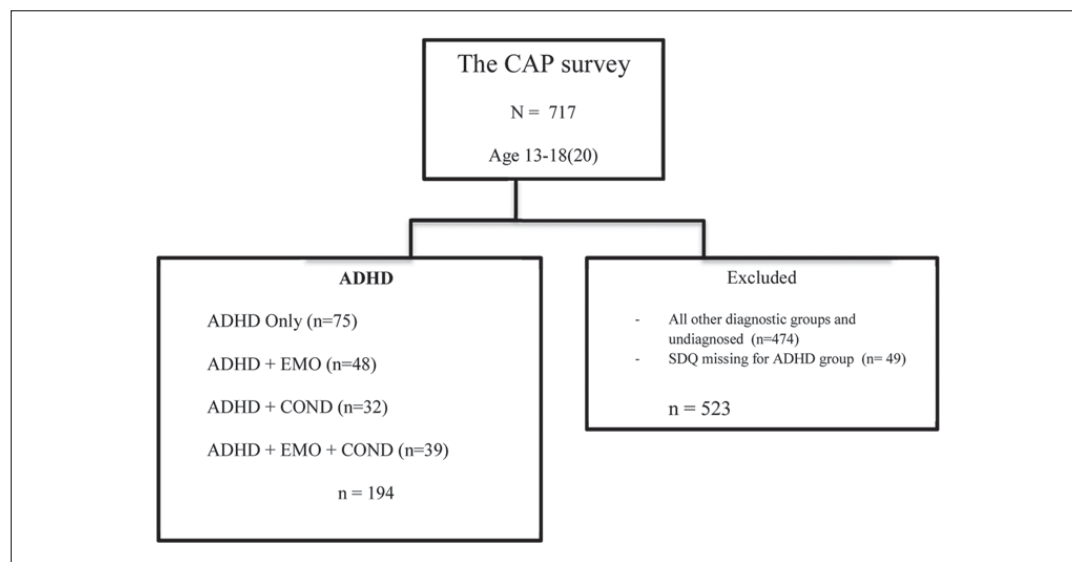
Figure 1. Flowchart of the sample.

participate in the study at their first attendance after the project commenced. Written informed consent was obtained from adolescents and parents prior to inclusion, according to the CAP survey procedures. The participating adolescents responded to an electronic questionnaire and data were collected from clinical charts. Parents also responded to a questionnaire with some information of socioeconomic status (SES), including educational level of both parents.

Measures

Sociodemographic information. Participants completed a demographic form with information about age, sex, and SES. The highest educational level of parents on an 8-point Hollingshead-type scale was used to estimate SES (Hollingshead, 1958).

Clinical diagnosis. Diagnoses were collected from clinical charts and followed the *International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10)* multiaxial diagnostic system (i.e., Axes I-VI; World Health Organization, 1992). All diagnoses were made by a clinical psychologist or a child and adolescent psychiatrist based on all clinical information. The CAP clinic's standardized procedure for the assessment and diagnosis of hyperkinetic disorders is based on the national Guideline for Assessment and Treatment of ADHD (Norwegian Directorate of Health, 2007). This guideline, similar to other established ADHD guidelines (Subcommittee on

Attention-Deficit/Hyperactivity Disorder et al., 2011), requires a clinical diagnostic interview assessing ADHD and possible coexisting disorders, a somatic assessment, and an interview with the teacher; it recommends the use of questionnaires filled out by the adolescent, parent, and teacher to obtain ADHD symptom scores. The *ICD-10* diagnosis of hyperkinetic disorder is referred to as ADHD in this study. Diagnostic criteria for hyperkinetic disorder are nearly identical to criteria for ADHD combined type in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000); however, specifiers such as mainly attention problems or mainly hyperactivity/impulsivity problems are not utilized in the *ICD-10*. A recent study of adults showed that *DSM-IV* ADHD inattentive and hyperactive-impulsive types are less likely to qualify for a diagnosis of hyperkinetic disorder (Gomez, 2013).

SDQ. Coexisting problems were measured using the Norwegian version (Van Roy, Groholt, Heyerdahl, & Clench-Aas, 2006) of the SDQ (Goodman, 1997). This clinical and research instrument contains 25 items, and includes self-report and parent report, addressing behavioral problems, emotional problems, aggressive behavior, and attention problems (Goodman, 1997). The SDQ subscales have shown satisfactory to good internal consistency, and the stability of the basic psychometric properties of the SDQ have been demonstrated across clinical samples (Becker et al., 2006). The SDQ adolescent self-report has shown

satisfactory construct validity and internal consistency in a study by the main author (Cronbach's α = 0.73; Goodman, 2001), as well as a recent Norwegian study (Van Roy, Veenstra, & Clench-Aas, 2008).

We used the Norwegian cut-off points of borderline level (80th percentile) for subscale scores on the adolescent self-report (Van Roy et al., 2006). Thus, the ADHD group was divided into four groups according to coexisting emotional and conduct problems: ADHD without self-reported emotional or conduct problems (ADHD Only), ADHD with emotional problems (ADHD + EMO), ADHD with conduct problems (ADHD + COND), and ADHD with emotional and conduct problems (ADHD + EMO + COND). SDQ adolescent self-report has shown satisfactory construct validity and internal consistency (Cronbach's α = 0.73) (Goodman, 2001), supported by a recent Norwegian study (Van Roy et al., 2008).

General Functioning Scale (GFS). Family functioning was measured using the GFS of the Norwegian version (Reigstad, Jorgensen, Sund, & Wichstrom, 2010) of the McMaster Family Assessment Device (FAD; Epstein et al., 1983). The 12-item parent proxy-report and self-report inventories measure family functioning reflecting six different areas, including problem solving, communication, roles, affective responsiveness, affective involvement and behavioral control (Byles, Byrne, Boyle, & Offord, 1988). Each item was rated on an ordinal scale (1 = strongly agree, 4 = strongly disagree), which were summed (range = 12-48) with higher scores indicating poorer functioning. The unhealthy functioning is indicated by scores of 24 or higher (2 × 12), representing a family member's perception of emotional and physical health of the family members (Ryan, Epstein, Keitner, Miller, & Bishop, 2005). The reliability of the GFS is good, with a Cronbach's alpha of 0.92 (Epstein et al., 1983). The construct validity of the GFS was supported by findings in the Ontario Child Health study, a large epidemiological study of all children from 4 to 16 years (Byles et al., 1988).

Inventory of Life quality of Children and adolescents (ILC). QoL was measured using the Norwegian version (Jozefiak, Mattejat, & Remschmidt, 2012) of the ILC (Jozefiak, Larsson, Wichstrom, Mattejat, & Ravens-Sieberer, 2008; Mattejat & Remschmidt, 2006). The seven-item parent proxy-report and self-report inventories include one item for global evaluation of QoL and six items addressing the child's physical and mental health, perception of activities when the child is alone, perceived relationships with friends and family, and functioning in school. The ILC yields a score on a 0 to 100 scale (0 = *very low QoL*, 100 = *very high QoL*). Reliability testing of the Norwegian version indicates satisfactory internal consistency (Cronbach's α of parents report = 0.78, child report = 0.80-0.81) and a 2-week test–retest reliability of 0.86. Construct validity is also satisfactory.

Ethics

Written informed consent was obtained from adolescents and parents prior to inclusion, according to the study procedures in the CAP survey. Study approval was given by the Regional Committees for Medical and Health Research Ethics (reference numbers CAP survey: 4.2008.1393, present study: 2011/1772) and by the Norwegian Social Science Data Services (reference number CAP survey: 19976).

Statistical Analysis

According to ILC scoring guidelines for individuals with 1 to 3 items missing (less than 43% of each inventory), data were substituted by using expectation maximization algorithm procedures (Little & Rubin, 1987). Equivalent procedures were performed for the GFS scale. Across all variables, 0.1% to 6.1% of the data were missing.

Adjustment for SES in the cases with SES (n = 506) gave substantially similar results (results not shown). Therefore, SES was excluded from the analysis to maintain statistical power.

Differences between diagnostic group means were examined by one-way analysis of variance (ANOVA) and by analysis of covariance (ANCOVA), adjusting for age and gender. Post hoc tests were carried out according to the Sidak procedure. Normality of the residuals was confirmed by inspection of the Q–Q plots.

Two-sided p-value tests with $p < .05$ were taken to indicate statistical significance.

Results

Descriptive analyses of the data showed that age distribution of the adolescents were similar for all groups, while the sex distribution was different. Mothers were the responding parent in the main number of cases, and the response rate was lower for the ADHD + COND group. Educational levels among the four groups were similar (Table 1). Adolescent self-reports of family functioning were similar for unadjusted (Table 2) and adjusted results for age and gender (Table 3). Family functioning among adolescents with ADHD without additional emotional or conduct problems (ADHD Only; M = 21.76, 95% CI [20.3, 23.3]) was significantly better than for adolescents with ADHD and additional emotional and conduct problems (ADHD + EMO + COND; M = 29.30, CI 95% [27.2, 31.4]) and ADHD and additional conduct problems (ADHD + COND; M = 25.98, 95% CI [23.7, 28.3]; Table 3). Adolescents with ADHD and additional emotional problems (ADHD+EMO; M = 24.03, 95% CI [22.1, 25.9]) reported significantly better family functioning than adolescents with ADHD + EMO + COND. Adolescents with ADHD + EMO + COND reported significantly lower QoL (M = 51.34, 95% CI [46.4, 56.3]) than all the other ADHD groups after adjusting for age and gender (Table 3).

Table 1. Descriptive Data of the Study Sample.

Groups	Adolescents *n*	Boys %	*M* age (*SD*)	Parents *n*	Mother reports *n*	Parent/adolescent %	*M* SES (*SD*)
ADHD Only	75	69.3	15.25 (1.56)	62	50	82.7	4.76 (1.73)
ADHD + EMO	48	35.4	15.72 (1.91)	36	32	75.0	4.75 (1.90)
ADHD + COND	32	87.5	15.42 (1.65)	19	11	59.4	4.74 (1.66)
ADHD + EMO + COND	39	25.6	15.68 (1.82)	28	20	71.8	4.89 (2.08)
Total	194	55.2		145	113	74.7	

Note. SES = socioeconomic status (Highest educational level of parents); ADHD Only = ADHD without additional emotional or conduct problems; ADHD + EMO = ADHD with additional emotional problems; ADHD + COND = ADHD with additional conduct problems; ADHD + EMO + COND = ADHD with additional emotional and conduct problems.

Table 2. Means of Self- and Parents Reports of Family Functioning and QoL.

	ADHD Only		ADHD + EMO		ADHD + COND		ADHD + EMO + COND		Group comparison	Difference
	n	*M* (95% CI)	*n*	*M* (95% CI)	*n*	*M* (95% CI)	*n*	*M* (95% CI)	*F, df* (*p* value)	Sidak *p* < .05
Self-report										
GFS	71	21.54 [20.3, 22.8]	45	24.31 [22.3, 26.3]	32	25.75 [23.9, 27.6]	39	29.56 [26.9, 32.2]	*F*(3) = 13.96 (*p* < .000)	ADHD + EMO + COND > ADHD Only (*p* <.001) ADHD + EMO + COND > ADHD + EMO (*p* = .001) ADHD + COND > ADHD Only (*p* = .012)
QoL	73	77.40 [74.1, 80.7]	46	61.41 [56.4, 66.4]	32	68.53 [64.7, 72.3]	39	49.54 [43.5, 55.6]	*F*(3) = 29.71 (*p* < .000)	ADHD + EMO + COND < ADHD Only (*p* < .001) ADHD + EMO + COND < ADHD + COND (*p* < .001) ADHD + EMO + COND < ADHD + EMO (*p* = .003) ADHD + EMO < ADHD Only (*p* < .001) ADHD + COND < ADHD Only (*p* = .043)
Parent report										
GFS	60	22.45 [20.9, 24.0]	35	22.03 [20.4, 23.7]	19	20.79 [18.5, 23.1]	27	22.85 [20.7, 25.0]	*F*(3) = 0.60 (*p* = .614)	
QoL	61	72.72 [68.8, 76.6]	34	61.36 [54.8, 67.9]	19	68.05 [60.9, 75.2]	28	56.36 [51.4, 61.3]	*F*(3) = 8.35 (*p* < .001)	ADHD + EMO + COND < ADHD Only (*p* < .001) ADHD + EMO < ADHD Only (*p* = .006)

Note. QoL = quality of life; ADHD Only = ADHD without additional emotional or conduct problems; ADHD + EMO = ADHD with additional emotional problems; ADHD + COND = ADHD with additional conduct problems; ADHD + EMO + COND = ADHD with additional emotional and conduct problems; GFS = General Functioning Scale of the McMaster family assessment device.

Table 3. Means of Self- and Parents Reports of Family Functioning and QoL, Adjusted for Age and Gender.

	ADHD Only		ADHD + EMO		ADHD + COND		ADHD + EMO + COND		Group comparison	Difference
	n	*M* (95% CI)	*n*	*M* (95% CI)	*n*	*M* (95% CI)	*n*	*M* (95% CI)	*F, df* (*p* value)	Sidak *p* < .05
Self-report										
GFS	71	21.76 [20.3, 23.3]	45	24.03 [22.1, 25.9]	32	25.98 [23.7, 28.3]	39	29.30 [27.2, 31.4]	*F*(5) = 9.26 (*p* < .001)	ADHD + EMO + COND > ADHD Only (*p* < .001) ADHD + EMO + COND > ADHD + EMO (*p* = .001) ADHD + COND > ADHD Only (*p* = .013)
QoL	73	76.36 [72.8, 79.9]	46	62.73 [58.2, 67.2]	32	66.80 [61.3, 72.3]	39	51.34 [46.4, 56.3]	*F*(5) = 20.77 (*p* < .001)	ADHD + EMO + COND < ADHD Only (*p* < .001) ADHD + EMO + COND < ADHD + COND (*p* = .001) ADHD + EMO + COND < ADHD + EMO (*p* = .004) ADHD + EMO < ADHD Only (*p* < .001) ADHD + COND < ADHD Only (*p* = .021)
Parent report										
GFS	60	22.60 [21.2, 24.0]	35	21.73 [19.9, 23.6]	19	21.22 [18.7, 23.8]	27	22.6 [20.4, 24.8]	*F*(5) = 1.08 (*p* < .375)	
QoL	61	72.52 [68.4, 76.6]	34	61.71 [56.2, 67.2]	19	67.42 [59.9, 74.9]	28	56.78 [50.6, 63.0]	*F*(5) = 5.06 (*p* < .001)	ADHD + EMO + COND < ADHD Only (*p* < .001) ADHD + EMO < ADHD Only (*p* = .015)

Note. Marginal means, adjusted for age and gender. QoL = quality of life; ADHD Only = ADHD without additional emotional or conduct problems; ADHD + EMO = ADHD with additional emotional problems; ADHD + COND = ADHD with additional conduct problems; ADHD + EMO + COND = ADHD with additional emotional and conduct problems; GFS = General Functioning Scale of the McMaster family assessment device.

Table 4. Comparison of Self- and Parents-reports by Paired Samples *t*-Test.

	ADHD Only	ADHD + EMO	ADHD + COND	ADHD + EMO + COND
	M (95% CI)	M (95% CI)	M (95% CI)	M (95% CI)
Pairs (N)	58	32	19	27
GFS adolescents	21.60 [20.9, 22.3]	24.06 [22.8, 25.3]	25.42 [24.3, 26.5]	28.11 [26.8, 29.4]
GFS parents	22.19 [21.4, 23.0]	21.81 [21.0, 22.7]	20.79 [19.7, 21.9]	22.85 [21.8, 23.9]
Difference *p* < 0.05	(*p* = .555)	(*p* = .066)	(*p* = .001)	(*p* = .002)
Pairs (N)	60	33	19	28
QoL adolescents	78.87 [77.1, 80.7]	59.41 [56.5, 62.4]	70.30 [68.0, 72.6]	51.66 [48.4, 54.9]
QoL parents	73.04 [71.1, 75.0]	61.27 [57.9, 64.6]	68.05 [64.6, 71.5]	56.36 [54.0, 58.8]
Difference *p* < .05	(*p* = .009)	(*p* = .562)	(*p* = .580)	(*p* = .210)

Note. ADHD Only = ADHD without additional emotional or conduct problems; ADHD + EMO = ADHD with additional emotional problems; ADHD + COND = ADHD with additional conduct problems; ADHD + EMO + COND = ADHD with additional emotional and conduct problems; GFS = General Functioning Scale of the McMaster family assessment device; QoL = quality of life.

Parents reported no significant differences in family functioning between the groups in either unadjusted or adjusted analysis. Parents reported lower QoL for adolescents with ADHD + EMO + CD (*M* = 56.78, 95% CI [50.6, 63.0]) than for the ADHD Only group (*M* = 72.52, 95% CI [68.4, 76.6]; Table 2).

A paired *t*-test showed that compared with parents, adolescents with ADHD and additional problems reported significantly worse family functioning (Table 4). Adolescents from the ADHD Only group reported (*M* = 78.9, 95% CI [77.1, 80.6]) significantly better QoL than parents (*M* = 73.0, 95% CI [71.1, 75.0]), while parents and adolescents from all ADHD groups with additional problems reported similar levels of QoL (Table 4).

Discussion

The aim of this study was to assess the impact of self-reported coexisting problems on family functioning and QoL among adolescents with ADHD by using multiple informants. Our results revealed that coexisting problems worsened the self-reported family functioning and QoL of adolescents with ADHD. Thus, adolescents with emotional and conduct problems reported lower QoL and family functioning. While the parents reported similar levels of QoL as the adolescents, the parents' family functioning reports revealed no impact of coexisting problems. These results suggest that there might be differences in perspectives that should be considered in the assessment, diagnosis, and treatment of adolescents with ADHD.

Our study is the first to investigate self-reports of family functioning among adolescents with ADHD and coexisting emotional and conduct problems. Former studies of children with ADHD and additional emotional and conduct problems have revealed worse psychosocial functioning, more severe symptoms, and increased risk of other psychiatric disorders (Biederman et al., 2009; Peyre, Speranza,

Cortese, Wohl, & Purper-Ouakil, 2012) indicating that this is a high-risk group. According to standardized cut-off scores of the GFS, our results show that adolescents with ADHD and additional problems reported unhealthy levels of family functioning (Ryan et al., 2005). Lower family functioning may indicate problems caused by the adolescents' symptoms. However, it is important to consider parental factors too (Faraone, Kunwar, Adamson, & Biederman, 2009). A recent study found that ADHD symptoms were related to poorer family functioning (van Steijn, Oerlemans, van Aken, Buitelaar, & Rommelse, 2013). Studies of children with ADHD with and without additional conduct problems have shown that child ADHD plus conduct problems were associated with problems within the family (Chronis et al., 2003). In the present study additional conduct problems worsened self-reported family functioning, which is in agreement with findings in recent research (Deault, 2010). Thus, our findings add further evidence to the view that an increased awareness of ADHD patients with coexisting problems is needed in clinical assessment and research.

In our sample, parents reported no significant differences in family functioning between the groups, revealing no impact of coexisting problems. This result is in contrast to the report of the adolescents and shows that self-reports added important information to the results. Deault (2010) discussed the importance of assessing multiple informants, as there may be multiple risk factors for poor family functioning present within the same family (Deault, 2010). The adolescents' psychiatric disorders could have limited their ability to assess themselves and thereby biased their reports. However, importantly, by excluding informants, particular aspects of disorders may be missed (van der Ende & Verhulst, 2005). Furthermore, concerning patients with internalizing disorders, differences between informants typically become greater with age (van der Ende, Verhulst, & Tiemeier, 2012), with parents reporting less problems.

Externalizing disorders have been shown to be more burdensome for the parents than anxiety and depressive disorders, and parental burden associated with child psychiatric disorders is related to the use of specialist mental health services (Angold et al., 1998). Furthermore, maternal depression is associated with maternal reports of worse child behavior (Müller, Achtergarde, & Furniss, 2011). Because parental reports can be biased, it is important to include their children's self-reports for more accurate assessments of well-being and functioning, especially during adolescence. Thus, in this study the value of self-reports was considered important and was used to categorize the ADHD group according to emotional and conduct problems. By including both perspectives on outcome measures, clinicians can improve the foundation for therapeutic discussion with the adolescent.

A higher level of coexisting psychiatric problems with ADHD in our sample had a significant impact on the QoL reports. These findings are consistent with a large study of ADHD and coexisting psychiatric problems (Steinhausen et al., 2006). In addition to parent reports, our results also included adolescents' self-reports, which were not included in former studies. Our findings showed that adolescents' self-reports and their parent reports regarding coexisting problems had similar impact on QoL. Nevertheless, parents and adolescents made their assessments based on different perspectives. As stated in a recent practitioner review by Coghill and coworkers, "Child self-completed QoL scales could help identify which outcomes are most important as treatment targets and provide a more ecologically valid measure of the positive and negative impact of a treatment regime. Using parent ratings can provide a sense of the wider impact of the treatment regime" (Coghill et al., 2009). It has previously been reported that most adolescents with chronic conditions and parents agreed on adolescents QoL, and as adolescents are expected to become partners in their own health care, the perceptions of their own QoL are important (Sattoe, van Staa, & Moll, 2012). The QoL concept focuses on subjective feelings, and physical and mental health providers are increasingly regarding QoL as one of the main aspects of health (World Health Organization, 1995). Even though improved QoL is associated with reduction of symptoms, long-term effects of treatment remain relatively unexplored (Buitelaar & Medori, 2010).

The findings of the present study are limited by the rather small sample sizes for some of the diagnostic groups, and by a low response rate, which could lead to imprecise results. Nevertheless, the reason for referral did not differ from the population of patients treated in the clinic during the study period. Response rate for parent reports differed between ADHD groups, as shown in Table 1. Thus, parent reports of the ADHD + COND group could be biased, and results should be interpreted with caution. Among the parents represented in our study, parental educational level had

overlapping CI for all four groups. Family structure and clinical interview/information about the parents were not obtained, so we could not adjust for parental ADHD, or other chronic conditions in the analysis. Another limitation of the study is the cross-sectional design, which does not allow for causal inferences based on the data. A longitudinal study would allow for assessment of reciprocal relationships between the variables, and development of family functioning and QoL. Finally, the diagnostic groups were based on clinical *ICD-10* diagnoses rather than on standardized semistructured child psychiatric interviews. Interrater reliability scores are not available; however, all diagnoses were set by an experienced child and adolescent psychiatrist or a clinical psychologist based on standard national and international guidelines.

In conclusion, a higher level of coexisting psychiatric problems had a significant impact on the QoL and family functioning reports by adolescents with ADHD. Furthermore, by including self-reports in the assessment, new information became available. A large percentage of the adolescents treated in child and adolescent psychiatric clinics are diagnosed with ADHD, and as patients, their perspectives of emotional and conduct problems, family functioning, and QoL should be acknowledged. In a time when clinical practices are diversifying, providing health care for adolescents with complex, chronic disorders is challenging. The findings of the present study suggest that multidimensional and multi-informant perspectives generate useful information that may help to optimize clinical assessment.

Declaration of Conflicting Interests

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Paper II

Improved quality of life among adolescents with attention-deficit/hyperactivity disorder is mediated by protective factors: a cross sectional survey

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Abstract

Background: The aim of this study was to assess the role of protective factors as mediators and/or moderators of the relationship between coexisting emotional and conduct problems and quality of life (QoL) among adolescents with attention-deficit/hyperactivity disorder (ADHD).

Methods: The sample consisted of 194 adolescents with ADHD. Participants completed measures of individual competencies, family cohesion and social support, and QoL. Coexisting emotional and conduct problems were assessed using the Strength and Difficulties Questionnaire.

Results: Individual competencies and social support mediated the association between emotional and conduct problems and QoL. Family cohesion was associated with both emotional and conduct problems. No moderating effects of protective factors and coexisting problems were found.

Conclusions: The assessment of individual competencies, social resources, and family cohesion may identify potential treatment goals for adolescents with ADHD and coexisting problems, and may contribute to improvements in QoL.

Keywords: ADHD, Adolescence, Coexisting problems, Protective factors, QoL

Background

Attention-deficit/hyperactivity disorder (ADHD) is a heterogeneous and composite disorder
[1] that is characterized by symptoms of inattention, hyperactivity, and impulsivity, which
affect functioning in academic, social, and family contexts [2,3]. Adolescents with ADHD
and coexisting emotional and conduct problems exhibit an increased risk of criminality [4],
substance abuse [5], psychiatric admissions [6], premature death [7], poorer psychosocial
functioning [8], and quality of life (QoL) [9] than do adolescents with ADHD without
coexisting problems. Although ADHD is considered a strongly hereditary disorder [10],
environmental factors in early life may also be important risk factors for the development of
this condition [11]. The literature shows that individual and environmental factors may
interact with genes to affect brain maturation among individuals with ADHD during
childhood and adolescence [12]. Thus, the investigation of risk and protective factors that are
important for outcome among adolescents with ADHD is critical. Although the impact of
coexisting disorders on QoL has been documented among adolescents with ADHD [9,13],
little is known about which protective factors, if any, mediate and/or moderate this
relationship.

Protective factors include both individual and environmental factors, and can be measured
[14]. These factors lessen child maladjustment after life events [15]. Individual factors include
competencies such as structured style, social competence, and personal competence.
Structured style relates to executive functioning skills, e.g., planning, organization, and goal
orientation. Environmental factors include social resources and family cohesion. Social
resources address social support, such as having friends. A substantial proportion of ADHD
patients have deficits in executive functioning tasks, which could be a causal factor for
ADHD symptoms in a subset of patients [16,17]. ADHD patients also have poor social
functioning (i.e., possessing a positive social orientation) and personal competence (i.e., self-

esteem and self-efficacy) [18]. Poor social competence has been associated with conduct and emotional problems [19], including ADHD [20], and poor self-esteem plays a role in the association between social phobia and depression [21].

Coexisting emotional and conduct problems are risk factors for an unfavorable outcome for adolescents with ADHD [4–7,22]. We recently found that coexisting emotional and conduct problems in adolescents with ADHD were associated with low self-reported family functioning [23]. Rinsky and Hinshaw [24] found that childhood planning abilities predicted comorbid emotional and behavioral problems and social functioning in adolescence. The authors [24] reported that social functioning mediated the relationship between planning abilities and comorbidities, and that comorbidity mediated the relationship between planning abilities and social functioning.

QoL is a multidimensional concept and has various definitions [25]; nevertheless, it is commonly referred to as subjectively perceived well-being and satisfaction within several life domains [26], such as physical and mental health, friends, family, school, and time alone. Among a clinical sample of children with various diagnoses, it was shown that it is possible to improve QoL without reducing symptoms, which demonstrates the importance of assessing QoL [27]. A large European study [13] that assessed multiple factors that are possibly associated with QoL among children and adolescents with ADHD found that the presence of peer problems and emotional problems was most strongly associated with poor QoL outcomes. However, to date, few studies have addressed why adolescents with ADHD and coexisting emotional and conduct problems have impaired QoL [9].

For children and adolescents with ADHD, medical treatment is one of the major options to decrease ADHD symptoms and improve psychosocial functioning and QoL [25,28–30]. However, the complex nature of ADHD means that several channels of intervention are

needed, especially in comorbid cases [31]. These interventions might include peer and friendship coaching [32] and organizational training [33].

Previous research has focused on the direct relationships between psychopathology and QoL [9,13]. However, protective factors may mediate and/or moderate the relationship between coexisting emotional problems and conduct problems and be considered as targets of treatment [9,34]. Therefore, we aimed to assess the mediating and moderating effect of individual competencies, family cohesion, and social resources on the relationship between coexisting emotional problems and conduct problems and QoL. By exploring these relationships in a sample of adolescents with ADHD, we hypothesized that the direct effect between emotional and conduct problems and QoL is mediated by individual competencies, family cohesion, and social resources, which implies that better protective factors decreased the negative effect of risk factors on QoL. Our second hypothesis was that adolescents in the sample who were receiving medication have fewer emotional and conduct problems and better QoL. Finally, our third hypothesis was that protective factors moderate the effect of coexisting problems and ADHD symptom level on QoL. We included key covariates in the direct and final path model (age, sex, level of ADHD symptoms, and medication) to determine the specificity of the protective factors. Associations in the path model were also adjusted for all other variables included in it.

Methods

Clinical sample

This study was part of The Health Survey performed by the Department of Child and Adolescent Psychiatry (CAP) at St. Olav's University Hospital in Norway. This was a cross-sectional study of a defined clinical population. The catchment area was a county in Norway with 303,664 inhabitants, which includes urban and rural areas. The Department of CAP at

the University Hospital covers all inhabitants in the county. The inclusion criteria were as follows: referred adolescents, age between 13 and 18 years, and presence of at least one attendance to the clinic between February 15, 2009 and February 15, 2011. Exclusion criteria were as follows: major difficulties in answering the questionnaire because of psychiatric state, cognitive dysfunctions, or lack of sufficient language skills. Emergency patients were invited to take part once stabilized. Among the 1,648 eligible and invited adolescents, 717 (43.5%) participated in the CAP survey. This survey and the representativeness of the sample have been described in detail previously [19]. Of the 717 participants, 243 adolescents were diagnosed with ADHD. Patients with a missing Strengths and Difficulties Questionnaire (SDQ) [35-36] were excluded from the study ($n = 49$), leaving 194 participants in the present study (final response rate, 34.8%): 87 girls and 107 boys.

Procedure

Newly referred patients and patients who were already enrolled in the CAP clinic received oral and written invitations to participate in the study at first attendance after commencement of the project. The participating adolescents responded to an electronic questionnaire and data were collected from clinical charts. The ADHD rating scale was collected from the period of assessment prior to the initiation of medical treatment. Parents also responded to a questionnaire with items related to educational level.

Measures

Sociodemographic information

The parents of the participants completed a demographic form with information about age, sex, and socioeconomic status (SES). The highest educational level of parents on an 8-point Hollingshead scale was used to estimate SES [37].

Clinical diagnosis

Diagnoses were collected from clinical charts and were established according to the

International Statistical Classification of Diseases and Related Health Problems (10th

revision (*ICD-10*) [38] multiaxial diagnostic system (i.e., axes I–VI). All diagnoses were

made by a clinical psychologist or a child and adolescent psychiatrist based on the available

clinical information. The CAP clinic's standardized procedure for the assessment and

diagnosis of hyperkinetic disorders is based on the national guideline for the assessment and

treatment of ADHD [39]. This guideline, similar to other established ADHD guidelines [40],

requires a clinical diagnostic interview based on ADHD as described in the *Diagnostic and*

Statistical Manual of Mental Disorder 4th edition, text revision *(DSM-IV-TR) [41]*, possible

coexisting disorders, and a somatic assessment; it recommends the use of questionnaires filled

out by the adolescent, parent, and teacher to obtain ADHD symptom scores (ADHD rating

scale). The *ICD-10* diagnosis of hyperkinetic disorder is referred to as ADHD in this study.

The diagnostic criteria for hyperkinetic disorder are nearly identical to the criteria for ADHD

combined type in the *DSM-IV-TR* [41], however, specifiers such as mainly attention problems

or hyperactivity/impulsivity problems are not utilized in the *ICD-10*. A recent study of adults

showed that *DSM-IV-TR* ADHD inattentive and hyperactive-impulsive types are less likely to

qualify for a diagnosis of hyperkinetic disorder [42]. Coexisting disorders from clinical charts

were not used in the present study.

Medication

Information about medical treatment was collected from clinical charts, including prescribed

medicines (methylphenidates, amphetamines, or atomoxetine). Data from the clinical charts

verified that the patients had entered a stable phase with a documented effect of the

medication.

ADHD Rating Scale IV (ADHD-RS)

ADHD symptoms were measured using the ADHD-RS, parent version [43]. The instrument contains 18 items that address ADHD symptoms based on the DSM-IV criteria. The items are measured on a 5-point scale, in which higher scores reflect higher frequencies of symptoms. The scale is organized into two sections, each with its own sum score. One reflects symptoms of inattention, whereas the other reflects hyperactivity and impulsivity.

Strengths and Difficulties Questionnaire (SDQ)

Coexisting problems were measured using the Norwegian version [35] of the SDQ [36]. This clinical and research instrument contains 25 items that address emotional and behavioral problems, as well as personal strengths [36]. The SDQ subscales have shown satisfactory to good internal consistency, and the stability of the basic psychometric properties of the SDQ has been demonstrated across clinical samples [44]. In the present study, the three subscales, Emotional Problems, Conduct Problems, and Hyperactivity/Inattention, were used as indicators of latent construct emotional problems, conduct problems, and hyperactivity/inattention problems, respectively. The SDQ adolescent self-report exhibited satisfactory construct validity and internal consistency in a study performed by the original author; the Cronbach alphas of the self-report were as follows: total difficulties, 0.80; emotional problems, 0.66; conduct problems, 0.60; and hyperactivity/inattention, 0.67 [45]. Van Roy et al. [35] found the SDQ self-report to be appropriate for children and adolescents aged 10–19 years. Another study performed by the same authors divided the sample according to the following age groups: 10–13 (preadolescent), 13–16 (early adolescent), and 16–19 (late adolescent) years. The early and late adolescent groups had the following Cronbach alphas, respectively: emotional problems, .71 and .70; conduct problems, .59 and .54; and hyperactivity, .65 and .66 [46].

Resilience Scale for Adolescents (READ)

Protective factors were measured using the READ, which is a 23-item self-report scale that is based on a 5-point Likert scale [14]. Higher scores on the READ reflect lower degrees of resilience. The construct and convergent validity were adequately assessed. The READ is based on the Resilience Scale for Adults [47], and consists of the same five subscales: 1) Personal Competence, 2) Social Competence, 3) Structured Style, 4) Family Cohesion, and (5) Social Resources. The items on three subscales (i.e., Personal Competence, Social Competence, and Structured Style) were used as indicators of the latent concept individual competencies; items from the Family Cohesion and Social Resources subscales were used as indicators of two latent environmental protective factors. In the current study, READ showed satisfactory psychometric characteristics for the total scale ($\alpha = 0.98$) and for the three subscales: Personal Distributions ($\alpha = 0.97$), Family Cohesion ($\alpha = 0.89$), and Social Resources ($\alpha = 0.91$).

Inventory of Life Quality in Children and Adolescents (ILC)

QoL was measured using the Norwegian version [48] of the ILC [49,50]. This 7-item self-report inventory includes one item for global evaluation of QoL and six items that address the child's physical and mental health, perception of activities when alone, perceived relationships with friends and family, and functioning in school. Each item uses a 5-point Likert scale, with lower scores reflecting a higher QoL. In the present study, the seven items were used as indicators of the latent concept QoL. Reliability testing in the present study indicated good internal consistency ($\alpha = 0.94$). The construct validity of the ILC is also satisfactory [50].

Ethics

Written informed consent was obtained from adolescents and parents prior to inclusion,
according to the study procedures of the CAP survey. Study approval was given by the
Regional Committees for Medical and Health Research Ethics (CAP survey reference
number: 4.2008.1393; present study: 2011/1772) and by the Norwegian Social Science Data
Services (CAP survey reference number: 19976).

Statistical analyses

Statistical analyses were conducted using SPSS version 19 and Mplus version 7 [51]. The
frequency of missing values was between 2% and 5%. All missing values were imputed using
full information maximum likelihood. We used a confirmatory factor analysis of the READ to
validate the three subscales. The following indexes were used to assess the goodness of fit of
the models [52]: the chi-squared test, the comparative fit index (CFI), the Tucker–Lewis index
(TLI), and the root mean square error of approximation (RMSEA). Regarding CFI and TFI,
values above 0.95 are considered indicators of good fit; for RMSEA, values below 0.06 are
considered indicators of good fit [53]. The structural equation model was estimated using the
weight least square parameter estimator (WLSMV), because of the categorical nature of the
indicators. A saturated structural model was tested, in which all latent variables were
regressed on each other and on the observable scales (see Figure 1). In addition to the
mediator model, we tested if protective factors interacted with the Emotional Problems,
Conduct Problems, and Hyperactivity/Inattention SDQ scales in the model. Two-tailed tests
($p < 0.05$) were used to measure statistical significance.

Results

Descriptive data of the sample

See Table 1. The mean scores of the ADHD-RS were similar to those reported for another

Norwegian clinical sample of adolescents with ADHD [54].

Confirmatory factor analyses

Confirmatory factor analyses using items from the three subscales of the READ were

conducted using our sample of ADHD patients (n = 194). The 23-item model showed an

acceptable model fit, $\chi^2(227)$ = 495.790; CFI = .949; TLI = .943; RMSEA = .078, CI [.069,

.088]. Standardized factor loadings are presented in Table 2.

Measurement model

The model showed an acceptable fit: CFI = .94; TLI = .93; RMSEA = .056, CI [.049, .063],

with a significant chi-squared value, $\chi^2(524)$ = 846.541, p = 0.000. The chi-squared/df-ratio

was 1.62, which is commonly regarded as acceptable [55].

Path models

Protective factors as mediators of ADHD

A model analyzing the direct effect of coexisting problems on QoL was developed (see Figure

2). In this model, a higher level of Emotional Problems (β = 0.535) and Conduct Problems (β

= 0.165) and Increasing Age (β = 0.143) decreased QoL.

   The final path model, which also included indirect effects of protective factors and

medicated/unmedicated adolescents, is shown in Figure 3. Emotional Problems was mediated

by Individual Competencies; thus, the direct effect on QoL (β = 0.535) was reduced in the

final path model (β = 0.241). Similarly, Conduct Problems was mediated by Social

Resources, thus diminishing the direct effect on QoL (β = 0.165). A higher level of Conduct

Problems was associated with lower Family Cohesion ($\beta = 0.240$) and Social Resources ($\beta = 0.229$) and with being unmedicated ($\beta = -0.261$). A higher level of Emotional Problems was associated with lower Individual Competencies ($\beta = 0.468$), Family Cohesion ($\beta = 0.314$), and Social Resources ($\beta = 0.411$). A lower level of Individual Competencies ($\beta = 0.285$) and Social Resources ($\beta = 0.418$) was associated with a decreased QoL. Medical treatment was almost significantly associated with a better QoL in the present study ($\beta = -0.150$, $p = 0.062$). A higher level of Hyperactivity/Inattention was associated with decreased QoL when adjusted for all variables included in the final path model ($\beta = 0.143$). Increased Age was associated with decreased QoL ($\beta = 0.120$), similar to that observed in the direct effect model.

Protective factors as moderators: interaction model

Our analyses showed no interaction between coexisting problems (i.e., Emotional Problems, Conduct Problems, and Inattention/Hyperactivity) and protective factors (i.e., Individual Competencies, Family Cohesion, and Social Resources) and no effect on QoL. For example, Individual Competencies was not a moderator of the effect of Conduct Problems on QoL ($\beta = -0.034$, $p = 0.644$), of the effect of Emotional Problems on QoL ($\beta = 0.005$, $p = 0.644$), or of Hyperactivity/Inattention on QoL ($\beta = -0.023$, $p = 0.221$).

Discussion

The aim of this study was to assess the role of protective factors as mediators and moderators of the relationship between coexisting emotional problems and conduct problems and QoL among adolescents with ADHD. The results, based on self-reports, showed that protective factors mediated the association between emotional and conduct problems and QoL, even after adjusting for prescribed medication. Individual Competencies was the strongest mediator of the relationship between coexisting emotional problems and QoL. Furthermore, we found

no significant interactions between coexisting factors and individual competencies, which indicates that there were no moderators.

The major finding of this study was that individual competencies, which include structured style, social competence, and personal competence, were the strongest mediators of the relationship between emotional problems and QoL among adolescents with ADHD. These results suggest that adolescents with ADHD and a better structured style, social competence, and personal competence are more protected from coexisting emotional problems, and that these factors are associated with a better QoL. Executive function impairments among children with ADHD are heterogeneous [16,56]. The present study assessed organizational and planning skills, which might be particularly important during adolescence, whereas different aspects of executive functioning may be more important among younger children [57]. Another study indicated that planning and organizational abilities predicted academic functioning above and beyond the impact of ADHD symptoms [58]. It has been suggested that social competence mediates the relationship between ADHD and depression in children [59]. Moreover, personal competence may be an influential factor in everyday life, as it was found to mediate the relationship between ADHD symptoms and test anxiety [60] and to mediate partially the relationship between ADHD symptoms and adjustment to college [61]. Our results indicate that social competence and personal competence might also mediate the relationship between coexisting emotional problems and QoL. The use of individual competencies might allow the implementation of more targeted interventions aimed at improving coexisting problems and QoL. Structured style, social competence, and personal competence are considered plastic brain functions, and some studies have found that cognitive training is beneficial for individuals with ADHD [62–65], including studies of adults [66]. Furthermore, findings from the ADHD literature suggest that medical treatment significantly improves social functioning and self-esteem [19,67].

Our second finding was that social resources mediated the relationship between both emotional and conduct problems and QoL. Peer difficulties represent a significant area of impairment for adolescents with ADHD [13,68]. Our results indicate that ADHD patients with better social resources may be protected from coexisting emotional and conduct problems, and better Social Resources was associated with a greater QoL. Heiman [69] found that children with ADHD define friendship differently than do typically developing children. They tend to value certain characteristics in friendships that may conflict with those valued by their peer group, such as having fun compared with receiving emotional support; this can lead to a decreased likelihood of developing mutually satisfying friendships [70]. Longitudinal studies suggest that peer rejection predicts later negative outcomes, including emotional and conduct problems [2,20]. Moreover, according to McQuade et al. [71], being socially successful combined with modest perceptions of competence is a protective factor against behavioral problems. Several studies have found that coexisting conduct problems in children with ADHD severely worsen the adult outcome [6,7]. Therefore, supporting protective factors that attenuate the risk beyond the effect of medical treatment may be of great importance in the comprehensive treatment of these children and adolescents. Further research on these relationships is recommended

Another finding was the association between coexisting emotional and conduct problems and family cohesion. In a previous study, we found that coexisting problems had an impact on family functioning [23]. Better family functioning, as experienced by the adolescents with ADHD, was associated with fewer emotional and conduct problems. These findings are in line with recent research suggesting that higher family cohesion mediates the effect of foster care on children's ADHD symptomatology [72]. Furthermore, positive development of executive functions, social competence, and peer outcomes has been associated with higher family cohesion, family functioning, and/or parent–child attachment during childhood

[72,73]. We found no association between family cohesion and QoL; however, previous studies found that parental support was associated with QoL among college students with ADHD [74,75]. These differences in findings might be attributable to variations in the instruments used to measure QoL; in addition, the subjects included in the Grenwald-Mayes [74] and Wilmshurst et al. [75] studies were older than those reported in our study (mean age, 25 and 19 vs 15 years, respectively). The results of our study underline the importance of considering both individual and environmental factors in ADHD.

Finally, adolescents with ADHD who received medical treatment had fewer conduct problems, indicating a positive effect of medication on conduct problems, which is consistent with previous work [76]. Conversely, the level of emotional problems was unrelated to medication. The effect of medication on QoL did not quite reach statistical significance, which might have been caused by statistical power limitations. Some studies indicate that comorbid anxiety disorders are associated with a lower effect of medication on ADHD symptoms and psychosocial functioning, which leads to discontinuation of medical treatment [30]. A study of children and adolescents documented that, among treated individuals, about 6% were also treated for emotional disorders [77]. Some clinical samples of adolescents with ADHD have reported even higher levels of emotional problems [78]. In our sample, emotional problems included primarily coexisting problems, part of the ADHD symptomatology, or a side effect of medical treatment. However, the latter is somewhat less likely, because care is taken to minimize side effects [79]. Furthermore, our sample included a relatively high percentage of girls, who exhibit a higher prevalence of emotional problems during adolescence in both clinical and epidemiological studies [80,81].

The findings of the present study were limited by a low response rate, which could have led to imprecise results. Nevertheless, the reason for referral did not differ from the population of patients treated in the clinic during the study period. Another limitation was that

the results were based only on self-reports. Previous studies have found that children with ADHD have a positive illusory bias and perceive their level of competence inaccurately [82,83]. Goodman [45] has described the sensitivity of the SDQ scale. The odds ratios for the emotional scale were similar for self-reports and parent reports, whereas the odds ratios for the conduct scale were higher in parent reports. This might indicate that conduct problems were underreported in the present study, which is in agreement with prior research [84]. Parent reports might have yielded different results regarding conduct problems. Conversely, self-report scales may increase awareness of internalizing problems [85]. A clinical interview with parents was not conducted, and the family structure was not assessed. Therefore, we were not able to adjust for parental ADHD or other chronic conditions in the analysis. Another limitation of the study was its cross-sectional design, which did not allow causal inferences based on the data. A longitudinal study would allow the assessment of reciprocal relationships between the variables, as well as the examination of the development of family functioning and QoL. Finally, the ADHD diagnosis was based on clinical *ICD-10* diagnoses rather than on standardized semistructured child psychiatric interviews. Interrater reliability scores were not available; however, all diagnoses were established by an experienced child and adolescent psychiatrist or a clinical psychologist, and were based on standard national and international guidelines. Furthermore, the mean scores of the ADHD-RS were in the same range as those reported by other studies, including those of Norwegian clinical samples of adolescents with ADHD [55,86].

Conclusions

The current study provided new information regarding the role of protective factors in the relationship between ADHD and coexisting emotional and conduct problems, and regarding the impact of these factors on QoL. Individual competencies, family cohesion, and social resources may reduce emotional problems and behavioral problems and improve QoL among

adolescents with ADHD and among medicated individuals. The assessment of protective factors, in addition to risk factors, may identify potential treatment goals.

Competing interests

Authors' contributions

All authors contributed to the design of the study. JS analyzed the data. All authors contributed to the drafting and approved the final manuscript.

Acknowledgments

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Tables

Table 1. Descriptive data of the study sample: 194 adolescents with ADHD

	Mean (SD)	*n* **(%)**
Age	15.48 (1.71)	
SES	4.78 (1.82)	
SDQ Emotional Problem scale	4.23 (2.76)	
SDQ Conduct Problem scale	3.01 (1.88)	
SDQ Hyperactivity/Inattention scale	6.29 (2.15)	
ADHD-RS Inattention scale	18.73 (5.67)	
ADHD-RS Hyperactivity/Impulsivity scale	12.90 (7.11)	
ADHD-RS Total Scale	31.62 (10.42)	
Medicated		148 (76.3)

Note. SES, highest educational level of the parents

SDQ, Strengths and Difficulties Questionnaire

ADHD-RS, ADHD rating scale

Table 2. Standardized factor loadings for the 23-item READ scale (*n* = 194)

Item number and content	Standardized factor loadings
Personal Dispositions	
7 goal orientation items	0.76
12 realism items	0.55
17 competence items	0.77
20 self-confidence items	0.80
26 positive outlook items	0.69
2 aims and objectives	0.69
8 planfulness items	0.65
13 organizational skill items	0.65
6 positive social orientation items	0.76
11 making contact items	0.65
22 humor items	0.87
25 comforting others items	0.80
Family Cohesion	
5 shared values items	0.86
15 familial agreement items	0.81
10 comfort items	0.90
21 common positive outlook items	0.70
24 support items	0.86
27 shared activities items	0.72
Social Resources	
3 encouragement items	0.73
9 cohesion items	0.71
14 support items	0.82
19 help items	0.80
28 appreciated by others items	0.87

Figure legends

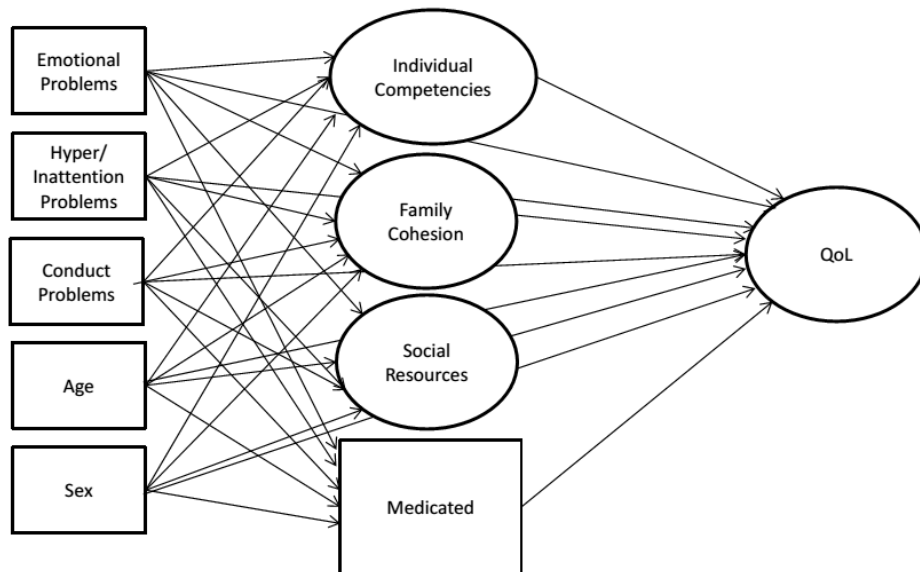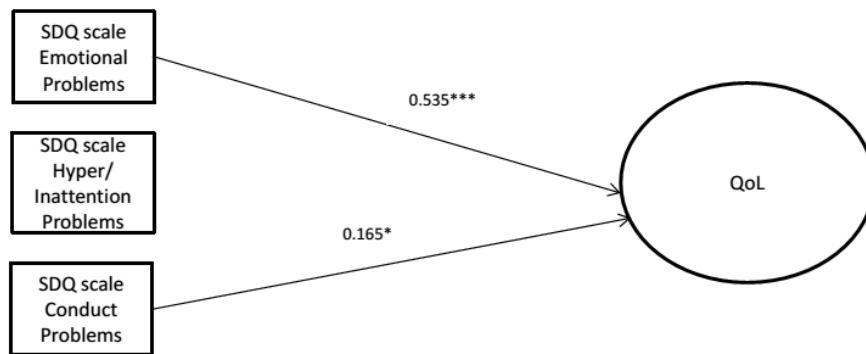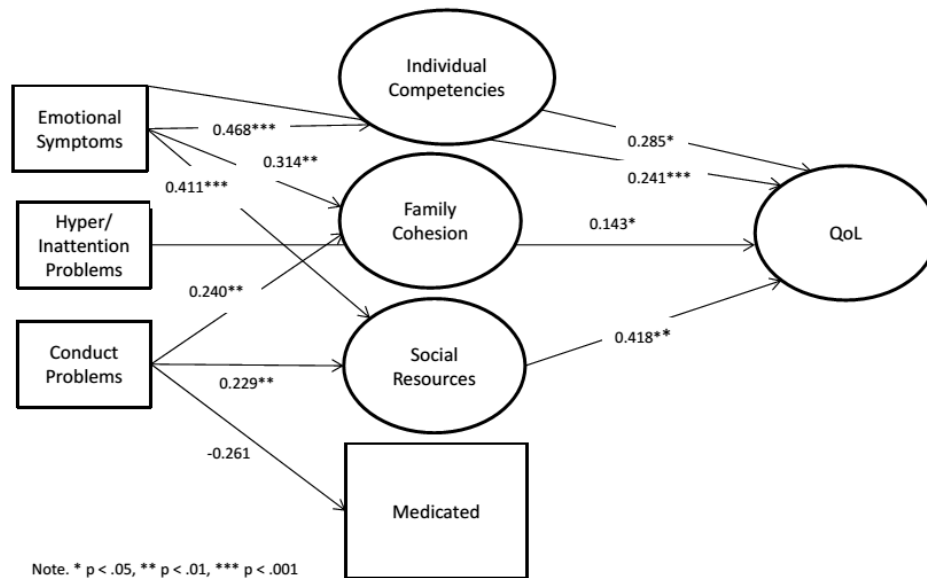**Figure 1 The tested mediator model.**

Figure 2 Path model with standardized estimates for direct effects without protective factors, adjusted for age and sex.

Note. * p < .05, ** p < .01, *** p < .001. SDQ – Strength and Difficulties Questionnaire

Figure 3 Final path model with standardized estimates adjusted for age and sex.

Note. * p < .05, ** p < .01, *** p < .001

Paper III

What predicts a good adolescent to adult transition in ADHD?

The role of self-perceptions as personal resilience

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Abstract

Objective: Attention deficit hyperactivity disorder (ADHD) is a disorder associated with impairment and comorbid psychiatric problems in young adulthood; therefore factors which may imply a more favorable outcome among adolescents with ADHD are of interest.

Method: This study used a longitudinal design to assess whether adolescent personal resilience characteristics during adolescence protected against psychosocial impairment, depression and anxiety three years later. Self-reported protective factors were used as baseline measures in the assessment of 190 clinically referred adolescents with ADHD. A semi-structured diagnostic interview was performed at the follow-up. **Results:** In a group of youths with ADHD personal resilience characteristics were associated with better psychosocial functioning in young adulthood, and less depression and anxiety. **Conclusion:** Although further research is needed, these results indicate that personal resilience characteristics may be protective factors in the transitional period from adolescence to early adulthood.

Keywords: ADHD, self-perceptions, personal resilience, anxiety, depression.

What predicts a good adolescent to adult transition in ADHD?

The role of self-perceptions as personal resilience

Attention deficit hyperactivity disorders (ADHD) is a persistent disorder which confers an increased risk of developing additional psychiatric disorders, including depression and anxiety, and more psychosocial impairment in young adulthood (Barkley, Fischer, Smallish, & Fletcher, 2002, 2006; Biederman, Petty, O'Connor, Hyder, & Faraone, 2012). Therefore, identification of factors promoting a better adolescence to adult outcome among individuals with ADHD is of importance. The transition into young adulthood represents a particularly challenging period, as parental support declines and environmental demands increases (Fleming & McMahon, 2012). Recently, risk factors for persistent ADHD and a poor outcome in adolescence were identified, such as severity of ADHD, comorbidity, low social competence and peer rejection (Mrug et al., 2012; Murray-Close et al., 2010; Weiss, 1993). Impairment could be explained by factors that are critical for functioning, and potentially be treated. On the other hand, protective factors might be important as they are known to promote resilience, and lessen child maladjustment after life events (Rutter, 2000)

People aged 18-25 they see themselves as gradually making their way into adulthood, although academic and social life, including romantic relationships remains to be fully established. Developmentally this period differs from adolescence and young adulthood, and is phrased merging adulthood (Arnett, 2000). For individuals with ADHD, this period could be particularly demanding as they tend to have poorer social and organizational skills (Fleming & McMahon, 2012). In addition, young individuals with ADHD are transitioning between child services and adult mental health services (Young, Murphy, & Coghill, 2011). Considering these developmental challenges, it is of considerable interest to know factors that promote a better psychosocial functioning and symptom remission in merging adulthood for adolescents with ADHD.

When addressing individual factors important for outcome in adolescents with ADHD results based on self-reports will be considered in the following. Studies of children with ADHD indicate that self-perceptions of competence are overinflated in comparison to reports of parents and teachers, called the positive illusory bias (Hoza et al., 2004). Young adolescents with ADHD showed less obvious positive illusory bias concerning academic competence (Scholtens, Rydell, & Yang-Wallentin, 2013). A recent study of adolescent girls with ADHD reported that their scholastic competencies measured by achievement tests and self-reports were similar to that of peers, and self-reported social acceptance ratings were not significantly different from peer-rated positive nominations, although self-appraisals were higher than teacher and parent reports (Swanson, Owens, & Hinshaw, 2012). Furthermore, adults with ADHD were aware of problems in cognitive functioning shown by considerable perceived neuropsychological impairments (Fuermaier et al., 2014). Adolescents with ADHD reported worse family functioning when co-existing emotional and conduct problems increased, while parent reports showed no association between family functioning and level of co-existing problems (Schei, Jozefiak, Novik, Lydersen, & Indredavik, 2013). Differences between child and parent information typically become greater with age (van der Ende, Verhulst, & Tiemeier, 2012), thus, self-perceptions of individual competencies should be considered in youth with ADHD.

The original meaning of the English word *resilience* is "to bounce or spring back" (Simpson, 2005). In a social context, this could refer to the ability of a person to "bounce back" after facing adversity. Smith and colleagues (Smith, 2013) referred to resilience as resistance to illness and the ability to positive adaptation. Resilience has also been referred to as a stable coping style, adaptation, or response to stress (Luthar, Cicchetti, & Becker, 2000). Rutter (2008) used the term resilience to refer only to persons who adapt well to high levels of

environmental adversity. In research, measures of resilience have not specifically described the ability to "bounce back,", but rather has incorporated protective factors that are thought to promote resilience (Friborg, Hjemdal, Rosenvinge, & Martinussen, 2003). Protective factors include both individual and environmental factors, and can be measured (von Soest, Mossige, Stefansen, & Hjemdal, 2010).

We previously examined if individual competencies, social support and family cohesion were mediators between emotional problems and quality of life among adolescents with ADHD (Schei, Nøvik, Thomsen, Indredavik, & Jozefiak, 2015). Individual competencies, which included self-esteem, structured style and social competence, were the strongest mediators of the relationship between emotional problems and QoL. We speculated that individual competencies could be more important than family cohesion and social support in the transitional period from adolescence to young adulthood among ADHD patients. Adolescence is known of to be a period to achieve psychological independence, thus individual competencies are important for the perceptions of well-being. Individual competencies may include self-esteem, structured style and social competence.

Self-esteem includes self-esteem and self-efficacy, addressing belief in one's-self and belief in one's capability to organize and execute tasks, respectively. Multiple studies of adolescents have demonstrated the association between low self-esteem and depression and anxiety disorders (Costello, Swendsen, Rose, & Dierker, 2008; Izgic, Akyuz, Dogan, & Kugu, 2004). A twin-study of adolescents indicated a heritability of self-esteem between 30 – 60% (Kamakura, Ando, & Ono, 2007). Stability in self-esteem was due to genetic and non-shared environmental effects (environment unique to individuals within the family), whereas change in self-esteem was explained by non-shared environmental influences (Kamakura et al., 2007). Individuals at risk with better self-efficacy has been shown to adapt better to past and present life events (Buckner, Mezzacappa, & Beardslee, 2009). Because of problems with

inattention, impulsivity and hyperactivity, ADHD patients commonly have interpersonal, academic and occupational difficulties (Fischer, Barkley, Smallish, & Fletcher, 2002). A recent review indicates that lower self-esteem may lead to frequent experiences of failure in childhood, and have consequences that persist into adulthood (Cook, Knight, Hume, & Qureshi, 2014). Thus, individuals with ADHD often grow up with negative feed-back concerning their abilities and often lack self-efficacy (Young, Bramham, Gray, & Rose, 2008). They feel incapable to manage their problems, and attempt to overcome them with inadequate coping strategies (Young et al., 2008). Moreover, previous disappointments may impact the patients' self-esteem and self-efficacy. As a result, negative cognitions lead to continual disappointments (Newark & Stieglitz, 2010), and makes it less likely that adolescents with ADHD will use adaptive compensatory strategies (Knouse & Safren, 2010).

Structured style measured by planning, being organized and aim-oriented relates in part to executive functioning skills. Research has suggested that emotional control and inhibition are the most important executive functions in childhood, while organization and planning abilities may be more important in adolescence (Jacobson, Williford, & Pianta, 2011; Langberg, Dvorsky, & Evans, 2013). A substantial proportion of ADHD patients have executive function deficits (Nigg, Willcutt, Doyle, & Sonuga-Barke, 2005; Roberts, Martel, & Nigg, 2013), which are heterogeneous (Lambek et al., 2011). A recent study found that planning and working memory skills predicted the presence of comorbid internalizing problems, and that executive function problems and symptoms due to ADHD-combined type were additive in predicting adolescent psychopathology (Rinsky & Hinshaw, 2011). Executive function deficits may persist into young adulthood (Joseph Biederman et al., 2009), and be associated with poor behavioral and social outcomes independent of the course of ADHD (Biederman et al., 2006).

Social competence has been defined as the possession of skills and behaviors that allow for successful interaction in social situations (Vaughn et al., 2009), measured by e.g., social adeptness, ability to initiate activities and flexibility in social matters. Prosocial skills among children are associated with peer popularity (Warden, 2003), while poor social skills are associated with peer rejection (Newcomb, Bukowski, & Pattee, 1993). Impairments in social functioning related to ADHD symptoms have been shown to persist into adolescence (Bagwell, Molina, Pelham, & Hoza, 2001). Negative interactions between children with ADHD and other children occur so often that the child with ADHD is rejected from their peer group (Hodgens, Cole, & Boldizar, 2000). ADHD and social difficulties in childhood predict an increased risk for depression and/ or anxiety in early adolescence (Greene, Biederman, Faraone, Sienna, & Garcia-Jetton, 1997; McQuade et al., 2014; Mikami & Hinshaw, 2006; Roy, Hartman, Veenstra, & Oldehinkel, 2014). Few studies have specifically assessed whether anxiety and depression in ADHD is related to social competence (Becker, Luebbe, & Langberg, 2012). A better understanding of the possible protective role of social competence among adolescents with ADHD in a longitudinal perspective study is called for (Becker et al., 2012; Nijmeijer et al., 2008).

The predictive role of good self-esteem, structured style and social competence in adolescents with ADHD for outcomes in emerging adulthood needs to be clarified, and are addressed in the present study. Executive function difficulties are known to persist into emerging adulthood (Biederman et al., 2009), but the role of structured style in adolescents with ADHD for outcomes in emerging adulthood is still unclear. Furthermore, few studies have specifically assessed whether social competence is related to anxiety and depression in young adults with ADHD (Becker et al., 2012), and if this relation is stronger for girls than boys during adolescence (Becker, McBurnett, Hinshaw, & Pfiffner, 2013). Treatment studies of adult populations with ADHD have shown significant improvement of individual

characteristics such as social functioning, self-esteem and self-efficacy (Bramham et al., 2009; Emilsson et al., 2011); therefore, these characteristics could be considered plastic phenomena. Similar findings might apply to adolescents and young adults, and thus, the identification of factors related to a more favorable outcome is important.

The objective of the present study was to investigate whether self-esteem, structured style and social competence in clinically referred adolescents with ADHD were predictors of a more favorable outcome, with better psychosocial functioning, and less anxiety and depression in young adulthood. We included key covariates in the analyses (age, gender, level of ADHD-symptoms) to determine the specificity of protective factor outcome associations. We had the following hypotheses: (1) Better self-esteem among adolescents with ADHD predicts better psychosocial functioning, and less depression and anxiety 3 years later; (2) A more structured style among adolescents with ADHD predicts better psychosocial functioning and less ADHD symptoms, depression and anxiety 3 years later; and (3) Better social competence among adolescents with ADHD predicts better psychosocial functioning, and less depression and anxiety 3 years later.

Method

The Clinical Sample

The study was part of The Health Survey performed by the Department of Child and Adolescent Psychiatry (CAP), St. Olav's University Hospital, Norway. The baseline study was of a defined clinical population. The catchment area was a county in Norway with 303,664 inhabitants, which includes urban and rural areas. The Department of CAP at the University Hospital covers all inhabitants in the county. Inclusion criteria were as follows: referred adolescents, age between 13 to 18 years, and presence of at least one attendance at

the clinic between February 15, 2009 and February 15, 2011. Exclusion criteria were as follows: major difficulties in answering the questionnaire because of their psychiatric state, cognitive function or lack of sufficient language skills. Emergency patients were invited to take part once stabilized. In the study period, 2,032 adolescent patients had at least one attendance at the CAP clinic. Of these, 289 were excluded on the basis of the exclusion criteria. Additionally, 95 were lost in the registration process (i.e., missing). Among the 1,648 (81.1 %) eligible and invited adolescents, 717 (43.5 %) participated in the CAP baseline survey: 393 girls (54.8 %) and 324 boys (45.2 %).

To explore the representativeness of the study sample, anonymous information about the reference population was collected from annual reports from St. Olav's University Hospital, 2009-2011. All adolescents in the study period ($n = 2,032$) minus those excluded ($n = 289$) were defined as the reference population ($n = 1,743$). In accordance with the permission given by the Norwegian Social Science Data Services, The Data Protection Official for Research, we compared age, sex, and main reason for referral between participants ($n = 717$) and non-participants ($n = 1,026$) of the reference population. Participants were 0.27 years (95% CI [0.10, 0.45]) older than non-participants, ($M = 15.66$, $SD = 1.65$) v. ($M = 15.39$, $SD = 1.95$), $p < 0.001$. There were more girls in the study group than in the non-participating group: ($n = 393$; 54.8%) v. ($n = 509$; 49.6%), $p = 0.032$. The main reason for referral did not differ between participants and non-participants (data not shown, Pearson Exact Chi-Square test; $p = 0.11$). The sample was re-examined after three years. Of the 684 who had consented to be invited for follow-up, 575 (84.1%) participated of whom 550 (80.4%) took part in the diagnostic interview (Figure 1). Of the 717 participants in the CAP survey baseline, 243 adolescents were diagnosed with ADHD, of whom 104 were female. Of the ADHD patients from the baseline survey, 190 took part in the diagnostic interview (78.5%), of whom 79 were female (Figure 1).

Procedures

Baseline. Newly referred patients and patients who were already enrolled in the CAP clinic received oral and written invitations to participate in the study at first attendance after commencement of the project. The participating adolescents responded to an electronic questionnaire and data were collected from clinical charts. The ADHD rating scale was collected from the period of assessment prior to the initiation of medical treatment. Parents also responded to a questionnaire with items related to educational level.

Follow-up. Diagnoses were based on telephone interviews with the participants. The interviewers were blind to the participants' baseline assessment. The interviewers had a graduate degree in medicine or psychology, and were experienced in child and adolescent psychiatric assessment. The interviewers were extensively trained and supervised, and a blinded experienced child and adolescent psychiatrist, supervised the interviewers throughout the study. The inter-rater reliability study was designed as follows: Seven of the interviewers were used as second opinion raters of audio taped telephone interviews. Each of the seven re-scored four interviews performed by four of the other six interviewers. Hence, the number of re-scored patients was $7 \times 4=28$. We excluded bipolar disorder from the analysis, as the agreement for bipolar disorder was very poor. The median Cohen's kappa coefficient was 0.786 which is regarded as very good agreement. Kappa coefficients for individual diagnosis included; ADHD = 0.825, depression = 1.000 and anxiety = 0.435. The variance between the raters for the Children's global assessment scale (CGAS) scores was not statistically significant (Likelihood ratio test p=0.19).

Baseline measures

Clinical diagnosis. Diagnoses were collected from clinical charts at baseline according the *International Statistical Classification of Diseases and Related Health*

Problems, 10th revision (ICD-10) (World Health Organization, 1992) multiaxial diagnostic

system (i.e., axes I- VI;). All diagnoses were made by a clinical psychologist or a child and

adolescent psychiatrist based on the available clinical information. The CAP clinic's

standardized procedure for the assessment and diagnosis of hyperkinetic disorders is based on

the National Guideline for Assessment and Treatment of ADHD (Norwegian Directorate of

Health, 2007). This guideline, similar to other established ADHD guidelines (e.g.,

Subcommittee on Attention-Deficit/Hyperactivity & Steering Committee on Quality

Improvement and Management, 2011), requires a clinical diagnostic interview of the ADHD

symptoms described in the *Diagnostic and Statistical Manual of Mental Disorder (DSM-IV)*

(American Psychiatric Association, 4th ed., text rev., 2000), possible coexisting disorders, and

a somatic assessment; it recommends the use of questionnaires filled out by the adolescent,

parent, and teacher to ADHD symptom score (ADHD rating scale). The *ICD-10* diagnosis of

hyperkinetic disorder is referred to as ADHD in this study. Diagnostic criteria for

hyperkinetic disorder are nearly identical to criteria for ADHD combined type in the DSM-

IV, however, specifiers such as mainly attention problems or mainly hyperactivity/

impulsivity problems are not used in the *ICD-10*. However, the Norwegian Health Authorities

permit the use of *DSM-IV* criteria for ADHD, and patients who fulfill the criteria for one of

the ADHD subtypes may be diagnosed with one of the categories within *ICD-10* hyperkinetic

disorders.

   ADHD rating scale IV (ADHD-RS). ADHD symptoms were measured using the

ADHD-RS parent version (Dupaul, 1998). The instrument contains 18 items that address

ADHD symptoms based on the DSM-IV criteria. The items are measured on a 5-point scale,

in which higher scores reflect higher frequencies of symptoms. The scale is organized into

two sections, each with its own sum score. One reflects symptoms of inattention, whereas the

other reflects hyperactivity and impulsivity.

Strength and difficulties questionnaire (SDQ). Emotional problems were measured using the Norwegian version (Van Roy, Groholt, Heyerdahl, & Clench-Aas, 2006) of the Strength and Difficulties Questionnaire (SDQ; (Goodman, 1997). This clinical and research instrument contains 25 items that address emotional and behavioral problems, as well as personal strengths (Goodman, 1997). For descriptive data, we used the Norwegian cut-off points of borderline level (80th percentile) (Van Roy et al., 2006). Thus, the ADHD group at baseline was divided into two groups, with and without emotional problems. The SDQ adolescent self-report exhibited satisfactory construct validity and internal consistency in a study performed by the original author; the Cronbach alphas of the self-report were as follows: total difficulties, 0.80; emotional problems, 0.66; conduct problems, 0.60; and hyperactivity/inattention, 0.67 (Goodman, 2001). Van Roy et al. (Van Roy, Veenstra, & Clench-Aas, 2008) found the SDQ self-report to be appropriate for children and adolescents aged 10–19 years. Another study performed by the same authors divided the sample according to the following age groups: 10–13 (preadolescent), 13–16 (early adolescent), and 16–19 (late adolescent) years. The early and late adolescent groups had the following Cronbach alphas, respectively: emotional problems, .71 and .70; conduct problems, .59 and .54; and hyperactivity, .65 and .66 (Van Roy et al., 2006).

Resilience scale for adolescents (READ). Protective factors were measured using the READ, which is a 23-item self-report scale that is based on a five-point Likert scale (von Soest et al., 2010). Higher scores on the READ reflect lower degrees of resilience. The construct and convergent validity was adequately assessed (von Soest et al., 2010). The READ is based on the Resilience scale for adults (Friborg et al., 2003), and consist of the same five subscales: (1) Self-esteem, (2) Social competence, (3) Structured style, (4) Family cohesion, and (5) Social resources. The present study used the three dimensions assessing individual resiliencies: (1) Self-esteem measured self-esteem, self-efficacy, self-liking, hope

and determination and a realistic orientation to life; (2) Structured style measured the ability to uphold daily routines, to plan and organize; and (3) Social competence measured extraversion, social adeptness, humor, good communication skills and flexibility in social matters.

Follow-up measures

      Kiddie-Schedule for Affective Disorders and Schizophrenia (Present and Lifetime version) (K-SADS-PL). KSADS-PL (Kaufman et al., 1997) (Translated to Norwegian by Sund, NTNU, Trondheim) is a well-established, semi-structured diagnostic interview designed to assess present and past episodes of psychopathology among children and adolescents on Axis I of the DSM-IV-TR. Diagnoses were based on interviews with the participants. Diagnosis of depression included major depressive episodes, dysthymia and depression INA at present and during the last 3 years. Diagnosis of anxiety included panic disorder, separation anxiety, specific phobia, social Phobia, agoraphobia, general anxiety and anxiety disorder INA at present and during the last 3 years. Diagnosis of ADHD included ADHD inattentive and hyperactive/ impulsive type and ADHD INA. Young adults currently taking medication prescribed for ADHD were classified with a diagnosis of ADHD whether or not they fulfilled symptom criteria.

      Children's Global Assessment Scale (CGAS). As a measure of overall functioning, we used the Norwegian version of the CGAS (Shaffer et al., 1983, Schorre & Vandvik, 2004), a summary score assigned by the interviewers was based on information gathered during the diagnostic structured interview. The instrument yields a score on a 1 to 100 scale, in which 1 indicates the most severely disordered child and 100, the superior functioning child in all areas (at home, in school and with friends). Scores above 70 indicate normal functioning (Bird et al., 1990). The CGAS has been validated against many different psychiatric

assessment scales (Winters, Collett, & Myers, 2005), and has been shown to distinguish cases from non-cases (Bird et al., 1990).

Ethics

Written informed consent was obtained from adolescents and parents prior to inclusion, according to the study procedures in the CAP survey. Study approval was given by the Regional Committees for Medical and Health Research Ethics (Reference No. CAP survey: 4.2008.1393, present study Reference No.: 2011/1772, and by the Norwegian Social Science Data Services (Reference No. CAP survey: 19976).

Statistical Analysis

Binary regression was used to calculate the odds of being diagnosed with ADHD, depression or anxiety disorder at the 3-year follow-up assessment depending on protective factors.

Linear regression analysis was used to assess the association between ADHD at baseline and psychosocial functioning at the 3-year follow-up assessment. To include the effects of protective factors and to control for potential confounders, adolescent age, gender, level of ADHD symptoms at baseline (ADHD-RS) and protective factors were included in the regression analyses separately.

We used expectation maximization algorithm procedures as recommended (Little, 1987) on missing values and multiple imputations on missing cases. On the READ scale, 94 of 5320 (1.8%) values were missing. We had missing cases on the READ scale (2 of 190), SDQ scale (42 of 190) and on the ADHD-RS (63 of 190). All relevant variables used in the analyses model in addition to variables in the data set and assumed to be relevant predictors for missing values were included in the imputation model. Variables used in the imputation model were associated with treatment, including stimulants, psychotherapy, family and school-therapy. We imputed with no restrictions to the range, and with no post-imputation

rounding, as recommended by Rodwell and colleagues (Rodwell, Lee, Romaniuk, & Carlin, 2014). The normality of relevant variables was assessed by visual inspection of Q-Q plots. 95 % confidence intervals (CI) are reported. A two-sided p value < .05 was considered statistically significant. SPSS version 21 (SPSS Inc., Chicago, IL, USA) was used for data analyses.

Results

Analyses were performed to assess differences between participants and non-responders at follow-up, based on baseline data. There were no differences between participant and non-responders for the following variables; age, female ratio, SDQ Emotional, conduct, hyperactivity/ inattention scale problems and impact score (results not shown). Table 1 shows correlations between variables included in the analyses, in addition to emotional problems at baseline.

Descriptive data of the study sample

At baseline 80 (42.1%) of the ADHD patients reported emotional problems. Of these, 28 (35%) were diagnosed with an anxiety disorder and 35 (39%) with a depressive disorder at follow-up. Among ADHD patients without emotional problems, 18 (16.4%) were diagnosed with an anxiety disorder and 19 (17.3%) with a depressive disorder at follow-up. For further descriptive data of the study sample, see Table 2.

Lower psychosocial functioning

Adolescents with ADHD and lower self-esteem (higher scores) (B = −0.74, p = 0.005) and a lower degree of structured style (higher scores) (B = −0.82, p = 0.048) had the most severe psychosocial functioning during the 3-year follow-up period. Female gender was associated with lower psychosocial functioning (B = 6.30, p= 0.005). Older age was associated with lower psychosocial functioning (B = −1.85, p = 0.005) (Table 3).

Diagnoses of depression and anxiety at follow-up

Adolescents with ADHD and lower self-esteem (higher scores) had higher odds for depressive disorders during the follow-up period (OR = 1.09, p = 0.038), while those with lower social competence (higher scores) had higher odds for anxiety disorders (OR = 1.12, p = 0.032). Females had higher odds for depressive disorders (OR 3.82, p < 0.001) and anxiety disorders (OR = 4.93, p < 0.001). Older age at baseline was associated with higher odds for anxiety disorders (OR 1.33, p = 0.006) (Table 4).

Diagnosis of ADHD at follow-up

Adjusted nominal regression analysis showed that adolescents with higher levels of inattention at baseline had higher odds ratio (OR) for persistent ADHD at 3-year follow-up (OR 1.08, p = 0.030). There were no associations between protective factors and persistence of ADHD (Table 5).

Gender interactions

No interactions between female gender and protective factors were found (results not shown).

Discussion

In a clinical sample of ADHD patients, our 3-year follow-up study showed that better self-esteem in adolescence was a predictor of better psychosocial functioning in young adulthood. A more structured style and better social competence were also associated with this outcome. Further, better self-esteem in adolescence was associated with fewer depressive disorders, while social competence in adolescence was associated with fewer anxiety disorders in young adulthood. Our results support the protective role of self-esteem, structured style and social competence in a critical developmental period.

Consistent with our hypothesis, self-esteem was associated with the outcome of psychosocial functioning and depressive disorders in young adulthood. Worse psychosocial functioning and depression in young adulthood might have developed because of the ADHD symptomatology, rather than being independent phenomena. Several studies have indicated

that ADHD symptoms affect the formation of self-esteem and self-efficacy, which are core elements of self-esteem, suggesting that underachievement and negative experiences about one's abilities are often experienced by ADHD patients (Cook et al., 2014; Young, Bramham, 2012). Importantly, the work of Hoza and colleagues must also be considered. Children with ADHD do not always report low self-esteem even when they experience considerable difficulty in particular areas of functioning. Self-perceptions of boys and girls with ADHD tend to be characterized by positive illusions (Hoza et al., 2004). Further, the adolescents tended to inflate their self-perception most in domains of greatest deficit, such as conduct problems (Hoza et al., 2004). On the other hand, in children with co-existing emotional problems self-perceptions were comparable with healthy controls (Hoza et al., 2004). In our sample, the level of emotional problems is relatively high compared to conduct problems, thus, the positive illusory bias may be less prominent. Negative cognitions may enhance negative emotions and lead to dysfunctional behavior, highlighting the importance of improving self-esteem as a treatment goal (Newark & Stieglitz, 2010). Although further interventional studies are needed, the existing literature on cognitive behavior therapy in adults with ADHD has shown a treatment effect on ADHD symptoms and functioning (Bramham et al., 2009; Emilsson et al., 2011). A more thorough understanding of personal difficulties related to ADHD may constitute the basis for improvements in self-esteem, which may be important for a favorable long-term outcome. Our results add to the existing literature showing that self-esteem is an important and relevant measure during adolescence and indicate that ADHD patients with better self-esteem manage better in the long-term. Thus, self-esteem should be assessed in clinical practice and be of concern as a treatment priority.

Our findings suggest that structured style is associated with better psychosocial functioning at the 3-year outcome. Rinsky and colleagues (Rinsky & Hinshaw, 2011) assessed girls with ADHD and found an association between executive functions in childhood and

psychopathology in early adolescence. In line with our finding, college students with ADHD reported that organizational skills predicted academic functioning and overall impairment (Dvorsky & Langberg, 2014). As poor structured style among ADHD patients is common, and considering the plasticity of brain functions with possibilities of learning and development, further studies of these relationships are recommended. A recent meta-analysis and other work has found cognitive training to be beneficial for improving working memory in individuals with ADHD (Cortese et al., 2015; Evans, Owens, & Bunford, 2013; Mitchell et al., 2013; Thompson et al., 2009), although approaches targeting multiple neuropsychological processes may be needed to improve clinical ADHD symptoms. We also hypothesized that structured style would predict less depression and anxiety, but this was not verified. Impaired executive functions and emotional problems may be associated in younger populations as reported by parents, but not by teachers, although the latter finding may reflect methodological problems (Riggs, Blair, & Greenberg, 2003). Furthermore, a study assessing preschool children with ADHD failed to find a relationship between executive functioning and emotional problems (Wahlstedt, Thorell, & Bohlin, 2008). Thus, this relationship appears to be weak among younger children with ADHD. Our results lend support to the finding that structured style in adolescence may not be protective in regard to depression or anxiety in early adulthood.

We found an association between better social competence in adolescence and less anxiety in young adulthood. A recent study demonstrated cross-domain effects from early externalizing problems through effects on social and school competence into later internalizing problems (Burt & Roisman, 2010). Inattention is associated with anxiety (Hodgens et al., 2000; Maedgen & Carlson, 2000) and inattentive behavior, in addition to hyperactive and impulsive behavior, and may contribute to rejection by peers (Nijmeijer et al., 2008). Inattention manifests as being distracted, not listening, and having trouble switching

roles. It has been suggested that ADHD symptoms may have a bigger impact on girls' social status (Carlson, Tamm, & Gaub, 1997; Hinshaw, Carte, Sami, Treuting, & Zupan, 2002). Nevertheless, in a study among boys with ADHD, social disability predicted more anxiety in early adolescence (Greene et al., 1997). Our results adjusted for gender indicate that social competence in adolescents with ADHD may protect from anxiety disorders from a developmental perspective, but further studies are needed to explore this association.

Our sample has 41.6 % girls, which is a higher female to male ratio than in previous work (Gershon, 2002). Gender ratios in referred ADHD samples differ between countries with higher female to male ratios in Scandinavian countries (Novik et al., 2006). However, although community-based studies assessing ADHD typically demonstrate a higher female ratio than clinical-based studies (Ramtekkar, Reiersen, Todorov, & Todd, 2010; Willcutt, 2012), the ratio in our study is still higher than expected. A referral bias is normal as girls are less likely to be referred for treatment than boys (Rucklidge, 2010). Thus, the ratio might be partially explained by the sample's age as girls are often referred later than boys (Berry, Shaywitz, & Shaywitz, 1985). The levels of parent-reported inattention and hyperactivity are similar for boys and girls in our sample, in line with recent research (Arnett, Pennington, Willcutt, DeFries, & Olson, 2014; Derks, Dolan, Hudziak, Neale, & Boomsma, 2007; Rucklidge, 2010). At our follow-up, even more girls compared to boys had a persistent ADHD diagnosis. Female gender did not quite reach statistical significance for persistent ADHD, which might have been due to statistical power limitations. Female gender severely increased the risk for depression, anxiety and worse psychosocial functioning. In line with our finding; follow-up studies of girls with ADHD found poor outcomes in early adulthood (Hinshaw et al., 2012) while it is speculated that comorbidity may emerge in early adulthood among boys with ADHD (J. Biederman, Petty, Woodworth, et al., 2012). It is well-known that females in the normal population have an increased risk of anxiety and depression, and

females with ADHD have 2.5 times higher risk for major depressive disorder than female peers (J. Biederman et al., 2008).

The findings of the present study are limited by the low response rate of the baseline sample, which could have led to imprecise results. However, the reason for referral did not differ from the population of patients treated in the clinic during the study period. Children and adolescents referred to the CAP department have to be referred by a medical doctor and most have been assessed by the school based psychological and pedagogic service (Psykologisk Pedagogisk Tjeneste, PPT) before referral. Thus, children and adolescents with ADHD symptoms who are less impaired were not included in the present study. Another limitation was that emotional problems and protective factors were based on self-reports. Previous studies have found that children with ADHD have positive illusory bias and perceive their level of competence inaccurately (Emeh & Mikami, 2012). Hoza and colleagues (Hoza, Pelham, Dobbs, Owens, & Pillow, 2002) found that children with conduct problems overestimated competencies in several areas, whereas emotional problems attenuated this tendency. Our sample has a relatively high level of emotional problems compared to conduct problems. Further, samples investigated by the authors mentioned above include children below the age of 13. The illusory bias may become less as these children grow up. It has been shown that adolescents and adults are not overinflated in their reports compared to clinician's ratings (Slomkowski, Klein, & Mannuzza, 1995). Furthermore, self-report scales may increase awareness of internalizing problems (Skogli, Teicher, Andersen, Hovik, & Oie, 2013). We wanted to adjust for baseline levels of depression and anxiety in the analysis. Because this was an observational study and the factor of emotional problems could be a mediator, it could have been critical to the causal chain from the study factor to the study outcome (Christenfeld, Sloan, Carroll, & Greenland, 2004). Other problems arise because of different measures of anxiety and depression in the study, and only proxies for underlying

constructs; at baseline we used a self-reported emotional problems scale, and at the follow-up

a categorical clinician-set diagnosis. A clinical interview with parents was not conducted and

the family structure was not assessed. Therefore, we could not adjust for parental ADHD or

other chronic conditions in the analyses. Finally, the ADHD diagnosis at baseline was based

on clinical ICD-10 diagnoses; however, all diagnoses were made by an experienced child and

adolescent psychiatrist or a clinical psychologist, and were based on standard national and

international guidelines. In addition we used parent reported inattention, hyperactivity and

impulsive symptoms (ADHD-RS) to validate our data. Our results show similar mean scores

as another Norwegian study assessing an ADHD sample (Egeland, Johansen, & Ueland,

2010), and a clinical ADHD sample in a Danish validity study of ADHD-RS, which is

assumed to be representative for the Scandinavian countries (Szomlaiski et al., 2009). At the

3-year follow up, standardized semi-structured child psychiatric interviews were conducted,

and the degree of persisting ADHD in our sample matches former studies (Barkley et al.,

2002; Biederman, Petty, Clarke, Lomedico, & Faraone, 2011).

Conclusion

This study expands the current information about personal factors in adolescents with ADHD,

which may be protective and provide for a more favorable longitudinal outcome. Better self-

esteem in adolescence, younger age, and male gender were associated with better

psychosocial functioning in early adulthood in the present study. Although further research is

needed, our findings indicate that better self-esteem may protect from developing depression,

better social competence may protect from developing anxiety and better social competence

and structured style may be of importance for psychosocial functioning. Knowledge of

possible protective factors would be useful in the development of support and clinical

interventions for ADHD patients in the transitional period from adolescence to early adult

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Table 1. ANOVA analyses of differences between participants and non-responders at follow-up, based on baseline data.

	Participants at follow-up		Non-responders at follow-up		Differences
N	190	(78.2%)	53	(21.8%)	
Age	15.41		15.36		n.s.
Female ratio	0.42		0.47		n.s.
SDQ Emotional problems	4.14		4.54		n.s.
SDQ Conduct problems	3.05		2.87		n.s.
SDQ Hyperactivity/ Inattention	6.40		5.93		n.s.
SDQ Impact score	1.53		1.63		n.s.

Table 2. Correlations between variables used in study 2 and 3.

	Emo	Self-est	Str.style	Soc.comp	Depr	Anx	ADHD	CGAS
Emo	1	0.590**	0.407**	0.334**	0.412**	0.306**	0.177*	-0.565**
Self-esteem	0.590**	1	0.705**	0.668**	0.259**	0.263**	0.122	-0.313
Str. Style	0.407**	0.705**	1	0.452**	0.153*	0.177*	0.166*	-0.245**
Soc. comp	0.334**	0.668**	0.452**	1	0.081	0.207**	0.104	-0.164
Depression	0.412**	0.259**	0.153*	0.081	1	0.379**	0.177*	-0.565**
Anxiety	0.306**	0.263**	0.177*	0.207**	0.379**	1	0.043	-0.407**
ADHD	0.174*	0.122	0.166*	0.104	0.177*	0.043	1	-0.221**
CGAS	-0.565**	-0.313**	-0.245**	-.164*	-0.565**	-0.407**	-0.221**	1

*$P < 0.05$. **$p < 0.01$

Emo - emotional problem scale from the Strength and difficulties questionnaire (SDQ)

Self-esteem, Str. Style (Structured style) and Soc. Comp. (Social Competence) from the Resilience Scale for Adolescents (READ)

Depression, Anxiety and ADHD diagnoses from k-SADS

CGAS – psychosocial functioning

Table 3. Descriptive data of the sample of study 3 (190 adolescents with ADHD)

	Mean	SD	N	%
Age at baseline	15.41	1.7		
Female gender			79	41.6
ADHD-RS inattention	18.70	5.8		
ADHD-RS hyperactivity	12.71	7.1		
SDQ emotional problems at baseline			80	42.1
Psychotherapy			79	41.6
Family-oriented interventions			88	46.3
Environmental interventions (schools etc.)			60	31.6
Medicated during follow-up (nr of months)			127	66.8
Medicated at follow-up			85	44.7
CGAS at follow-up	72.42	13.4		
Persistent ADHD at follow-up			118	62.1
Females with persistent ADHD diagnosis			55	46.6

ADHD diagnosis using DSM-IV criteria. SDQ: Strength and difficulties questionnaire; emotional problems when above 80%. CGAS: Children's global assessment scale.

Table 4. Adjusted logistic regression analyses of adolescent with ADHD at baseline, with persistent ADHD at 3-year follow-up as the dependent variable (independent variables adjusted for age, gender, hyperactivity and inattention)

Independent variables	N	OR	95% CI	p
Personal competence	190	1.05	0.97–1.13	0.205
Personal structure	190	1.08	0.96–1.03	0.178
Social competence	190	1.08	0.98–1.17	0.159
Female gender	190	1.84	0.97–3.48	0.063
Age	190	0.95	0.78–1.14	0.568
ADHD-RS hyperactivity	190	0.97	0.92–1.03	0.295
ADHD-RS inattention	190	1.08	1.01–1.16	0.030

Table 5. Unstandardized beta coefficients of linear regression analysis with psychosocial functioning during and at follow-up as dependent variables among adolescents with ADHD

Independent variables	N	B	95% CI	p
Most severe psychosocial function during the last 3 years. Adjusted for age, gender, hyperactivity and inattention				
Personal competence	190	−0.74	−1.25–0.22	0.005
Personal structure	190	−0.82	−1.63–0.01	0.048
Social competence	190	−0.54	−1.16–0.08	0.090
Age	190	−1.85	−3.15–0.55	0.005
Female gender	190	6.30	1.99–10.74	0.005
ADHD-RS hyperactivity	190	−0.01	−0.41–0.39	0.612
ADHD-RS inattention	190	−0.13	−0.61–0.36	0.953
Psychosocial functioning at follow-up. Adjusted for age, gender, hyperactivity and inattention				
Personal competence	190	−0.75	−1.20–0.31	0.001
Personal structure	190	−0.56	−1.26–0.15	0.121
Social competence	190	−0.57	−1.10–0.03	0.040
Age	190	−1.43	−2.56–0.29	0.014
Female gender	190	5.66	1.86–9.46	0.004
ADHD-RS hyperactivity	190	0.01	−0.33–0.36	0.954
ADHD-RS inattention	190	−0.16	−0.58–0.25	0.438

Table 6. Adjusted logistic regression analyses of adolescents with ADHD, with depression or anxiety at 3-year follow-up as the dependent variable

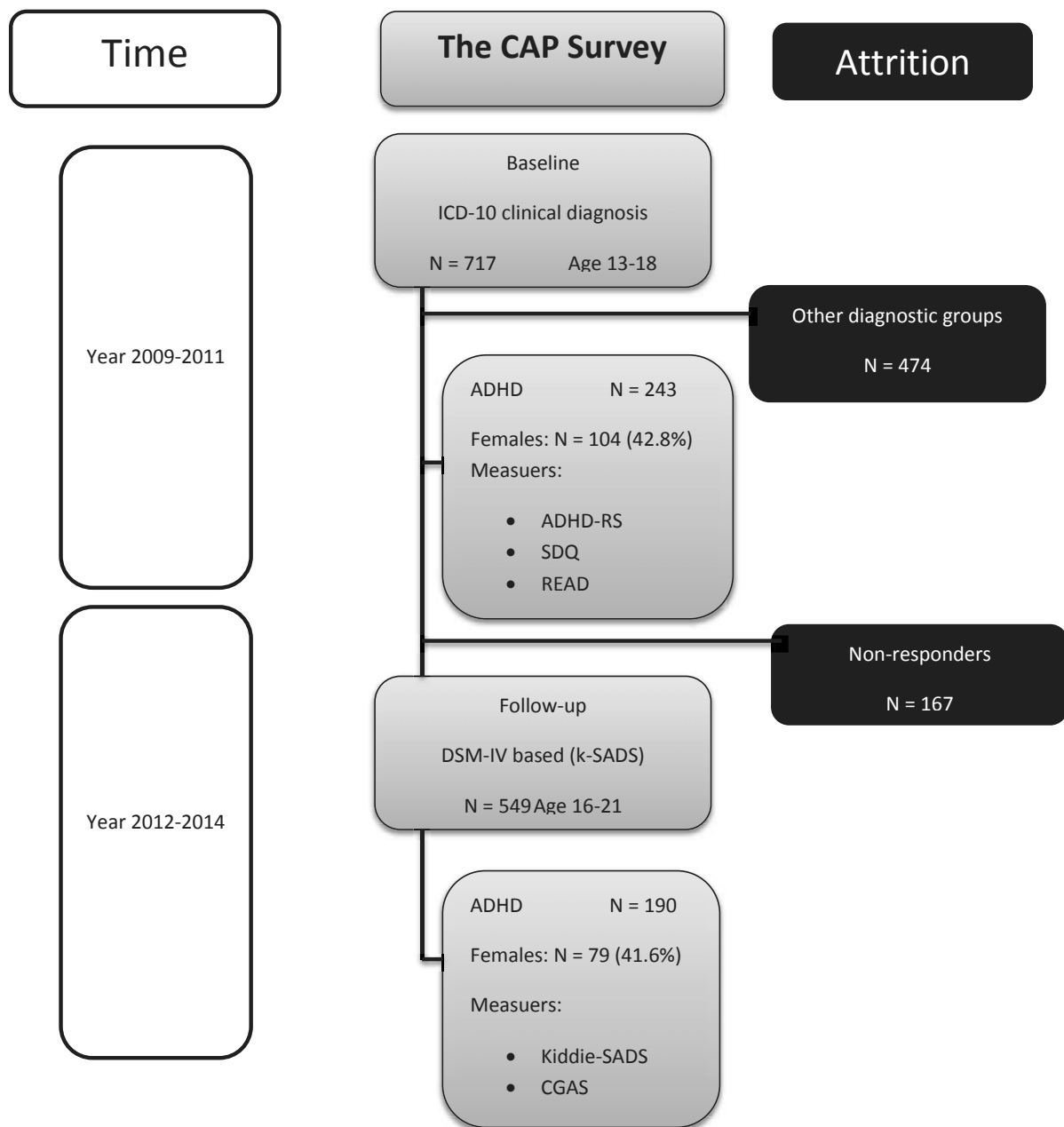| Independent variables	N	OR	95% CI	p
Depression among ADHD patients on a 3-year follow-up. Adjusted for age, gender, hyperactivity and inattention measured at baseline				
Personal competence	190	1.09	1.01–1.18	0.036
Structured style	190	1.06	0.93–1.20	0.391
Social competence	190	1.03	0.94–1.13	0.568
Age	190	1.02	0.84–1.25	0.820
Female gender	190	3.81	1.94–7.61	<0.001
ADHD-RS hyperactivity	190	1.01	0.95–1.07	0.896
ADHD-RS inattention	190	1.01	0.94–1.09	0.839
Anxiety among ADHD patients on a 3-year follow-up. Adjusted for age, gender, hyperactivity and inattention measured at baseline				
Personal competence	190	1.07	0.98–1.16	0.136
Structured style	190	1.05	0.92–1.20	0.489
Social competence	190	1.12	1.01–1.24	0.032
Age	190	1.20	0.97–1.48	0.006
Female gender	190	4.92	2.33–10.37	<0.001
ADHD-RS hyperactivity	190	0.98	0.91–1.04	0.480
ADHD-RS inattention	190	1.00	0.92–1.08	0.966

Figure 1: Flow-chart of sample.