Optimising Adult Mental Health Outcomes in Children with Neurodevelopmental Problems: Interplay of Social and Genetic Factors

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Thesis Summary

Background: Previous research has indicated that individuals with ADHD have an increased likelihood of developing mental health problems including depression, anxiety, and conduct disorder. However, not all individuals who experience childhood ADHD will go on to have poor mental health outcomes and why some individuals with ADHD show higher levels of mental health resilience than others is not yet clear.

Methods: Data were utilised from the Avon Longitudinal Study of Parents and Children, a population-based birth cohort. A symptom based high-risk ADHD group was identified in childhood. Mental health resilience in young adulthood was measured both as the absence of any mental health problem and as better-than-expected mental health. Regression analyses were used to investigate associations with individual, social, and family protective factors across childhood, adolescence, and young adulthood. Also, mediation analyses were used to examine pathways between childhood father involvement and young adult emotional problems using structural equation modelling.

Results: Across childhood and adolescence, peer relationships, family relationships, and self-esteem all demonstrated long-lasting association with better mental health in young adulthood. In young adulthood practical and emotional support showed strong associations with better mental health outcomes across depression, anxiety, and conduct problems. Support continued to show a strong association once adult ADHD symptoms had been accounted for. Lastly, adolescent self-esteem was found to partly explain the relationship between childhood father involvement and fewer emotional problems at age 25 years.

Conclusion: Findings from this thesis identified that a group of individuals who experienced high childhood ADHD symptoms were resilience to mental health problems in young adulthood. Key factors including childhood father involvement,

family relationship quality, adolescent self-esteem, adolescent and young adult peer relationships, and practical and emotional support in young adulthood should be further explored as targets of preventative interventions aimed at improving mental health outcomes for those with ADHD.

1. Chapter 1: Introduction

This introductory chapter will first provide a definition and overview of attention deficit hyperactivity disorder and will outline important considerations when assessing ADHD. The aetiology and development of ADHD are also described, and well as additional neurodevelopmental problems and adverse outcomes often experienced by individuals with ADHD. Next, this chapter focuses on describing current literature on the relationship between ADHD and depression, anxiety and conduct problems. More specifically, literature on mental health risk factors for children with ADHD are reviewed, some of which are accounted for within the analyses in the current thesis. The focus of the current thesis is on identifying protective factors that may increase mental health resilience therefore, the next section reviews previous research on potential modifiable protective factors. This section is structured around individual, family, and social factors since the current thesis has investigated a wide range of factors across these domains. In the final section, definitions of resilience are explored as well as, outlining how the current thesis has operationalised resilience. Previous literature that examined mental health resilience in ADHD has also been described. Lastly, this chapter ends with specific limitations of current literature and the specific aims and hypotheses of the current thesis.

1.1. Attention Deficit Hyperactivity Disorder

1.1.1. Definition and Assessment

Attention Deficit Hyperactivity Disorder (ADHD) is a childhood-onset neurodevelopmental disorder, which manifests as inattention, hyperactivity, and impulsivity that is impairing and developmentally inappropriate. The DSM-5 criteria (see Table 1.1) indicate that six or more symptoms of inattention or six or more symptoms of hyperactivity/impulsivity must be present for at least six months. These symptoms must indicate a persistent pattern of inattention or hyperactivity-impulsivity or both, across settings, which interferes with functioning or development (American Psychiatric Association, 2013). These symptoms must also directly negatively impact on social, academic or occupational activities and be present before twelve years of age. Where individuals have both hyperactive-

impulsive and inattentive symptoms they are considered to have a combined presentation of ADHD. When symptoms are only in one dimension, individuals are considered to have a predominantly inattentive or hyperactive-impulsive presentation of ADHD. Despite historically being considered a childhood disorder there is increasing evidence of ADHD symptom persistence into adulthood (Faraone & Biederman, 2005; Sibley et al., 2017). Therefore, ADHD is a lifelong condition for many individuals who initially experience ADHD in childhood. Additionally, limited recent research has indicated that some individuals may experience 'late-onset ADHD' having not shown symptoms in childhood (Cooper et al., 2018; Riglin et al., 2022). This research, however, will focus on ADHD as a childhood neurodevelopmental disorder and examine the impact this has on mental health in adulthood. Overall, ADHD is a complex disorder to disentangle in terms of diagnosis and course across the lifespan.

Table 1.1 DSM-5 Diagnostic Symptoms for Attention Deficit Hyperactivity Disorder

Inattention Symptoms
a) Fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities. b) Has difficulty sustaining attention in tasks or play activities. c) Does not seem to listen when spoken to directly. d) Does not follow through on instructions and fails to finish schoolwork, chores, or workplace duties. e) Has difficulty organizing tasks and activities. f) Avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort. g) Loses things necessary for tasks or activities. h) Easily distracted by extraneous stimuli. i) Forgetful in daily activities.
Hyperactivity and Impulsivity Symptoms
a) Fidgets with or taps hands or feet or squirms in seat. b) Leaves seat in situations when remaining seated is expected. c) Runs about or climbs in situations where it is inappropriate. d) Unable to play or engage in leisure activities quietly. e) Often 'on the go' acting as if 'driven by a motor.' f) Talks excessively. g) Blurts out an answer before a question has been completed. h) Difficulty waiting his or her turn. i) Interrupts or intrudes on others

(American Psychiatric Association, 2013)

In the general population, the estimated prevalence of ADHD in children is 3.4% (Polanczyk et al., 2015). For adults, prevalence is estimated to be around 2.5%

(Simon et al., 2009). However, prevalence rates do differ as studies differ in their approaches to ADHD diagnosis (Thapar & Cooper, 2016). There is an excess of males who are affected by ADHD compared to females. However, the male: female ratio in epidemiological samples (3-4:1) differs to clinical samples (7-8:1) which may suggest there is a referral bias for female patients with ADHD (Thapar & Cooper, 2016).

The complexity of ADHD is increased by the substantial heterogeneity seen among individuals with ADHD. This is due to variation in the causes and clinical presentations of the disorder (Thapar & Cooper, 2016). The heterogeneity present within ADHD has led to the argument that it would be more appropriate to consider ADHD as an extreme of a continuous trait rather than as a categorical disorder (Sonuga-Barke et al., 2005). Lubke, Hudziak, Derks, van Bijsterveldt, and Boomsma (2009) used factor mixture models to show that maternal ratings of attention problems in ADHD vary along a continuum ranging from mild to severe attention problems. This indicates that children significantly affected by ADHD, and who would probably be categorically diagnosed, are at the extreme end of this continuum. Other research has considered the genetic makeup of ADHD and has examined the differences in the genetic risks associated with ADHD in those with and those just below the threshold for an ADHD diagnosis. Stergiakouli et al., (2015) illustrated that the risk alleles which contribute to ADHD trait levels also contribute to the risk of an ADHD diagnosis and increased symptoms. Therefore, this research also supports the idea that as a disorder ADHD lies on a continuum of normal trait variation and highlights the dimensionality of the ADHD phenotype. Another study indicated that individuals with a large rare copy number variants (CNV) required less polygenic risk score (PRS) burden of common alleles to express the disorder (Martin et al., 2015). The authors indicated that their findings were in line with a polygenic liability threshold model with both common single-nucleotide polymorphisms (SNP's) and rare CNV's implicated in the risk for ADHD. These findings support the notion that the risk for ADHD lies on a spectrum, which indicates that those with and those just below the ADHD diagnosis threshold will have similar genetic risk patterns. This genetic research has implied that those just above and below the cut-off will have similar genetic risks for ADHD and will exhibit similar patterns of problems whether they meet

diagnostic criteria for ADHD or not. These findings alongside those of Sonuga-Barke et al., (2005) and Lubke et al., (2009) indicate that ADHD exists on a continuum rather than as discrete categories, which has implications for both researchers and clinicians and potentially in the diagnostic criteria of ADHD itself. This evidence also suggests that it is heuristically valuable to take a dimensional approach to investigating ADHD within research to gain a wider view of ADHD than the diagnostic categories allow and to increase our understanding of the patterns of this disorder. This is important since individuals with subthreshold symptoms often experience similar heightened risk to adverse outcomes as seen in individuals with a clinical diagnosis (Bussing et al., 2010; Loe & Feldman, 2007).

1.1.2. Co-occurring Neurodevelopmental Problems

Neurodevelopmental disorders are common (Boyle et al., 2011), emerge in early life and often result in impaired functioning (Howlin et al., 2004). These disorders are a group of disorders defined by the Diagnostic and Statistical Manual of Mental Disorders 5th Edition (DSM-5) (American Psychiatric Association, 2013) as including intellectual disability, communication disorders, autism spectrum disorder (ASD), ADHD, specific learning disorders and motor disorders. These neurodevelopmental disorders are grouped together since they are highly correlated and share some common features, early onset in development, showing a steady course, and affecting males more commonly than females (Thapar et al., 2017). Thapar et al., (2017) also indicated that research needs to reflect the high level of overlap between neurodevelopmental disorders.

This is particularly important in the current thesis, since many individuals who experience childhood ADHD will also experience additional neurodevelopmental difficulties (Ghirardi et al., 2020). In particular, those with ADHD often show symptoms or a diagnosis of other neurodevelopmental conditions including learning disability (Koolwijk et al., 2014), language disorders (Korrel et al., 2017), ASD (Grzadzinski et al., 2016; Saito et al., 2020; Zablotsky et al., 2020), and intellectual disability (Faraone et al., 2017). This is especially concerning since children with both, for example, ADHD and ASD experience more difficulties in adaptive skills, including communication, daily living skills and socialization, compared to those with only one disorder (Scandurra et al., 2019). It has also been found that individuals with symptoms of both ADHD and ASD have more

severe mental health problems in childhood (Jang et al., 2013; Pehlivanidis et al., 2020). In particular, Zablotsky, Bramlett, & Blumberg, (2017) found that around one in eight children with a current diagnosis of ADHD were also diagnosed with concurrent ASD. They also found that compared to children with a diagnosis of ADHD alone those with co-occurring ASD had increased treatment needs and more co-occurring psychopathology, as well as being more likely to have a combined diagnosis of ADHD. The pattern is similar for the co-occurrence of ADHD with other neurodevelopmental difficulties (Eyre, Hughes, et al., 2019; Thapar et al., 2017). As many individuals with ADHD experience comorbid neurodevelopmental symptoms this indicates that it is vital for research to consider these additional conditions as they are important in explaining variation in outcomes for children who experience ADHD.

1.1.3. Adverse Outcomes Associated with ADHD

Individuals with ADHD are vulnerable to a range of negative outcomes across their lifespan, especially into adolescence and early adulthood (Shaw et al., 2012; Thapar & Cooper, 2016). Individuals who experience ADHD have an elevated risk of experiencing poor mental health outcomes including depression and suicide in adolescence (Chronis-Tuscano et al., 2010) and emerging adulthood (Meinzer et al., 2016; Patros et al., 2013). Individuals with comorbid ADHD and depression have a more severe course of psychopathology and higher risk of long-term impairment and suicide (Daviss, 2008). It has also been shown that individuals with persistent or late onset ADHD experience poorer mental health than those with remitted ADHD (Agnew-Blais et al., 2018). Alongside poorer mental health, many individuals who experience ADHD also struggle in other areas, such as, in peer relationships (Humphreys et al., 2013; Powell et al., 2020; Roy et al., 2015), family relationships (Babinski et al., 2011), educational (Richardson et al., 2015) and work outcomes (Anker et al., 2019) and lower self-esteem (Schei et al., 2018). There is, however, significant heterogeneity in these outcomes among those with ADHD, and not all individuals will experience symptom persistence, poor mental health, and social difficulties (Thapar & Cooper, 2016).

1.1.4. ADHD and associated outcomes summary

ADHD is a common and highly impairing disorder, which for many leads to adverse outcomes across the lifespan. Although traditionally seen as a categorical

childhood disorder, emerging evidence has indicated that ADHD may be best conceptualised as an extreme of a continuous trait where all individuals lie on the spectrum. The conceptualisation of ADHD is further complicated by the relatively high prevalence of co-occurring neurodevelopmental problems including ASD, which leads to poorer outcomes compared to one disorder alone. ADHD itself, as well as the additional concerns associated with it, has been seen to lead to a range of adverse outcomes through adolescence and early adulthood indicating that the negative impacts of ADHD do not only affect sufferers in childhood. Therefore, ADHD is a highly complex neurodevelopmental disorder that warrants significant further research to increase the understanding of how co-occurring disorders interact to worsen symptoms and how these concerns lead to poorer outcomes across a range of domains. Research has indicated that ADHD in childhood can impact on mental health throughout childhood, adolescence, and early adulthood. The current thesis specifically aims to investigate how we can optimise mental health outcomes by understanding how different factors may promote mental health resilience to explain why some individuals with ADHD experience better mental health outcomes than others.

1.2. ADHD and Mental Health

The current thesis has focussed on the associations between depression, anxiety, and conduct problems with ADHD. These mental health problems are common in young adulthood (Suvisaari et al., 2009) and have previously been found to be related to ADHD (Bendiksen et al., 2017; Gundel et al., 2017; Hargitai et al., 2023). Rates of depression, anxiety, and conduct problems are generally higher amongst those with ADHD and are associated with additional poor outcomes.

1.2.1. Depression

According to previous literature, there is a prospective association between ADHD and depression (Eyre, Riglin, et al., 2019; Gundel et al., 2017). This acts as a heterotypic continuity where one disorder earlier in life leads to an increase in risk for another disorder (Rutter et al., 2006). Chronis-Tuscano et al., (2010) indicated that all ADHD subtypes in younger children predicted depression in adolescence, and that either a combined or hyperactive-impulsive subtype were linked to suicidal behaviours. There is also evidence that females with ADHD may be at greater risk of experiencing depression with an earlier age of onset, greater

duration and more severe impairment including a higher rate of suicidality and hospitalisation than females without depression (Biederman et al., 2008). In a meta-analysis, ADHD was found to be associated with depression (Meinzer et al., 2014). However, this study found that most studies used clinical samples of ADHD and that there was stronger evidence of the association from cross-sectional rather than longitudinal studies (Meinzer et al., 2014). This suggests there is a need for further investigation of the longitudinal association between ADHD and depression in population-based samples.

The association between ADHD and depression extends into young adulthood (Riglin, Leppert, et al., 2021). Meinzer et al., (2016) found that a history of childhood ADHD significantly predicted greater levels of depressive symptoms at every age between 18 and 25 years. However, childhood ADHD did not impact on the rate of change in depressive symptoms from age 18 to age 25, with those with and without histories of ADHD illustrating reductions in depressive symptoms levels between the ages of 18 and 25 at very similar rates. Nelson and Liebel (2018) found that a group of college students with ADHD self-reported higher anxiety and depression symptoms compared to a matched control group. This association is exacerbated as it appears that college students with ADHD may under report symptoms compared to their parents as the self-reports were lower than the parent-reports in this study. Additionally, there may be an increased risk of suicide among college students (aged 18-24) with combined type ADHD (Patros et al., 2013). However, all these studies relied on cross-sectional designs or reports of past childhood ADHD symptoms, therefore more research utilising longitudinal measures of childhood ADHD and depressive symptoms in young adulthood are needed.

Utilising population-based samples would allow findings to be more representative of the general population rather than only including individuals who are clinically diagnosed in terms of their ADHD or depression symptoms. Employing a longitudinal design is also important since the ages of onset for ADHD and depression differ from each other. ADHD normally onsets in early childhood (Thapar & Cooper, 2016), whereas depression symptoms typically onset in adolescence or early adulthood (Zisook et al., 2007), so longitudinal studies of individuals with childhood ADHD with follow up that includes the risk period for

depression are important. The mechanisms of the association between ADHD and depression remain somewhat unclear (Meinzer et al., 2014), therefore, in order for the current thesis to better understand how to optimise mental health outcomes for those with childhood ADHD it is necessary to use a longitudinal design spanning childhood into young adulthood to investigate how ADHD leads to depression over time.

1.2.2. Anxiety

ADHD and anxiety disorders have been found to co-occur even in young children (Overgaard et al., 2014). It has been suggested that this co-morbidity between ADHD and anxiety develops in part due to early ADHD symptoms contributing to anxiety symptoms, but more research is needed to further clarify this mechanism (Gair et al., 2021; Wichstrøm et al., 2013, 2017). There are also high rates of ADHD-anxiety disorder comorbidity in adolescence (de la Barra et al., 2013; Jarrett & Ollendick, 2008; Yüce et al., 2013) and adulthood (Kessler et al., 2006; Van Ameringen et al., 2011). Individuals experiencing both ADHD and comorbid anxiety disorders are more likely to experience worse clinical outcomes including suicide attempts, higher rates of hospitalisation and a higher disposition towards anger (Quenneville et al., 2022). It appears that anxiety is more strongly related to inattention symptoms rather than to hyperactivity/impulsivity symptoms (Gustavson et al., 2021; Michelini et al., 2015). Limited research has suggested that this relationship between ADHD and anxiety symptoms in children is in part mediated by overprotective parenting, since child ADHD symptoms may lead to an increase in protective parenting, which in turn, can contribute to the development of anxiety symptoms (Meyer et al., 2022). Other research has similarly suggested that the association between anxiety and ADHD may be improved by targeting family-based factors (Gustavson et al., 2021). However, there has been a lack of investigation into specific protective factors in other areas that could potentially be targeted in preventative interventions to help alter the development of anxiety symptoms in individuals who experience childhood ADHD.

1.2.3. Conduct Problems

Childhood ADHD has been concurrently and prospectively associated with conduct disorder (Drabick et al., 2006). More specifically, children with combined ADHD or more severe inattentiveness are more likely to experience co-occurring

conduct disorder (Bendiksen et al., 2017). Comorbid conduct disorder appears to mediate the development of later antisocial behaviour and criminality among individuals with childhood ADHD (Retz et al., 2021). The factors influencing the relationship between ADHD and conduct problems are not yet clear. However, limited research has suggested that maternal depression acts as a risk factor and that early positive parenting may be protective against the development of conduct problems (Chronis et al., 2007).I Individuals with ADHD who experience conduct problems may also be vulnerable to poor outcomes in other domains. A meta-analysis found that both ADHD and conduct disorder were longitudinally associated with several poor outcomes including low academic achievement, mental health and substance use disorders, criminality and unemployment, however the mechanisms driving these poor outcomes remain unclear (Erskine et al., 2016). There have been suggestions that the causes behind ADHD and conduct disorder are mostly genetic (Azeredo et al., 2018; Rice et al., 2018). There appears to be a clear relationship between ADHD and conduct disorder. However, more research on factors that drive the mechanisms behind this association would be valuable. Therefore, research into potential protective factors could help to optimise conduct disorder outcomes for individuals with ADHD and help protect these individuals, their families, and society against the poor outcomes associated with conduct disorder linked to ADHD.

1.2.4. ADHD and mental health summary

To summarise, experiencing childhood ADHD is associated with poor mental health outcomes across depression, anxiety and conduct disorder. These outcomes are often first seen in childhood, however, there are long term associations between ADHD and poor mental health through adolescence and into adulthood. Evidence has also suggested that those individuals who experience both ADHD and an associated mental health problem tend to experience worse outcomes than individuals who do not experience this comorbidity (Biederman et al., 2008; Daviss, 2008; Eskander, 2020; Quenneville et al., 2022). However, despite these concerning findings it does appear that some individuals who experience childhood ADHD are able to show resilience to later mental health problems (Costello & Maughan, 2015). There has been some research indicating that there may be individual, social and family factors that play

a role in the development of co-morbid or later mental health problems in individuals with ADHD. However, very few studies have considered different protective factors and whether they explain the variation seen in mental health resilience among individuals with ADHD. Therefore, longitudinal research is needed which investigates the long-term mental health outcomes of individuals who experience ADHD across multiple domains. Within this research it would be valuable to examine the impact of multiple family, social and individual protective factors to direct future research efforts into effective interventions to optimise young adult mental health outcomes for individuals who have experienced childhood ADHD.

1.3. Mental Health Risk Factors in children with ADHD

The following section outlines risk factors that increase the likelihood of young people with ADHD experiencing mental health problems. The current thesis focuses on investigating the role of potential protective factors on mental health resilience in individuals with ADHD. However, it is important to first consider risk factors which contribute to the development of mental health problems, since, for an individual to show resilience they must first experience risk.

1.3.1. ADHD Persistence

Limited research has indicated that ADHD persistence into adulthood is associated with poor mental health outcomes. Around 15% will continue to meet criteria for ADHD in adulthood (Faraone & Biederman, 2005) and persistence of ADHD symptoms in clinical populations is high (Langley et al., 2010). Agnew-Blais et al., (2018) found that those with remitted ADHD did not have poorer mental health at age 18 compared to those who had never had ADHD, except for conduct disorder. Those with persistent or late-onset ADHD showed greater depression, anxiety, conduct disorder and suicide or self-harm than those without ADHD and appeared to be equally impaired. Overall results suggested that children with ADHD are not destined to experience negative outcomes across all domains in young adulthood. However, those with ADHD at 18 showed a stronger association with poor outcomes including mental health, substance misuse and psychosocial outcomes.

1.3.2. Sex

Both within the general population and in an ADHD population, sex can be a significant factor in the development of mental health disorders. Lahey et al., (2007) examined the effect of having ADHD on both boys and girls over an eight-year period. Their results indicated that although both sexes showed higher symptoms of conduct disorder, major depression, and anxiety disorders in adolescence compared to controls, girls exhibited more rapidly rising symptoms of anxiety and depression than boys. Similarly, Chronis-Tuscano et al., (2010) found that being female contributed to the prediction of which children with ADHD were at greatest risk of developing depression. They also observed that girls in their study were at greatest risk for suicide attempts. These studies imply that females with ADHD are at a greater risk for depression and suicide attempts than males with ADHD. Other research has illustrated that females with ADHD show worse depression symptoms than control females. Hinshaw et al., (2006) conducted a five-year follow-up study and found that childhood ADHD in girls leads to continuing impairment 5 years after childhood diagnoses. They found higher levels of depression among the girls with ADHD compared to the control girls. Similarly, Biederman et al., (2008) found that females with ADHD had a 2.5 times higher risk for developing major depression in adolescence than females without ADHD. More recently, in a systematic review Faheem et al., (2022) found that females with ADHD were more affected by mood and anxiety disorder than males with ADHD. However, Levy et al., (2001) found that there were higher rates of conduct disorder among males with ADHD than in females with ADHD. Current evidence indicates that within an ADHD population, females fair worse than males in terms of depressive and anxiety symptoms, and females with ADHD show poorer mental health outcomes than females without ADHD. In contrast, males with ADHD may show worse conduct disorder symptoms. In summary, there may be important differences between boys and girls in how ADHD affects later mental health.

1.3.3. Genetic Risk

Both ADHD and depression are heritable disorders, and ADHD and depression are genetically correlated (Demontis et al., 2019a; Wray et al., 2018). Recent genetic findings for ADHD and other psychiatric disorders include genome-wide association studies (GWAS) which examine the association of genetic variants

and specific disorders in population samples to further our knowledge of the biology behind psychiatric disorders (Visscher et al., 2017). These genetic variants reported by GWAS studies are SNP's which are common in the population. Recently, Levey et al., (2021) conducted the first genetic study of depression that involved more than one million participants. They found 223 independently significant SNPs in 178 genomic loci for depression using GWAS summary statistics across four cohorts. For ADHD, heritability on the liability scale has been estimated to be 0.216 (Demontis et al., 2019a). However, more SNPs are likely to be found since GWAS develop quickly and increased sample size will also impact on these results in the future (Visscher et al., 2017). Very recently, Demontis et al., (2023) identified 27 genome-wide significant loci and 76 potential risk genes associated with ADHD. They also indicated that 84-98% of ADHD-influencing variants are shared with other psychiatric disorders. It has also been found that there are significant genetic overlaps between many psychiatric disorders, and specifically between ADHD and depression (Lee et al., 2019). Rice et al., (2019) examined trajectories of self-reported depression. They found that the more common trajectory of depression which onsets around age 16 was associated with major depressive disorder genetic risk, but that less typical depression trajectories with early onset was associated with genetic risk for ADHD and schizophrenia, and with childhood ADHD and neurodevelopmental traits phenotypically. This suggests that the genetic risk for depression in those with ADHD may be related to the genetic risk of ADHD, and there is likely to be a neurodevelopmental influence in some cases of depression when the onset is early. Du Rietz et al., (2018) conducted a large-scale genome-wide association study to examine the overlap between ADHD and cooccurring conditions and traits. They found that common genetic variations underlying the risk for ADHD also contributed to the risk of higher body mass index, neuroticism, anxiety and depressive disorders, alcohol and nicotine use, risk taking, and lower cognitive ability. This suggests that the co-occurrence between ADHD and depression may be partly genetic in nature. Overall, there are genetic risks for both ADHD and depression which may in part be shared meaning that individuals with ADHD could be at greater genetic risk for depression too.

1.3.4. Irritability

One significant risk factor for depression in the general population and in those with ADHD is irritability or emotion dysregulation. In a review, (Vidal-Ribas et al., 2016) found that irritability is often stable over time and is associated with both anxiety and depression in longitudinal studies. They also discussed that irritability is somewhat heritable and that this may explain its link with depression. Other studies have considered irritability trajectories in children. Pagliaccio et al., (2018) found that children aged 3-5 years, with persistently elevated irritability increased the risk of later depression and decreased overall function. Similarly, Wiggins et al., (2014) also examined irritability trajectories in children and found that those with consistently high irritability, or those with high and increasing irritability had higher internalising symptoms later on, including higher than those with decreasing levels of irritability. Individuals with ADHD may be at particular risk of irritability acting as a risk factor for depression. Shaw et al., (2014) indicated that emotion dysregulation is common in ADHD throughout the lifespan and contributes to the impairment affected individuals face, although some current ADHD treatments can often reduce emotion dysregulation symptoms (Hirsch et al., 2019). Other studies have shown that irritability in individuals with ADHD may contribute to the elevated risk for depression seen in this population. Eyre et al., (2019) found that in children with ADHD irritability at baseline was linked to depression symptoms at follow up, as was persistent irritability. Their findings indicated that children with ADHD and persistent irritability were at an elevated risk of developing depression symptoms. Similarly, Wang et al., (2018) found that high dysregulation scores in childhood predicted increased ADHD symptoms, and the development of depression and anxiety symptoms in later adolescence. This indicated that an elevated dysregulation score was a long-term risk factor for mental disorder in adolescents. Overall, there appear to be significant overlaps between irritability, ADHD, and depression, some of which may in part be due to shared heritability. The evidence converges to suggest that irritability is common in ADHD and increases risk for later depression.

1.3.5. Parental Mental Health

Children whose parents have diagnoses of depression are likely to be at a greater risk for developing mental health problems themselves. Children of parents who

suffer from depression are three to four times more likely to have depression compared to the children of parents who don't have depression (Thapar et al, 2012). Tully et al., (2008) using an adoption design found that maternal depression was an environmental risk factor for the development of major depression in adolescents, but that paternal depression did not increase the risk of poor mental health in adolescents. Additionally, Avenevoli & Merikangas, (2006) suggested that the offspring of parents with depression were at an increased risk of depression compared to the children of parents without psychological illnesses. This risk was further increased if children's parents suffered from moderate to severe or recurring depression and if there was a multigenerational family history of depression. This suggests that children of parents with diagnoses of depression could benefit from preventative interventions. However, it isn't inevitable that the offspring of parents with depression will also develop depression. For example, Weissman et al., (2006) examined the effects of medication based treatment for mothers on their children's diagnoses and symptoms. They found that the remission of maternal depression after three months led to reductions of 11% in children's diagnoses, compared to an increase of 8% in diagnoses for the children of mothers whose depression didn't remit during this period. This suggests that the treatment of mother's depression is key given that remission also has positive effects on their children, whereas, if maternal depression continues their children's mental health is likely to continue to worsen. Within an ADHD sample, Agha et al., (2017) found that self-reported maternal depression predicted an increase in childhood conduct disorder symptoms among boys with an ADHD diagnosis. Collishaw et al., (2016) tested whether multiple protective factors including family and social factors as well as self-efficacy and physical exercise, predicted sustained good mental health among adolescents who had a parent with depression. They found that the most important factor in whether adolescents had good mental health outcomes was the number of protective factors they experienced. For those with zero or one only 4% had sustained good mental health compared to 48% of those with five protective factors. This study also used a residual scores method to examine the associations between these protective factors and better than predicted depression symptoms to control for differences in the severity of risk experienced by different individuals. This approach (which will be described in detail in section 2.3.4) helped to ensure that the protective factors

identified were not merely markers of the severity of parental depression. Overall, children whose parents have poor mental health are more likely to suffer from worse mental health outcomes themselves. And there is limited evidence that maternal depression in mothers with children with ADHD may be linked to worse mental health for those children. Therefore, as ADHD is already a risk factor for poor long-term mental health outcomes children who experience both adversities could be at an even greater risk.

1.3.6. Socioeconomic Status

Children and adolescents with low socioeconomic status are at higher risk of developing mental health problems (Reiss, 2013). More specifically, children and adolescents with lower socioeconomic status tend to suffer from multiple stressful life events and are therefore exposed to a higher risk of developing mental health problems (Reiss et al., 2019). There also appears to be an association between ADHD and socioeconomic status, as children from disadvantaged families are more likely to have ADHD than those from advantaged backgrounds (Russell et al., 2016). Therefore, socioeconomic disadvantage is associated with both worse mental health and ADHD outcomes.

1.3.7. Mental health risk factors summary

Overall, there are many risk factors which increase the likelihood of individuals with ADHD developing poor mental health outcomes across their lifetimes. There are multiple pathways through which individuals with ADHD may develop mental health problems, and these are likely to involve genetic, social, family, and individual risk factors. All these factors are important; however, it would be valuable for the current thesis to examine potentially modifiable social, family, and individual factors across time that could be targeted in preventative interventions to improve mental health resilience for individuals who experience childhood ADHD symptoms. However, it is important that when examining the role of modifiable risk and protective factors in children with ADHD, variation in symptoms and persistence of ADHD, as well as differences in genetic risk and comorbid neurodevelopmental problems, are taken into account. This is because there is substantial heterogeneity in how individuals experience ADHD and in the level of different risks associated with having ADHD.

1.4. Modifiable Protective Factors

This section outlines potential modifiable protective factors that may improve mental health resilience among individuals with ADHD. The previous section on mental health risk factors outlined those factors which are unlikely to be modifiable but likely to increase the vulnerability of individuals with ADHD going on to develop mental health problems in young adulthood. Whereas the following individual, family, and social protective factors may have the potential to protect individuals with ADHD from experiencing poor mental health outcomes. It was important to first consider risk factors since there is significant heterogeneity in the level of risk individuals with ADHD experience. Therefore, the current thesis will aim to first account for individual levels of risk, before testing potential protective factors to ensure that any promotive effect found is not a marker of ADHD risk.

1.5. Individual protective factors

1.5.1. Self-esteem

It has been reported that self-esteem may be vital among those with ADHD in promoting more positive mental health outcomes. Kurman et al., (2018) found that children with ADHD showed significantly lower self-esteem, and that self-esteem in children with ADHD was linked to parenting warmth and support. Self-esteem in adolescents with ADHD has been found to be a predictor of better psychosocial functioning in young adulthood, and lowers the risk of depressive disorders (Schei et al., 2018). Similarly, in a population sample of early adolescents, Babore et al., (2016) found that self-esteem was a predictor of depressive symptoms. The authors further suggested that interventions aiming to both monitor self-esteem and supporting relationships with both parents would be valuable in preventing the emergence of depressive symptoms. Through a systematic review, it has also been found that experiencing ADHD is associated with lower self-esteem in adulthood, but that it is plausible that these difficulties could, at least to some extent, be remediated (Cook et al., 2014). In another study focussing on early adulthood, Shaw-zirt et al., (2005) found that college age students with ADHD also had lower levels of self-esteem compared to controls. This study also found that the relationship between ADHD and poor college adjustment was partially mediated by self-esteem. There is also evidence that self-esteem may be

protective against poor mental health in young adulthood. In particular, Fritz et al., (2018) conducted a systematic review which found that self-esteem acted as a resilience factor in the relationship between childhood adversity and poor mental health outcomes in young people. Overall, research has found associations between self-esteem and mental health for those with ADHD from childhood through to young adulthood. Limited research has also indicated that self-esteem has potential to be protective in the relationship between childhood adversity and later mental health problems, and well as being important during the transition into young adulthood. However, previous studies examining the relationship between self-esteem and mental health in individuals with ADHD have been mostly small cross-sectional studies. Therefore, more research which examines this association in a larger population-based ADHD sample are warranted.

1.5.2. Avoiding problematic alcohol and drug use

Alcohol and drug use is a potential risk in the transition into young adulthood and avoiding problematic use of either may prove to predict resilience among individuals with ADHD. ADHD has been found to elevate individual's risk of substance use disorders (Erskine et al., 2016; Mannuzza et al., 1993; Molina & Pelham, 2003). Specifically in young adulthood, Mochrie et al., (2018) found that university-aged students with ADHD were more likely than controls to report frequent alcohol use, binge drinking, regular marijuana use and to have used other drugs in the last year. It has also been found that individuals, with and without ADHD, who have problems with substance abuse and binge drinking may show higher levels of antisocial behaviour (Hussong et al., 2004) and depression (Wang et al., 2019). There are links between experiencing ADHD and problematic drug and alcohol use which in turn is associated with poorer mental health outcomes. However, research into the links between ADHD, substance use, and mental health are limited, especially for anxiety disorders. Therefore, research examining problematic substance use in those with ADHD across different areas of mental health including depression, anxiety, and conduct disorder are warranted. Since, recent research is limited but does indicate that avoiding problematic use may be associated with mental health resilience.

1.6. Family protective factors

1.6.1. Parenting and family environment

Family life may also be impacted for those experiencing ADHD. For example, Babinski et al., (2011) found that those with ADHD had higher levels of impairment in family relationships. However, Dvorsky and Langberg, (2016) conducted a review which reported that positive parenting, including positive attitudes, parenting behaviours, emotional support, and affection could act as protective factors for individuals with ADHD. Positive parenting has generally been found to promote positive adjustment in all young people, including those with ADHD. For example, Chronis et al., (2007) found that parental psychopathology predicted conduct problems, whilst, positive parenting predicted fewer future conduct problems in children with ADHD. This suggests that early positive parenting is a protective factor in the development of conduct problems among children with ADHD. This indicates that alongside other treatment options for children it may be important to consider behavioural parenting interventions which encourage the use of positive parenting techniques in early childhood.

Likewise, Healey et al., (2011) indicated that the symptoms of ADHD can increase the likelihood of negative parenting styles. They found that high levels of child impulsivity were related to high levels of maternal parenting stress which led to higher levels of inconsistent parenting and lower levels of positive parenting. Harold et al., (2013) utilised an adoption study which illustrated that early childhood ADHD behaviour influences adoptive mothers' level of hostility which in turn was predictive of the child's later ADHD symptoms. This association is not due to shared genetic influences indicating that the child's ADHD symptoms have a causal effect on parent behaviours. This implies that ADHD reduces the likelihood of positive parenting acting as a protective factor, and therefore increasing a mother's coping skills may help to reduce parenting stress and increase positive parenting which may help improve a child's functioning. Much of the research so far has focused on the impact of mother's parenting rather than considering the positive impact father's parenting may have on children with ADHD. Also, most of the research to date has focused on social and academic functioning and conduct problems and not yet tested whether there are protective effects for emotional problems within those with ADHD.

Other research has focussed on parent-child relationships and family environment in the relationship between ADHD and mental health problems. Humphreys et al., (2013) examined whether parent-child relationship difficulties mediated the relationship between ADHD and the likelihood of developing depression, they found that parent-child relationship problems were unique mediators of the relationship between ADHD and depressive symptoms. There are often elevated rates of parent-child problems in families of children with ADHD and depression (Deault, 2010). Previously, Drabick et al., (2006) had found that in boys with ADHD a family environment high in conflict, low in cohesion, and low in marital satisfaction predicted child conduct problems and depression symptoms. They suggested that these family factors are likely to lead to more negative parent-child relationships, and that the co-occurrence often seen between ADHD, conduct problems and depression leads to worse functional impairment compared to one disorder alone. Therefore, the family environment appears to be an important context which can influence associations between ADHD and mental health problems and further research could help to develop intervention strategies to mitigate the negative effects of a negative family environment. Alongside the other family factors discussed, it appears that many of these factors are intertwined and influence or worsen each other further adding to the environmental adversity experienced by individuals with ADHD. Therefore, further research is needed that investigates a range of family relationship and environmental factors within one study rather than focussing on one or two specific factors. Many of the previous studies have also focussed on family factors during childhood, however, further research should also consider the potential protective role of family relationships and environment in adolescence and young adulthood.

1.6.2. Sibling relationships

Comparatively little research has focussed on sibling relationships among individuals with ADHD. However, it has been found that children with ADHD experience more conflict in their sibling relationships than typically developing children (Mikami & Pfiffner, 2008). More recently, it has been reported that children with ADHD experienced greater hostility in their sibling relationships and this was also found to be linked to having fewer friendships (Kouvava & Antonopoulou, 2020). The social impairment children with ADHD often experience,

including in their sibling relationships, is associated with adverse outcomes (Daffner et al., 2020). However, recently a sibling-mediated social intervention study reported that the children with ADHD increased their use of positive social behaviours (Daffner et al., 2020). This indicates that the sibling relationships of children with ADHD may be ideal targets for interventions that may increase resilience. However, up until this point there has been relatively little research examining the potential of siblings in interventions.

1.6.3. Parental involvement

Cong et al., (2020) found that in a general population sample higher levels of childhood parental involvement lowered the risk of developing depression in early adulthood, showing that parental involvement in early life promotes good mental health across the life course. In an at-risk sample of youth with mothers who have depression Collishaw et al., (2016) found that paternal emotional support was a robust predictor of mental health resilience. In the same high-risk sample, Mahedy et al., (2018) found that paternal emotional support acts as a mediator between the parental relationship and depressive symptoms in their children. This further suggests that paternal involvement is a strong predictor of mental health resilience in young people. However, there is limited evidence of the effect of paternal involvement and support on mental health resilience within a high-risk ADHD sample. And past research has suggested that further research is needed on the role of fathers in the development of depressive symptoms among young people with ADHD symptoms (Meinzer et al., 2021).

1.6.4. Support for parents

Families with children who have ADHD are likely to have lower levels of social support than families who do not have a child with ADHD (Lange et al., 2005). This may contribute to parents of children with ADHD experiencing high levels of stress which they attribute to their child's behaviour but also social stigma and a lack of available support (Leitch et al., 2019). More recently, evidence has suggested that social networks may increase the likelihood of parents seeking help for their children with ADHD (Kappi & Martel, 2022). This is particularly important since early treatment may be beneficial (Thapar & Cooper, 2016). There have only been limited studies which have examined the impacts of family support on families with ADHD, however, the benefits of targeting parenting stress

reduction in the development of family level interventions have been highlighted as important (Theule et al., 2011).

1.7. Social protective factors

1.7.1. Peer relationships

Many children with ADHD experience difficulties in their peer relationships (Humphreys et al., 2013; Powell et al., 2020; Roy et al., 2015). Evidence has suggested that the relationship between ADHD, peer relationships and later mental health outcomes may vary across different outcomes. McQuade et al., (2014) indicated that self-perceived social acceptance by those with ADHD was associated with fewer depression symptoms, but also higher conduct problems. More recently, friendship quality was found to be a key pathway through which ADHD symptoms were associated with later depressive symptoms, and that positive parent-child relationships further contribute by moderating the relationships between ADHD, friendship quality and depression (Powell et al., 2021).

Many individuals who have ADHD continue to experience difficulties within peer relationships into adulthood. Barkley et al., (2006) found those who were hyperactive in childhood had fewer close friends, and parents reported that they had more social problems than controls in young adulthood. Evidence has also suggested that young adults with more severe ADHD symptoms felt less able to provide emotional support and manage interpersonal conflict (Mckee, 2017). However, Khalis et al., (2018) found that positive relationships with new peers at university was predictive of good adjustment among adults with ADHD moving away to university for the first time. This suggests that peer relationships remain challenging in young adulthood for those with ADHD, however, if positive relationships can be formed then this may be protective.

In terms of promoting better peer relationships among those with ADHD, having good prosocial skills is associated with peer popularity (Warden & Mackinnon, 2003). Recently, Velő et al., (2021) reported that children with ADHD who were not currently undergoing treatment, showed lower levels of prosocial behaviour and hence had more peer problems than a control group. This is in line with Paap et al., (2013) who reported that high levels of ADHD and behavioural symptoms

were associated with low levels of prosocial behaviour and high levels of peer problems. It has also been found that individuals with both ADHD and depression are likely to experience higher levels of difficulty with prosocial behaviours, as well as in other areas of impairment (Coutinho et al., 2018). Overall, if prosocial behaviours could be improved in children with ADHD this may lead to better peer relationships and improved mental health outcomes.

1.7.2. School Environments

Expectations placed on children in school environments are often not a good fit for those with ADHD, and this can lead to poor social and educational outcomes (Richardson et al., 2015). ADHD is a significant predictor of schoolwork noncompletion, suspension, expulsion, and changing schools (Martin, 2014). However, multimodal treatment approaches to ADHD appear to improve academic achievement and outcomes (Arnold et al., 2020). Specifically, Mackenzie, (2018) indicated that promoting academic achievement through academic interventions would lead to increased interest and motivation in schoolwork which could increase academic success throughout an individual's academic career and could lead to long-term mitigation. Likewise, schools adopting strengths-based assessment and intervention approaches may improve the school environment for those with ADHD (Climie & Mastoras, 2015). Therefore, it appears that if individuals with ADHD can experience greater engagement and enjoyment in their educational environments then greater educational and therefore occupational success are likely to follow. This is likely to lead to mental health benefits. However, few studies have used measures which specifically consider the level of enjoyment individuals with ADHD experience at school, and this may lead to improved outcomes, both educationally and to longer-term mental health benefits.

1.7.3. Avoiding poor educational and occupational outcomes

Those with ADHD often have poor educational outcomes (Costello & Maughan, 2015). This can lead to occupational difficulties. Barkley et al., (2006) indicated that individuals with hyperactivity had difficulty maintaining employment and lower job performance in early adulthood than matched controls. A review by Gordon & Fabiano, (2019) indicated that those with a history of ADHD experience more educational impairment and consequently also experienced lower occupational attainment, higher job instability, and showed impaired job performance. In turn

this also appeared to predict financial challenges. These concerns are likely to lead to increased levels of stress and worse mental health as individuals enter young adulthood.

1.7.4. Social Support

Recently, Mastoras et al., (2018) found that children with ADHD received lower levels of social support than other children. The authors indicated that there is likely to be an influence of perceived social support on emotional well-being over time. A meta-analysis also found a positive association between social support and well-being which increased with age in a general sample of children and adolescents (Chu et al., 2010). This indicates that social support may be a worthwhile target for further research into resilience into young adulthood. There has also been research into the effect of social support on adjustment. Demaray et al., (2005) found that both parental and peer support can have a positive effect on emotional symptoms of adolescents. Social support may also differ dependent on sex. Rueger et al., (2010) reported that perceived social support had a positive relationship with depression, anxiety, and self-esteem. Parental support was significant for both sexes; however, classmate support was only significant for boys.

Another potential form of support in young adulthood is from romantic relationships. Enduring and healthy romantic relationships are critical to quality of life in adulthood, however some of those with ADHD tend to struggle to maintain romantic relationships (Bruner et al., 2015; Wymbs et al., 2021). Similarly in adolescence, individuals with ADHD tend to experience poorer-quality romantic relationships (Rokeach & Wiener, 2018). This indicates that individuals who have ADHD may struggle to gain support from a partner, however if they experienced a healthy relationship this may prove protective. Social support may, therefore, be a significant protective factor in promoting well-being and adjustment in youth. However, this relationship is potentially complex and may differ with age. Therefore, further investigation considering potentially promotive effects of social support on emotional wellbeing and adjustment through into young adulthood among those with ADHD are justified.

1.7.5. Protective factors Summary

Overall, previous research has demonstrated that there is a wide range of potential factors across individual, family, and social areas that could prove protective for those with ADHD. However, not many of these factors have previously been tested to understand whether they are promotive of better mental health outcomes in individuals who have experienced childhood ADHD symptoms. It is also clear from the previous section (section 1.3) that there is heterogeneity in the level of risk experienced by individuals with ADHD. Therefore, the current thesis will attempt to investigate whether these factors are protective for depression, anxiety, and conduct disorder symptoms among individuals with ADHD, whilst accounting for differences in risk associated with experiencing ADHD.

1.8. Resilience

This section outlines how resilience has been defined and conceptualised in the literature, how resilience has been operationalised in the current thesis and considers previous studies which have examined mental health resilience among individuals with ADHD.

1.8.1. Theory and Definition

Resilience is increasingly being considered as important in the promotion of mental health since it is not always possible to remove or reduce the risks associated with experiencing poor mental health. However, identifying factors which increase resilience has been complicated by differing views on theory and methodology (Dvorsky & Langberg, 2016). For an individual to be resilient they must experience risk or adversity and show positive adjustment despite their experience (Luthar et al., 2000). However, resilience is considered to be a normal process that is common and arises from normal human adaptive functions (Masten, 2001). This is a very positive view which suggests that there is potential for the outcomes of at-risk children to be improved by alterations to policy and practice. Rutter, (2015) suggested that resilience had three main features; individuals had to have experienced adversity, outcomes must be heterogeneous, and resilience is inferred based the presence of exposure to risk and an unexpectedly positive outcome. According to this view it is not a directly measurable trait. Resilience is an interactive process, and for an individual to

show resilience they must have a better outcome than others who have experienced similar adversity (Rutter, 2013).

One important distinction that needs to be made is that resilience is not simply the opposite of risk. Resilience focuses on the individual differences in responses to similar adversities (Rutter, 2006). Research therefore often focuses on the processes which impact on individual variations. For example, resilience-based research designs tend to utilize within-group designs to focus on better and worse outcomes among children with similar risks to attempt to further understand within-group heterogeneity (Collishaw, Hammerton, et al., 2016; Oddo et al., 2018). In contrast, studies focused on risk often look at the impact that experiencing a specific risk has on one group compared to a control group. Overall, future research into resilience has potential to increase the understanding of processes which impact on at-risk individuals and influence the outcomes they have following adverse experiences. In particular, individuals who experience childhood ADHD exhibit significant heterogeneity in their long-term outcomes (Thapar & Cooper, 2016). Therefore, resilience-based research approaches have the potential to increase the understanding of factors which may lead to improved outcomes in ADHD populations.

Resilience is increasingly seen as important in the promotion of mental health, however, research attempting to identify factors that improve resilience has been complicated by differing views on the theory behind promotive and protective effects (Dvorsky & Langberg, 2016). Broadly, the field uses the term promotive to describe main effects and protective to describe interactions (Masten, 2001; Mikami & Hinshaw, 2003). In essence, promotive factors are beneficial across the population, whereas protective factors are important where individuals have experienced a high-level of risk since they mitigate or reduce the effects of risk on a specific outcome (Wright & Masten, 2013). More recently, (Brumley & Jaffee, 2016) defined promotive factors as main effects related to decreases in problematic outcomes, and protective factors as buffering factors which buffer individuals from externalizing problems in the presence of risk. The authors also indicate that to understand whether an effect is promotive or protective research must test for interactions between positive factors and risk factors. In the current thesis we have adopted the term ‘protective factors’ for the positive and potentially

modifiable factors that we examine. This term was chosen since in the current thesis the effect of these protective factors is tested within a high-risk ADHD sample only so these factors were identified to test whether they mitigate the relationship between experiencing childhood ADHD symptoms (risk) and later mental health problems (specific outcome). Another methodological concern is whether risk and protective factors are distinct categories or whether it can be argued protective factors are instead the absence of risk factors. However, Diehl et al., (2012) defined risk factors as individual characteristics that increase the individual's vulnerability to daily stress. Whereas protective factors protect the individual against the effect of daily stressors. In the current thesis experiencing increased childhood ADHD symptoms is conceptualised as a risk factor, and the protective factors were all hypothesised to have a potential role in protecting those individuals within the ADHD group from experiencing poor adult mental health problems. However, it is difficult to fully separate risk and protective factors and it is likely that risk and protective factors interplay and interact with each other (Klasen et al., 2015).

Overall, resilience research has the potential to increase the understanding of the processes that affect individuals at risk of poor outcomes due to their experience of ADHD. The heterogeneity in outcomes discussed above indicates that some individuals with ADHD can show positive functioning across different areas, and identifying relevant protective factors which have contributed to these individuals overcoming adversity may help to inform the development of further clinical research and the development of interventions to increase resilience among individuals with ADHD. Resilience research which focuses on identifying protective factors can provide valuable insights into what may be involved for individuals with ADHD overcoming adversity. Many, but not all, children with ADHD experience increased difficulties at school, home, in their social relationships and friendships, and affected children often have low self-esteem (Harpin, 2005; Shaw-Zirt et al., 2005). A few studies have tested protective factors across individual, family and social domains. The current thesis aims to build understanding of resilience in ADHD specifically, by aiming to identify factors which protect against young adult mental health problems among individuals with ADHD.

The current thesis conceptualises resilience in two ways within the research chapters. Firstly, sustained good mental health across 18-25 years was operationalised to allow for a group of individuals, who had experienced high childhood ADHD symptoms, to be identified as being resilient through the absence of any clinical level of mental health problem throughout this period of young adulthood. Secondly, resilience was operationalised as when individuals exhibit lower symptom scores than those predicted by measures of risk. This approach is advantageous since by defining resilience as better-than-expected rather than good adaptation this allows for levels of risk to be accounted for meaning that any protective factors identified are not markers of lower risk severity. It also, unlike the sustained good mental health approach, allows for specific protective factors to be identified for different mental health outcomes. To the best of our knowledge, no studies have used this approach to investigate resilience to young adult mental health problems among individuals with high childhood ADHD symptoms.

1.8.2. Mental Health Resilience in ADHD

Overall, as a group, young people with ADHD experience a wide range of difficulties. However, there is substantial variation in the impairments and outcomes of individuals who experience ADHD (Dvorsky & Langberg, 2016). It is not a given that all individuals with ADHD will develop poor mental health outcomes. For example, a minority of individuals who experience ADHD can avoid negative outcomes and show positive outcomes in different areas of functioning (Biederman et al., 1998; Lee et al., 2008). Specifically, Biederman et al., (1998) found that around 20% of their ADHD sample functioned effectively across school, social, and emotional outcomes; around, 60% showed mixed outcomes between these outcomes, and 20% showed poor outcomes across all these areas. Recognising this heterogeneity in outcomes among those with ADHD is important and highlights the need to identify protective factors and mechanisms that may contribute to resilience outcomes for those with ADHD.

Kuriyan et al., (2013) suggest that it is possible for some young people with ADHD to transition from school into higher education and successful occupations if interventions and support continue into young adulthood. Similarly, Modesto-Lowe et al., (2011) suggested that strengthening family support and improving access to

health and educational resources would lead to functional improvements for those with ADHD.

Research investigating mental health resilience within an ADHD population is sparse. Oddo et al., (2018) found that some adults experiencing ADHD could be resilient to depression. They identified that those who were less engaged in ruminative thinking and those with more extensive ADHD treatment histories were more likely to be resilient. However, this study employed a cross-sectional design, and the authors suggested that prospective longitudinal studies are needed that examine factors that promote resilience to depression among those with ADHD. This study also defined resilience to depression as the complete absence of lifetime depressive disorder, however, a positive or resilient outcome for an individual with ADHD could be considered positive for that individual without a complete lifetime absence of depressive symptoms.

1.8.3. Resilience Summary

Overall, previous literature suggests that there is a group of individuals who experience ADHD who are resilient, in that they show good levels of adaptation across one specific or multiple areas of functioning. However, there is insufficient research that has examined mental health resilience within an ADHD population. Studies which have done so have been cross-sectional in design and have defined resilience as either the absence of any mental health disorder or used a more general resilience measure. Therefore, more research examining mental health resilience in those with ADHD which measure resilience in a more individualised method accounting for additional risks of experiencing such a complex neurodevelopmental disorder are needed. By examining within-group mental health resilience it is then possible to investigate protective factors which are specific to an ADHD population that may promote more positive mental health outcomes for individuals in this high-risk group.

1.9. Limitations of the Existing Literature

Overall, there is research indicating that a substantial relationship between ADHD symptoms and depression, anxiety and conduct problems exists. However, there remains a lack of research focussed on the relationship between these mental health problems and ADHD, especially for anxiety (Hargitai et al., 2023). Within

previous studies examining the relationship between ADHD and mental health much of this research has focussed on small clinically diagnosed samples (Meinzer et al., 2014). More research is needed which adopts population-based samples, since individuals with sub-threshold ADHD symptoms also experience similar poor outcomes (Bussing et al., 2010; Loe & Feldman, 2007).

Young adulthood is a key developmental period of transition. Many life changes occur during young adulthood (around 18-25 years) including finishing compulsory education, moving into jobs and apprenticeships or into higher education, and potentially living independently for the first time (Cleverley et al., 2018). This does however, mean that young adults may be less supported by family networks whilst facing increasing demands (Signorini et al., 2018). Schilling et al., (2007) indicated that the transition to adulthood is a 'watershed' developmental period and therefore the impacts of poor mental health during this developmental period are likely to be far reaching. However, the authors also implied that young adulthood also offers a potential 'turning point' for individuals who have experienced significant risk (in this study adverse childhood experiences). It is likely that, individuals with ADHD may face particular challenges during this transitional phase in young adulthood. Ford, (2020) indicated that the difficulties experienced by those with ADHD, such as the reduced ability to organise and regulate themselves is likely to make this transitional phase more challenging. However, very few studies have examined the relationship between childhood ADHD and young adult mental health problems longitudinally. Specifically, more research examining potential protective factors which promote better young adult depression, anxiety, and conduct outcomes in individuals who have experience of childhood ADHD symptoms is needed. This is a particularly important developmental phase to consider since ADHD manifests in childhood (Thapar & Cooper, 2016) whereas mental health problems tend to onset later in adolescence or early adulthood (Zisook et al., 2007).

ADHD itself is a complex neurodevelopmental disorder with significant variation in clinical presentation (Sonuga-Barke et al., 2005). This heterogeneity among individuals with ADHD requires further examination from a resilience point of view. The aim of resilience-based research is to understand within-group heterogeneity among individuals at high risk in order to identify factors which may prove

protective in the context of that risk (Collishaw, Hammerton, et al., 2016; Oddo et al., 2018). The current thesis focuses on one particularly high-risk group - children with ADHD. However, it is important for research designs to fully account for differences in ADHD risk, co-morbid neurodevelopmental problems and genetic risk, so that any protective factors identified are not simply markers of the differences in ADHD risk.

Several studies have considered potential protective factors in the relationship between ADHD and various mental health problems, especially for depression. However, there remains a lack of research into specific protective factors for depression, anxiety and conduct problems in young adulthood among those who have experienced ADHD in childhood. Other research has highlighted the difficulties experienced by individuals with ADHD across individual (Kurman et al., 2018), family (Babinski et al., 2011), and social factors (Humphreys et al., 2013). Many of these studies have focussed on one or two specific factors, yet it appears that these factors are likely to be intertwined and exert influences on each other within the relationship between ADHD and mental health problems. Therefore, more research is justified which explores a range of factors within the same population-based sample. Any potential protective pathways which may exist between factors which occur in childhood through to adolescence remain unexplored.

1.10. Thesis Aims and Hypotheses

The overall aims of this thesis were to identify child, adolescent and young adult protective factors that optimise adult mental health outcomes in individuals at high risk due to childhood ADHD symptoms, and to consider possible mechanisms that explain protective associations across development. These aims are addressed in three empirical research chapters.

The aim of the first study was to examine associations between individual, family, and social protective factors across childhood and adolescence with young adult mental health resilience in those with high childhood ADHD symptoms. This study utilised two methods of measuring mental health resilience: i) via defining it as sustained good mental health across the ages of 18-25 years, and ii) using a

residual scores approach to examine better-than-predicted adult mental health outcomes at age 25 years.

The aim of the second study was to examine associations between individual, family and social protective factors occurring during the young adult years (18-25 years) with adult mental health resilience in those with high childhood ADHD symptoms. This study also examined and accounted for the persistence of ADHD symptoms into young adulthood since many, but not all, individuals continue to experience symptoms into adulthood.

Building on findings from the first two studies, the aim of the third study was to mechanistically examine the association between childhood father involvement and better emotional outcomes at age 25 in individuals with high childhood ADHD symptoms. This analysis aimed to understand whether adolescent peer relationships and self-esteem mediated the relationship between childhood father involvement and emotional problems at age 25 years.

2. Chapter 2: Methods

2.1. Sample

2.1.1. ALSPAC

Data were from the Avon Longitudinal Study of Parents and Children (ALSPAC) (http://www.bristol.ac.uk/alspac/). ALSPAC is a transgenerational prospective observational study which examines health and development across the life course (Boyd et al., 2013). It aims to increase the understanding of genetic and environmental factors that influence health and development in both parents and children (Fraser et al., 2013). All pregnant women resident in Avon, England with an expected delivery date between 1st April 1991 and 31st December 1992 were considered for the study. There were 14,541 pregnancies originally included and 13,988 children were alive at one year of age. When the oldest children were seven years of age the sample was increased with eligible children who had not joined the original cohort. This led to an additional enrolment of 913 children, with the total sample of children alive at one year increasing to 14,901 (Northstone et al., 2019).

The children's development has been followed since birth via questionnaires and face-to-face visits. The sample is believed to be largely representative of UK children, although mothers enrolled in ALSPAC were more likely to live in owner

occupied housing, have a car, be married and be white (Fraser et al., 2013). At 16 years children enrolled in ALSPAC had higher educational attainment compared to the national average, and were less likely to be eligible for school meals (Boyd et al., 2013).

2.1.2. Recruitment

ALSPAC used opportunistic recruitment and aimed to recruit eligible women as early in pregnancy as possible. Initial contact was made by recruitment staff visiting community locations and through promotion in media coverage and in routine antenatal and maternity services (Boyd et al., 2013). Women were given an 'expression of interest' card which allowed them to request more information about the study or decline participation. This card allowed the study team to determine eligibility (Golding et al., 2001). An information booklet was also given to eligible women explaining the reasons for carrying out the study and information on participation and confidentiality, this was followed by an initial questionnaire (Golding et al., 2001).

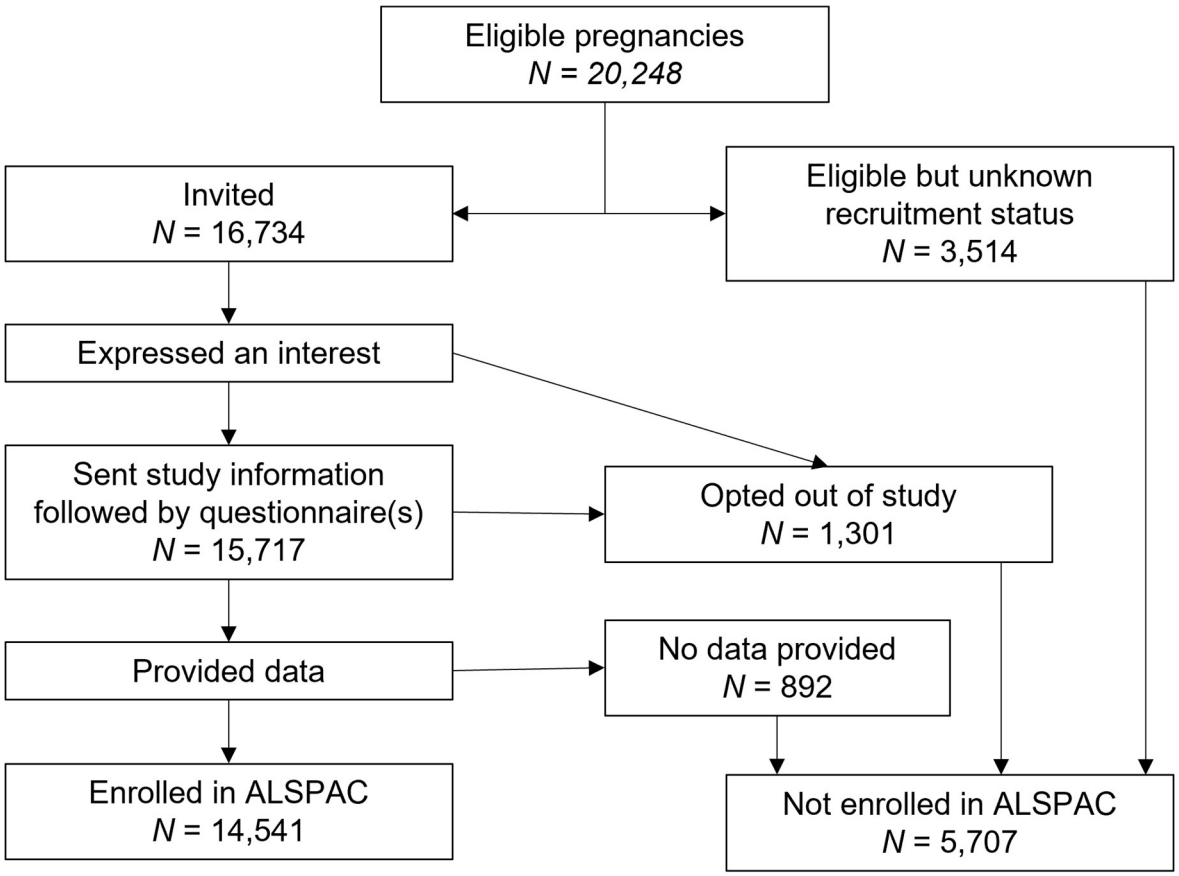


Figure 2.1 DSM-5 Diagnostic Symptoms for Attention Deficit Hyperactivity Disorder

2.1.3. Retention

The ALSPAC sample has been subject to attrition across the repeated follow-up assessments. Attrition rates were greatest when the participants were in infancy and increase again as they enter adulthood (Boyd et al., 2013). Some of this attrition is due to permanent attrition. However, a large proportion of the original participants (around 82%) remain engaged with the study and show different patterns of response with some completing every other questionnaire, or not completing several in a row but then responding (Fraser et al., 2013). The ALSPAC team aim to keep interest in the study as high as possible through media coverage highlighting the survey as well as regular newsletters being sent to all enrolled parents. Additionally, all the children are sent birthday cards and were invited to join a club to keep them interested and engaged with the study (Golding et al., 2001). Despite this, the amount of missing data in specific measures especially once the participants reached early adulthood is substantial, even more so when analysis requires using data points across childhood, adolescence, and young adulthood. In the current thesis the problems with missing data and attrition have been addressed using multiple imputation. More detail is available below.

2.1.4. ADHD high-risk group

The Development and Wellbeing Assessment (DAWBA) is a semi-structured interview that was administered to the main carer as a postal questionnaire at ages 7 and 10 years. It includes items on children's mental health symptoms and their impact (Goodman et al., 2000). It can be used to derive ADHD DSM-5 diagnoses as well as symptom scores and includes 18 ADHD items (each scored 0 "No", 1 "A little more than others", and 2 "A lot more than others"). These were summed to create total ADHD symptom scores, so all scores were between 0 and 36.

To identify children with high childhood ADHD traits, those scoring in the highest 10% on either, or both, of the two timepoints were identified (*N* = 1,195; 14% of those with childhood data). To be included in the measure participants had to have data available for one of these two timepoints (See figure 2.2 below). Multiple imputation was then applied to this group (*N* = 1,195) (see section 2.4.1).

The sample from which the high ADHD risk group was derived included participants who had data available for a DAWBA ADHD measure at either age 7 or 10 years (*N* = 8, 266). Those participants included in the sample differed from those excluded due to missing data at ages 7 and 10 years on a number of demographic characteristics. Mothers were slightly older at birth [OR 1.10 (95% CI 1.09, 1.11)] and had lower parity [OR 0.87 (95% CI 0.83, 0.90)]. Those included were also more likely to own their home [OR 2.67 (95% CI 2.48, 2.88)] and mothers had higher education levels [OR 1.45 (95% CI 1.42, 1.49)].

Compared to other participants in the ALSPAC sample (*N* = 7,071), those in the high-risk ADHD group (*N* = 1,195) differed slightly on some demographic characteristics. Mothers' age at birth was younger [OR 0.97 (95% CI 0.96, 0.99)] and they had increased parity [OR 1.02 (95% CI 0.95, 1.09)]. They were also less likely to own their own home [OR 0.62 (95% CI 0.54, 0.72)] and mother's had lower education levels [OR 0.90 (95% CI 0.85, 0.95)].

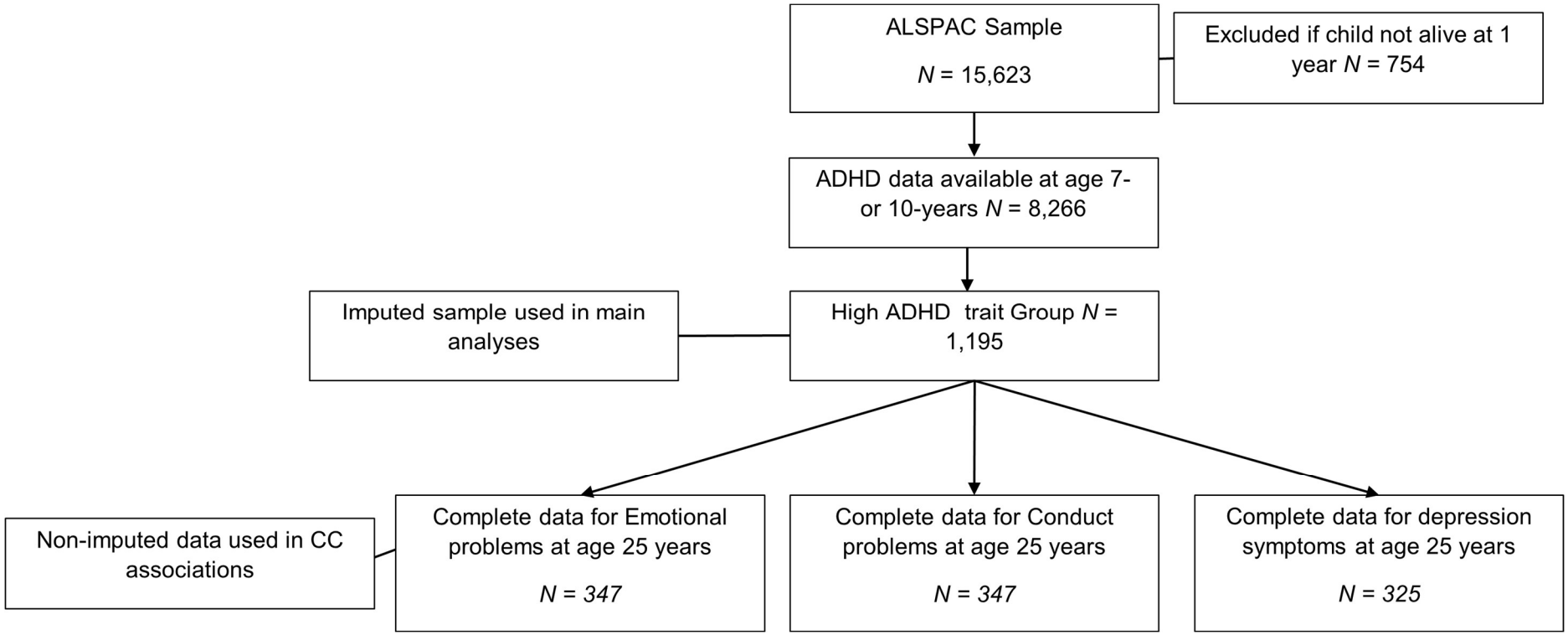


Figure 2.2 Flow chart of the ALSPAC sample and retention within the high ADHD trait group, Complete data includes those in the high-risk ADHD group who have data for each of the mental health outcome.

2.2. Procedure

The ALSPAC study has followed the parents and children regularly via both questionnaire and clinic-based assessments over time. Data is still being collected and so far, is available up to around age 28 years. The current thesis utilises data collected from birth through to age 25 years collected from mother, child and teacher reports via both questionnaire and in person interview assessments.

Questionnaires sent during pregnancy would be followed-up by reminder letters seven days afterwards if the mother had not responded. After another 10 days with no response a second reminder letter was sent, and after one month of no response the mother would be contacted via phone or home visit by a member of the ALSPAC team who would encourage or help them to complete the questionnaire (Golding et al., 2001). After the child had been born the date of delivery was used to determine when the subsequent questionnaires were sent to the mothers and children (Golding et al., 2001). Between the ages of seven and 17 children in the study were invited to attend focus clinics where the child and parent would attend for a half-day session annually (Boyd et al., 2013).

ALSPAC has also collected biobank samples. Repeated blood samples from mothers were collected both during routine antenatal appointments as well as during follow-up appointments. These have been used to establish a maternal DNA bank (Fraser et al., 2013). Samples of DNA have also been collected from children with samples being collected for at least 11, 343 of the children in ALSPAC (Boyd et al., 2013). Analyses are only carried out on these samples if mothers have given their consent (Golding et al., 2001).

Written informed consent was obtained from all mothers who were recruited into the ALSPAC study and ethical approval was obtained from the ALSPAC Ethics and Law committee and the Local Research Ethics Committees. The current thesis also obtained specific approval from the ALSPAC executive committee (project no. B3587).

Consent was implied for any self-completion questionnaire data when these questionnaires were returned. For data collected at focus clinics verbal consent was obtained from the parents or guardians who attended the clinic with the child

and verbal agreement was also obtained from the children before all measures were collected.

The UK Medical Research Council the Wellcome Trust and the University of Bristol provide core funding for ALSPAC. Further details on sample characteristics and methodology are available (Boyd et al., 2013; Fraser et al., 2013). Detailed information on ALSPAC can be found on the study website (http://www.bristol.ac.uk/alspac/). A fully searchable data dictionary is also available (http://www.bristol.ac.uk/alspac/researchers/our-data/).

2.3. Measures

Figure 2.3 shows a timeline of the main analysis measures used throughout this thesis. Measures used were mainly from parent and self-report questionnaires: however, teacher-reports and some interview measures from focus clinics have also been used. Specific detail on the main measures across all research chapters are described below. Further details on protective factor measures and any others used in specific analyses are described fully in the relevant research chapters (Chapters 3, 4, and 5).

Figure 2.3 Timeline of main analysis variables from ALSPAC used in this thesis

2.3.1. ADHD risk markers

ADHD symptom levels, co-occurring neurodevelopmental problems and ADHD genetic risk were included to account for heterogeneity among individuals within the high ADHD trait group. These markers were used to calculate adult mental health residual outcome scores to ensure that any associations with protective factors do not reflect measured heterogeneity in ADHD risk.

2.3.1.1. ADHD Symptom Levels

ADHD symptoms were measured using DAWBA ADHD symptom scores at age seven and ten years (see section 2.1.4).

2.3.1.2. Neurodevelopmental Problems

Children with ADHD often experience additional neurodevelopmental problems, which can lead to worse outcomes than experiencing ADHD alone. As in Eyre et al., (2019) we derived a set of dichotomous variables to index neurodevelopmental problems in childhood (~ages seven-nine years). We used the following measures to index intellectual disability, communication problems, ASD (Autistic Spectrum Disorder) problems, impairment in reading and developmental co-ordination difficulties respectively: the Wechsler Intelligence Scale for Children (WISC) (Wechsler, 1991), the Children's Communication Checklist (CCC) (Bishop, 1998), the Social Communication Disorders Checklist (SCDC) (Skuse et al., 2005), the Wechsler Objective Reading Dimension (WORD) (Rust et al., 2003), and the Movement Assessment Battery for Children (MABC) (Henderson & Sugden, 1992). Children scoring in the worst 5% (of the full ALSPAC sample) on each measure were identified as having that additional neurodevelopmental difficulty (see Eyre et al., 2019). Table 2.1 shows the prevalence of each neurodevelopmental problem within the high ADHD trait group.

Table 2.1 Prevalence of each neurodevelopmental problem within the high ADHD trait group (N = 1,195)

Measure	Age	N (%) with difficulty
Social Cognition Problems (SCDC)	7 Years	29.40%
Reading Problems (WORD)	7 Years	13.73%
Motor Disorder (MABC)	7 Years	7.00%
Low IQ (WISC)	8 Years	12.93%
Communication (Syntax - CCC)	9 Years	14.96%
Communication (Pragmatics - CCC)	9 Years	24.92%

SCDC, Social Communication Disorders; WORD, Wechsler Objective Reading Dimension; MABC, Movement Assessment Battery for Children; WISC, Wechsler Intelligence Scale for Children; CCC, Children's Communication Checklist.

2.3.1.3. ADHD Genetic Risk

ADHD genetic risk was examined using ADHD PRS. PRS were generated as the weighted mean number of disorder risk alleles in approximate linkage equilibrium, derived from imputed autosomal SNPs using PRSice (Euesden et al., 2015). Risk alleles were defined as those associated with case-status at $p < 0.05$ in large consortia analyses of ADHD (Demontis et al., 2019b). The PRS scores used in the current thesis were derived as part of a previous study (Riglin et al., 2020).

2.3.2. Adult Mental health outcomes

Emotional and conduct problems were assessed at age 25 years using the self-reported Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997). The SDQ emotional and conduct subscales each include five items coded zero "not true", one "somewhat true", and two "certainly true" (subscale-scores range: 0-10). The SDQ is well validated for use in children and young people, and recent research suggests its applicability in young adults (NHS, 2020; Riglin, Shameem, et al., 2021).

Depression symptoms were assessed at age 25 using the Short Moods and Feelings Questionnaire (sMFQ) (Angold et al., 1996). This measure has been found to be a reliable and valid measure of depression (Wood et al., 1995), including in young adults (Eyre et al., 2021). Thirteen items are scored as zero "not true", one "sometimes true", and two "true". Scores range from 0 to 26 with 12 or higher indicating probable depression. Items in the sMFQ include 'has there

been a period where you have been really miserable nearly every day?' and 'have there been times when you have lost interest in everything that you normally enjoy doing?'.

Criminal behaviours were assessed using the Self Report of Delinquency Scale (SRDS) at age 18, 20, and 22. This is a self-report questionnaire considering crimes committed in the previous year, originally used by the Edinburgh Study of Youth Transitions and Crime (Smith & McVie, 2003). Within ALSPAC, 12 items were used, scored from 0 "Not at all", 1 "Just once", 2 "2-5 times" and 3 "six or more times". These items included 'how often in the last year have you' followed by 'stolen something from a shop or store?' and 'deliberately damaged or destroyed property that did not belong to you?'.

2.3.3. Sustained Good Mental Health in young adulthood (18-25 years)

Sustained good mental health was investigated within the high ADHD trait group by combining eight measures of depression, criminal behaviour, conduct problems, and emotional problems: the SDQ emotional and conduct subscales at age 25, the sMFQ at ages 18, 22, and 25 and a short version of the SRDS as a measure of criminal behaviours at ages 18, 20, and 22.

A dichotomous variable was derived for each of these eight measures. For the SDQ measures cut-offs used the 4-band categorisation, six and above for conduct problems, and 7 and above for emotional problems, so that individuals identified in these measures were in the 'Very high' category (Green et al., 2004). For the sMFQ a score of 12 or greater was used to indicate the presence of depression (Eyre et al., 2021). Any occurrence of any criminal behaviour was used as the cut-off for the SRDS.

Finally, all eight dichotomous indicators of depression, emotional problems, conduct problems and criminal behaviour were combined into a composite measure which identified individuals who either scored below these cut-offs across all eight measures (sustained good mental health) or who experienced poor mental health in one or more domains and timepoints.

2.3.4. Residual scores method

The residual scores method has been used previously in studies examining resilience ((Bowes et al., 2010), Collishaw et al., (2016)) . The aim of this analysis

approach in the current thesis is to enable resilience to be examined from a better-than-expected approach. This method has allowed us to assess a wide range of protective factors to see if they predict better-than-expected depressive, emotional and conduct problems in young adulthood beyond that accounted for by differences in the risk of experiencing ADHD and co-occurring genetic and neurodevelopmental risk.

I derived the continuous residual scores for mental health resilience using regression analyses. Each of the depression, emotional and conduct problem symptom scores at age 25 years were regressed onto the predictor variables which were selected to index risks associated with experiencing childhood ADHD. These ADHD risk markers included ADHD symptom levels, additional neurodevelopmental problems and ADHD genetic risk (PRS score). Full details for these measures are given above in section 2.3.1. Residual scores were saved and then reverse coded so that a positive residual score indicates better-than-expected mental health resilience at age 25 having accounted for variability in ADHD-related risk.

These residual scores were then used in univariable and multivariable regression models to test associations with protective factors, see below.

2.3.5. Potential confounders

Sex and socio-economic status were assessed via questionnaires completed during pregnancy (mother's education, parity and home ownership) and were considered confounders given associations with both protective factors and mental health outcomes (Dvorsky & Langberg, 2016; Gilman et al., 2002). Home ownership responses included mortgaged/owned, privately rented or council rented. Parity measures the number of previous births, and mother's education assessed whether the mother in the study had qualifications equivalent to GCSE/O-Level standard, A-Level standard, or university degree standard.

2.3.6. Protective factors

Potential individual, family and social protective factors were examined in childhood, adolescence and/or young adulthood. Please see chapters 3 and 4 for full details on the measures use to define these factors.

2.4. Statistical Analysis

As an initial step in all three research chapters multiple imputation was used to deal with bias arising from missing data. There are also two main statistical techniques used in this thesis, regression analyses and structural equation modelling (SEM) mediation analyses. All three are described below and more detail is available in specific research chapters.

2.4.1. Multiple Imputation

To help reduce bias arising from missing data across all research chapters we used multiple imputation by chained equations to impute data on protective factors, outcomes, markers of ADHD risk (including the ADHD PRS score) and confounders within the high ADHD trait group (*N* =1,195). We conducted multiple imputation via chained equations using the -mi ice- command in STATA 17 (StataCorp, 2021). We used 10 cycles of regression-switching and generated 100 imputed datasets. Monte Carlo errors were examined, and these indicated that that 100 datasets were sufficient given that the Monte-Carlo errors were less than 10% of the standard error for each parameter in the main analyses. After imputation, all analyses were combined across the 100 datasets using Rubin's rules (White et al., 2011).

There were four imputed data sets used across the current thesis (Table 2.3). Two for Chapter 3, one which passively imputed the categorical sustained good mental health resilience variable and a separate model for the residual scores analyses. Chapters 4 and 5 have one imputation model each. All variables used in the analyses were included in the imputation models alongside additional auxiliary variables. ADHD risk markers and socioeconomic status were often associated with the main exposure and outcome variables that were incomplete in the original dataset. Mother's ADHD PRS scores were specifically included to strengthen the imputation of the child's ADHD PRS scores since they were highly correlated.

Imputation models were run using binary logistic and linear regression models as appropriate. Predictive mean matching was used when continuous variables were not normally distributed. All variables with missing data used in the analyses were imputed up to the maximum sample size of the ADHD high-risk group of (*N* = 1,195).

Table 2.2 Demographics and descriptive statistics of mental health outcomes for the four imputed samples and initial cohort that met criteria for the high-risk ADHD group

	Complete Case Sample	Imputed Samples			
Demographics	**ADHD group *N* = 325**	**Chapter 3 – Residual Scores**	**Chapter 3 - Sustained good mental health**	**Chapter 4**	**Chapter 5**
Male (%)	51.69%	67.28%	67.28%	67.28%	67.28%
Housing Tenure (% Owned)	77.93%	73.70%	73.70%	73.80%	73.69%
Maternal Education (% A-Level or higher)	49.00%	36.45%	36.47%	36.60%	36.46%
Parity (% First pregnancy)	54.24%	49.06%	48.80%	48.59%	48.99%
Mental Health Outcomes - 25 years					
Emotional Problems [M (SD)]	3.74 (2.59)	3.85 (2.63)	3.93 (2.64)	3.83 (2.62)	3.82 (2.63)
Conduct Problems [M (SD)]	1.78 (1.46)	1.85 (1.55)	1.92 (1.60)	2.01 (1.61)	1.88 (1.57)
Depressive Symptoms [M (SD)]	6.77 (6.12)	6.75 (6.14)	7.02 (6.28)	7.21 (6.35)	6.66 (6.08)

All four imputed samples *N* = 1, 195. Imputed samples were imputed for outcomes, protective factors, markers of ADHD severity including ADHD PRS score, and confounders up to the full number of individuals (*N* = 1, 195) who had ADHD symptom data at either age 7 or 10 years and were in the highest 10% of these measures. Complete case data is from individuals in the ADHD high-risk group that have data for each demographic or mental health outcome included in the table

2.4.2. Regression models

In chapters three and four of the current thesis regression analyses tested for associations between protective factors and mental health resilience.

In chapter three, sustained good mental health was indexed by a dichotomous indicator of the absence of mental health problems across the ages of 18-25 years (see 2.3.3). This dichotomous indicator was then regressed onto childhood and adolescent protective factors to test for associations using logistic regression.

The derived continuous residual scores were also regressed onto the same protective factors to test for associations with better-than-expected mental health resilience. Linear regression was used in this instance as the residual scores were a continuous outcome. In this instance essentially a two-step multiple regression approach has been used.

In chapter four, similar methods were used. Again, the two-step regression approach has been used with residual scores being derived using the same ADHD risk markers as in the first results chapter. These were derived again since a different imputed sample was used for the analysis in chapter 4. Tables showing the results of the multivariable regression models used to derive both sets of residual scores are available in their respective chapters. The second step was to use linear regression to test for associations with protective factors. However, this time protective factors that occurred during young adulthood were tested and current ADHD symptom scores were also included to additionally account for differences in ADHD at age 25 in some of the regression models.

2.4.3. Mediation analyses

Structural Equation Modelling (SEM) is a versatile and widely used statistical modelling technique which can be used to examine the validity of substantive theories with empirical data (Lei et al., 2007). The aim is to determine whether a hypothesised model is consistent with the data (Lei et al., 2007).

In the current thesis path analysis (a type of SEM) has been used. Path analysis estimates multiple regression models simultaneously which is an effective way to model mediation and indirect effects among multiple variables. The aim of this

analysis is to study direct and indirect effects and to uncover whether a hypothesised model is found within the data (Jeon, 2015).

Specifically, within the current thesis mediation analyses were used in chapter five. Mediation analyses examine whether the relationship between an exposure and an outcome variable can be explained by a hypothesised third (intervening) variable. It is assumed that the exposure causes the mediator, which in turn causes the outcome to occur (Mackinnon et al., 2007). Mediation models can also include multiple mediators, and these models are extensions of the single mediator model. Indirect effects can be calculated from the product of coefficients from exposure to mediator and from the mediator to the outcome. The percentage of total effect explained by the mediators can also be calculated.

In Chapter five a multiple mediation model was run using the SEM approach to examine the relationship between childhood male caregiver involvement and emotional problems in young adulthood via potential mediators. See chapter five for full details and a diagram of the hypothesised mediation model.

3. Chapter 3: Childhood and Adolescent Protective Factors in Young Adulthood Mental Health Resilience for Individuals with High Childhood ADHD Symptoms

The work presented in this chapter has been submitted for publication and is being revised to be resubmitted to the Journal of Child Psychology and Psychiatry: Ushaw, L., Hammerton, G., Langley, K., Heron, J., & Collishaw, S. (under review). Young Adulthood Mental Health Resilience in Individuals with High Childhood ADHD Symptoms.

The paper submitted for publication has been edited for this chapter in order to include additional results and reduce repetition with other chapters of this thesis.

3.1. Chapter Summary

Children with ADHD are more vulnerable to mental health problems in adulthood; however, it is not inevitable that children who experience ADHD will go on to experience poor mental health. Therefore, identifying factors which protect against later mental health problems may identify ways to promote more positive outcomes for this high-risk group. Previous studies of resilience in this high-risk group have focussed on small clinical samples of children and adolescents with ADHD. We therefore aimed to examine associations between a range of child and adolescent protective factors and young adult mental health resilience, among those with high ADHD symptoms in a prospective population sample. The Avon Longitudinal Study of Parents and Children (ALSPAC) was utilised. The high-risk ADHD group was identified at ages seven and 10 years using the parent-reported Development and Well-being Assessment (DAWBA). Mental health resilience was assessed in two ways; Sustained good mental health between ages 18 and 25; and better-than-expected mental health at age 25 using residual scores that account for differing risks of childhood ADHD. Both approaches were used to examine potential associations with individual, family and social protective factors across childhood and adolescence. Mental health problems were very common in this group, and only around 1 in 9 children in the ADHD sample showed sustained good mental health between 18 and 25 years. Emotional problems resilience at age 25 was associated with male caregiver involvement at 8 years ($\beta = 0.136$, $p = 0.011$), better peer relationships at 13 years ($\beta = 0.129$, $p = 0.011$) and higher self-esteem at 17 years

(β = 0.297, $p < 0.001$). Depressive symptoms resilience was associated with self-esteem (β = 0.145, $p = 0.029$). No resilience factors were found for adult conduct problems. Social relationships, family relationships and self-esteem showed long-term associations with young adult mental health resilience in those with high childhood ADHD symptoms.

3.2. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a childhood-onset neurodevelopmental disorder, which manifests as inattention, hyperactivity, and impulsivity that is impairing and developmentally inappropriate (American Psychiatric Association, 2013).

Childhood ADHD is associated with an increased likelihood of depression and antisocial behaviour in adolescence (Chronis-Tuscano et al., 2010; Langley et al, 2010) and emerging adulthood (Meinzer et al., 2016; Patros et al., 2013). Individuals with comorbid ADHD and depression have a more severe course of psychopathology and higher risk of long-term impairment and suicide (Daviss, 2008).

Not all individuals with ADHD develop poor mental health in adulthood (Dvorsky & Langberg, 2016; Lee et al., 2008). This heterogeneity indicates that it is possible for individuals with ADHD to have good mental health outcomes in adulthood, and there may be factors which mitigate the link between ADHD and later mental health problems. Identifying child and adolescent protective factors may inform more effective and timely interventions (Rutter et al, 2006). Previous studies examining adult mental health resilience amongst individuals with ADHD have typically involved small clinical samples of adults (e.g. Oddo et al., 2018). According to Chan et al., (2021), longitudinal studies of resilience in ADHD are needed which aim to identify individual, family and social-community factors that promote adaptive outcomes. Prospective studies following children with ADHD into adulthood and focusing on child and adolescent predictors of adult mental health resilience are lacking, as are investigations focused on children with ADHD problems in representative population cohorts.

Resilience has been defined in different ways within the literature (Luthar et al, 2000). However, there is agreement that resilience can broadly be thought to occur when individuals experience risk or adversity and show positive or better than

expected outcomes despite this experience (Luthar et al., 2000; Rutter, 2013, 2015). It is important to consider whether resilience reflects differences between individuals in adaptive responses to similar adversities (Rutter, 2006), or instead simply reflects differences in the severity of risk.

The current study conceptualises resilience using two methods (Bowes et al., 2010; Collishaw, Hammerton, et al., 2016) (Collishaw et al., 2016). First, we examine resilience as the absence of young adult mental health problems known to be associated with childhood ADHD, emotional problems, depression, and antisocial behaviour. This approach has the benefit of combining multiple mental health outcomes and examining sustained good mental health across young adulthood. Secondly, we conceptualise resilience as better outcomes in each mental health domain than predicted by multiple measures of childhood ADHD risk. This approach has advantages since it ensures that any identified protective factors are not simply a reflection of lower levels of ADHD or related neurodevelopmental risk, and it allows different protective factors to be identified for different mental health outcomes. To my knowledge, no studies have examined mental health resilience in individuals who have experienced childhood ADHD using both approaches.

Many, but not all, children with ADHD experience increased difficulties at school, home, in their social relationships and friendships and often have low self-esteem (Harpin, 2005; Shaw-Zirt et al., 2005). However, only a few studies have tested the potential role of individual, family, and social protective factors on mental health outcomes.

Many children with ADHD experience difficulties in their peer relationships (Humphreys et al., 2013; Powell et al., 2020; Roy et al., 2015). Evidence has suggested that the relationship between ADHD, peer relationships and later mental health outcomes may vary across different outcomes. McQuade et al., (2014) indicated that self-perceived social acceptance by those with ADHD was associated with fewer depression symptoms, but also higher conduct problems. More recently, friendship quality was found to be a key pathway through which ADHD symptoms were associated with later depressive symptoms, and that positive parent-child relationships further contribute by moderating the relationships between ADHD, friendship quality and depression (Powell et al., 2021).

Schei et al., (2018) suggested that self-esteem in adolescents with ADHD was a predictor of better psychosocial functioning in young adulthood, and lower risk of depressive disorders. Additionally, expectations placed on children in school environments are often not a good fit for those with ADHD, and this can lead to poor social and educational outcomes (Richardson et al., 2015).

Finally, family life may also be impacted for those experiencing ADHD. For example, Babinski et al., (2011) found that those with ADHD had higher levels of impairment in relationships with family. Family support networks have been investigated less often, but limited evidence suggests that social networks may increase the likelihood of parents seeking help for their children with ADHD (Kappi & Martel, 2022). There are more details given on potential protective factors in Chapter 1.

In sum, there is limited evidence that considers protective factors that contribute to young adult mental health resilience in children with ADHD. The current study extends previous research by considering individual, family, and social factors, by taking a developmental approach with a focus on protective factors in childhood and adolescence using longitudinal outcome data to examine whether there are enduring protective associations that persist across early adulthood. The study uses data from a prospective birth cohort - the Avon Longitudinal Study of Parents and Children (ALSPAC) - to improve the generalisability of findings to children with ADHD problems in the general population.

The aim of the current study is to examine associations between individual, family, and social protective factors across childhood and adolescence with adult mental health resilience in those with childhood ADHD problems. First, I will examine predictors of sustained good mental health across young adulthood. I will then examine specific associations between protective factors and depression, emotional, and conduct problems at age 25. Lastly, I will use a residual scores approach to examine whether protective factors predict better-than-expected adult mental health outcomes beyond that accounted for by levels of ADHD symptoms and co-occurring neurodevelopmental risk. It is hypothesised that the childhood and adolescent protective factors selected will predict better young adult mental health.

3.3. Methods

3.3.1. Sample

Data were from the Avon Longitudinal Study of Parents and Children (ALSPAC). Further detail on the sample is given in Chapter 2 section 2.1.

3.3.2. High ADHD Trait Group

The Development and Wellbeing Assessment (DAWBA) (Goodman et al., 2000) was used to derive ADHD symptom scores at age seven and ten years. Those scoring in the highest 10% on either or both were identified as having high childhood ADHD traits (N = 1,195; 14.46% of those with childhood data). More details are available in chapter 2.

3.3.3. Markers of ADHD Risk

ADHD symptom levels, co-occurring neurodevelopmental problems and ADHD genetic risk were included to account for heterogeneity among individuals within the high ADHD trait group. These markers were used to calculate adult mental health residual outcome scores to ensure that any associations with protective factors do not reflect measured heterogeneity in ADHD risk. Full details of the measures included are in chapter two.

3.3.4. Adult Mental Health Outcomes

Emotional and conduct problems were assessed at age 25 years using the self-reported Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997).

Depression symptoms were assessed at age 25 using the Short Moods and Feelings Questionnaire (sMFQ) (Angold et al., 1996).

Criminal behaviours were assessed using the Self Report of Delinquency Scale (SRDS), originally used by the Edinburgh Study of Youth Transitions and Crime (Smith & McVie, 2003).

Full details are available in chapter two.

3.3.5. Sustained Good Mental Health in young adulthood (18-25 years)

Sustained good mental health was investigated within the high ADHD trait group by combining eight measures of depression, criminal behaviour, conduct problems, and emotional problems: the SDQ emotional and conduct subscales at age 25, the sMFQ

at ages 18, 22, and 25 and a short version of the SRDS as a measure of criminal behaviours at ages 18, 20, and 22. These measures were combined into one composite dichotomous measure which identified individuals who showed no signs of mental health problems in any of these areas across the ages of 18-25 years. More details are available in chapter two.

3.3.6. Child and adolescent protective factors

3.3.6.1. School Enjoyment

School enjoyment was assessed using two self-report questions at ages eight and fourteen years. The item at age eight is from a modified version of the Bullying and Friendship Interview Schedule (Woods & Wolke, 2003) and asks whether the child likes school ("Yes very much", "Yes most of the time", "Not much", and "No"). The item at age fourteen asks young people whether school is a place they like to be ("Strongly agree", "Agree", "Disagree", and "Strongly disagree").

3.3.6.2. Self-esteem

Self-esteem was assessed in childhood (eight years) and late adolescence (17.5 years). At age eight the Global Self-Worth score from Harter's self-perception profile (Harter, 1985) for children was used with scores ranging from 0 to 24. At age seventeen, the self-esteem score from the Bachman revision of the Rosenberg self-esteem scale (Rosenberg, 1995) was used with scores ranging from 0 to 40.

3.3.6.3. Teacher perceptions of above average school attainment

Teachers rated children's general ability for their age during school year three (7-8 years) in five categories: 'Very good' (five), 'Good', 'Average', 'Not very good', and 'Poor' (one).

3.3.6.4. Sibling Relationships (joint activities)

Parents completed a questionnaire at seven years about how often their child participated in seven positive activities with their sibling (play, read, sing, make things, go out, talk and eat together), each scored 'Never' (zero) to 'Nearly every day' (four). Items were summed to create an overall score out of 28. As we focussed on potential positive effects of sibling relationships, children without a sibling were coded zero.

3.3.6.5. Female and Male Caregiver Involvement

Caregiver involvement was assessed using a questionnaire at age eight years with 18 items each for female and male caregivers separately completed by the child's main carer. Items asked how often a child's main female and male caregivers participated in different activities with the child (e.g., 'does homework with the child' and 'reads with the child'). For most individuals, these caregivers were their mother and father; however, this was not always the case, and stepparents, grandparents and older siblings were sometimes considered to be main caregivers. Items were summed into two continuous scores (range 0-90), one for female and one for male caregiver (Cong et al., 2020; Lawson & Mace, 2009).

3.3.6.6. Family Relationship Quality

During an in-person assessment at age 17.5, young people were asked five items about their relationships with family. Example items included 'How close do you feel to your parents?' Two items were coded one to five and the other three were coded one to four with higher scores reflecting more positive responses (total score range: 5-22).

3.3.6.7. Peer relationships

The parent reported SDQ peer problems subscale at ages eight and thirteen years was used to assess child and adolescent peer relationships (Goodman, 1997). It includes five items such as 'Solitary, tends to play alone' and 'Teenager is often picked on or bullied', each scored zero "Not true", one "Somewhat true", two "Certainly true". The subscale has a range of 0 to 10 and was scored according to the manual before being reverse coded so that a higher score represented fewer peer problems.

Friendships at eight years were assessed using the 5-item Cambridge Hormones and Moods Project friendship questionnaire (Goodyer et al., 1989, 1990). Items include 'Child sees friends outside of school' and 'Child can talk to friends about their problems.' Each item is coded 0 to 3, and an overall continuous score is derived out of 15. Traditionally this measure is scored so that 15 is a negative friends score, however, in this case we have reverse coded the measure so 15 is the most positive score.

3.3.6.8. Prosocial behaviour

The parent-reported SDQ prosocial subscale was used at ages eight and thirteen to assess prosocial abilities (Goodman, 1997). This subscale includes five items such as 'Teenager is considerate of other people's feelings' and 'Teenager has shared readily', each scored zero "Not true", one "Somewhat true", two "Certainly true". This subscale has a range of 0 to 10.

3.3.6.9. Mother's Social Support

The social network score (Sidebotham et al., 2002; Sidebotham & Heron, 2006) measured mothers' social support when children were aged two years. It includes ten questionnaire items such as 'in the last month how many times did you get together with one or more friends?'. Items were scored from zero "None" to 3 "More than four" (total score range: 0-30).

3.3.7. Potential Confounders

Sex and socio-economic status (mother's education, parity and home ownership) were considered confounders given associations with both protective factors and mental health outcomes (Dvorsky & Langberg, 2016; Gilman et al., 2002).

3.3.8. Statistical Analyses

First, we identified individuals with scores in the top 10% for childhood ADHD symptoms at ages seven or 10 years. All analyses were within the high ADHD trait group (*N*=1,195). For descriptive purposes, this high ADHD trait group was characterised on mental health outcomes in adulthood and on childhood socio-demographic indicators.

Second, we tested univariable associations between protective factors and sustained good mental health using logistic regression, followed by two multivariable models including childhood and adolescent protective factors respectively. The multivariable models included the childhood ADHD risk markers and potential confounders.

Third, we examined associations between protective factors and continuous mental health outcomes at age 25 (emotional problems, conduct problems, depression symptoms) utilising linear regressions.

Finally, to examine better-than-expected mental health, we derived three residual mental health scores by separately regressing each age 25 mental health outcome (emotional, conduct, depression) onto markers of childhood ADHD risk (symptom

levels, co-occurring neurodevelopmental problems, ADHD genetic risk) to account for individual differences in ADHD difficulties within our high-risk group. The residuals from these linear regressions were reverse coded and used as outcomes in further univariable linear regression models to test associations between protective factors and better-than-expected young adult mental health. To examine whether the protective factors showed independent effects, multivariable regression models were performed for childhood and adolescent factors separately, including sex and socioeconomic status as potential confounders.

3.3.9. Multiple Imputation

To help reduce bias arising from missing data we used multiple imputation by chained equations to impute data on protective factors, outcomes, markers of ADHD risk and confounders within the high ADHD trait group (*N*=1,195). Two separate imputation models were used, one for the analysis model using sustained good mental health as the outcome and one for the analysis model using residual scores as outcomes. We used 10 cycles of regression-switching and generated 100 imputed datasets using the -mi ice- command in Stata version 17 (StataCorp, 2021). Monte Carlo errors were examined to ensure that 100 datasets were sufficient. All variables used in the analyses were included in the imputation models alongside additional auxiliary variables (See chapter two for more details). Data were also imputed for the non-ADHD group in order to present comparable descriptive information for the sustained good mental health overall and individual measures in Table 3.1.

3.4. Results

3.4.1. Childhood ADHD problems and adult mental health

Sociodemographic characteristics and adult mental health outcome data for the high ADHD trait group are shown in Table 3.1. Between 1 in 6 and 1 in 4 scored above cut points for depression or antisocial behaviour at each young adult assessment. Cumulative rates of mental health difficulty were high, and only 12% reported no mental health difficulty across all assessments (sustained good mental health). The non-ADHD group showed better rates of good mental health on each separate indicator, however, a slightly worse overall rate of sustained good mental health.

Table 3.1 Childhood socio-demographic characteristics and adult mental health in the high ADHD trait group versus the non-ADHD group

	ADHD Group *N* = 1,195	**Non-ADHD Group *N* = 7,071**
Socio-Demographic Characteristics		
Gender, Male (%)	67%	49%
Home Ownership, Mortgaged/Owned (%)	73%	82%
Parity, no previous pregnancy (%)	49%	46%
Mother's Highest Education, A-level or above (%)	36%	41%
Mental Health Outcomes, 25 years		
SDQ Emotional (mean, sd)	3.85 (2.63)	3.34 (2.47)
SDQ Conduct (mean, sd)	1.85 (1.55)	1.47 (1.14)
sMFQ (mean, sd)	6.75 (6.14)	5.96 (5.88)
Sustained Good Mental Health Measures		
Sustained good mental health (%)	12%	10%
Emotional Problems, age 25 (%)	18%	12%
Conduct Problems, age 25 (%)	3%	1%
Depression Symptoms, age 18 (%)	24%	18%
Depression Symptoms, age 22 (%)	23%	15%
Depression Symptoms, age 25 (%)	21%	16%
Anti-Social Behaviour, age 18 (%)	23%	16%
Anti-Social Behaviour, age 20 (%)	24%	15%
Anti-Social Behaviour, age 22 (%)	16%	9%

3.4.2. Protective factors associated with adult mental health resilience amongst children with ADHD problems

3.4.2.1. Sustained good mental health (18 to 25 years)

Associations of child and adolescent protective factors with sustained good mental health are shown in Table 3.2. Self-esteem and family relationship quality at 17.5 years were associated with sustained good mental health. There was no evidence for associations for any other protective factors.

Table 3.2 Associations between individual, family and social protective factors with sustained good mental health

Protective Factor	OR (95% CI)	P-Value
Friendship quality - 8 years	0.96 (0.88-1.04)	0.299
SDQ Prosocial - 8 Years	1.09 (0.97-1.23)	0.158
SDQ Prosocial - 13 Years	1.07 (0.95-1.21)	0.244
SDQ Peer - 8 years	1.08 (0.95-1.23)	0.218
SDQ Peer - 13 years	1.05 (0.94-1.17)	0.367
Sibling relationships - 7 years	1.02 (0.99-1.05)	0.199
Mother's Social Support - 21 months	1.02 (0.97-1.08)	0.449
Self-esteem - 8 years	1.01 (0.95-1.09)	0.647
Self-esteem - 17.5 years	1.09 (1.05-1.14)	<0.001
Female caregiver Involvement - 8 years	1.02 (0.99-1.05)	0.161
Male caregiver Involvement - 8 years	1.02 (0.99-1.04)	0.158
Family relationships - 17.5 years	1.12 (1.01-1.25)	0.035
School attainment - 7.5 years	0.99 (0.79-1.24)	0.928
School liking - 8 years	1.04 (0.79-1.38)	0.760
School liking - 14 years	1.21 (0.89-1.66)	0.211

Data are imputed for the ADHD group, N = 1,195. Separate regressions were performed for each protective factor and controlled for sex, mother's education, home ownership and parity.

Multivariable associations between protective factors assessed in childhood and sustained good mental health are shown in Table 3.3, and multivariable associations for protective factors assessed in adolescence are shown in Table 3.4.

Table 3.3 Multivariable associations between child protective factors and sustained good mental health

Protective Factors	OR (95% CI)	P-Value
Peer relationships - 8 years	0.94 (0.85-1.03)	0.170
SDQ Peer - 8 years	1.05 (0.90-1.22)	0.550
SDQ Prosocial - 8 Years	1.05 (0.91-1.21)	0.510
Sibling relationships - 6.75 years	1.02 (0.98-1.05)	0.312
Mother's social support - 21 months	1.01 (0.95-1.07)	0.831
Self-esteem - 8 years	1.02 (0.95-1.10)	0.633
Female caregiver involvement - 8 years	1.02 (0.98-1.05)	0.338
Male caregiver involvement - 8 years	1.01 (0.99-1.04)	0.405
School attainment - 7.5 years	1.00 (0.75-1.32)	0.982
School enjoyment - 8 years	1.03 (0.76-1.39)	0.836

Data are imputed for the ADHD group, N = 1,195. The model controlled for sex, mother's education, home ownership and parity. The model also included ADHD risk markers (genetic risk, additional neurodevelopmental problems, and ADHD symptom levels).

Table 3.4 Multivariable associations between adolescent protective factors and sustained good mental health

Protective Factors	OR (95% CI)	P-Value
SDQ Peer - 13 years	1.01 (0.90-1.14)	0.900
SDQ Prosocial - 13 Years	0.99 (0.86-1.14)	0.866

Self-esteem - 17.5 years	1.10 (1.05-1.15)	<0.001
Family relationships - 17.5 years	1.07 (0.94-1.20)	0.297
School enjoyment - 14 years	1.22 (0.85-1.73)	0.278

Data are imputed for the ADHD group, N = 1,195. The model controlled for sex, mother's education, home ownership and parity. The model also included ADHD risk markers (genetic risk, additional neurodevelopmental problems, and ADHD symptom levels).

3.4.2.2. Continuous Mental Health Outcomes (25 years)

Associations between the protective factors and continuous mental health outcomes (age 25 emotional problems, conduct problems, depression symptoms) are shown in Table 3.5. Peer relationship quality at eight and 13 years, male caregiver involvement at eight years and self-esteem at 17 years were each associated with lower emotional problems at 25 years. Only self-esteem at 17 was associated with lower depression at 25. Prosocial behaviours and peer relationships at eight and 13 years were associated with lower conduct problems at age 25. Results for complete case analyses were comparable with the exception that self-esteem at 17 was not associated with lower depression at age 25 (see Table 3.6).

Table 3.5 Associations between protective factors and adult mental health in the high ADHD trait group

Protective Factors	**Mental Health Outcomes 25 years, beta (SE); p-value**		
	Emotional Problems	**Depression Symptoms**	**Conduct Problems**
Friendship quality - 8 years	0.003 (0.055); 0.967	0.035 (0.128); 0.551	-0.079 (0.029); 0.137
SDQ Peer - 8 years	-0.115 (0.064); 0.027	-0.010 (0.144); 0.832	-0.174 (0.042); 0.003
SDQ Peer - 13 years	-0.167 (0.059); 0.002	-0.017 (0.146); 0.756	-0.161 (0.039); 0.006
SDQ Prosocial - 8 Years	-0.087 (0.067); 0.119	0.028 (0.155); 0.602	-0.126 (0.038); 0.018
SDQ Prosocial - 13 Years	-0.095 (0.064); 0.066	-0.007 (0.159); 0.900	-0.115 (0.042); 0.046
Sibling relationships - 6.75 years	-0.026 (0.017); 0.669	0.011 (0.042); 0.854	0.004 (0.010); 0.942
Mother's Social Support - 21 months	-0.070 (0.032); 0.206	-0.045 (0.081); 0.453	-0.094 (0.019); 0.091
Self-esteem - 8 years	-0.011 (0.043); 0.861	-0.046 (0.095); 0.434	0.000 (0.022); 0.997
Self-esteem - 17.5 years	-0.297 (0.022); <0.001	-0.128 (0.054); 0.050	-0.041 (0.013); 0.509
Female caregiver Involvement - 8 years	0.035 (0.017); 0.512	-0.067 (0.045); 0.276	-0.002 (0.010); 0.964
Male caregiver Involvement - 8 years	-0.146 (0.012); 0.007	-0.077 (0.032); 0.191	-0.019 (0.008); 0.751
Family relationships - 17.5 years	-0.035 (0.064); 0.608	-0.046 (0.161); 0.531	-0.070 (0.037); 0.290
School attainment - 7.5 years	-0.042 (0.125); 0.474	0.080 (0.313); 0.209	0.035 (0.074); 0.557
School liking - 8 years	-0.061 (0.160); 0.289	-0.022 (0.401); 0.719	0.011 (0.098); 0.858
School liking - 14 years	-0.130 (0.214); 0.053	-0.048 (0.504); 0.478	-0.014 (0.126); 0.828

Data are imputed for the ADHD group, so N is always 1,195. Regressions included confounders sex, mother's education, home ownership and parity.

Table 3.6 Complete case associations between protective factors and mental health outcomes for those in the high-risk ADHD trait group

Protective Factor	**Mental Health Outcomes 25 years, beta (SE); p-value**		
	Emotional Problems	**Depression Symptoms**	**Conduct Problems**
Peer Relationships - 8 years	-0.046 (0.055); 0.458	0.006 (0.13); 0.926	-0.064 (0.033); 0.324
SDQ Peer - 8 years	-0.126 (0.073); 0.03	-0.004 (0.177); 0.952	-0.178 (0.045); 0.004
SDQ Peer - 13 years	-0.224 (0.063); <0.001	-0.05 (0.159); 0.424	-0.183 (0.037); 0.003
SDQ Prosocial - 8 Years	-0.147 (0.073); 0.012	-0.001 (0.177); 0.989	-0.126 (0.045); 0.041
SDQ Prosocial - 13 Years	-0.127 (0.078); 0.034	-0.05 (0.192); 0.427	-0.095 (0.045); 0.132
Sibling relationships - 6.75 years	-0.038 (0.018); 0.509	-0.008 (0.043); 0.889	0.007 (0.011); 0.911
Mother's Social Support - 21 months	-0.112 (0.033); 0.059	-0.108 (0.081); 0.081	-0.091 (0.021); 0.145
Self-esteem - 8 years	0.001 (0.042); 0.982	-0.039 (0.1); 0.557	0.01 (0.026); 0.884
Self-esteem - 17.5 years	-0.232 (0.024); 0.001	-0.077 (0.062); 0.293	-0.045 (0.016); 0.553
Female caregiver Involvement - 8 years	-0.019 (0.019); 0.757	-0.112 (0.045); 0.075	-0.006 (0.012); 0.919
Male caregiver Involvement - 8 years	-0.143 (0.015); 0.022	-0.084 (0.034); 0.197	0.027 (0.009); 0.683
Family relationships - 17.5 years	0.017 (0.064); 0.809	0.027 (0.166); 0.711	-0.073 (0.041); 0.335
School attainment - 7.5 years	-0.03 (0.174); 0.707	0.096 (0.446); 0.264	0.066 (0.107); 0.447
School liking - 8 years	-0.104 (0.189); 0.099	-0.056 (0.455); 0.389	-0.011 (0.115); 0.865
School liking - 14 years	-0.122 (0.244); 0.064	-0.084 (0.601); 0.228	-0.052 (0.144); 0.46

Each association includes those in the high-risk ADHD group that have data for both the mental health outcome and protective factor included, controlled for sex, mother's education, home ownership and parity. (Ns range from 135 (school attainment and depressive symptoms) to 283 (mother's social support and emotional or conduct problems).

3.4.3. Better than predicted mental health symptom scores (25 years)

3.4.3.1. Residual scores - estimation models

The residual symptom scores were calculated for individuals in the childhood high ADHD trait group using three multivariable regression models, one for each adult mental health outcome (emotional problems, conduct problems and depression symptoms). Models included ADHD symptom levels, presence of additional neurodevelopmental difficulties, and child ADHD genetic risk score (see Tables 3.7, 3.8 and 3.9 for associations between these ADHD risk markers and each mental health outcome). Residual scores were reverse scored so that a positive residual score indicates a better-than-expected outcome, and a negative residual score indicates a worse-than-expected outcome.

Table 3.7 Multivariable associations between markers of ADHD risk and emotional problems

Measure	**Beta**	**SE**	**P-value**
IQ - 8 Years	-0.006	0.539	0.931
Social Cognition - 7 Years	0.117	0.376	0.076
Reading - 7 Years	0.001	0.515	0.986
Communication (Syntax) - 9 Years	-0.043	0.474	0.511
Communication (Pragmatics) - 9 Years	0.107	0.325	0.048
Motor Disorder - 7 Years	0.008	0.605	0.895
ADHD Symptoms - 7 Years	0.012	0.019	0.839
ADHD Symptoms - 10 Years	-0.064	0.020	0.312
Child ADHD PRS Score	0.102	0.160	0.102
R-Squared	0.060		
Adjusted R-Squared	0.053		

Table 3.8 Multivariable associations between markers of ADHD risk and conduct problems

Measure	Beta	SE	P-value
IQ - 8 Years	0.012	0.394	0.893
Social Cognition - 7 Years	0.113	0.217	0.081
Reading - 7 Years	-0.035	0.323	0.620
Communication (Syntax) - 9 Years	0.057	0.289	0.387
Communication (Pragmatics) - 9 Years	0.120	0.219	0.052
Motor Disorder - 7 Years	-0.010	0.383	0.881
ADHD Symptoms - 7 Years	-0.014	0.012	0.820
ADHD Symptoms - 10 Years	0.060	0.011	0.283
Child ADHD PRS Score	0.052	0.087	0.366
R-Squared	0.083		
Adjusted R-Squared	0.076		

Table 3.9 Multivariable associations between markers of ADHD risk and depressive symptoms

Measure	Beta	SE	P-value
IQ - 8 Years	-0.088	1.154	0.167
Social Cognition - 7 Years	0.042	0.855	0.510
Reading - 7 Years	-0.037	1.176	0.574
Communication (Syntax) - 9 Years	-0.057	1.010	0.331
Communication (Pragmatics) - 9 Years	0.107	0.807	0.062
Motor Disorder - 7 Years	0.045	1.472	0.463
ADHD Symptoms - 7 Years	0.005	0.044	0.937
ADHD Symptoms - 10 Years	-0.118	0.045	0.053
Child ADHD PRS Score	0.161	0.368	0.010
R-Squared	0.074		
Adjusted R-Squared	0.067		

3.4.3.2. Residual scores – association with child and adolescent protective factors

As shown in Table 3.10, male caregiver involvement at eight years, peer relationships at 13 years and self-esteem at 17 years were associated with better-than-expected levels of emotional difficulties after accounting for an individual's background ADHD risk. Self-esteem at 17 years was also associated with better-than-expected depression symptoms. None of the protective factors were associated with better-than-expected conduct problems. Multivariable models were then

conducted separately for childhood (Table 3.11) and adolescent protective factors, and the results were consistent with the univariable results (Table 3.12).

Table 3.10 Associations between protective factors and mental health residual scores in the high ADHD trait group

Protective Factor	Mental Health Residuals 25 years, beta (SE); p-value		
	Emotional Problems	**Depression Symptoms**	**Conduct Problems**
Peer Relationships - 8 years	-0.013 (0.021); 0.827	-0.033 (0.021); 0.583	0.062 (0.019); 0.246
SDQ Peer - 8 years	0.061 (0.023); 0.198	0.010 (0.022); 0.833	0.077 (0.024); 0.130
SDQ Peer - 13 years	0.129 (0.022); 0.011	0.022 (0.022); 0.678	0.074 (0.022); 0.145
SDQ Prosocial - 8 Years	0.044 (0.023); 0.385	-0.030 (0.024); 0.561	0.052 (0.024); 0.307
SDQ Prosocial - 13 Years	0.049 (0.024); 0.331	-0.005 (0.025); 0.920	0.046 (0.027); 0.421
Sibling relationships - 6.75 years	0.025 (0.007); 0.674	-0.005 (0.007); 0.936	-0.020 (0.007); 0.732
Mother's Social Support - 21 months	0.055 (0.012); 0.325	0.036 (0.014); 0.557	0.074 (0.013); 0.192
Self-esteem - 8 years	0.007 (0.017); 0.917	0.049 (0.016); 0.407	-0.016 (0.014); 0.768
Self-esteem - 17.5 years	0.297 (0.009); <0.001	0.145 (0.009); 0.029	0.022 (0.009); 0.725
Female caregiver Involvement - 8 years	-0.040 (0.007); 0.460	0.062 (0.008); 0.319	-0.005 (0.007); 0.920
Male caregiver Involvement - 8 years	0.136 (0.005); 0.011	0.078 (0.005); 0.185	-0.008 (0.005); 0.899
Family relationships - 17.5 years	0.032 (0.024); 0.636	0.039 (0.026); 0.588	0.059 (0.025); 0.386
School attainment - 7.5 years	0.041 (0.045); 0.469	-0.027 (0.048); 0.655	-0.078 (0.049); 0.200
School liking - 8 years	0.057 (0.063); 0.333	0.023 (0.067); 0.713	-0.016 (0.066); 0.811
School liking - 14 years	0.127 (0.081); 0.060	0.041 (0.083); 0.548	0.016 (0.084); 0.813

Data are imputed for the ADHD group, so N is always 1,195. Regressions included confounders sex, mother's education, home ownership and parity.

Table 3.11 Multivariable associations between child protective factors and better than predicted mental health

Protective Factors	Mental Health Residuals 25 years, beta (SE); p-value		
	Emotional Problems	**Depressive Symptoms**	**Conduct Problems**
Peer relationships - 8 years	-0.041 (0.022); 0.523	-0.054 (0.023); 0.408	0.058 (0.02); 0.308
SDQ Peer - 8 years	0.046 (0.026); 0.396	0.02 (0.025); 0.712	0.068 (0.026); 0.219
SDQ Prosocial - 8 Years	0.009 (0.024); 0.865	-0.062 (0.027); 0.283	0.029 (0.025); 0.587
Sibling relationships - 6.75 years	-0.007 (0.007); 0.912	-0.02 (0.007); 0.762	-0.025 (0.007); 0.673
Mother's social support - 21 months	0.038 (0.013); 0.518	0.026 (0.014); 0.685	0.072 (0.013); 0.218
Self-esteem - 8 years	0.003 (0.018); 0.966	0.05 (0.017); 0.431	-0.026 (0.015); 0.649
Female caregiver involvement - 8 years	-0.07 (0.007); 0.198	0.05 (0.008); 0.444	-0.013 (0.007); 0.821
Male caregiver involvement - 8 years	0.144 (0.005); 0.011	0.083 (0.005); 0.177	-0.02 (0.006); 0.748
School attainment - 7.5 years	0.045 (0.047); 0.441	-0.016 (0.05); 0.805	-0.09 (0.05); 0.149
School enjoyment - 8 years	0.045 (0.064); 0.45	0.014 (0.069); 0.823	-0.036 (0.069); 0.582

Data are imputed for the ADHD group, so N is always 1,195. Regressions included confounders sex, mother's education, home ownership and parity.

Table 3.12 Multivariable associations between adolescent protective factors and better than predicted mental health

Protective Factors	Mental Health Residuals 25 years, beta (SE); p-value		
	Emotional Problems	**Depressive Symptoms**	**Conduct Problems**
SDQ Peer - 13 years	0.107 (0.023); 0.047	0.013 (0.024); 0.812	0.063 (0.024); 0.245
SDQ Prosocial - 13 Years	-0.014 (0.026); 0.807	-0.037 (0.027); 0.508	0.012 (0.03); 0.847
Self-esteem - 17.5 years	0.301 (0.009); <0.001	0.15 (0.01); 0.038	0.004 (0.009); 0.955
Family relationships - 17.5 years	-0.05 (0.024); 0.467	0.01 (0.028); 0.902	0.059 (0.026); 0.422
School enjoyment - 14 years	0.111 (0.08); 0.092	0.037 (0.081); 0.576	0.015 (0.086); 0.825

Data are imputed for the ADHD group, so N is always 1,195. Regressions included confounders sex, mother's education, home ownership and parity.

3.5. Discussion

Our findings show that many of those with ADHD in childhood showed some difficulty with their mental health in young adulthood. However, around 12% of children with ADHD problems showed sustained good mental health between 18 and 25. Self-esteem, family relationship quality and peer relationships all demonstrated long-lasting associations with better mental health in young adulthood. Overall, protective factors in adolescence appeared to show more robust associations than did childhood factors. Identified protective factors were associated with better-than-expected emotional and depressive symptoms using a residual scores method indicating that these protective factors are not simply markers of variation in ADHD risk.

These findings highlight several novel protective factors in childhood and adolescence which are associated with mental health resilience in early adulthood and are not markers of variation in childhood ADHD risk. These findings advance our understanding by directly accounting for variation in the difficulty of childhood ADHD and by examining protective effects across individual, family and social domains which have rarely been examined together in previous research in this high-risk group.

Similar to previous research, self-esteem in adolescence emerged as a strong predictor of mental health resilience. This is in line with Schei et al., (2018) who indicated that better self-esteem predicted lower levels of depression and anxiety in a smaller clinical sample of children with ADHD. The current findings are generalisable to individuals with high ADHD traits in the general population.

The current study found strong associations between better adolescent peer relationships and emotional mental health resilience, but an association was not found with depressive symptoms. These findings are partially in line with previous research which has suggested that the relationship between childhood ADHD and increased risk of later depression (at age 17 years) is in part mediated by peer relationships and decreased friendship quality (Powell et al., (2020); Powell et al, 2021). Differences in findings with respect to depression resilience may reflect the larger gap between assessments in our study compared with previous research.

However, all three studies suggest that improving peer relationships for individuals with ADHD may help to improve later depressive or emotional symptoms.

The current research found associations between male caregiver involvement in childhood and adult emotional resilience and between family relationship quality in adolescence and sustained good mental health. Similarly, in the broader mental health resilience literature Collishaw et al., (2016) and Mahedy et al., (2018) found that parental positive expressed emotion and support from co-parents predicted sustained good mental health in a high-risk sample of youth with parents with recurrent depression. Recently, Meinzer et al., (2021) found that males with elevated ADHD symptoms were more likely to report worsening relationship quality with their mothers throughout adolescence and this mediated the relationship between ADHD and depressive symptoms. This indicates that for high-risk youth, including those with high ADHD symptoms, having two involved parent figures may be important, and that interventions focussing on improving parent-child relationships may help to improve later mental health.

The current study did not find robust associations between school-based factors and mental health resilience. This was surprising because past research has indicated that school life and school transitions are important for adolescent mental health and can be especially difficult for those with ADHD (Ford, 2020; Richardson et al., 2015). The lack of associations may be because any protective influences of better school experiences are limited to the school years. It is also important to note that our study did not include measures of the school environment, and measures of school enjoyment used in the current study were based on single self-report items. Further research with higher quality measures is needed.

There are several important implications. First, levels of mental health problems in young adulthood were high, despite identifying a group with ADHD symptoms using a general population sample. Secondly, the current study identified protective factors across childhood and adolescence that demonstrated long-lasting associations with better adult mental health. The identification of these factors suggests further research could inform the development of interventions to improve self-esteem, peer and family relationships. Both interpersonal group therapy and CBT have been found to improve levels of self-esteem among adults

with ADHD (Bramham et al., 2009; Shaikh, 2018). Further evidence of effectiveness in adolescents with ADHD would be valuable. Limited research has indicated that classroom-based interventions which focus on encouraging the peer group to be socially inclusive of children with ADHD may improve peer relationships (Mikami et al., 2013). Finally, promising results have also been found among adolescents with a parent-assisted friendship-building program (Gardner et al., 2019), but long-term benefits for mental health are unknown.

This study used longitudinal data within a cohort study which included repeated measures from well validated assessments of childhood ADHD and adult mental health, alongside rich data on potential resilience factors. However, there are also limitations. Firstly, despite being a carefully designed longitudinal study we cannot claim to have identified causal relationships due to the possible impacts of unmeasured confounders or reverse causation. Additionally, the results from the multivariable models should be interpreted with caution since some of the protective factors could be on the causal pathway between other protective factors and mental health resilience. Secondly, the results may have been affected by the quality of protective factor measures and changes across time of the choice of measures. Thirdly, we have only used self-reported measures of mental health in early adulthood and some evidence suggests that individuals with ADHD under-report mental health symptoms compared to their parents, which is the opposite of what is seen in the general population (Fraser et al., 2018). Additionally, the ALSPAC cohort has experienced drop out of participants across time, which can introduce bias and result in conservative estimates of levels of difficulty. However, we used multiple imputation to attempt to address any bias due to missing data. Lastly, the high-risk ADHD trait group was selected from a population sample, therefore the generalisability of findings to children with ADHD in clinical settings is unclear.

Overall, even though mental health problems are common among those who experience ADHD, they are not a certainty. A minority of young people who experienced high ADHD traits in childhood showed sustained good mental health. This research identified protective factors that are associated with better mental health in early adulthood. These findings could now be taken forward through

further research into how they could be applied to the development of early preventative interventions.

4. Chapter 4: Young adult protective factors in mental health resilience among individuals with high childhood ADHD symptoms

4.1. Chapter Summary

Individuals who experience childhood ADHD are more vulnerable to mental health problems in young adulthood. Therefore, identifying factors which protect against later mental health problems may promote more positive outcomes for this high-risk group. Chapter 3 highlighted that there are several protective factors across childhood and adolescence that showed long-lasting associations with mental health resilience in young adulthood. The following chapter builds on these findings by investigating whether continued ADHD symptoms into adulthood are associated with poor mental health outcomes, and whether there are protective factors occurring during young adulthood that promote mental health resilience. The specific aims of this chapter included to firstly clarify whether, within the same high-risk ADHD trait group, there is an association between current ADHD symptoms and mental health problems at age 25. Next, we aimed to understand whether current ADHD symptoms add to the effect of the childhood ADHD markers on mental health at age 25. The final aim was to identify protective factors occurring across young adulthood that were associated with better mental health outcomes at age 25 years. The results from this chapter show that current ADHD symptoms at age 25 were strongly associated with poor emotional, conduct and depressive outcomes, and that current ADHD symptoms influenced mental health outcomes adding to the effect of childhood ADHD risk markers. Practical and emotional social support in adulthood were robustly associated with mental health resilience across all mental health outcomes. Overall, findings highlight the importance of continued support into young adulthood for those who experience ADHD symptoms into young adulthood. and could be a target for interventions aiming to improve mental health resilience for young adults.

4.2. Introduction

ADHD is a childhood-onset neurodevelopmental condition (American Psychiatric Association, 2013) which often leads to individuals being more vulnerable to additional mental health problems (Chronis-Tuscano et al., 2010; Meinzer et al., 2016; Patros et al., 2013). See Chapter 1 for full details. Despite this vulnerability there is heterogeneity in the mental health outcomes for individuals with ADHD (Dvorsky & Langberg, 2016). In the previous chapter (Chapter 3) several novel protective factors were identified across childhood and adolescence. Specifically, family relationships, peer relationships, and self-esteem were found to promote young adult mental health resilience in those with childhood ADHD. The current study aims to build on these findings by attempting to identify potential protective factors occurring in young adulthood that may also prove to be promotive of young adult mental health resilience.

An important consideration in testing adult protective factors is that there are also differences in the level and persistence of ADHD symptoms that individuals experience, including once they reach adulthood. Rates of ADHD diagnosis persistence vary across studies due to differences in definitions and methodology but a meta-analysis of children with ADHD showed that around 15% will continue to meet criteria for ADHD in adulthood (Faraone & Biederman, 2005) and persistence of ADHD symptoms, especially inattention, is high (Langley et al., 2010). Resilience based research which examines the variation seen in mental health outcomes in young adulthood, whilst accounting for differences in young adult ADHD symptom levels would be a valuable approach to identifying potential protective factors which contribute to positive outcomes. This is because this approach will allow for the current study to examine whether protective factors explain variation in mental health over and above ADHD symptom persistence. This will add to current literature since few, if any, studies have investigated the impact of continuing to experience ADHD symptoms into adulthood on mental health resilience at the same time as identifying potential adult protective factors across individual, social, and family domains.

Previous literature has indicated that there is a relationship between persistent ADHD and mental health problems in adulthood. Agnew-Blais et al., (2018) found that those with remitted ADHD did not have poorer mental health at age 18

compared to those who had never had ADHD, except for conduct disorder. Those with persistent or late-onset ADHD showed greater depression, anxiety, conduct disorder and suicide or self-harm than those without ADHD, and both groups appeared to be equally impaired. Overall, results suggested that children with ADHD are not destined to experience negative outcomes across all domains in young adulthood. However, those with ADHD at 18 experienced poorer outcomes, including mental health, substance misuse and poor psychosocial outcomes, than those whose ADHD symptoms remitted.

In a similar but cross-sectional study, Oddo et al., (2018) investigated resilience to depression in adults with ADHD. They identified a group of participants who did not have current depression symptoms and also did not have a history of depression. Findings indicated that those with a greater ADHD treatment history and who had better cognitive coping strategies were less likely to experience depression. It could be that persistence of ADHD is driving associations with adult mental health problems, however, since there is some variation in outcomes this indicates that factors other than ADHD persistence may also play a role.

Two questions require clarification. The first is whether the relationship between adult ADHD symptoms and mental health is driven by adult ADHD or if other earlier ADHD-related risk plays a continued role. The second is whether, adult protective factors promote mental health resilience in young adults over and above any effect of ADHD persistence. Many children with ADHD continue to experience symptoms of ADHD as they grow up which are associated with poorer mental health outcomes, but it is plausible that continued psychosocial support and other protective influences will also be important.

The transition to adulthood can be challenging for young people with ADHD, although it can also bring new opportunities. There is, however, evidence that developmental ‘turning points’ can lead to changes in outcomes as demonstrated previously in studies of children with conduct disorder and antisocial behaviour (Laub & Sampson, 1993; Quinton et al., 1993; Sampson & Laub, 2005). The importance of supportive social contexts into adulthood and the need for appropriate services for adults with neurodevelopmental conditions has also been highlighted (Maughan & Collishaw, 2015). Therefore, the current research chapter aims to test associations between potential individual, family, and social young

adult protective factors and mental health outcomes during a key transition period, young adulthood. The next section outlines the hypothesised protective factors tested in the current study, how these factors are associated with mental health or ADHD and if there is any research that has already tested them as protective factors in ADHD.

As individuals move into young adulthood they are more in control of their own educational and occupational choices, which can be empowering for some. However, those with ADHD often have poor educational outcomes (Costello & Maughan, 2015). This can lead to occupational related difficulties. Barkley et al., (2006) indicated that individuals with hyperactivity had difficulty maintaining employment and lower job performance in early adulthood than matched controls. Additionally, a review by Gordon & Fabiano, (2019) indicated that those with a history of ADHD experience more educational impairment and consequently also experienced lower occupational attainment, higher job instability, and showed impaired job performance. In turn this also appeared to lead to financial challenges. However, poor educational and occupational outcomes are not inevitable and progression into employment can promote resilience, for example, for children with conduct disorder (Laub & Sampson, 2001). However, it is not yet clear whether there is a protective effect of education and employment on young adult mental health resilience among those with ADHD, and whether ADHD symptoms in young adulthood may negate any protective effect.

Peer relationships often change during young adulthood, and positive peer relationships are important for mental health. However, many individuals who have ADHD continue to experience difficulties within peer relationships into adulthood. Barkley et al., (2006) found those who were hyperactive in childhood had fewer close friends, and parents reported that they had more social problems than controls in young adulthood. Evidence has also suggested that young adults with more severe ADHD symptoms felt less able to provide emotional support and manage interpersonal conflict (Mckee, 2017). However, Khalis et al., (2018) found that positive relationships with new peers at university was predictive of good adjustment among emerging adults moving away to university for the first time. This suggests that peer relationships remain challenging in young adulthood for

those with ADHD, however, if positive relationships can be formed then this may be protective.

Romantic relationships take on greater importance and are critical to quality of life in emerging adulthood. Whilst those with ADHD can struggle more than others to build and maintain healthy romantic relationships (Bruner et al., 2015; Wymbs et al., 2021), for many this could also be an important new form of support as they become adults. There is little research that has tested whether the presence and quality of romantic relationships acts as protective factor for young adults with ADHD.

Most previous research has considered social support among children and adolescence with ADHD, with only very limited research investigating support for adults with ADHD. Mastoras et al., (2018) found that perceived social support influenced emotional well-being over time in children with ADHD, but also that as a group they received lower levels of support than other children. A meta-analysis also found a positive association between social support and well-being which increased with age in a general sample of children and adolescents (Chu et al., 2010). Evidence from adult samples is more limited, but recently Karawekpanyawong et al., (2021) highlighted the importance of perceived social support, and especially family support for medical students experiencing ADHD symptoms. This sample, however, is not necessarily generalisable to other ADHD young adult populations. It does appear that social support would be a valuable target for research attempting to identify possible protective factors in young adulthood that promote mental health resilience, especially given the lack of current research that has investigated social support among adults with ADHD.

ADHD has been found to elevate individuals' risk of substance use disorders (Erskine et al., 2016; Mannuzza et al., 1993; Molina & Pelham, 2003). Specifically in young adulthood, Mochrie et al., (2018) found that university-aged students with ADHD were more likely than controls to report frequent alcohol use, binge drinking, regular marijuana use and to have used other drugs in the last year. Those in the ADHD group also showed higher levels of depressive symptoms. It has also been found that individuals, with and without ADHD, who have problems with substance abuse and binge drinking may show higher levels of antisocial behaviour (Hussong et al., 2004) and depression (Wang et al., 2019). There are

links between experiencing ADHD and problematic drug and alcohol use which in turn is associated with poorer mental health outcomes. Therefore, if individuals with ADHD can avoid problematic substance use this may be associated with mental health resilience.

Overall, the transition to adulthood is a critically important life phase for people with ADHD – one that brings challenges but also new opportunity. There is limited evidence that has considered potential protective factors occurring during young adulthood that may promote mental health resilience. In testing the role of protective factors, there is also a need to take into account the role of young adult ADHD symptoms as well as markers of childhood ADHD risk.

The current study will consider associations between ADHD persistence, young adult protective factors and mental health symptoms at age 25. Few studies have examined the impact of ADHD persistence on mental health beyond the age of 18 years. Previous literature, to the best of my knowledge, has also not examined associations between young adult protective factors and mental health resilience, whilst accounting for current ADHD symptoms and childhood markers of ADHD risk. This approach ensures that any protective factors identified as having associations with better-than-expected mental health outcomes are not driven by either childhood ADHD risk or adult symptoms of ADHD. Given many individuals experience ADHD as a lifelong disorder it is highly valuable to identify protective factors occurring in young adulthood as a next step from identifying factors across childhood and adolescence (Chapter 3).

The specific aims of the current study are to test whether there is an association between current ADHD symptoms and mental health problems at age 25 years within a high-risk ADHD trait group. Secondly, the chapter tests whether the association between current ADHD symptoms and mental health problems at age 25 is explained by childhood ADHD risk markers. Finally, the chapter will examine whether hypothesised protective factors in young adulthood are associated with better-than-expected mental health outcomes at age 25, accounting for background ADHD risk and when accounting for ADHD persistence.

4.3. Methods

4.3.1. Sample

Data were from the Avon Longitudinal Study of Parents and Children (ALSPAC). Further detail on the sample is given in Chapter 2.

4.3.2. High ADHD Trait Group

To identify children with high childhood ADHD traits, those scoring in the highest 10% on the DAWBA ADHD symptom score at age 7 or 10 were identified (N = 1,195; 67% Male; 14.46% of those with childhood data). Full details are given in Chapter 2.

4.3.3. Childhood Markers of ADHD Risk

ADHD symptom levels, co-occurring neurodevelopmental problems and ADHD genetic risk were included to account for heterogeneity among individuals within the high ADHD trait group. These markers were used to calculate adult mental health residual outcome scores to ensure that any associations with protective factors do not reflect measured heterogeneity in ADHD risk. Full details of the measures included are in chapter two.

4.3.4. Adult Mental Health Outcomes

Emotional and conduct problems were assessed at age 25 years using the self-reported Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997).

Depression symptoms were assessed at age 25 using the Short Moods and Feelings Questionnaire (sMFQ) (Angold et al., 1996).

Full details are available in chapter two.

4.3.5. Current ADHD symptoms

ADHD symptoms were also assessed in adulthood using a parent rated DAWBA measure of ADHD at age 25. Like the previous childhood ADHD DAWBA measures, the continuous symptom scores were used which range from 0 to 36 (for more information see above section 4.3.2 on ADHD trait group). This measure of ADHD symptoms at age 25 was selected to maintain consistency with the measures used in childhood to identify the high-risk ADHD trait group. The DAWBA has also been used in other research to measure ADHD in adulthood (Riglin et al., 2022).

4.3.6. Predictors of Resilience

4.3.6.1. ***In Education, Employment, and Training***

Whether an individual was in some form of education, employment, or training was assessed at 23 years. Any individual within our sample who answered ‘yes’ to being in full time paid work, part time paid work, doing an apprenticeship, in full-time education, or self-employed have been included as ‘1 – In education, employment, or training’ within a dichotomous variable. Those who did not respond ‘yes’ to any of the above categories have been coded as ‘0 – Not in education, employment, or training’. This is similar to the method used in (López-López et al., 2020) and reflects a definition used by the Office for National Statistics to classify individuals as ‘NEET' but has been reversed to be positive.

4.3.6.2. ***Education – A-Levels***

Participants at age 21 were asked whether they had achieved A-levels, or equivalent qualifications, up to that point. In the UK A-levels are typically sat around the age of 18 and serve to provide entry to higher education, data from the age 21 questionnaire was utilised as earlier questionnaires asking about A-level standard education were asked at a timepoint when not all participants would have yet had the opportunity to gain these qualifications. This is a dichotomous variable in which individuals are coded as ‘1 - Yes’ or ‘0 - No’.

4.3.6.3. ***Absence of cannabis use***

At age 24 the CAST (Cannabis Abuse Screening Test) measure of cannabis use (Legleye et al., 2007) was used to assess for problematic cannabis use among the ALSPAC sample. In this study two items have been used separately. The first item asks whether an individual has ever tried cannabis and was coded as ‘1’ No and ‘0’ Yes.

The second item asked how frequently an individual uses cannabis, in this case we have recoded the item dichotomously so that those who use cannabis less than weekly are coded as ‘1’ and those who use cannabis weekly, or more frequently, are coded as ‘0’.

4.3.6.4. ***Low risk alcohol use***

In an interview at age 24, alcohol consumption was measured using the AUDIT-C (Fujii et al., 2016). This measure was used to derive an overall score for each

participant which ranged from 0-12. A score of 8 or above indicates higher risk of alcohol-related disorders (Khadjesari et al., 2017). Therefore, in the current study a dichotomous variable was derived to reflect this cut-off with those scoring 8 or over scoring ‘0’ for high alcohol use risk, and those scoring 7 or below as ‘1’ low alcohol risk.

4.3.6.5. ***Positive romantic relationship***

Relationship quality was assessed at age 25 in ALSPAC using the relationship assessment scale (Funk & Rogge, 2007; Hendrick, 1988). Respondents first reported whether or not they had a romantic partner. For those who did, five positive items from the questionnaire were used which were coded in a 0-4 scale and were used to create a positive relationship score (range 0-20). Items included ‘Does your partner meet your needs?’ and ‘Is your relationship good compared to most?’. A median split, across the whole ALSPAC sample of individuals who were currently in relationships, was used to distinguish more positive (18 or above) or less positive (17 or below) relationships. Those without a partner were also scored ‘0’.

4.3.6.6. ***Peer relationships and Prosocial Traits***

The parent-rated SDQ was used to examine peer relationships and prosocial traits at age 25 (Goodman, 1997). The SDQ peer and prosocial subscales each include five items coded zero “not true”, one “somewhat true”, and two “certainly true” (subscale-scores range: 0-10). The SDQ is well validated for use in children and young people, and recent research suggests its applicability in young adults (NHS, 2020; Riglin, Shameem, et al., 2021). The peer relationships scale was reverse coded so that a higher score indicates better peer relationships. For more information on the SDQ see the above section (4.3.4) on emotional and conduct problems.

4.3.6.7. ***Practical and Emotional Support***

At age 25 the NIH toolbox measures of social support have been used (Cyranowski et al., 2013; Salsman et al., 2013). This measure included 16 items scored 0-4 from ‘never’ to ‘always’ with each item asking the frequency an individual reported specific kinds of support including ‘I have someone I trust to talk with about my problems’ and ‘I have someone to take me to the doctor if

needed'. These 16 items were used to measure emotional and practical support, with 8 items each. Scores for each of the two support measure ranged 0-32.

4.3.7. Potential Confounders

Sex and socio-economic status (mother's education, parity and home ownership) were considered confounders given associations with both protective factors and mental health outcomes (Dvorsky & Langberg, 2016; Gilman et al., 2002).

4.3.8. Statistical Analyses

All analyses were undertaken within the high ADHD trait group (*N* = 1,195). This included individuals with scores in the top 10% for childhood ADHD symptoms at ages seven or 10 years (see Chapter 2).

Analyses first tested associations between mental health outcomes and ADHD symptoms at age 25 to understand the relationship between ongoing adult ADHD symptoms and mental health in young adulthood.

Then to examine better-than-expected mental health outcomes I derived residual scores models using the methods described in Chapter 3.

Firstly, I tested for associations between ADHD symptoms at 25 years and mental health residual scores to consider whether current ADHD was associated with resilience after accounting for the effect of the childhood ADHD risk markers.

I then examined associations between each of the hypothesised young adulthood protective factors and each of the mental health residual scores (emotional problems, conduct problems and depression symptoms. I did this both with and without accounting for ADHD symptoms at age 25 to establish whether each protective factor was associated with mental health resilience beyond current adult ADHD symptoms. Potential confounders were also accounted for in these models.

4.3.9. Multiple Imputation

To help reduce bias arising from missing data I used multiple imputation by chained equations to impute data on protective factors, outcomes, markers of ADHD risk and confounders within the high ADHD trait group (*N* = 1,195). I used 10 cycles of regression-switching and generated 100 imputed datasets using the -mi ice- command in Stata version 17 (StataCorp, 2021). Monte Carlo errors were examined to ensure that 100 datasets were sufficient. All variables used in the

analysis were included in the imputation models alongside additional auxiliary variables.

4.4. Results

Descriptive statistics for the high ADHD trait group are shown in Table 4.1. Percentages represent those who have experienced that protective factor, for example, 80.40% are in education, employment or training.

Table 4.1 Descriptive statistics for Young Adult Protective Factors in the ADHD Group (N =1,195)

Protective Factor	**% of those in ADHD group (*N* = 1, 195)**
In Education, Employment or Training	80.40%
A-Level Education	53.50%
Positive Romantic Relationship	27.30%
Never used Cannabis	37.00%
No Frequent Cannabis Use	81.30%
Low-Risk Alcohol Use	60.80%
	M (SE)
Peer Relationships	8.02 (2.01)
Prosocial Traits	7.55 (2.34)
Practical Support	24.84 (7.52)
Emotional Support	24.59 (8.23)

4.4.1. ADHD and Mental Health at age 25

Within the high-risk ADHD trait group (*N* = 1,195) linear regressions examined associations between ADHD symptoms at age 25 and mental health outcomes at age 25. Emotional and conduct problems and depressive symptoms all showed strong associations with ADHD symptom levels at age 25 (see Table 4.2).

Table 4.2 Associations between ADHD symptoms and Mental Health Outcomes at age 25

ADHD at 25 Years	**Beta**	**SE**	**P>t**
Emotional Problems	0.176	0.020	0.007
Conduct Problems	0.257	0.014	0.001
Depressive Symptoms	0.207	0.051	0.003

4.4.2. Better than predicted mental health symptom scores (25 years)

4.4.2.1. Residual Scores – estimation models

The residual scores were calculated using three multivariable regression models, one for each mental health outcome (emotional problems, conduct problems, and depressive symptoms), using the same methods as described in Chapters 2 and 3. The models for the imputed sample used in the current chapter are presented below (See tables 4.3, 4.4 and 4.5).

Table 4.3 Multivariable associations between markers of ADHD risk and emotional problems at 25 years

Emotional Problems	**Beta**	**SE**	**P-value**
IQ - 8 Years	-0.083	0.537	0.230
Social Cognition - 7 Years	0.087	0.375	0.187
Reading - 7 Years	0.069	0.571	0.372
Communication (Syntax) - 9 Years	-0.084	0.443	0.168
Communication (Pragmatics) - 9 Years	0.133	0.365	0.030
Motor Disorder - 7 Years	-0.005	0.661	0.937
ADHD Symptoms - 7 Years	-0.003	0.021	0.968
ADHD Symptoms - 10 Years	-0.074	0.018	0.182
Child ADHD PRS Score	0.106	0.144	0.061
R-square	**0.067**		
Adj R-square	**0.060**		

Table 4.4 Multivariable associations between markers of ADHD risk and conduct problems at 25 years

Conduct Problems	Beta	SE	P-value
IQ - 8 Years	0.063	0.399	0.452
Social Cognition - 7 Years	0.057	0.231	0.384
Reading - 7 Years	-0.033	0.366	0.687
Communication (Syntax) - 9 Years	0.034	0.342	0.659
Communication (Pragmatics) - 9 Years	0.135	0.251	0.048
Motor Disorder - 7 Years	-0.063	0.354	0.295
ADHD Symptoms - 7 Years	0.010	0.013	0.877
ADHD Symptoms - 10 Years	0.052	0.012	0.377
Child ADHD PRS Score	0.028	0.094	0.639
R-square	**0.076**		
Adj R-square	**0.069**		

Table 4.5 Multivariable associations between markers of ADHD risk and depressive Symptoms at 25 years

Depressive Symptoms	Beta	SE	P-value
IQ - 8 Years	-0.120	1.217	0.065
Social Cognition - 7 Years	-0.007	0.861	0.915
Reading - 7 Years	-0.019	1.260	0.795
Communication (Syntax) - 9 Years	-0.068	1.063	0.257
Communication (Pragmatics) - 9 Years	0.097	0.877	0.107
Motor Disorder - 7 Years	0.077	1.692	0.290
ADHD Symptoms - 7 Years	0.018	0.050	0.772
ADHD Symptoms - 10 Years	-0.107	0.047	0.082
Child ADHD PRS Score	0.139	0.324	0.008
R-square	**0.075**		
Adj R-square	**0.068**		

4.4.2.2. Residual scores – association with young adult current ADHD symptoms

Table 4.6 shows associations between the mental health residual scores and ADHD symptoms at age 25. There were substantial associations between all three mental health residual scores and current levels of ADHD. The strongest association was shown between the sMFQ residual score (depressive symptoms)

and ADHD at 25. Lower ADHD symptoms were associated with greater mental health resilience (I.e., better-than-expected mental health as indexed by the residual scores).

Table 4.6 Associations between Mental Health Resilience and ADHD at age 25

Emotional Problems	**Beta**	**SE**	**P>t**
ADHD at 25 Years	-0.161	0.007	0.007
Depression Symptoms	**Beta**	**SE**	**P>t**
ADHD at 25 Years	-0.258	0.007	<0.001
Conduct Problems	**Beta**	**SE**	**P>t**
ADHD at 25 Years	-0.166	0.008	0.014

4.4.2.3. Emotional Problems Protective Factors

The first set of regression models examining associations between the residual scores and young adult protective factors included the emotional problems residual score as the outcome, and each specific protective factor in turn, together with sex and SES as confounders. These models were run twice firstly, without accounting for ADHD at 25 and secondly, including ADHD symptoms at 25 as a covariate.

As shown in Table 4.7, better quality adult peer relationships, practical support and emotional support were all strongly associated with greater resilience to emotional problems at age 25. Table 4.7 also shows that the same protective factors remained important when current ADHD symptoms at 25 are accounted for with little or no attenuation in effect size. This indicates that associations between peer problems, practical support and emotional support with emotional problems resilience were not explained by current ADHD symptoms at 25.

Table 4.7 Associations between Emotional Problems Residual Scores and Protective Factors, with and without accounting for adult ADHD symptoms

Emotional Problems (Residual Score)	Not Accounting for Adult ADHD beta (SE); p-value	Accounting for Adult ADHD beta (SE); p-value
In Education, Employment or Training	0.088 (0.185); 0.229	0.042 (0.204); 0.598
A-Level Education	0.098 (0.151); 0.193	0.065 (0.157); 0.406
Positive Romantic Relationship	0.018 (0.112); 0.713	-0.004 (0.112); 0.946
Never used Cannabis	-0.003 (0.125); 0.959	0.004 (0.123); 0.947
No Frequent Cannabis Use	0.028 (0.185); 0.697	0.016 (0.183); 0.814
Low-Risk Alcohol Use	-0.085 (0.129); 0.179	-0.091 (0.128); 0.149
Peer Relationships	0.197 (0.027); <0.001	0.155 (0.035); 0.03
Prosocial Traits	0.038 (0.028); 0.568	-0.04 (0.031); 0.587
Practical Support	0.228 (0.007); <0.001	0.206 (0.007); <0.001
Emotional Support	0.175 (0.006); <0.001	0.18 (0.006); <0.001

Data are imputed for the ADHD group, so N is always 1,195. Regressions included confounders sex, mother's education, home ownership and parity.

4.4.3. Depressive Symptoms Protective Factors

Next, analyses examined associations between protective factors and depressive symptoms resilience (depression residual scores indexing better-than-predicted symptoms at 25). Again, two sets of models were run: firstly without, and then accounting for ADHD symptoms at 25 years. Table 4.8 shows that having A-level or equivalent qualifications, being in a positive romantic relationship, lower levels of peer problems, practical and emotional support were all associated with depression resilience at age 25.

A number of these protective factors no longer had strong effects once ADHD symptoms at age 25 had been accounted for. practical and emotional support remained strongly associated with depressive symptoms resilience.

Table 4.8 Associations between Depressive Symptoms Residual Scores and Protective Factors, with and without accounting for adult ADHD symptoms

Depressive Symptoms (Residual Score)	Not Accounting for Adult ADHD beta (SE); p-value	Accounting for Adult ADHD beta (SE); p-value
In Education, Employment or Training	0.019 (0.177); 0.784	-0.063 (0.185); 0.392
A-Level Education	0.144 (0.143); 0.045	0.092 (0.146); 0.211
Positive Romantic Relationship	0.122 (0.118); 0.021	0.09 (0.12); 0.095
Never used Cannabis	0.068 (0.123); 0.253	0.08 (0.123); 0.18
No Frequent Cannabis Use	0.079 (0.219); 0.352	0.061 (0.213); 0.456
Low-Risk Alcohol Use	0.047 (0.139); 0.489	0.038 (0.135); 0.559
Peer Relationships	0.185 (0.026); 0.001	0.076 (0.033); 0.258
Prosocial Traits	0.096 (0.023); 0.074	-0.019 (0.026); 0.751
Practical Support	0.282 (0.007); <0.001	0.245 (0.007); <0.001
Emotional Support	0.261 (0.007); <0.001	0.268 (0.007); <0.001

Data are imputed for the ADHD group, so N is always 1,195. Regressions included confounders sex, mother's education, home ownership and parity.

4.4.4. Conduct Problems Protective Factors

The same set of associations were examined for the conduct problems residual scores, again initially not accounting for ADHD symptoms at age 25, then including them in the model. Table 4.9 shows that being in a positive romantic relationship, prosocial traits, practical and emotional support were all protective when ADHD symptoms are not accounted for.

However, for conduct problems the associations with prosocial traits and positive romantic relationships weakened when adult ADHD symptoms were accounted for. Practical and emotional support remained protective once ADHD symptoms at age 25 were accounted for.

Table 4.9 Associations between Conduct Problems Residual Scores and Protective Factors, with and without accounting for adult ADHD symptoms

Conduct Problems (Residual Score)	Not Accounting for Adult ADHD beta (SE); p-value	Accounting for Adult ADHD beta (SE); p-value
In Education, Employment or Training	0.076 (0.202); 0.343	0.033 (0.216); 0.700
A-Level Education	0.119 (0.163); 0.149	0.09 (0.167); 0.283
Positive Romantic Relationship	0.121 (0.113); 0.017	0.103 (0.117); 0.050
Never used Cannabis	0.014 (0.139); 0.827	0.021 (0.138); 0.750
No Frequent Cannabis Use	0.086 (0.231); 0.338	0.076 (0.231); 0.395
Low-Risk Alcohol Use	0.146 (0.158); 0.059	0.142 (0.157); 0.065
Peer Relationships	0.058 (0.027); 0.290	-0.023 (0.034); 0.739
Prosocial Traits	0.153 (0.026); 0.015	0.106 (0.03); 0.133
Practical Support	0.272 (0.008); <0.001	0.252 (0.008); <0.001
Emotional Support	0.131 (0.007); 0.024	0.136 (0.007); 0.020

Data are imputed for the ADHD group, so N is always 1,195. Regressions included confounders sex, mother's education, home ownership and parity.

4.5. Discussion

The study's findings of this study show strong associations between current symptoms of ADHD at age 25 and mental health outcomes at age 25 in a population-based sample of those with high ADHD symptoms in childhood. There were substantial associations for each of our outcomes: depressive symptoms, emotional problems and conduct problems. This suggests that for children with high ADHD symptoms in childhood, the continuity of ADHD symptoms into young adulthood in part explains some of the variation in mental health outcomes. This finding was further supported by the associations found between current ADHD symptoms and better-than-expected mental health, given background ADHD risk (analyses using residual scores). The residual scores were derived to account for a range of childhood ADHD risk markers (ADHD genetic risk, ADHD symptoms, and additional neurodevelopmental problems). Therefore, the associations between the residual scores and adult ADHD symptoms indicate that current ADHD symptoms add to the effect of childhood risk markers on emotional, conduct and depressive mental health outcomes. These findings are similar to those of Agnew-Blais et al., (2018) since they suggest that those with continued ADHD symptoms at age 18 had poorer mental health outcomes compared to those who had previously but were not currently experiencing ADHD symptoms. However, the current study extends these findings by examining ADHD and mental health outcomes at an older age (25 years) and by considering variation in symptom levels rather than categorically defined patterns of ADHD persistence

This study further improves current knowledge by examining the role of hypothesised protective factors within the relationship between ADHD and mental health problems in young adulthood. Firstly, for emotional problems, peer relationship quality and greater emotional and practical support were found to be protective, even accounting for adult ADHD with little or no attenuation of effect sizes.

Conversely for conduct problems and depressive symptoms the protective factors that showed substantial associations did differ dependent on whether current ADHD symptoms were accounted for. For depressive symptoms, having A-levels, being in a positive relationship, having lower peer problems, practical and emotional support were all protective. However, once current ADHD symptoms

were accounted for only practical and emotional support continued to have strong protective effects. For conduct problems, being in a positive relationship, higher prosocial traits, and practical and emotional support were initially found to be protective. When accounting for current ADHD symptoms at age 25, being in a positive relationship, and practical and emotional support remained protective of mental health resilience. Thus, these findings suggest that protective factors may to some extent also be markers of young adult ADHD symptom levels.

The current research found a robust association between peer relationship quality and emotional problems resilience even when young adult symptoms of ADHD had been accounted for. This finding is in line with previous cross-sectional research in ADHD in a University student sample that has indicated that positive peer relationships led to good adjustment during a period of transition in young adulthood (Khalis et al., 2018). The current results are also partially in line with previous research that has indicated that the relationship between childhood ADHD and increased risk of adolescent depression is in part mediated by peer relationship and friendship quality (Powell et al., 2020, 2021). The current findings add to this prior research by demonstrating that positive peer relationships during young adulthood are protective of emotional problems in young adulthood even when variation in prior and current ADHD symptoms is taken into account.

Practical and emotional support were robustly associated with better mental health resilience at age 25 across emotional, depressive, and conduct problems. This is in line with limited previous research that has suggested that social support is a predictor of positive mental health (Harris-lane et al., 2021), and reinforces the view that social support should be targeted in resilience-based interventions among individuals with ADHD (Mastoras et al., 2018). The current findings have shown the importance of both practical and emotional support for individuals with ADHD in young adulthood. Future research unpicking the most valuable support for young people with ADHD in term of understanding who provides such support and what barriers exist in young people with ADHD feeling supported would be valuable.

Somewhat surprisingly, the current study did not find robust associations between lower substance use, or educational and occupational measures and mental health resilience. Both drug and alcohol use (Hussong et al., 2004; Wang et al.,

2019) and educational and occupational difficulties (Gordon & Fabiano, 2019) have been found to be common problems among individuals with ADHD in young adulthood. However, the current research suggests that avoiding these issues may not lead to greater mental health resilience in young adulthood. These results may be reflective of the quality of the measures. The definition used for educational and occupational outcomes was crude. It was also only measured at one timepoint, so the measure has not captured the stability of education and occupational status. Additionally, the educational measure used only considered A-level education (normally taken around 18 years). Further research could consider a broader range of educational outcomes since the continuation of education post-16 in the UK can take different forms. Other forms of vocational courses or returning to education later in life can also lead to positive outcomes in terms of occupational success and improved self-esteem.

There are several important implications from the current study. Firstly, these findings confirm that current symptoms of ADHD at age 25 have a strong association with a range of poor mental health outcomes for those with high childhood ADHD symptoms. Additionally, ADHD symptoms in young adulthood continued to be associated with young adult mental health problems when childhood ADHD risk markers were accounted for. The current study has identified several protective factors in young adulthood which promote mental health resilience at age 25. The quality of social relationships and the availability of both emotional and practical social support appeared particularly important. Therefore, these findings suggest that further research should investigate how to increase levels of emotional and practical support for individuals with ADHD, and support networks around young people with ADHD, including family members and friends should be included in efforts to improve mental health outcomes for those with ADHD. These findings have the potential to inform the development of interventions that could occur during the transition from adolescence into adulthood to improve mental health resilience among young adults with continued ADHD symptoms.

The study used a large longitudinal birth cohort which included repeated measures of well validated assessments of childhood ADHD and adult mental health, alongside rich data on potential protective factors in young adulthood.

However, there are also limitations which need to be considered. Firstly, we cannot claim to have identified causal relationships due to the possible effects of unmeasured confounders or reverse causation, particularly due to the cross-sectional nature of some of the associations found. Again, only self-reported measures of early adulthood mental health problems were used and it is likely that individuals with ADHD under-report mental health symptoms (Fraser et al., 2018). Additionally, the ALSPAC cohort has experienced participant attrition across time, which can introduce bias and result in conservative estimates of levels of difficulty. However, we used multiple imputation to attempt to address any bias due to missing data within our high ADHD trait group. Lastly, the high-risk ADHD trait group was selected from a population sample, therefore it cannot be presumed that these findings would generalise to children with ADHD diagnoses. This allows our research to be relevant for a population-based sample, however, further longitudinal research is needed into protective factors within clinical samples. Such research should also consider the implications of ADHD treatment on later mental health resilience. This may be particularly valuable since the current study indicated that mental health outcomes and ADHD symptoms at age 25 are strongly associated with each other. Therefore, if ADHD symptoms could be reduced this may lead to better mental health outcomes and could potentially help strengthen some of the associations with some of the young adult protective factors found.

Overall, this longitudinal study suggests that in individuals who had high levels of ADHD symptoms in childhood, those that continue to have symptoms in adulthood are more likely to experience poor mental health outcomes at age 25. We found that higher ADHD symptoms at age 25 are associated with poorer mental health outcomes - over and above the risks associated with experiencing childhood ADHD. Several protective factors were found across emotional, conduct and depressive outcomes which remained protective even when accounting for childhood ADHD risk and adult ADHD symptom levels. Emotional and practical support were strongly protective across all the mental health outcomes. These findings could now be taken forward to more closely examine the mechanisms involved in these associations, which could help to further clarify pathways for individuals with ADHD in childhood, and in young adulthood, to experience better-

than-predicted mental health in adulthood. Further research is also needed within clinical ADHD samples into how these findings could be applied to the development of preventative interventions for young adults.

5. Chapter 5: Do childhood peer relationships and adolescent self-esteem mediate the relationship between male caregiver involvement and resilience to emotional problems?

5.1. Chapter Summary

Many but not all individuals who experience ADHD go on to develop poor mental health in adulthood. Child and adolescent protective factors which contribute to better mental health outcomes can help inform the development of more effective early preventative interventions. However, there has been a lack of research into longitudinal pathways that contribute to better mental health outcomes in young adulthood for individuals who experience ADHD in childhood. The analyses in chapter 3 found associations between individual, family and social protective factors across childhood and adolescence and mental health resilience at age 25. This chapter builds on these findings by examining the mechanisms involved in these associations to help further clarify developmental pathways for individuals with ADHD to experience better mental health in young adulthood. Specifically, this chapter examines whether the association between childhood male caregiver involvement and young adult emotional resilience is mediated by adolescent peer relationships and self-esteem. This will also help to clarify the direction of effects between these factors and help to address the possibility of reverse causation by accounting for earlier childhood emotional problems. The chapter uses the same high-risk ADHD sample in ALSPAC, with mediation analyses conducted using Structural Equation Modelling (SEM). These analyses account for baseline and intermediate confounders. Results showed that in line with Chapter 3, associations were again found between childhood male caregiver involvement, adolescent peer relationships and self-esteem with reduced emotional problems in young adulthood. An association between male caregiver involvement and self-esteem was also identified. There was evidence of indirect effects of male caregiver involvement on adult emotional problems via adolescent self-esteem, but an indirect effect via peer relationships was not found. The pattern of results was similar when baseline confounders and an intermediate confounder of childhood emotional problems were included in the model. Findings indicate that there is a

protective pathway via adolescent self-esteem between male caregiver involvement at age 8 years and adult emotional problems resilience at age 25 years suggesting that interventions aimed at improving parent-child relationships and self-esteem may be beneficial. Peer relationships also appear to be important, but in a pathway that is independent of childhood male caregiver involvement.

5.2. Introduction

Childhood ADHD often leads to individuals experiencing higher levels of vulnerability to mental health problems (Chronis-Tuscano et al., 2010; Meinzer et al., 2016; Patros et al., 2013). See Chapter 1 for full details. However, these poor outcomes are not inevitable (Dvorsky & Langberg, 2016). Resilience based research which examines this variation may allow protective factors to be identified which contribute to positive outcomes.

The thesis has identified several protective factors across childhood and adolescence, namely childhood male caregiver involvement and adolescent peer relationships and self-esteem, which promote mental health resilience in young adulthood. The current study aims to examine the longitudinal relationships between these factors to identify protective developmental pathways for those with high levels of childhood ADHD symptoms. This will add to the current body of knowledge since there is a lack of longitudinal mechanistic studies, and the current study will also account for the high level of heterogeneity seen in ADHD by including markers of ADHD risk (ADHD symptom levels, genetic risk, and additional neurodevelopmental problems) as baseline confounders in the model.

Previous literature, and findings in the current thesis, suggest male caregiver involvement can promote better mental health outcomes among their children. For example, Cong et al., (2020) found that in a general population sample higher levels of childhood parental involvement lowered the risk of developing depression in early adulthood, showing that parental involvement in early life promotes mental health across the life course. In an at-risk sample of youth experiencing maternal depression Collishaw et al., (2016) found that paternal emotional support was a robust predictor of mental health resilience. In the same high-risk sample Mahedy et al., (2018) found that paternal emotional support acts as a mediator between parental relationship quality and depressive symptoms in their children. This further suggests that paternal involvement is a strong predictor of mental health resilience in young people. However, there is limited evidence of the effect of paternal involvement and support on mental health resilience within children at high risk due to ADHD , and past research has suggested that further research is needed into the role of male caregivers in depressive symptoms among young people with ADHD symptoms (Meinzer et al., 2021). In the current thesis, findings

in chapter 3 indicated that there are long-lasting protective associations between childhood paternal involvement and reduced emotional problems in young adulthood, this association was not explained by differences in childhood ADHD risk.

Two possible factors linking childhood male caregiver involvement and young adult mental health among those with high ADHD symptoms are the quality of young people's peer relationships and their self-esteem. Difficulties with peers have been found to be linked to mental health among individuals with ADHD (Humphreys et al., 2013; Powell et al., 2020; Roy et al., 2015). However, this relationship can be complex as outcomes may vary across mental health domains. McQuade et al., (2014) indicated that self-perceived social acceptance by those with ADHD was associated with fewer depression symptoms, but also higher conduct problems. More recently, friendship quality was found to be a key pathway through which ADHD symptoms were associated with later depressive symptoms, and that positive parent-child relationships further contribute by moderating the relationships between ADHD, friendship quality and depression (Powell et al., 2021). There has been limited research considering possible links between parental factors and peer relationships among those with ADHD. Hurt et al., (2007) found that paternal warmth was associated with greater peer acceptance and lower levels of problematic social behaviour. It therefore appears that there may be a relationship between male caregiver-child relationship quality, peer problems, and mental health outcomes for individuals with ADHD. It could be that if children with ADHD have better relationships with their parents this may provide more opportunities for effective social skills to be gained, that could in turn lead to improved mental health outcomes.

It has also been reported that self-esteem may be vital among those with ADHD in promoting more positive mental health outcomes. Kurman et al., (2018) found that children with ADHD showed significantly lower self-esteem, and that self-esteem in children with ADHD was linked to parenting warmth and support. Greater self-esteem in adolescents with ADHD has been found to be a predictor of better psychosocial functioning in young adulthood, and lowers the risk of subsequent depressive disorders (Schei et al., 2018). Similarly, in a population sample of early adolescents, Babore et al., (2016) found that self-esteem was a robust predictor of

depressive symptoms, and the authors indicated that interventions aiming to both monitor self-esteem and supporting relationships with both parents would be valuable in preventing the emergence of depressive symptoms. Previous studies have found an association between self-esteem and mental health for those with and without ADHD, including chapter 3 in the current thesis. There also appears to be a strong relationship between parenting and self-esteem (Kurman et al., 2018). The present chapter examines whether the relationship between male caregiver involvement and emotional problems in a high-risk ADHD symptom group may be partially explained via effects of self-esteem. However, self-esteem and emotional problems are highly correlated and therefore reverse causation is a concern. The current study attempts to address this concern by utilising longitudinal data and repeated assessments of emotional problems, before and after self-esteem was measured.

In summary, only a small number of studies have mechanistically examined the pathways between protective factors and mental health outcomes to inform potential interventions that may help optimise mental health outcomes in children with ADHD. There is limited research that has considered the effect of paternal involvement on the mental health outcomes in those who have experienced childhood ADHD. There is a need for further research examining the relationship between male caregiver involvement and emotional problems in individuals with ADHD, and previous research suggests there is potential for peer relationships and self-esteem to explain part of this relationship. In the present study, we test whether peer relationships and self-esteem in adolescence mediate the relationship between childhood male caregiver involvement and young adult emotional problems (Figure 5.1) in a large prospective population study. I hypothesised that our findings would confirm the association between higher childhood male caregiver involvement and lower young adult emotional problems (as seen in chapter 3), and further show that peer relationships and self-esteem in adolescence contribute to this association.

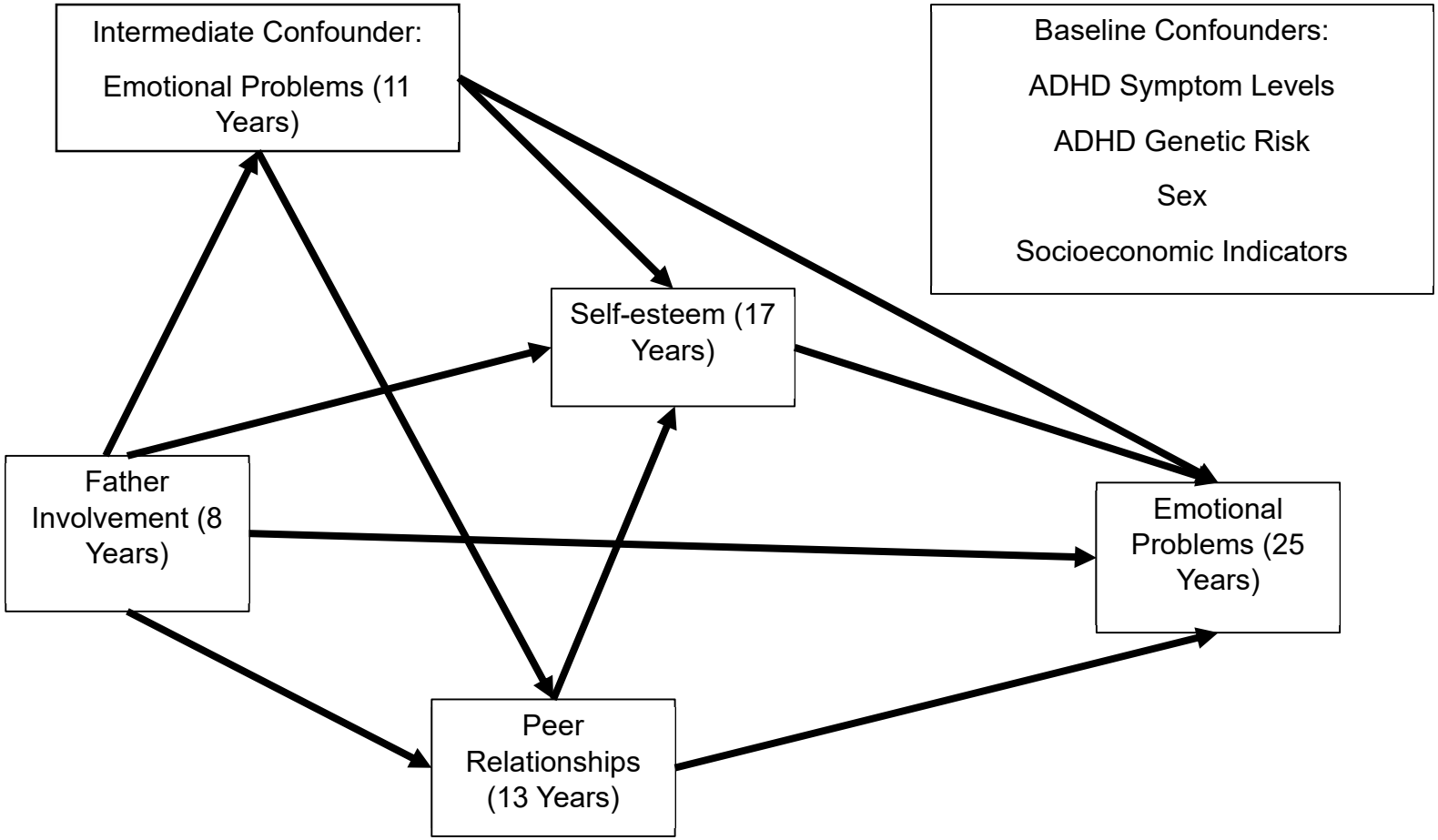


Figure 5.1 The mediation model showing hypothesised pathways from childhood male caregiver involvement (exposure) to young adult emotional problems (outcome) through adolescent peer relationships and self-esteem (mediators).

5.3. Methods

5.3.1. Sample

Data were from the Avon Longitudinal Study of Parents and Children (ALSPAC). Further detail on the sample is given in Chapter 2.

5.3.2. High ADHD Trait Group

To identify children with high childhood ADHD traits, those scoring in the highest 10% on the DAWBA ADHD symptom score at age 7 or 10 were identified (N = 1,195; 67% Male; 14.46% of those with childhood data). Full details are given in Chapter 2.

5.3.3. Emotional Problems

Emotional problems were assessed at age 25 years using the self-reported Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997). Further detail is given in Chapter 2.

5.3.4. Male caregiver Involvement

Male caregiver involvement at age 8 years was the exposure in the model. Details of this questionnaire measure are available in Chapter 3.

5.3.5. Hypothesised Mediators

Quality of peer relationships (13 years), and self-esteem (17 years) were included in the analyses as hypothesised protective mediators in the relationship between childhood male caregiver involvement and resilience to emotional problems in young adulthood. Full details of the mediators are given in Chapter 3.

5.3.6. Potential Baseline Confounders

ADHD symptom levels, co-occurring neurodevelopmental problems and ADHD genetic risk were included as baseline confounders in the associations and mediation model to account for heterogeneity among individuals within the high ADHD trait group. These variables were also used to derive the residual scores in the previous two chapter. Residual scores were not used as the outcomes for the analyses in the current chapter since the measures of ADHD risk are also important for the exposure mediator associations and using residual scores as the outcome would not account for this. Full details of these variables can be found in Chapter 2. In addition, sex and family socioeconomic status were considered as

baseline confounders. These confounders were considered for all paths in the mediation model and were hypothesised to confound all pathways.

5.3.6.1. ***ADHD Symptom Levels***

ADHD was measured using DAWBA ADHD symptom scores at age seven and ten years (see Chapter 2).

5.3.6.2. ***Neurodevelopmental Problems***

Children with ADHD often experience additional neurodevelopmental problems, which can lead to worse outcomes than experiencing ADHD alone. As in previous chapters we derived a set of dichotomous variables to index neurodevelopmental problems in childhood (~ages seven-nine years). We used several measures to index intellectual disability, communication problems, ASD problems, impairment in reading and developmental co-ordination difficulties, see Chapter 2 for full details.

5.3.6.3. ***ADHD Genetic Risk***

ADHD genetic risk was examined using ADHD polygenic risk scores (PRS). PRS were generated as the weighted mean number of disorder risk alleles in approximate linkage equilibrium, derived from imputed autosomal SNPs using PRSice (Euesden et al., 2015). Risk alleles were defined as those associated with case-status at $p < 0.05$ in large consortia analyses of ADHD (Demontis et al., 2019b).

5.3.6.4. ***Sex and Socioeconomic Indicators***

Sex and socio-economic status (mother's education and home ownership) were considered confounders given associations with both protective factors and mental health outcomes (Dvorsky & Langberg, 2016; Gilman et al., 2002).

5.3.7. Potential Intermediate Confounder

We also examined the mediation model including emotional problems at age 11 as an intermediate confounder (e.g., a confounder of the mediation-outcome associations that is a consequence of the exposure). The measure used was the SDQ emotional problems subscale (see Chapter 2). This was included since male caregiver involvement (the exposure) may impact on childhood emotional problems. It is also likely that childhood emotional problems will impact on peer relationships, self-esteem, and emotional problems in adulthood. Accounting for

emotional problems at age 11 in the mediation model helps to address the potential for reverse causation between the mediators (adolescent peer relationships and self-esteem) and emotional problems in young adulthood.

5.3.8. Statistical Analysis

The same ADHD risk group identifying those with scores in the top 10% for childhood ADHD symptoms at ages seven or 10 years was used. All analyses were undertaken within this high ADHD trait group (*N* = 1,195). See Chapter 2 for more details.

Next, we used linear regression to test the association between male caregiver involvement and emotional problems at age 25 years. Separate regression analyses were used to test associations between male caregiver involvement and hypothesised mediators (adolescent peer relationships and self-esteem) and between the mediators and emotional problems at age 25. Regressions included the baseline confounders including the ADHD risk markers. The intermediate confounder, emotional problems at 11 years was included when the outcome was regressed on the mediators.

Next, to test whether the association between childhood male caregiver involvement and young adult emotional problems was explained through peer relationships and self-esteem (see Figure 5.1), indirect effects were examined using the traditional 'product of coefficients' approach with the -sem- command in STATA 17 (StataCorp, 2021). The indirect effects were tested first in a model with the baseline confounders to account for differences in ADHD risk within the high ADHD trait group and for sex and socioeconomic differences. The indirect effects were also then tested in a model with the addition of the intermediate confounder, emotional problems at age 11 years in addition to the baseline confounders.

5.3.9. Multiple Imputation

To help reduce bias arising from missing data we used multiple imputation by chained equations to impute data on protective factors, outcomes, markers of ADHD risk and confounders within the high ADHD trait group (*N* = 1,195). We used 10 cycles of regression-switching and generated 100 imputed datasets using the -mi ice- command in Stata version 17 (StataCorp, 2021). Monte Carlo errors were examined to ensure that 100 datasets were sufficient. All variables used in

the analysis were included in the imputation models alongside additional auxiliary variables (See Chapter 2 for full details). Indirect, direct and total effects were estimated within each imputed dataset (using a loop) and effects estimates were combined across imputed datasets using Rubin's rules. This involved substantial work to develop new Stata code that incorporated the -sem- command into a loop as standard packages were not able to do this.

5.4. Results

5.4.1. Associations of childhood male caregiver Involvement, adolescent peer relationships and self-esteem, and adult emotional problems

Male caregiver involvement at age 8 years was associated with emotional problems at age 25 and with self-esteem at age 17 (Table 5.1). However, male caregiver involvement was not associated with peer relationships at 13 years. There was strong evidence for an association between self-esteem and emotional problems, but only weak evidence for peer relationships and emotional problems.

Table 5.1 Associations between male caregiver involvement, emotional problems, peer relationships and self-esteem

	Adjusted Associations - Beta (SE); P-value	**Unadjusted Associations - Beta (SE); P-value**
Male caregiver Involvement ~ Emotional Problems	-0.133 (0.230) 0.014	-0.152 (0.228); 0.005
Male caregiver Involvement ~ Peer Relationships	0.038 (0.190) 0.320	0.076 (0.180); 0.037
Male caregiver Involvement ~ Self-Esteem	0.148 (0.094) 0.015	0.175 (0.091); 0.003
Peer Relationships ~ Emotional Problems	-0.104 (0.046) 0.050	-0.180 (0.44); 0.001
Self-Esteem ~ Emotional Problems	-0.262 (0.191) <0.001	-0.311 (0.174); <0.001

High ADHD trait group; N = 1,195. Multivariable regressions (adjusted associations) included markers of ADHD symptoms, sex, mother's education, and home ownership. Peer relationships and self-esteem onto adult emotional problems also included emotional problems at 11 years

5.4.2. Indirect Effects

Male caregiver involvement was minimally indirectly associated with emotional problems via peer relationships in adolescence (Table 5.2). This indirect effect only accounted for 3.78% of the total effect of childhood male caregiver involvement on emotional problems in young adulthood. This is in line with the lack of association found between male caregiver involvement and peer relationships above (Table 5.1).

However, male caregiver involvement and emotional problems were indirectly associated via late adolescent self-esteem (Table 5.2). This indirect effect accounted for 30.6% of the total effect of male caregiver involvement on emotional problems in young adulthood.

Table 5.2 Indirect effects via peer relationships and self-esteem in the association between male caregiver involvement and emotional problems

Effect	Beta	SE	95% CI	Percentage of total effect mediated
Indirect effect via only self-esteem	-0.009	0.004	(-0.001, -0.018)	30.6%
Indirect effect via only peer relationships	-0.001	0.001	(0.001, -0.004)	3.8%
Indirect effect via both peer relationships and self-esteem	0.000	0.000	(0.000, -0.001)	<1%
Total indirect effect	-0.011	0.004	(-0.002, -0.019)	34.9%
Direct effect	-0.020	0.013	(0.005, -0.044)	-
Total Effect	-0.030	0.012	(-0.007, -0.054)	-

High ADHD trait group; N = 1,195. Models include all baseline confounders (markers of ADHD symptoms, sex, mother's education, and home ownership)

5.4.3. Indirect Effects including Emotional Problems at 11

Incorporating emotional problems at age 11 into the mediation model as an intermediate confounder had minor effects on the indirect effects (Figure 5.2). The percentage of total effect mediated was slightly reduced for all the indirect effects. Yet, the indirect effect via self-esteem remained substantial accounting for 28.29% of the total effect between male caregiver involvement and adult emotional problems (Table 5.3). Since self-esteem in adolescence continues to account for a substantial proportion of the association between male caregiver involvement and

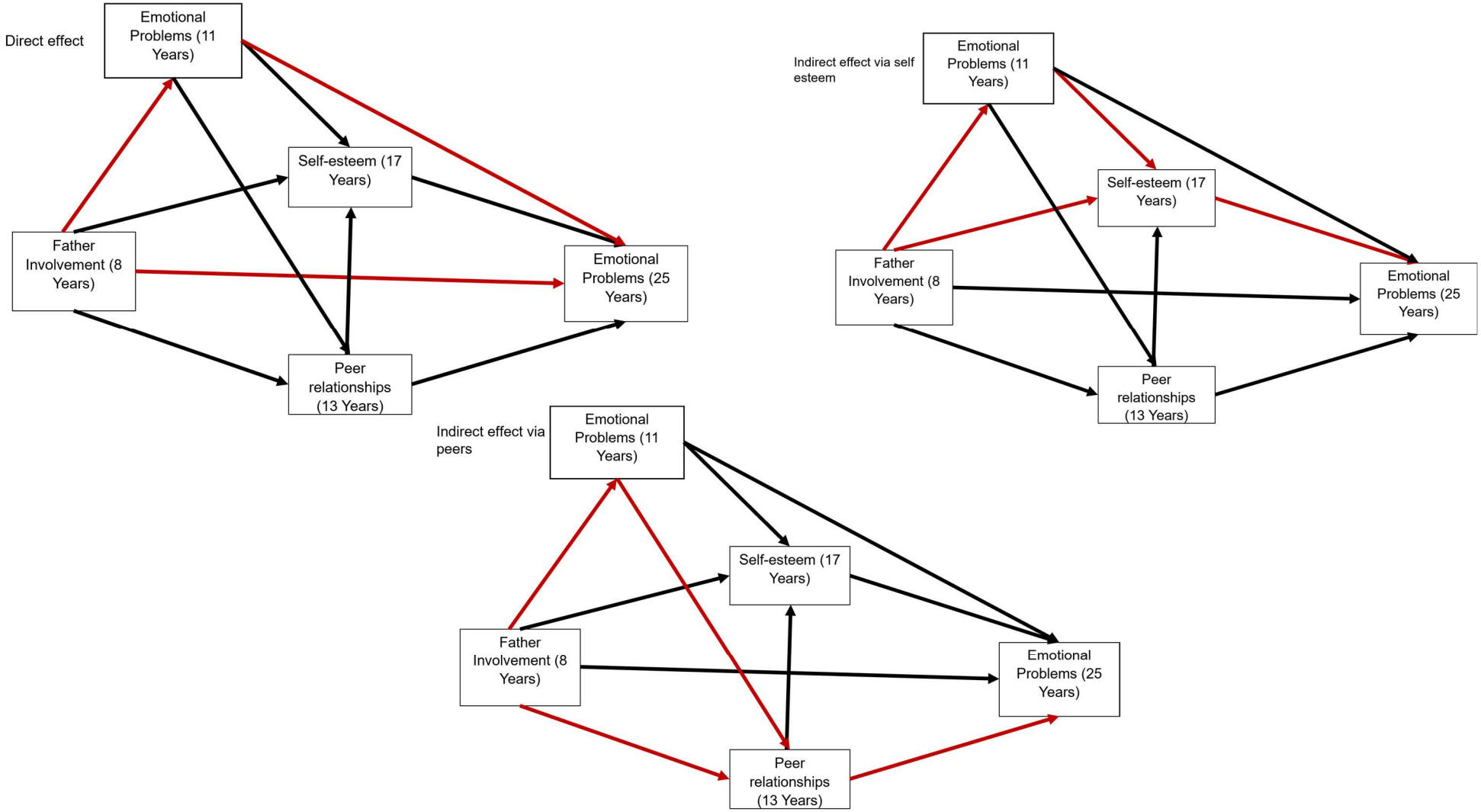
adult emotional problems, even with the inclusion of childhood emotional problems, this suggests that self-esteem has an effect on emotional problems at age 25 over and above emotional problems at age 11.

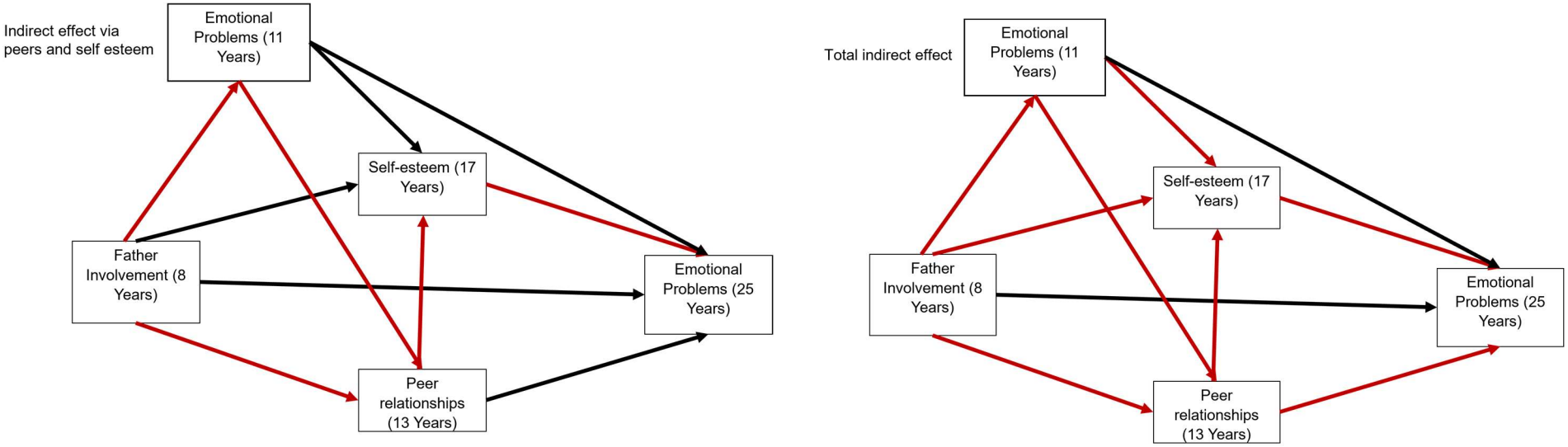
Table 5.3 Indirect effects via peer relationships and self-esteem in the association between male caregiver involvement and emotional problems accounting for emotional problems at 11 years

Effect	Beta	SE	95% CI	Percentage of total effect mediated
Indirect effect via self-esteem	-0.009	0.004	(0.000, -0.017)	28.3%
Indirect effect via peer relationships	-0.001	0.001	(0.001, -0.003)	2.8%
Indirect effect via both	0.000	0.000	(0.000, 0.000)	<1%
Total indirect effect	-0.009	0.004	(0.000, -0.018)	31.2%
Direct effect	-0.021	0.013	(0.004, -0.045)	-
Total Effect	-0.030	0.012	(-0.007, -0.054)	-

High ADHD trait group; N = 1,195. Models include all baseline confounders (markers of ADHD symptoms, sex, mother's education, and home ownership) and emotional problems at age 11.

Figure 5.2 Partitioning of indirect effects via emotional problems at 11 years





This figure illustrates how the intermediate confounder (emotional problems at age 11 years) was included in each of the indirect effects tested. There were six different indirect paths from male caregiver involvement at 8 years (exposure) to emotional problems at 25 years (outcome) that went via childhood emotional problems as an intermediate confounder.

5.5. Discussion

This study examined the association between childhood male caregiver involvement and young adult emotional problems among those with high levels of ADHD traits in childhood. This was undertaken using a large population cohort and by evaluating potential mediation via adolescent peer relationships and self-esteem. Results showed an association between higher childhood male caregiver involvement and lower emotional problems at age 25 years, in line with Chapter Three and previous literature (Collishaw, Hammerton, et al., 2016; Cong et al., 2020; Mahedy et al., 2018).

Mediation results demonstrated that better self-esteem at 17 years contributes to the protective pathway between higher childhood male caregiver involvement and reduced risk of emotional problems in young adulthood as hypothesised. In contrast, peer relationships at 13 years, though predictive of later emotional problems, did not contribute as a mediator to the relationship between male caregiver involvement and emotional problems.

Self-esteem accounted for around 30% of the relationship between male caregiver involvement and emotional problems. Studies had already shown that parenting is associated with self-esteem in children with ADHD (Kurman et al., 2018), and that higher self-esteem is robustly associated with better psychosocial and depressive outcomes in adolescence (Babore et al., 2016; Schei et al., 2018). The current study longitudinally investigating the specific effect of male caregiver involvement longitudinally on self-esteem in individuals with ADHD is, to the best of my knowledge, novel.

However, those who experience ADHD often have lower levels of self-esteem. For example, in a systematic review, Cook et al., (2014) indicated that ADHD is associated with lower self-esteem in adulthood compared to control samples. There is some limited evidence that both interpersonal group therapy and CBT could improve levels of self-esteem among adults with ADHD (Bramham et al., 2009; Shaikh, 2018). Current findings suggest that early intervention efforts incorporating male caregiver involvement may lead to increased self-esteem in adolescence. Further evidence of effectiveness of interventions in adolescents with ADHD would also be valuable.

One limitation of much past research is that self-esteem might be both a cause and a consequence of emotional problems, and this is rarely taken into account. Indeed, low self-worth is a symptom of depression (American Psychiatric Association, 2013). There is thus potential for reverse causation between measures of self-esteem and emotional problems within research studies. A strength of the current study is that it identified adolescent self-esteem as a prospective mediator of the link between male caregiver involvement and emotional problems assessed later in young adulthood. The inclusion of emotional problems at age 11 as an intermediate confounder further strengthens the argument that adolescent self-esteem is an important protective factor for later emotional problems.

Peer relationships in early adolescence were also hypothesised to mediate the relationship between male caregiver involvement and emotional problems; however, this was not found. It has previously been found that there is an association between peer relationships and depressive symptoms in individuals with ADHD (Humphreys et al., 2013; Powell et al., 2020; Roy et al., 2015). Chapter 3 also found some evidence of an association between adolescent peer relationships and emotional problems in young adulthood. However, previous research into the impact of parenting on peer relationships has been limited. Therefore, further research is needed to clarify what pathways peer relationships are present in that lead to better mental health for individuals with ADHD.

Gardner et al., (2019) examined the effectiveness of a parent-assisted peer relationship intervention program. This study found that the adolescents involved in the intervention improved their social skills and many initiated at least one new friendship. This was a pilot study with a small sample, but the results are promising. The current findings suggest that without intervention paternal involvement for children with ADHD does not improve peer relationships leading to better mental health outcomes. This does not, however, rule out the possibility that specific interventions involving parents in increasing social skills and promoting peer relationships would be useful.

There are several important implications of the current findings. Firstly, these findings confirm that there is a robust relationship between childhood paternal involvement and emotional problems in young adulthood among individuals with ADHD, even accounting for confounders such as sex, family background and levels

of ADHD symptoms. Additionally, the current study has longitudinally shown that adolescent self-esteem substantially contributes to this association and the analyses also addressed the possibility of reverse causation occurring within this relationship. The current study suggests that higher levels of paternal involvement can improve the self-esteem of children with ADHD, and this could form a protective pathway that leads to improved mental health outcomes in young adulthood. These findings therefore have the potential to inform the development of interventions that could span across childhood and adolescence to promote mental health resilience in young adulthood. There have already been some promising results suggesting that interventions that strengthen parent-child relationships (Abikoff et al., 2015; Meinzer et al., 2021) and self-esteem (Barney et al., 2022; Schuck et al., 2018) could be valuable in improving mental health outcomes in those with ADHD.

This study utilised a large longitudinal cohort study which included repeated measures of well validated assessments of childhood ADHD and adult mental health, alongside rich data on protective factors across time. However, the results need to be considered within the context of several limitations. Firstly, I did not account for paternal mental health within the mediation model, Paternal mental health and possible ADHD symptoms may have had an impact on paternal involvement as well as on the mediators and mental health outcomes (Collishaw, Hammerton, et al., 2016; Klasen et al., 2015; Mahedy et al., 2018). The male caregiver involvement measure was a measure completed by the primary caregiver that measured the level of involvement at age 8 years. This measure captures one specific timepoint from the primary caregiver's opinion whereas in future measuring male caregiver involvement across childhood and including a measure completed by male caregivers themselves would strengthen the findings. Despite this being a carefully designed longitudinal mediation study which attempted to control for the potential of reverse causation between self-esteem and emotional problems we cannot fully rule out reverse causation or possible effects of unmeasured confounders. Additionally, the ALSPAC cohort has experienced drop out of participants across time, which can introduce bias and result in conservative estimates of levels of difficulty (Sterne et al., 2009). To address this, we used multiple imputation to reduce bias due to missing data. Lastly, the high-risk ADHD trait group was selected from a population sample. This allows our research to be

relevant for population-based settings; however, further longitudinal research is needed into protective factors for children within clinical samples. Such research should also consider the implications of ADHD treatment on protective factors and later mental health.

Overall, this study suggests that childhood paternal involvement is robustly associated with emotional problems in young adulthood among individuals who experienced high levels of ADHD symptoms in childhood. We found that adolescent self-esteem substantially contributed to this relationship, indicating that better paternal involvement might lead to increased self-esteem in adolescence and therefore to better emotional outcomes at age 25 years. However, peer relationships were not found to mediate this relationship. This indicates that despite a probable association between adolescent peer relationships and adult emotional problems, higher levels of paternal involvement in childhood did not specifically lead to improved peer relationships in adolescence. Further research should consider other factors, such as paternal ADHD symptoms and parental relationship quality, that may contribute to the relationship between paternal involvement and better emotional outcomes. It would also be useful to examine the mechanisms involved in associations between protective factors and other mental health outcomes in young adulthood, such as conduct problems. Lastly, further longitudinal research is warranted within clinical ADHD samples into how these findings could be applied to the development of preventative interventions to improve young adult mental health outcomes.

6. Chapter 6: General Discussion

The overall aim of my thesis was to identify protective factors across childhood, adolescence and young adulthood that may optimise mental health outcomes (across emotional, depressive and conduct problems) for those children at high-risk due to childhood ADHD symptoms. This final chapter will discuss the findings from the previous results chapters before discussing any potential implications of these findings, as well as the strengths and limitations of the thesis. Suggestions for future work will also be considered.

6.1. Summary of aims and findings

Mental health problems were common among the high-risk ADHD group we identified in childhood. Yet around 1 in 9 children in this group showed sustained good mental health between 18 and 25 years. This finding is in line with previous work which suggested that a minority of individuals with ADHD can show well adapted functional outcomes (Biederman et al., 1998; Dvorsky & Langberg, 2016; Lee et al., 2008). However, despite some research highlighting the importance of mental health outcomes for individuals with ADHD (Hargitai et al., 2023) there remains a significant lack of research into the longitudinal relationship between ADHD and later depression, emotional and conduct problems. Many of these previous studies have focussed on small clinically diagnosed samples (Meinzer et al., 2014), and have not examined mental health in young adulthood despite this being a key period in development and mental health problems often onsetting during this time (Zisook et al., 2007). Therefore, the first aim of this thesis was to test associations between individual, family, and social protective factors across childhood and adolescence with adult mental health resilience in the high-risk childhood ADHD group. In Chapter 3, self-esteem, family relationships, and peer relationships were found to have long-lasting associations with better-than-expected emotional and depressive symptoms in young adulthood. These findings are in line with previous literature that indicated that for individuals with ADHD self-esteem (Schei et al., 2018) and peer relationships (Powell et al., 2020, 2021) are associated with lower levels of mental health problems. Worsening relationships with mothers during adolescence have also been found to mediate the relationship between ADHD and depression (Meinzer et al., 2021). These findings extend results from previous literature by highlighting that there is a minority group of those with high

ADHD symptoms who are able to show sustained good mental health across young adulthood. The study presented in chapter 3 is novel and advances previous research by accounting for variation in childhood ADHD and by examining protective factors across individual, family, and social domains together and across childhood and adolescence.

ADHD is now seen as a disorder which continues to impact on individuals' lives into young adulthood and beyond (Meinzer et al., 2016; Patros et al., 2013). It has also been suggested that those with current ADHD symptoms in young adulthood are more likely to experience poor mental health (Agnew-Blais et al., 2018). Therefore, the second aim of this thesis was to test associations between individual, family, and social protective factors occurring during young adulthood and adult mental health resilience. This study further accounted for current ADHD symptoms at age 25 in these associations. Findings from Chapter 4 showed that there are robust associations between continued ADHD symptoms and depressive, emotional and conduct symptoms at age 25. This study also found that peer relationships (for emotional problems resilience), being in a positive relationship (for conduct problems resilience), and practical and emotional support were all associated with better mental health in young adulthood. These findings support other studies that have shown that peer relationships can promote good adjustment in young adulthood (Khalis et al., 2018). Previous research has also indicated that social support is a predictor of better mental health and should be a target of resilience-based interventions for children with ADHD (Harris-lane et al., 2021; Mastoras et al., 2018). However, this study has extended prior research by testing for associations with a wide range of protective factors which occur during young adulthood, and it is the first study to account for both differences in childhood ADHD symptoms and ongoing ADHD symptoms into young adulthood within these associations.

Findings from this thesis and from previous research highlight that protective factors across childhood, adolescence, and young adulthood together contribute to resilience in individuals with ADHD. These factors may be intwined with each other and span across different developmental periods and domains. It is important to understand the protective pathways that may exist across the first 25 years of life and the relationships across time that may exist between these different factors, yet little research has previously examined potential mechanisms. Therefore, the third

aim of this thesis built on the findings from chapter 3 to examine whether adolescent peer relationships and self-esteem mediated the relationship between childhood father involvement and emotional problems at age 25 years. Findings from Chapter 5 showed that adolescent self-esteem partly explained the relationship between higher childhood father involvement and lower emotional problems at age 25. However, peer relationships did not act as a mediator in this relationship. These findings are in line with previous studies that had shown higher self-esteem is associated with better psychosocial and depressive outcomes in adolescence (Babore et al., 2016; Schei et al., 2018). These findings indicate that higher levels of paternal involvement can improve self-esteem, and this could form a pathway that promotes mental health resilience in those with ADHD.

Overall, the results from this thesis highlight that there is a minority group who were able to show mental health resilience throughout young adulthood despite experiencing childhood ADHD symptoms. Several protective factors were associated with lower levels of depression, emotional, and conduct problems at age 25 years across childhood, adolescence, and young adulthood. Self-esteem, peer relationships, family relationships, being in a positive relationship, practical and emotional support are all associated with better mental health. This thesis has also begun to unpick these protective effects further by finding that self-esteem partly explains the relationship between childhood father involvement and later emotional problems. Further implications of these findings are discussed next.

6.2. Potential Implications

Within the high-risk ADHD group identified in the current thesis mental health problems in young adulthood (18-25 years) were common. However, they were not inevitable. Around 1 in 9 of those with high childhood ADHD symptoms were able to show sustained good mental health across domains throughout young adulthood. These findings highlight that mental health resilience is possible for some in a high-risk ADHD sample. Although, this finding also illustrates that the majority of individuals with ADHD do struggle with some element of their mental health in young adulthood, warranting significant further research and prioritisation in terms of clinical support. This is particularly concerning since this finding has stemmed from a broad ADHD risk group rather than a group limited to clinical diagnoses. Therefore, this indicates that those who have sub-threshold symptoms also experience significant

poor mental health outcomes in young adulthood. This is in line with other studies which have implied that those with sub-threshold ADHD symptoms experience similar problems and adversities (Bussing et al., 2010; Loe & Feldman, 2007). Individuals with sub-threshold ADHD symptoms are therefore at significant risk of heightened mental health problems yet may not qualify for clinical support.

The current thesis has taken two complimentary approaches to measuring resilience. The sustained good mental health approach allowed for multiple measures assessing different areas of mental health to be combined into one measure that indicates whether an individual has any mental health problem at all across young adulthood (18-25 years). This is beneficial since it was possible to identify a group who had shown resilience with sustained good mental health across multiple domains despite being high-risk due to ADHD. Whereas the better-than-expected mental health approach has allowed for differences between depression, emotional, and conduct problems to be investigated, but only at one specific age (25 years). The major benefit of the better-than-expected approach is that through the use of residual scores any protective factors that were identified in this thesis are not markers of childhood ADHD risk (Collishaw, Hammerton, et al., 2016). These two approaches have complimented each other by allowing for both associations between protective factors and mental health resilience across the entire span of young adulthood to be tested, as well as, between protective factors and specific mental health problems at age 25 accounting for differences in ADHD risk.

It is important to optimise individual outcomes rather than purely focussing on the alleviation of ADHD symptoms. The identification of specific protective factors most strongly associated with resilience highlights the importance of providing support to those with ADHD to help optimise the outcomes in different areas of these individual's lives. The findings in the current thesis indicate that to optimise outcomes supporting families with a child with ADHD, and especially increasing father involvement will be important. Also, helping children and young people with ADHD build and maintain friendships and ensuring adults with ADHD have support networks that provide both emotional and practical support could help improve mental health outcomes in young adulthood. Recognition and treatment of core ADHD symptoms also remains important, in order to improve mental health outcomes. The current thesis found that mental health throughout young adulthood

is generally poor among those with childhood ADHD symptoms. and that the persistence of ADHD symptoms further influences risk of mental health problems into young adulthood (Agnew-Blais et al., 2018; Shaw et al., 2012; Sibley et al., 2017).

One key protective factor highlighted in the current thesis was childhood father involvement. Father involvement was found to be protective against young adult emotional problems. This measure in ALSPAC was completed by the child's main caregiver (often the mother) and focussed on how often a main male figure in the child's life took part in different activities and engaged with the child. Whether this protective effect is truly due to having an involved male figure in their lives, or whether it is reflective of having two involved parents (regardless of sex) is difficult to unpick. Previous research has suggested that maternal and paternal parenting may uniquely predict ADHD symptoms (Keown, 2012). But more research is warranted on the potential differences between maternal and paternal parenting within ADHD and whether these uniquely link to later mental health outcomes. It is also not possible to rule out that the male caregiver involvement measure used in the current thesis did not act as a proxy of other factors, for example, parental relationship quality or family or home environment.

Another key protective factor highlighted in this thesis was practical and emotional support in young adulthood. This factor was found to be promotive of reduced depressive, emotional and conduct symptoms at age 25 years, indicating that the effects of ADHD on mental health in young adulthood could be lessened by changes to policies that improve the support available to young people with ADHD. In particular, improving support to young people with ADHD in the transition from CAMHS services to adult mental health services (Young et al., 2011), or the support offered by universities to students with ADHD (Müller et al., 2022) could be particularly valuable in helping to promote more positive mental health outcomes in this group. An increasing number of universities and employers are recognising neurodiversity and providing structures and support groups for individuals who are neurodiverse. Future studies could consider evaluating the impacts of such initiatives, including on mental health.

By identifying key protective factors in a population sample the current thesis has paved the way for further clinical research. Limited research has already indicated

that some of the protective factors identified in the current thesis could be improved via intervention. Interpersonal group therapy was found to be effective for college students with ADHD diagnoses at improving self-esteem, compared to a control group of individuals with ADHD (Shaikh, 2018). However, the group was relatively small (*N* = 39) and there were more females (*N* = 25/39) than males in the experimental group, this doesn't reflect that more males are diagnosed with ADHD than females and may indicate that females with ADHD are more likely to see improvements in their self-esteem levels from this type of group therapy. A similar group cognitive behavioural therapy (CBT) intervention also found greater improvement in self-esteem levels for individuals with ADHD in the treatment group (Bramham et al., 2009). The sample was slightly larger in this study, and the sex ratio was more representative of a clinical ADHD sample (*N* = 60; Males = 40). However, a third of participants (*N* = 20) did drop out during the treatment phase which suggests that individuals with ADHD may struggle to complete a full program of group-based therapy. Both interventions were around three months in length and self-esteem was assessed when the intervention finished. Therefore, longer term improvements in self-esteem have not yet been investigated. The current thesis has indicated that there are longer term associations between adolescent self-esteem and emotional problems at age 25. Therefore, further research should examine whether group-based therapy interventions could lead to longer term sustained improvements in the self-esteem of adolescents and young adults with ADHD since this could in turn lead to improvements in emotional outcomes.

Positive peer relationships were also found to be promotive of better mental health outcomes in the current thesis. There has been limited work developing interventions to improve peer relationships for individuals with ADHD. Mikami et al., (2013) found that interventions which involve both behavioural management for children with ADHD and training peers to be more socially inclusive were effective in classroom settings at improving peer relationships for children with ADHD. It has also been found that a parent-assisted friendship building program for adolescents with ADHD was also successful in improving peer relationships (Gardner et al., 2019). This suggests that peer relationships can be improved for both children and adolescents with ADHD, however, more longer-term follow-ups of this kind of intervention are needed to assess longer term improvements in peer relationships and the potential

promotion of better mental health outcomes this may lead to. Overall, the protective factors identified in the current thesis have potential to be investigated further by intervention studies that aim to understand how these factors can be improved for individuals with ADHD. In particular, improvements in self-esteem and peer relationships appear to be plausible, however, further research including larger clinical trials which assess the longer-term impacts of such interventions and measure the impact on the mental health of participants are needed.

6.3. Strengths and Limitations

This thesis extends prior research by utilising a prospective, population sample to test associations between a wide range of individual, social, and family protective factors with young adult mental health resilience in those with high childhood ADHD symptoms. Two complementary approaches examined resilience considering both the absence of young adult mental health problems and better-than-expected mental health outcomes. The specific strengths of this thesis as a whole are discussed below, with specific strengths and limitations of each research chapter having previously been discussed in the relevant chapter discussion sections.

First, the longitudinal design and prospective measures used allowed for potential individual, social, and family protective factors across childhood, adolescence, and young adulthood to be tested to identify associations with adult mental health resilience in those with childhood ADHD symptoms and to investigate developmental pathways that link these factors. A particular strength of the ALSPAC study is the rich social and mental health data with the same measures often being repeated across time. This has meant that the same measure of ADHD symptoms has been used in childhood and adulthood to account for symptom levels and persistence of adult ADHD symptoms in Chapter 4. By using prospective measures of childhood ADHD the current thesis was not impacted by recall bias which may have impacted the results of previous adult cross-sectional designs since there appears to be a recall bias in adult ADHD patients (Wirth et al., 2021). The study also used data to account for differences in childhood ADHD risk, including, symptoms and well-validated measures of co-occurring neurodevelopmental problems as well as polygenic risk scores to account for differences in ADHD genetic risk.

Second, key socio-demographic variables were collected during pregnancy in ALSPAC. This allowed for the associations in the current thesis to be adjusted for some potential confounders. These alternative explanations are important to consider since the overall aim of these studies was to identify possible modifiable protective factors to optimise mental health outcomes. Third, since ALSPAC is a large population-based sample, this allowed for a high-risk ADHD group to be identified with enough participants (*N* =1,195) to ensure statistical power when considering within group differences. This symptom count based high-risk group is advantageous since those individuals who do not enter ADHD treatment, or who are sub-threshold are not excluded from the identification of mental health protective factors.

Finally, potential mechanisms were examined using mediation analyses in Chapter 5. This study longitudinally assessed whether adolescent self-esteem and peer relationships in part mediated the relationship between childhood father involvement and adult emotional problems. Baseline confounders in the model included the ADHD risk markers used throughout this thesis to account for difference in ADHD risk. An intermediate confounder of emotional problems at age 11 years was also accounted for in the model to help address the potential for reverse causation between the mediators and emotional problems. Investigating longitudinal pathways is valuable because it can lead to the identification of relationships between factors that promote mental health resilience beyond single factors alone.

However, the findings also need to be considered in the context of several limitations. Firstly, as with most cohort studies ALSPAC has been subject to attrition with potential bias arising from missing data, the proportion of which increases over time. Throughout the current thesis a rigorous approach to multiple imputation was used in to deal with any potential bias arising from this missing data. Prior literature has recommended the use of multiple imputation to deal with these potential biases (Moodie et al., 2008). Imputation was used for the ADHD high-risk group only and Monte Carlo errors ensured enough datasets had been imputed. The imputation approach in chapter five was particularly novel since standard STATA packages were not able to accommodate SEM analyses. However, a limitation of the current thesis is that bias from missing data was not accounted for in the ADHD symptom

variables that were used to define the high-risk ADHD group. Full details on the imputation used are available in the Methods Chapter.

Second, even though a longitudinal study design was used with measures spanning childhood up to 25 years of age, adjusting for several potential confounders and attempting to control for reverse causation (in Chapter 5) it cannot be assumed that associations found in the current thesis are causal. Despite accounting for several socio-demographic confounders assessed in pregnancy, residual confounding by unmeasured characteristics such as, parental relationship quality, family structure or environment, and parental mental health, cannot be ruled out. It is also important to note that in some cases associations between certain protective factors and the mental health outcomes assessed in this thesis may have been stronger due to being temporally closer together than others. For example, in Chapter 3 adolescent factors were more strongly associated with the outcomes in young adulthood than those occurring in childhood. This may be because factors occurring in adolescence are indeed more strongly associated with young adult mental health outcomes. However, it cannot be ruled out that possible associations between childhood factors and mental health may have been weakened due to larger time lags. Thirdly, the ALSPAC cohort is not necessarily representative or inclusive of all population groups. In particular, the majority of ALSPAC participants are of White ethnicity which limits the generalisability of findings to other ethnic groups (Fraser et al., 2013). Furthermore, the results from this thesis are only generalisable to other western countries with similar socioeconomic backgrounds. It is also possible that children with ADHD today have a different experience to those born in the early 1990s in the ALSPAC cohort.

Fourth, there are likely to be a number of additional mechanisms that may play a role in the associations between adult mental health resilience and the protective factors that were not examined here which are likely to include parental mental health, parental relationship quality, ADHD medication usage, and differences in child temperament. Likewise, the results in the current thesis may have been affected by the quality of protective factors measures and changes across time of the choice of measures. In particular, the measures of school experience tested as potential protective factors were single item measures which limit their reliability and validity and thus the likelihood for associations to be found. School environment was

hypothesised to be promotive of later mental health resilience since the educational environment of those with ADHD is a significant challenge (Ford, 2020). Therefore, the lack of association could be due to poor measures, those in the high-risk group being less able to access any protective effects from their school experiences, or possibly due to the time lapse between school measures and young adult mental health. Future research should consider educational experiences of those with ADHD further. The limitations in this current thesis stemming from changes in measures across time and the quality of some measures arises due to the use of a longitudinal cohort study. Since, despite the benefits of using a large dataset from a study that has spanned decades it is necessary to work with the data that has already been collected.

Additionally, since a wide range of protective factors were tested in one thesis, across Chapters 3 and 4, the possibility of false positive results (type I error) cannot be ruled out. However, testing a broad range of factors across individual, social, and family domains was advantageous since few previous studies had examined more than a few potential factors in one study. This also allowed for the relationship between protective factors to be investigated further across time and different domains (Chapter 5).

Polygenic risk scores were used to account for ADHD genetic risk within the residual scores models. ADHD has a heritability estimate of 71-90% (Thapar et al., 2013), and polygenic risk scores are a useful indicator of disease risk for multifactorial disorders such as ADHD (Larsson et al., 2013). PRS have been found to be associated with ADHD symptom levels in the general population (Martin et al., 2014) as well as being higher in individuals with an ADHD diagnosis (Hamshere et al., 2013), indicating that those with higher ADHD PRS scores are likely to show higher levels of ADHD problems. However, Brikell et al., (2018) also found that there is a significant association between ADHD PRS and general psychopathology, indicating that the genetic variance captured by ADHD PRS also reflects a genetic risk for childhood psychopathology more broadly. Therefore, although PRS can account for some of the genetic risk seen in ADHD it cannot be claimed that the current thesis has fully accounted for the genetic variance seen specifically within ADHD. In future research, utilising measures of family ADHD history may be another potential method for accounting for genetic risk of ADHD.

Another potential limitation is that measures of adult mental health (used in the residual scores approach at age 25) relied purely on self-reported measures. Some evidence has suggested that those with ADHD under-report mental health symptoms compared to their parents, which is the opposite of what is seen in the general population (Fraser et al., 2018). It was also not possible in the current thesis to investigate sex differences within our high-risk ADHD group. The group consisted of 70% male participants and comparisons of protective associations between males and females would be potentially unreliable due to sample size differences. Also, since there were so few female participants statistical power would have also been a concern. However, it is likely that females are underdiagnosed with ADHD (Martin et al., 2018), and rates and predictors of mental health problems may differ for females and males with ADHD(Biederman et al., 2008).

Lastly, a limitation within the current thesis, and the wider resilience literature, is that there is no one overarching theory that can guide research in the selection and grouping of protective factors. Further work is needed to help guide similar research in the selection of protective factors to examine. In particular, one option may be to adopt an ecological model similar to Bronfenbrenner, (1977) whose ecological model of development emphasised that children should be considered within multiple related ecological systems in their social environments including with family and peers. For example, children who experience ADHD symptoms are more likely to have difficulties in their familial and peer relationships. These relationships, however, are also shaped by broader social and cultural factors such as the child's school environment and the stigma surrounding ADHD. It is important for any such theory to consider the interplay across different levels of an ecological model. The potential of an ecological model within resilience has been considered by Masten, (2001) who highlighted the importance of fundamental systems within a child's broad environment. The current thesis, and the resilience and protective factors literature overall, could greatly benefit from a universal theoretical approach that would allow for the selection of protective factors that are unified by theory rather than the focus being on singular factors of interest. Suggestions for future work are described next.

6.4. Suggestions for future work

In the current thesis, an association was identified between childhood father involvement and young adult mental health resilience among those at high-risk due

to childhood ADHD symptoms. This association was then investigated further through mediation analyses which showed that adolescent self-esteem partly accounted for this relationship. However, it was not possible in the current thesis to gain a complete picture of family life and relationships in childhood. Therefore, future research should consider examining how parental relationship quality, outside support, and family structure impact on later mental health resilience in those with ADHD. The data available for the current studies focussed on mother and father involvement. However, the association found may reflect that having two involved parents, rather than specifically an involved father, is important for future mental health resilience. Previous research had already indicated the benefits to mental health in the general and other high-risk populations (Collishaw, Hammerton, et al., 2016; Cong et al., 2020; Mahedy et al., 2018). More research has focussed on mother's parenting and involvement than that of fathers. In the current thesis the measures used were based on mother-reports of father's involvement and we were unable to investigate different family structures more widely. Therefore, investigating the role of fathers and the potential benefits of having two involved parents is an important area for future research. Attempting to account for father's ADHD symptoms and economic background and utilising reports from more than one family member will be important.

Secondly, Chapter 5 found that the relationship between childhood father involvement and emotional problems at age 25 was explained, in part, via adolescent self-esteem. These findings indicate that there is a developmental pathway for those with ADHD whereby higher paternal involvement leads to increased self-esteem which in turn is promotive of better emotional outcomes in young adulthood. There has been a lack of resilience-based ADHD research which has considered longitudinal pathways between different protective factors (Dvorsky & Langberg, 2016). However, there could be significant implications for preventative interventions of understanding how protective factors interact over time providing information on likely 'active ingredients' and hypothesised mechanisms of effect of these interventions. This could inform potential interventions of the importance of specific factors in childhood leading to increases in other factors later in life which lead onto improved mental health resilience. Previous research in other high-risk populations has found that the number of protective factors across individual, family

and social domains experienced by an individual has a major effect on mental health resilience (Collishaw, Gardner, et al., 2016; Collishaw, Hammerton, et al., 2016). Therefore, it is important for further research to consider how protective factors interact with each other over time as focusing on single protective factors is unlikely to be sufficient. The current thesis was only able to examine the relationship between protective factors spanning childhood and adolescence within mediation analyses, therefore further research is needed that links factors from childhood into young adulthood.

A limitation discussed above is that the findings in this study are not generalisable to other populations where the culture and sociodemographic status differ from those seen in ALSPAC. However, ADHD is a global concern, yet the way in which ADHD is viewed from an education, cultural, and political viewpoint differs immensely between regions (Smith, 2017). Therefore, an individual experiencing ADHD in one country is likely to have a vastly different experience than someone in another. This may be particularly relevant when considering resilience within ADHD. For example, what is considered a better-than-expected outcome for someone with ADHD may well differ dependent on culture. Also, potential protective factors are also likely to vary. For example, there are significant differences in education systems, mental health and ADHD treatment approaches, family environment, and the stigma around experiencing ADHD. Therefore, more research examining potential protective factors in cohorts such as The Pelotas Birth Cohort (Victora et al., 2008), based in Brazil, which differ from ALSPAC in terms of cultural and sociodemographic context would be valuable.

Lastly, the current thesis aimed to identify ways in which to optimise young adult mental health outcomes in individuals with high childhood ADHD symptoms. Identifying protective factors in population-based high-risk sample was advantageous since this means the associations found in the current thesis are relevant for individuals who experience sub-threshold ADHD symptoms, and those who may not seek or be eligible for clinical ADHD treatment. However, these findings therefore, are not generalisable to more severely affected clinical populations. Therefore, future research should build on the findings in the current thesis to investigate how the protective factors identified here could also benefit those with clinically diagnosed ADHD.

6.5. Conclusion

This thesis aimed to identify protective factors that may optimise adult mental health outcomes in children with high childhood ADHD symptoms. This thesis took an advantageous approach by utilising a prospective longitudinal cohort study to identify factors that promote mental health resilience in a population sample of those with high ADHD symptoms in childhood. Another strength of the current thesis is that resilience was approached in two complementary ways. Examining sustained good mental health allowed for resilience across many different types of mental health problem and across young adulthood (18-25 years) to be investigated. This was complimented by the better-than-expected residual scores approach which allowed for differences in ADHD risk to be accounted for whilst protective effects for specific mental health outcomes at age 25 could be investigated. A wide range of individual, social, and family factors across development were explored. Key factors that were found to promote mental health resilience in this high-risk ADHD sample included childhood father involvement, family relationship quality, adolescent self-esteem, adolescent and young adulthood peer relationships, and practical and emotional support in young adulthood. Further research should now take these findings further in order to start to develop preventative interventions.

7. Appendices

7.1. Appendix 1 – Code to conduct SEM on multiply imputed data using a loop

```
use "Y:\PSYCM\Projects\Neurodevelopmental Disorders\Lorna Ushaw\Collishaw_18Nov2020\Paper 3\mi_v2.dta", clear

capture postclose sem_loop
postfile sem_loop impdata ind1 ind1_var ind2 ind2_var ind3 ind3_var ///
 indtot indtot_var dir dir_var tot tot_var using "sem_unconditional_imp1.dta", replace

forvalues impdata = 1/100 {
        use mi_v2, clear
        di "`impdata'"
        keep if _mi_m==`impdata'
        qui sem (semotion <- fathinvol3 ta7025drecode ccxd860b kz021 a006grouped medugrouped childprs0_05std p7adhd_dawba_sx_score p10adhd_dawba_sx_score adhdsev_v1) ///
(ccxd860b <- fathinvol3 ta7025drecode kz021 a006grouped medugrouped childprs0_05std p7adhd_dawba_sx_score p10adhd_dawba_sx_score adhdsev_v1) (ta7025drecode <- fathinvol3 kz021 a006grouped medugrouped childprs0_05std p7adhd_dawba_sx_score p10adhd_dawba_sx_score adhdsev_v1)

*Indirect effect self-esteem *
nlcom (_b[ccxd860b:fathinvol3]*_b[semotion:ccxd860b])
local ind1 = r(b)[1,1]
local ind1_var = r(V)[1,1]
```

```
*Indirect effect via peers *
nlcom (_b[ta7025drecode:fathinvol3]*_b[semotion:ta7025drecode])
local ind2 = r(b)[1,1]
local ind2_var = r(V)[1,1]

* Indirect effect via both as sequence *
nlcom
(_b[ta7025drecode:fathinvol3]*_b[ccxd860b:ta7025drecode]*_b[semotion:ccxd860b])
local ind3 = r(b)[1,1]
local ind3_var = r(V)[1,1]

*Total indirect effect *
nlcom (_b[ta7025drecode:fathinvol3]*_b[semotion:ta7025drecode] + ///
_b[ccxd860b:fathinvol3]*_b[semotion:ccxd860b] + ///
_b[ta7025drecode:fathinvol3]*_b[ccxd860b:ta7025drecode]*_b[semotion:ccxd860b])
local indtot = r(b)[1,1]
local indtot_var = r(V)[1,1]

* Direct effect *
nlcom (_b[semotion:fathinvol3])
local dir = r(b)[1,1]
local dir_var = r(V)[1,1]

* total effect
nlcom (_b[ta7025drecode:fathinvol3]*_b[semotion:ta7025drecode] + ///
```

```
_b[ccxd860b:fathinvol3]*_b[semotion:ccxd860b] + ///
_b[ta7025drecode:fathinvol3]*_b[ccxd860b:ta7025drecode]*_b[semotion:ccxd860b])
+ (_b[semotion:fathinvol3])
local tot = r(b)[1,1]
local tot_var = r(V)[1,1]

post sem_loop (`impdata') (`ind1') (`ind1_var') (`ind2') (`ind2_var') (`ind3') (`ind3_var')
///
 (`indtot') (`indtot_var') (`dir') (`dir_var') (`tot') (`tot_var')
}
postclose sem_loop

use "Y:\PSYCM\Projects\Neurodevelopmental Disorders\Lorna
Ushaw\Collishaw_18Nov2020\Paper 3\sem_unconditional_imp1.dta", clear


clonevar ind1_b = ind1
clonevar ind2_b = ind2
clonevar ind3_b = ind3
clonevar indtot_b = indtot
clonevar dir_b = dir
clonevar tot_b = tot

renvars ind1 ind2 ind3 indtot dir tot / ind1_mn ind2_mn ind3_mn indtot_mn dir_mn
tot_mn
renvars ind1_var ind2_var ind3_var indtot_var dir_var tot_var / ind1_w ind2_w
ind3_w indtot_w dir_w tot_w
```

```
collapse (mean) ind1_mn ind2_mn ind3_mn indtot_mn dir_mn tot_mn ind1_w
ind2_w ind3_w indtot_w dir_w tot_w (sd) ind1_b ind2_b ind3_b indtot_b dir_b tot_b

for var ind1_b ind2_b ind3_b indtot_b dir_b tot_b: replace X = X^2

for any ind1_ ind2_ ind3_ indtot_ dir_ tot_: gen Xtotvar = Xw + (1 + 1/100)*Xb


for any ind1_ ind2_ ind3_ indtot_ dir_ tot_: gen Xtotse = Xtotvar^0.5


list ind1_mn ind1_totse

list ind2_mn ind2_totse

list ind3_mn ind3_totse

list indtot_mn indtot_totse

list dir_mn dir_totse

list tot_mn tot_totse



*Intermediate Confounder Added*


use "Y:\PSYCM\Projects\Neurodevelopmental Disorders\Lorna
Ushaw\Collishaw_18Nov2020\Paper 3\mi_v2.dta", clear

*keep if _mi_m==1

*paramed fathinvol3, avar(semotion) mvar(ccxd860b) a0(0) a1(1) m(0) yreg(linear)
mreg(logistic) boot reps(1000)


capture postclose sem_loop

postfile sem_loop impdata ind1 ind1_var ind2 ind2_var ind3 ind3_var ///

 indtot indtot_var dir dir_var tot tot_var using "sem_unconditional_imp1.dta", replace
```

```
forvalues impdata = 1/100 {
        use mi_v2, clear
        di "`impdata'"
        keep if _mi_m==`impdata'
        qui sem (semotion <- fathinvol3 ta7025drecode ccxd860b kz021 a006grouped medugrouped childprs0_05std p7adhd_dawba_sx_score p10adhd_dawba_sx_score kw6602b adhdsev_v1) ///
(ccxd860b <- fathinvol3 ta7025drecode kz021 a006grouped medugrouped childprs0_05std p7adhd_dawba_sx_score p10adhd_dawba_sx_score kw6602b adhdsev_v1) (ta7025drecode <- fathinvol3 kz021 a006grouped medugrouped childprs0_05std p7adhd_dawba_sx_score p10adhd_dawba_sx_score kw6602b adhdsev_v1) (kw6602b <- fathinvol3 kz021 a006grouped medugrouped childprs0_05std p7adhd_dawba_sx_score p10adhd_dawba_sx_score adhdsev_v1)

*Indirect effect self-esteem *
nlcom (_b[ccxd860b:fathinvol3]*_b[semotion:ccxd860b] + ///
_b[kw6602b:fathinvol3]*_b[ccxd860b:kw6602b]*_b[semotion:ccxd860b])
local ind1 = r(b)[1,1]
local ind1_var = r(V)[1,1]

*Indirect effect via peers *
nlcom (_b[ta7025drecode:fathinvol3]*_b[semotion:ta7025drecode] + ///
_b[kw6602b:fathinvol3]*_b[ta7025drecode:kw6602b]*_b[semotion:ta7025drecode])
local ind2 = r(b)[1,1]
local ind2_var = r(V)[1,1]

* Indirect effect via both as sequence *
```

```
nlcom
(_b[ta7025drecode:fathinvol3]*_b[ccxd860b:ta7025drecode]*_b[semotion:ccxd860b]
+ ///
_b[kw6602b:fathinvol3]*_b[ta7025drecode:kw6602b]*_b[ccxd860b:ta7025drecode]*_
b[semotion:ccxd860b])
local ind3 = r(b)[1,1]
local ind3_var = r(V)[1,1]

*Total indirect effect *
nlcom ((_b[ccxd860b:fathinvol3]*_b[semotion:ccxd860b] + ///
_b[kw6602b:fathinvol3]*_b[ccxd860b:kw6602b]*_b[semotion:ccxd860b]) + ///
(_b[ta7025drecode:fathinvol3]*_b[semotion:ta7025drecode]) + ///
(_b[kw6602b:fathinvol3]*_b[ta7025drecode:kw6602b]*_b[semotion:ta7025drecode])
+ ///
(_b[ta7025drecode:fathinvol3]*_b[ccxd860b:ta7025drecode]*_b[semotion:ccxd860b]
+ ///
_b[kw6602b:fathinvol3]*_b[ta7025drecode:kw6602b]*_b[ccxd860b:ta7025drecode]*_
b[semotion:ccxd860b]))
local indtot = r(b)[1,1]
local indtot_var = r(V)[1,1]

* Direct effect *
nlcom (_b[semotion:fathinvol3] + _b[kw6602b:fathinvol3]*_b[semotion:kw6602b])
local dir = r(b)[1,1]
local dir_var = r(V)[1,1]

* total effect
```

```
nlcom ((_b[ccxd860b:fathinvol3]*_b[semotion:ccxd860b] + ///
_b[kw6602b:fathinvol3]*_b[ccxd860b:kw6602b]*_b[semotion:ccxd860b]) + ///
(_b[ta7025drecode:fathinvol3]*_b[semotion:ta7025drecode]) + ///
(_b[kw6602b:fathinvol3]*_b[ta7025drecode:kw6602b]*_b[semotion:ta7025drecode])
+ ///
(_b[ta7025drecode:fathinvol3]*_b[ccxd860b:ta7025drecode]*_b[semotion:ccxd860b]
+ ///
_b[kw6602b:fathinvol3]*_b[ta7025drecode:kw6602b]*_b[ccxd860b:ta7025drecode]*_
b[semotion:ccxd860b]) + (_b[semotion:fathinvol3] +
_b[kw6602b:fathinvol3]*_b[semotion:kw6602b]))
local tot = r(b)[1,1]
local tot_var = r(V)[1,1]

post sem_loop (`impdata') (`ind1') (`ind1_var') (`ind2') (`ind2_var') (`ind3') (`ind3_var')
///
 (`indtot') (`indtot_var') (`dir') (`dir_var') (`tot') (`tot_var')
}
postclose sem_loop

use "Y:\PSYCM\Projects\Neurodevelopmental Disorders\Lorna
Ushaw\Collishaw_18Nov2020\Paper 3\sem_unconditional_imp1.dta", clear



clonevar ind1_b = ind1
clonevar ind2_b = ind2
clonevar ind3_b = ind3
clonevar indtot_b = indtot
```

```
clonevar dir_b = dir

clonevar tot_b = tot


renvars ind1 ind2 ind3 indtot dir tot / ind1_mn ind2_mn ind3_mn indtot_mn dir_mn
tot_mn

renvars ind1_var ind2_var ind3_var indtot_var dir_var tot_var / ind1_w ind2_w
ind3_w indtot_w dir_w tot_w


collapse (mean) ind1_mn ind2_mn ind3_mn indtot_mn dir_mn tot_mn ind1_w
ind2_w ind3_w indtot_w dir_w tot_w (sd) ind1_b ind2_b ind3_b indtot_b dir_b tot_b

for var ind1_b ind2_b ind3_b indtot_b dir_b tot_b: replace X = X^2

for any ind1_ ind2_ ind3_ indtot_ dir_ tot_: gen Xtotvar = Xw + (1 + 1/100)*Xb


for any ind1_ ind2_ ind3_ indtot_ dir_ tot_: gen Xtotse = Xtotvar^0.5


list ind1_mn ind1_totse

list ind2_mn ind2_totse

list ind3_mn ind3_totse

list indtot_mn indtot_totse

list dir_mn dir_totse

list tot_mn tot_totse
```

8. References

Abikoff, H. B., Thompson, M., Laver-Bradbury, C., Long, N., Forehand, R. L., Miller Brotman, L., Klein, R. G., Reiss, P., Huo, L., & Sonuga-Barke, E. (2015). Parent training for preschool ADHD: A randomized controlled trial of specialized and generic programs. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *56*(6), 618–631. https://doi.org/10.1111/jcpp.12346

Agha, S. S., Zammit, S., Thapar, A., & Langley, K. (2017). Maternal psychopathology and offspring clinical outcome: a four-year follow-up of boys with ADHD. *European Child and Adolescent Psychiatry*, *26*(2), 253–262. https://doi.org/10.1007/s00787-016-0873-y

Agnew-Blais, J. C., Polanczyk, G. V., Danese, A., Wertz, J., Moffitt, T. E., & Arseneault, L. (2018). Young adult mental health and functional outcomes among individuals with remitted, persistent and late-onset ADHD. *The British Journal of Psychiatry*, *213*(3), 526–534. https://doi.org/10.1192/bjp.2018.97

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders (DSM-5®) - American Psychiatric Association - Google Books*.

Angold, A., Costello, J., Van Kämmen, W., & Stouthamer-Loeber, M. (1996). Development of a short questionnaire for use in epidemiological studies of depression in children and adolescents: factor composition and structure across development. In *International Journal of Methods in Psychiatric Research* (Vol. 5, Issue 4, pp. 251–262).

Anker, E., Halmøy, A., & Heir, T. (2019). Work participation in ADHD and associations with social characteristics, education, lifetime depression, and ADHD symptom severity. *ADHD Attention Deficit and Hyperactivity Disorders*, *11*(2), 159–165. https://doi.org/10.1007/s12402-018-0260-2

Arnold, L. E., Hodgkins, P., Kahle, J., Madhoo, M., & Kewley, G. (2020). Long-Term Outcomes of ADHD: Academic Achievement and Performance. *Journal of Attention Disorders*, *24*(1), 73–85. https://doi.org/10.1177/1087054714566076

Avenevoli, S., & Merikangas, K. R. (2006). Implications of High-Risk Family Studies for Prevention of Depression. *American Journal of Preventive Medicine*, *31*(6 SUPPL. 1), 126–135. https://doi.org/10.1016/j.amepre.2006.07.003

Azeredo, A., Moreira, D., & Barbosa, F. (2018). ADHD, CD, and ODD: Systematic review of genetic and environmental risk factors. *Research in Developmental Disabilities*, *82*(February), 10–19. https://doi.org/10.1016/j.ridd.2017.12.010

Babinski, D. E., Pelham, W. E., Molina, B. S. G., Gnagy, E. M., Waschbusch, D. A., Yu, J., MacLean, M. G., Wymbs, B. T., Sibley, M. H., Biswas, A., Robb, J. A., & Karch, K. M. (2011). Late adolescent and young adult outcomes of girls diagnosed with ADHD in childhood: An exploratory investigation. *Journal of Attention Disorders*, *15*(3), 204–214. https://doi.org/10.1177/1087054710361586

Babore, A., Trumello, C., Candelori, C., Paciello, M., & Cerniglia, L. (2016). Depressive symptoms, self-esteem and perceived parent-child relationship in early adolescence. *Frontiers in Psychology*, *7*(JUN), 1–7. https://doi.org/10.3389/fpsyg.2016.00982

Barkley, R. A., Fischer, M., Smallish, L., & Fletcher, K. (2006). Young adult outcome of hyperactive children: Adaptive functioning in major life activities. *Journal of the American Academy of Child and Adolescent Psychiatry*, *45*(2), 192–202. https://doi.org/10.1097/01.chi.0000189134.97436.e2

Barney, S., Sibley, M. H., Coxe, S. J., Meinzer, M. C., & Pelham, W. E. (2022). High Versus Low Intensity Summer Adolescent ADHD Treatment Effects on Internalizing, Social, and Self-Esteem Problems. *Journal of Clinical Child and Adolescent Psychology*, *00*(00), 1–8. https://doi.org/10.1080/15374416.2022.2062761

Bendiksen, B., Svensson, E., Aase, H., Reichborn-Kjennerud, T., Friis, S., Myhre, A. M., & Zeiner, P. (2017). Co-Occurrence of ODD and CD in Preschool Children With Symptoms of ADHD. *Journal of Attention Disorders*, *21*(9), 741–752. https://doi.org/10.1177/1087054714538655

Biederman, J, Mick, E., & Faraone, S. (1998). Normalized functioning in youths with persistent ADHD. *Journal of Pediatrics*, *133*, 544–551.

Biederman, Joseph, Ball, S. W., Monuteaux, M. C., Mick, E., Spencer, T. J., McCreary, M., Cote, M., & Faraone, S. V. (2008). New insights into the comorbidity between ADHD and major depression in adolescent and young adult females. *Journal of the American Academy of Child and Adolescent Psychiatry*, *47*(4), 426–434. https://doi.org/10.1097/CHI.0b013e31816429d3

Bishop, D. V. M. (1998). Development of the Children ' s Communication Checklist (CCC) : A Method for Assessing Qualitative Aspects of Communicative Impairment in Children. *Journal of Child Psychology and Psychiatry*, *39*(6), 879–891.

Bowes, L., Maughan, B., Caspi, A., Moffitt, T. E., & Arseneault, L. (2010). Families promote emotional and behavioural resilience to bullying: Evidence of an environmental effect. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *51*(7), 809–817. https://doi.org/10.1111/j.1469-7610.2010.02216.x

Boyd, A., Golding, J., Macleod, J., Lawlor, D. A., Fraser, A., Henderson, J., Molloy, L., Ness, A., Ring, S., & Smith, G. D. (2013). Cohort profile: The 'Children of the 90s'-The index offspring of the avon longitudinal study of parents and children. *International Journal of Epidemiology*, *42*(1), 111–127. https://doi.org/10.1093/ije/dys064

Boyle, C. A., Boulet, S., Schieve, L. A., Cohen, R. A., Blumberg, S. J., Yeargin-Allsopp, M., Visser, S., & Kogan, M. D. (2011). Trends in the prevalence of developmental disabilities in US children, 1997-2008. *Pediatrics*, *127*(6), 1034–1042. https://doi.org/10.1542/peds.2010-2989

Bramham, J., Young, S., Bickerdike, A., Spain, D., McCartan, D., & Xenitidis, K. (2009). Evaluation of group cognitive behavioral therapy for adults with ADHD. *Journal of Attention Disorders*, *12*(5), 434–441. https://doi.org/10.1177/1087054708314596

Brikell, I., Larsson, H., Lu, Y., Pettersson, E., Chen, Q., Kuja-Halkola, R., Karlsson, R., Lahey, B. B., Lichtenstein, P., & Martin, J. (2018). The contribution of common genetic risk variants for ADHD to a general factor of childhood psychopathology. *Molecular Psychiatry*, 1–13. https://doi.org/10.1038/s41380-018-0109-2

Bronfenbrenner, U. (1977). Toward an Experimental Ecology of Human Development. *American Psychologist*, *32*, 513–531. https://doi.org/10.14195/0870-4147-48-1

Brumley, L. D., & Jaffee, S. R. (2016). Defining and distinguishing promotive and protective effects for childhood externalizing psychopathology: a systematic review. *Social Psychiatry and Psychiatric Epidemiology*, *51*(6), 803–815.

https://doi.org/10.1007/s00127-016-1228-1

Bruner, M. R., Kuryluk, A. D., & Whitton, S. W. (2015). Attention-deficit/hyperactivity disorder symptom levels and romantic relationship quality in college students. *Journal of American College Health*, *63*(2), 98–108. https://doi.org/10.1080/07448481.2014.975717

Bussing, R., Mason, D. M., Bell, L., Porter, P., & Garvan, C. (2010). Adolescent Outcomes of Childhood Attention-Deficit/Hyperactivity Disorder in a Diverse Community Sample. *Journal of the American Academy of Child & Adolescent Psychiatry*, *49*(6), 595–605. https://doi.org/10.1016/j.jaac.2010.03.006

Chan, E. S. M., Groves, N. B., Marsh, C. L., Miller, C. E., Richmond, K. P., & Kofler, M. J. (2021). Are There Resilient Children with ADHD? *Journal of Attention Disorders*. https://doi.org/10.1177/10870547211025629

Chronis-Tuscano, A., Molina, B. S. G., Pelham, W. E., Applegate, B., Dahlke, A., Overmyer, M., & Lahey, B. B. (2010). Very early predictors of adolescent depression and suicide attempts in children with attention-deficit/hyperactivity disorder. *Archives of General Psychiatry*, *67*(10), 1044–1051. https://doi.org/10.1001/archgenpsychiatry.2010.127

Chronis, A. M., Pelham, W. E., Baumann, B. L., Kipp, H., Lahey, B. B., Williams, S. H., Jones, H. A., & Rathouz, P. J. (2007). Maternal depression and early positive parenting predict future conduct problems in young children with attention-deficit/hyperactivity disorder. *Developmental Psychology*, *43*(1), 70–82. https://doi.org/10.1037/0012-1649.43.1.70

Chu, P. Sen, Saucier, D. A., & Hafner, E. (2010). Meta-analysis of the relationships between social support and well-being in children and adolescents. *Journal of Social and Clinical Psychology*, *29*(6), 624–645. https://doi.org/10.1521/jscp.2010.29.6.624

Cleverley, K., Rowland, E., Bennett, K., Jeffs, L., & Gore, D. (2018). Identifying core components and indicators of successful transitions from child to adult mental health services: a scoping review. *European Child and Adolescent Psychiatry*, *29*(2), 107–121. https://doi.org/10.1007/s00787-018-1213-1

Climie, E. A., & Mastoras, S. M. (2015). ADHD in Schools: Adopting a Strengths-

Based Perspective. *Canadian Psychology*, *56*(3), 295–300. https://doi.org/10.1037/cap0000030

Collishaw, S., Gardner, F., Aber, J. L., & Cluver, L. (2016). Predictors of Mental Health Resilience in Children who Have Been Parentally Bereaved by AIDS in Urban South Africa. *Journal of Abnormal Child Psychology*, *44*, 719–730. https://doi.org/10.1007/s10802-015-0068-x

Collishaw, S., Hammerton, G., Mahedy, L., Sellers, R., Owen, M. J., Craddock, N., Thapar, A. K., Harold, G. T., Rice, F., & Thapar, A. (2016). Mental health resilience in the adolescent offspring of parents with depression: A prospective longitudinal study. *The Lancet Psychiatry*, *3*(1), 49–57. https://doi.org/10.1016/S2215-0366(15)00358-2

Cong, X., Hosler, A. S., Tracy, M., & Appleton, A. A. (2020). The relationship between parental involvement in childhood and depression in early adulthood. *Journal of Affective Disorders*, *273*(March), 173–182. https://doi.org/10.1016/j.jad.2020.03.108

Cook, J., Knight, E., Hume, I., & Qureshi, A. (2014). The self-esteem of adults diagnosed with attention-deficit/hyperactivity disorder (ADHD): A systematic review of the literature. *ADHD Attention Deficit and Hyperactivity Disorders*, *6*(4), 249–268. https://doi.org/10.1007/s12402-014-0133-2

Cooper, M., Hammerton, G., Collishaw, S., Langley, K., Thapar, A., Dalsgaard, S., Stergiakouli, E., Tilling, K., Davey Smith, G., Maughan, B., O'Donovan, M., Thapar, A., & Riglin, L. (2018). Investigating late-onset ADHD: a population cohort investigation. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *59*(10), 1105–1113. https://doi.org/10.1111/jcpp.12911

Costello, E. J., & Maughan, B. (2015). Annual research review: Optimal outcomes of child and adolescent mental illness. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *56*(3), 324–341. https://doi.org/10.1111/jcpp.12371

Coutinho, D., Farias, A. C., Felden, E. P. G., & Cordeiro, M. L. (2018). ADHD Comorbid With Major Depression on Parents and Teachers Perceptions. *Journal of Attention Disorders*. https://doi.org/10.1177/1087054718815574

Cyranowski, J. M., Zill, N., Bode, R., Butt, Z., Kelly, M. A. R., Pilkonis, P. A.,

Salsman, J. M., & Cella, D. (2013). Assessing social support, Companionship, And distress: National institute of health (NIH) toolbox adult social relationship scales. *Health Psychology*, *32*(3), 293–301. https://doi.org/10.1037/a0028586

Daffner, M. S., DuPaul, G. J., Kern, L., Cole, C. L., & Cleminshaw, C. L. (2020). Enhancing Social Skills of Young Children With ADHD: Effects of a Sibling-Mediated Intervention. *Behavior Modification*, *44*(5), 698–726. https://doi.org/10.1177/0145445519843473

Daviss, W. B. (2008). A review of co-morbid depression in pediatric ADHD: Etiology, phenomenology, and treatment. *Journal of Child and Adolescent Psychopharmacology*, *18*(6), 565–571. https://doi.org/10.1089/cap.2008.032

de la Barra, F., Vicente, B., Saldivia, S., & Melipillan, R. (2013). Epidemiology of ADHD in Chilean children and adolescents. *ADHD Attention Deficit and Hyperactivity Disorders*, *5*, 1–8. https://doi.org/10.1007/s12402-012-0090-6

Deault, L. C. (2010). A systematic review of parenting in relation to the development of comorbidities and functional impairments in children with Attention-Deficit/ Hyperactivity Disorder (ADHD). *Child Psychiatry and Human Development*, *41*(2), 168–192. https://doi.org/10.1007/s10578-009-0159-4

Demaray, M. K., Malecki, C. K., Davidson, L. M., Hodgson, K. K., & Rebus, P. J. (2005). The relationship between social support and student adjustment: A longitudinal analysis. *Psychology in the Schools*, *42*(7), 691–706. https://doi.org/10.1002/pits.20120

Demontis, D., Walters, G. B., Athanasiadis, G., Walters, R., Therrien, K., Nielsen, T. T., Farajzadeh, L., Voloudakis, G., Bendl, J., Zeng, B., Zhang, W., Grove, J., Als, T. D., Duan, J., Satterstrom, F. K., Bybjerg-Grauholm, J., Bækved-Hansen, M., Gudmundsson, O. O., Magnusson, S. H., … Børglum, A. D. (2023). Genome-wide analyses of ADHD identify 27 risk loci, refine the genetic architecture and implicate several cognitive domains. *Nature Genetics*, *55*, 198–208. https://doi.org/10.1038/s41588-022-01285-8

Demontis, D., Walters, R. K., Martin, J., Mattheisen, M., Als, T. D., Agerbo, E., Baldursson, G., Belliveau, R., Bybjerg-Grauholm, J., Bækvad-Hansen, M., Cerrato, F., Chambert, K., Churchhouse, C., Dumont, A., Eriksson, N., Gandal, M., Goldstein, J. I., Grasby, K. L., Grove, J., … Neale, B. M. (2019a). Discovery

of the first genome-wide significant risk loci for attention deficit/hyperactivity disorder. *Nature Genetics*, *51*(1), 63–75. https://doi.org/10.1038/s41588-018-0269-7

Demontis, D., Walters, R. K., Martin, J., Mattheisen, M., Als, T. D., Agerbo, E., Baldursson, G., Belliveau, R., Bybjerg-Grauholm, J., Bækvad-Hansen, M., Cerrato, F., Chambert, K., Churchhouse, C., Dumont, A., Eriksson, N., Gandal, M., Goldstein, J. I., Grasby, K. L., Grove, J., … Neale, B. M. (2019b). Discovery of the first genome-wide significant risk loci for attention deficit/hyperactivity disorder. *Nature Genetics*, *51*(1), 63–75. https://doi.org/10.1038/s41588-018-0269-7

Diehl, M., Hay, E. L., & Chui, H. (2012). Risk and Resilience Factors in the context of Daily Stress. *Annu Rev Gerontol Geriatr.*, *32*(1), 251–274. https://doi.org/10.1891/0198-8794.32.251.Personal

Drabick, D. A. G., Gadow, K. D., & Sprafkin, J. (2006). Co-occurrence of conduct disorder and depression in a clinic-based sample of boys with ADHD. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *47*(8), 766–774. https://doi.org/10.1111/j.1469-7610.2006.01625.x

Du Rietz, E., Coleman, J., Glanville, K., Choi, S. W., O'Reilly, P. F., & Kuntsi, J. (2018). Association of Polygenic Risk for Attention-Deficit/Hyperactivity Disorder With Co-occurring Traits and Disorders. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, *3*(7), 635–643. https://doi.org/10.1016/j.bpsc.2017.11.013

Dvorsky, M. R., & Langberg, J. M. (2016). A Review of Factors that Promote Resilience in Youth with ADHD and ADHD Symptoms. In *Clinical Child and Family Psychology Review* (Vol. 19, Issue 4, pp. 368–391). Springer New York LLC. https://doi.org/10.1007/s10567-016-0216-z

Erskine, H. E., Norman, R. E., Ferrari, A. J., Chan, G. C. K., Copeland, W. E., Whiteford, H. A., & Scott, J. G. (2016). Long-Term Outcomes of Attention-Deficit/Hyperactivity Disorder and Conduct Disorder: A Systematic Review and Meta-Analysis. *Journal of the American Academy of Child and Adolescent Psychiatry*, *55*(10), 841–850. https://doi.org/10.1016/j.jaac.2016.06.016

Eskander, N. (2020). The Psychosocial Outcome of Conduct and Oppositional

Defiant Disorder in Children With Attention Deficit Hyperactivity Disorder. *Cureus*, *12*(8), 1–9. https://doi.org/10.7759/cureus.9521

Euesden, J., Lewis, C. M., & O'Reilly, P. F. (2015). PRSice: Polygenic Risk Score software. *Bioinformatics*, *31*(9), 1466–1468. https://doi.org/10.1093/bioinformatics/btu848

Eyre, O., Bevan-Jones, R., Shameem, S., Wootton, R. E., Thapar, A. K., Stergiakouli, E., Langley, K., Collishaw, S., Thapar, A., & Riglin, L. (2021). Validation of the short Mood and Feelings Questionnaire in young adulthood. *Journal of Affective Disorders*, *294*(April), 883–888. https://doi.org/10.1016/j.jad.2021.07.090

Eyre, O., Hughes, R. A., Thapar, A. K., Leibenluft, E., Stringaris, A., Davey Smith, G., Stergiakouli, E., Collishaw, S., & Thapar, A. (2019). Childhood neurodevelopmental difficulties and risk of adolescent depression: the role of irritability. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *60*(8), 866–874. https://doi.org/10.1111/jcpp.13053

Eyre, O., Riglin, L., Leibenluft, E., Stringaris, A., Collishaw, S., & Thapar, A. (2019). Irritability in ADHD: association with later depression symptoms. *European Child and Adolescent Psychiatry*, *28*(10), 1375–1384. https://doi.org/10.1007/s00787-019-01303-x

Faheem, M., Akram, W., Akram, H., Khan, M. A., Siddiqui, F. A., & Majeed, I. (2022). Gender-based differences in prevalence and effects of ADHD in adults : A systematic review. *Asian Journal of Psychiatry*, *75*(March), 103205. https://doi.org/10.1016/j.ajp.2022.103205

Faraone, S. V., & Biederman, J. (2005). What is the prevalence of adult ADHD? Results of a population screen of 966 adults. *Journal of Attention Disorders*, *9*(2), 384–391. https://doi.org/10.1177/1087054705281478

Faraone, S. V., Ghirardi, L., Kuja-Halkola, R., Lichtenstein, P., & Larsson, H. (2017). The Familial Co-Aggregation of Attention-Deficit/Hyperactivity Disorder and Intellectual Disability: A Register-Based Family Study. *Journal of the American Academy of Child and Adolescent Psychiatry*, *56*(2), 167–174. https://doi.org/10.1016/j.jaac.2016.11.011

Ford, T. (2020). Transitional care for young adults with ADHD: Transforming potential upheaval into smooth progression. *Epidemiology and Psychiatric Sciences*, *29*. https://doi.org/10.1017/S2045796019000817

Fraser, A., Cooper, M., Agha, S. S., Collishaw, S., Rice, F., Thapar, A., & Eyre, O. (2018). The presentation of depression symptoms in attention-deficit/hyperactivity disorder: comparing child and parent reports. *Child and Adolescent Mental Health*, *23*(3), 243–250. https://doi.org/10.1111/camh.12253

Fraser, A., Macdonald-wallis, C., Tilling, K., Boyd, A., Golding, J., Davey smith, G., Henderson, J., Macleod, J., Molloy, L., Ness, A., Ring, S., Nelson, S. M., & Lawlor, D. A. (2013). Cohort profile: The avon longitudinal study of parents and children: ALSPAC mothers cohort. *International Journal of Epidemiology*, *42*(1), 97–110. https://doi.org/10.1093/ije/dys066

Fritz, J., de Graaff, A. M., Caisley, H., van Harmelen, A. L., & Wilkinson, P. O. (2018). A Systematic Review of Amenable Resilience Factors That Moderate and/or Mediate the Relationship Between Childhood Adversity and Mental Health in Young People. *Frontiers in Psychiatry*, *9*(June). https://doi.org/10.3389/fpsyt.2018.00230

Fujii, H., Nishimoto, N., Yamaguchi, S., Kurai, O., Miyano, M., Ueda, W., Oba, H., Aoki, T., Kawada, N., & Okawa, K. (2016). The Alcohol Use Disorders Identification Test for Consumption (AUDIT-C) is more useful than pre-existing laboratory tests for predicting hazardous drinking : a cross-sectional study. *BMC Public Health*, *16*(379), 1–8. https://doi.org/10.1186/s12889-016-3053-6

Funk, J. L., & Rogge, R. D. (2007). Testing the Ruler With Item Response Theory: Increasing Precision of Measurement for Relationship Satisfaction With the Couples Satisfaction Index. *Journal of Family Psychology*, *21*(4), 572–583. https://doi.org/10.1037/0893-3200.21.4.572

Gair, S. L., Brown, H. R., Kang, S., Grabell, A. S., & Harvey, E. A. (2021). Early Development of Comorbidity Between Symptoms of ADHD and Anxiety. *Research on Child and Adolescent Psychopathology*, *49*, 311–323. https://doi.org/10.1007/s10802-020-00724-6

Gardner, D. M., Gerdes, A. C., & Weinberger, K. (2019). Examination of a Parent-Assisted, Friendship-Building Program for Adolescents With ADHD. *Journal of*

Attention Disorders, *23*(4), 363–373. https://doi.org/10.1177/1087054715588188

Ghirardi, L., Chen, Q., Chang, Z., Kuja-Halkola, R., Skoglund, C., Quinn, P. D., D'Onofrio, B. M., & Larsson, H. (2020). Use of medication for attention-deficit/hyperactivity disorder and risk of unintentional injuries in children and adolescents with co-occurring neurodevelopmental disorders. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *61*(2), 140–147. https://doi.org/10.1111/jcpp.13136

Gilman, S. E., Kawachi, I., Fitzmaurice, M., & Buka, S. L. (2002). *Socioeconomic status in childhood and the lifetime risk of major depression*. *31*, 359–367.

Golding, G., Pembrey, P., & Jones, J. (2001). ALSPAC - The Avon Longitudinal Study of Parents and Children I. Study methodology. *Paediatric and Perinatal Epidemiology*, *15*(1), 74–87. https://doi.org/10.1046/j.1365-3016.2001.00325.x

Goodman, R. (1997). The strengths and difficulties questionnaire: A research note. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *38*(5), 581–586. https://doi.org/10.1111/j.1469-7610.1997.tb01545.x

Goodman, R., Ford, T., Richards, H., Gatward, R., & Meltzer, H. (2000). The Development and Well-Being Assessment: Description and initial validation of an integrated assessement of child and adolescent psychopathology. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *41*(5), 645–655. https://doi.org/10.1017/S0021963099005909

Goodyer, I., Wright, C., & Altham, P. (1989). Recent friendships in anxious and depressed school age children. *Psychological Medicine*, *19*(1), 165–174. https://doi.org/10.1017/S0033291700011119

Goodyer, I., Wright, C., & Altham, P. (1990). Recent Achievements and Adversities in Anxious and Depressed School Age Children. *Journal of Child Psychology and Psychiatry*, *31*(7), 1063–1077. https://doi.org/10.1111/j.1469-7610.1990.tb00846.x

Gordon, C. T., & Fabiano, G. A. (2019). The Transition of Youth with ADHD into the Workforce: Review and Future Directions. In *Clinical Child and Family Psychology Review* (Vol. 22, Issue 3). Springer US. https://doi.org/10.1007/s10567-019-00274-4

Green, H., McGinnity, Á., Meltzer, H., Ford, T., & Goodman, R. (2004). *Mental health of children and young people in Great Britain, 2004*. Hampshire, UK. Palgrave Macmillan.

Grzadzinski, R., Dick, C., Lord, C., & Bishop, S. (2016). Parent-reported and clinician-observed autism spectrum disorder (ASD) symptoms in children with attention deficit/hyperactivity disorder (ADHD): Implications for practice under DSM-5. *Molecular Autism*, *7*(1), 1–12. https://doi.org/10.1186/s13229-016-0072-1

Gundel, L. K., Pedersen, C. B., Munk-Olsen, T., & Dalsgaard, S. (2017). Longitudinal association between mental disorders in childhood and subsequent depression – A nationwide prospective cohort study. *Journal of Affective Disorders*, *227*(September 2017), 56–64. https://doi.org/10.1016/j.jad.2017.10.023

Gustavson, K., Torvik, F. A., Eilertsen, E. M., Ask, H., Mcadams, T. A., Hannigan, L. J., Reichborn-kjennerud, T., Ystrom, E., & Gjerde, L. C. (2021). Genetic and Environmental Contributions to Co-Occurring ADHD and Emotional Problems in School-Aged Children. *Developmental Psychology*, *57*(8), 1359–1371.

Hamshere, M. L., Langley, K., Martin, J., Shameem Agha, S., Stergiakouli, E., Anney, R. J., Buitelaar, J., Faraone, S. V, Lesch, K.-P., Neale, B. M., Franke, B., Sonuga-Barke, E., Asherson, P., Merwood, A., Kuntsi, J., Medland, S. E., Ripke, S., Steinhausen, H.-C., Freitag, C., … Thapar, A. (2013). High Loading of Polygenic Risk for ADHD in Children With Comorbid Aggression. In *Am J Psychiatry* (Vol. 170, Issue 8).

Hargitai, L. D., Livingston, L. A., Waldren, L. H., Jarrold, C., Shah, P., & Robinson, R. (2023). Attention - deficit hyperactivity disorder traits are a more important predictor of internalising problems than autistic traits. *Scientific Reports*, *13*(31), 1–7. https://doi.org/10.1038/s41598-022-26350-4

Harold, G. T., Leve, L. D., Barrett, D., Elam, K., Neiderhiser, J. M., Natsuaki, M. N., Shaw, D. S., Reiss, D., & Thapar, A. (2013). Biological and rearing mother influences on child ADHD symptoms: Revisiting the developmental interface between nature and nurture. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *54*(10), 1038–1046. https://doi.org/10.1111/jcpp.12100

Harpin, V. A. (2005). The effect of ADHD on the life of an individual, their family, and

community from preschool to adult life. *Archives of Disease in Childhood*, *90*, 2–7. https://doi.org/10.1136/adc.2004.059006

Harris-lane, L., Hesson, J., Fowler, K., & Harris, N. (2021). Positive Mental Health in Youth with ADHD : Exploring the Role of Social Support. *Canadian Journal of Community Mental Health*, *40*(1). https://doi.org/10.7870/cjcmh-2021-002

Harter, S. (1985). Self-Perception Profile for Children: manual and questionnaires. In *University of Denver*.

Healey, D. M., Flory, J. D., Miller, C. J., & Halperin, J. M. (2011). Maternal Positive Parenting Style is Associated with Better Functioning in Hyperactive/Inattentive Preschool Children. *Infant and Child Development*, *20*(2), 148–161. https://doi.org/10.1002/icd

Henderson, S. E., & Sugden, D. A. (1992). *Movement MABC.* Psychological Corporation Harcourt Brace.

Hendrick, S. S. (1988). A generic measure of relationship satisfaction. *Journal of Marriage and the Family*, *59*, 93–98. https://www.jstor.org/stable/10.13169/reorient.3.2.0163

Hinshaw, S. P., Owens, E. B., Sami, N., & Fargeon, S. (2006). Prospective follow-up of girls with attention-deficit/hyperactivity disorder into adolescence: Evidence for continuing cross-domain impairment. *Journal of Consulting and Clinical Psychology*, *74*(3), 489–499. https://doi.org/10.1037/0022-006X.74.3.489

Hirsch, O., Chavanon, M. L., & Christiansen, H. (2019). Emotional dysregulation subgroups in patients with adult Attention-Deficit/Hyperactivity Disorder (ADHD): a cluster analytic approach. *Scientific Reports*, *9*(1). https://doi.org/10.1038/s41598-019-42018-y

Howlin, P., Goode, S., Hutton, J., & Rutter, M. (2004). Adult outcome for children with autism. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *45*(2), 212–229. https://doi.org/10.1111/j.1469-7610.2004.00215.x

Humphreys, K. L., Katz, S. J., Lee, S. S., Hammen, C., Brennan, P. A., & Najman, J. M. (2013). The association of ADHD and depression: Mediation by peer problems and parent-child difficulties in two complementary samples. *Journal of Abnormal Psychology*, *122*(3), 854–867. https://doi.org/10.1037/a0033895

Hurt, E. A., Hoza, B., & Pelham, W. E. (2007). Parenting , Family Loneliness , and Peer Functioning in Boys with Attention-Deficit / Hyperactivity Disorder. *Journal of Abnormal Child Psychology*, *35*, 543–555. https://doi.org/10.1007/s10802-007-9111-x

Hussong, A. M., Curran, P. J., Moffitt, T. E., Caspi, A., & Carrig, M. M. (2004). Substance abuse hinders desistance in young adults' antisocial behavior. *Development and Psychopathology*, *16*(4), 1029–1046. https://doi.org/10.1017/S095457940404012X

Jang, J., Matson, J. L., Williams, L. W., Tureck, K., Goldin, R. L., & Cervantes, P. E. (2013). Rates of comorbid symptoms in children with ASD, ADHD, and comorbid ASD and ADHD. *Research in Developmental Disabilities*, *34*(8), 2369–2378. https://doi.org/10.1016/j.ridd.2013.04.021

Jarrett, M. A., & Ollendick, T. H. (2008). Clinical Psychology Review A conceptual review of the comorbidity of attention-de fi cit / hyperactivity disorder and anxiety : Implications for future research and practice. *Clinical Psychology Review*, *28*, 1266–1280. https://doi.org/10.1016/j.cpr.2008.05.004

Jeon, J. (2015). *The Strengths and Limitations of the Statistical Modeling of Complex Social Phenomenon : Focusing on SEM , Path Analysis , or Multiple Regression Models*. *9*(5), 1634–1642.

Kappi, A., & Martel, M. (2022). Parental Barriers in Seeking Mental Health Services for Attention Deficit Hyperactivity Disorder in Children : Systematic Review. *Journal of Attention Disorders*, *26*(3), 408–425. https://doi.org/10.1177/1087054720986909

Karawekpanyawong, N., Wongpakaran, T., Wongpakaran, N., Boonnag, C., Siritikul, S., Chalanunt, S., & Kuntawong, P. (2021). Impact of perceived social support on the relationship between ADHD and depressive symptoms among first year medical students: A structural equation model approach. *Children*, *8*(5). https://doi.org/10.3390/children8050401

Keown, L. J. (2012). Predictors of boys' ADHD symptoms from early to middle childhood: The role of father-child and mother-child interactions. *Journal of Abnormal Child Psychology*, *40*(4), 569–581. https://doi.org/10.1007/s10802-011-9586-3

Kessler, R. C., Adler, L., Berkley, R., Biederman, J., Conners, C. K., Demler, O., Faraone, S. V., Greenhill, L. L., Howes, M. J., Secnik, K., Spencer, T., Ustun, T. B., Walters, E. E., & Zaslavsky, A. M. (2006). The prevalence and correlates of adult ADHD in the United States: Results from the National Comorbidity Survey Replication. *American Journal of Psychiatry*, *163*(4), 716–723. https://doi.org/10.1176/ajp.2006.163.4.716

Khadjesari, Z., White, I. R., McCambridge, J., Marston, L., Wallace, P., Godfrey, C., & Murray, E. (2017). Validation of the AUDIT-C in adults seeking help with their drinking online. *Addiction Science and Clinical Practice*, *12*(2), 1–11. https://doi.org/10.1186/s13722-016-0066-5

Khalis, A., Mikami, A. Y., & Hudec, K. L. (2018). Positive Peer Relationships Facilitate Adjustment in the Transition to University for Emerging Adults With ADHD Symptoms. *Emerging Adulthood*, *6*(4), 243–254. https://doi.org/10.1177/2167696817722471

Klasen, F., Otto, C., Kriston, L., Patalay, P., Schlack, R., & Ravens-Sieberer, U. (2015). Risk and protective factors for the development of depressive symptoms in children and adolescents: results of the longitudinal BELLA study. *European Child and Adolescent Psychiatry*, *24*(6), 695–703. https://doi.org/10.1007/s00787-014-0637-5

Koolwijk, I., Stein, D. S., Chan, E., Powell, C., Driscoll, K., & Barbaresi, W. J. (2014). Complex" attention-deficit hyperactivity disorder, more norm than exception? diagnoses and comorbidities in a developmental clinic. *Journal of Developmental and Behavioral Pediatrics*, *35*(9), 591–597. https://doi.org/10.1097/DBP.0000000000000109

Korrel, H., Mueller, K. L., Silk, T., Anderson, V., & Sciberras, E. (2017). Research Review: Language problems in children with Attention-Deficit Hyperactivity Disorder – a systematic meta-analytic review. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *58*(6), 640–654. https://doi.org/10.1111/jcpp.12688

Kouvava, S., & Antonopoulou, K. (2020). Sibling and friendship relationships of children with attention-deficit/hyperactivity disorder and typical development. *Early Child Development and Care*, *190*(6), 935–947.

https://doi.org/10.1080/03004430.2018.1503255

Kuriyan, A. B., Pelham, W. E., Molina, B. S. G., Waschbusch, D. A., Gnagy, E. M., Sibley, M. H., Babinski, D. E., Walther, C., Cheong, J., Yu, J., & Kent, K. M. (2013). Young adult educational and vocational outcomes of children diagnosed with ADHD. *Journal of Abnormal Child Psychology*, *41*(1), 27–41. https://doi.org/10.1007/s10802-012-9658-z

Kurman, J., Rothschild-Yakar, L., Angel, R., & Katz, M. (2018). How Good Am I? Implicit and Explicit Self-Esteem as a Function of Perceived Parenting Styles Among Children With ADHD. *Journal of Attention Disorders*, *22*(13), 1207–1217. https://doi.org/10.1177/1087054715569599

Lahey, B. B., Hartung, C. M., Loney, J., Pelham, W. E., Chronis, A. M., & Lee, S. S. (2007). Are there sex differences in the predictive validity of DSM-IV ADHD among younger children? *Journal of Clinical Child and Adolescent Psychology*, *36*(2), 113–126. https://doi.org/10.1080/15374410701274066

Lange, G., Sheerin, D., Carr, A., Dooley, B., Barton, V., Marshall, D., Mulligan, A., Lawlor, M., Belton, M., & Doyle, M. (2005). Family factors associated with attention deficit hyperactivity disorder and emotional disorders in children. *Journal of Family Therapy*, *27*(1), 76–96. https://doi.org/10.1111/j.1467-6427.2005.00300.x

Langley, K., Fowler, T., Ford, T., Thapar, A. K. A., Van Den Bree, M., Harold, G., Owen, M. J., O'Donovan, M. C., & Thapar, A. K. A. (2010). Adolescent clinical outcomes for young people with attention-deficit hyperactivity disorder. *British Journal of Psychiatry*, *196*(3), 235–240. https://doi.org/10.1192/bjp.bp.109.066274

Larsson, H., Asherson, P., Chang, Z., Ljung, T., Friedrichs, B., Larsson, J. O., & Lichtenstein, P. (2013). Genetic and environmental influences on adult attention deficit hyperactivity disorder symptoms: A large Swedish population-based study of twins. *Psychological Medicine*, *43*(1), 197–207. https://doi.org/10.1017/S0033291712001067

Laub, J. H., & Sampson, R. J. (1993). TURNING POINTS IN THE LIFE COURSE : WHY CHANGE MATTERS TO THE STUDY OF CRIME *. *Criminology*, *31*(3), 301–326.

Laub, J. H., & Sampson, R. J. (2001). Understanding Desistance from Crime Citation Understanding. *Crime and Justice*, *28*, 1–69.

Lawson, D. W., & Mace, R. (2009). Trade-offs in modern parenting : a longitudinal study of sibling competition for parental care. *Evolution and Human Behavior*, *30*(3), 170–183. https://doi.org/10.1016/j.evolhumbehav.2008.12.001

Lee, P. H., Anttila, V., Won, H., Feng, Y. C. A., Rosenthal, J., Zhu, Z., Tucker-Drob, E. M., Nivard, M. G., Grotzinger, A. D., Posthuma, D., Wang, M. M. J., Yu, D., Stahl, E. A., Walters, R. K., Anney, R. J. L., Duncan, L. E., Ge, T., Adolfsson, R., Banaschewski, T., … Smoller, J. W. (2019). Genomic Relationships, Novel Loci, and Pleiotropic Mechanisms across Eight Psychiatric Disorders. *Cell*, *179*(7), 1469-1482.e11. https://doi.org/10.1016/j.cell.2019.11.020

Lee, S. S., Lahey, B. B., Owens, E. B., & Hinshaw, S. P. (2008). Few preschool boys and girls with ADHD are well-adjusted during adolescence. *Journal of Abnormal Child Psychology*, *36*(3), 373–383. https://doi.org/10.1007/s10802-007-9184-6

Legleye, S., Karila, L., Beck, F., & Reynaud, M. (2007). Validation of the CAST , a general population Cannabis Abuse Screening Test. *Journal of Substance Use*, *12*(4), 233–242. https://doi.org/10.1080/14659890701476532

Lei, P., Wu, Q., & Pennsylvania, T. (2007). Introduction to Structural Equation Modeling : Issues. *Issues and Practice*, *26*, 33–43.

Leitch, S., Sciberras, E., Post, B., Gerner, B., Rinehart, N., Nicholson, J. M., & Evans, S. (2019). Experience of stress in parents of children with ADHD: A qualitative study. *International Journal of Qualitative Studies on Health and Well-Being*, *14*(1). https://doi.org/10.1080/17482631.2019.1690091

Levey, D. F., Stein, M. B., Wendt, F. R., Pathak, G. A., Zhou, H., Aslan, M., Quaden, R., Harrington, K. M., Nuñez, Y. Z., Overstreet, C., Radhakrishnan, K., Sanacora, G., McIntosh, A. M., Shi, J., Shringarpure, S. S., Concato, J., Polimanti, R., & Gelernter, J. (2021). Bi-ancestral depression GWAS in the Million Veteran Program and meta-analysis in >1.2 million individuals highlight new therapeutic directions. *Nature Neuroscience*, *24*(July), 954–963. https://doi.org/10.1038/s41593-021-00860-2

Levy, F., Hay, D. A., Bennett, K. S., Stephen, M. M. C., & Ons, B. S. C. H. (2001).

Gender Differences in ADHD Subtype Comorbidity. *Journal of the American Academy of Child & Adolescent Psychiatry*, *44*(4), 368–376. https://doi.org/10.1097/01.chi.0000153232.64968.c1

Loe, I. M., & Feldman, H. M. (2007). Academic and educational outcomes of children with ADHD. In *Journal of Pediatric Psychology* (Vol. 32, Issue 6, pp. 643–654). https://doi.org/10.1093/jpepsy/jsl054

López-López, J. A., Kwong, A. S. F., Washbrook, E., Pearson, R. M., Tilling, K., Fazel, M. S., Kidger, J., & Hammerton, G. (2020). Trajectories of depressive symptoms and adult educational and employment outcomes. *BJPsych Open*, *6*(1), 1–8. https://doi.org/10.1192/bjo.2019.90

Lubke, G. H., Hudziak, J. J., Derks, E. M., van Bijsterveldt, T. C. E. M., & Boomsma, D. I. (2009). Maternal Ratings of Attention Problems in ADHD: Evidence for the Existence of a Continuum. *Journal of the American Academy of Child and Adolescent Psychiatry*, *48*(11), 1085–1093. https://doi.org/10.1097/CHI.0b013e3181ba3dbb

Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development*, *71*(3), 543–562. https://doi.org/10.1111/1467-8624.00164

Mackenzie, G. (2018). *JOURNAL OF ADHD AND CARE ISSN NO: COMING SOON Review Building Resilience among Children and Youth with ADHD through Identifying and Developing Protective Factors in Academic, Interpersonal and Cognitive Domains*. www.openaccesspub.org

Mackinnon, D. P., Fairchild, A. J., & Fritz, M. S. (2007). Mediation Analysis. *Annual Review of Psychology*, *58*, 593–614. https://doi.org/10.1146/annurev.psych.58.110405.085542

Mahedy, L., Harold, G. T., Maughan, B., Gardner, F., Araya, R., Bevan, R., Hammerton, G., Sellers, R., Thapar, A., & Collishaw, S. (2018). Resilience in high-risk adolescents of mothers with recurrent depressive disorder : The contribution of fathers. *Journal of Adolescence*, *65*(March), 207–218. https://doi.org/10.1016/j.adolescence.2018.03.016

Mannuzza, S., Klein, R. G., Bessler, A., Malloy, P., & Lapadula, M. (1993). Adult

Outcome of Hyperactive Boys: Educational Achievement, Occupational Rank, and Psychiatric Status. *Archives of General Psychiatry*, *50*(7), 565–576. https://doi.org/10.1001/archpsyc.1993.01820190067007

Martin, A. J. (2014). The Role of ADHD in Academic Adversity. *School Psychology Quarterly*, *29*(4), 395–408.

Martin, J., Hamshere, M. L., Stergiakouli, E., O'Donovan, M. C., & Thapar, A. (2014). Genetic risk for attention-deficit/hyperactivity disorder contributes to neurodevelopmental traits in the general population. *Biological Psychiatry*, *76*(8), 664–671. https://doi.org/10.1016/j.biopsych.2014.02.013

Martin, J., O'Donovan, M. C., Thapar, A., Langley, K., & Williams, N. (2015). The relative contribution of common and rare genetic variants to ADHD. *Translational Psychiatry*, *5*(2). https://doi.org/10.1038/tp.2015.5

Martin, Joanna, Taylor, M. J., Rydell, M., Riglin, L., Eyre, O., Lu, Y., Lundström, S., Larsson, H., Thapar, A., & Lichtenstein, P. (2018). Sex-specific manifestation of genetic risk for attention deficit hyperactivity disorder in the general population. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *59*(8), 908–916. https://doi.org/10.1111/jcpp.12874

Masten, A. S. (2001). Ordinary Magic: Resilience Processes in Development. *American Psychologist*, *56*(3), 227–238.

Mastoras, S. M., Saklofske, D. H., Schwean, V. L., & Climie, E. A. (2018). Social Support in Children With ADHD: An Exploration of Resilience. *Journal of Attention Disorders*, *22*(8), 712–723. https://doi.org/10.1177/1087054715611491

Maughan, B., & Collishaw, S. (2015). Conceptual issues and research A : Developmental psychopathology. In *Rutter's Child and Adolescent Psychiatry, Sixth Edition* (pp. 1–16).

Mckee, T. E. (2017). Peer Relationships in Undergraduates With ADHD Symptomatology : Selection and Quality of Friendships. *Journal of Attention Disorders*, *21*(12), 1020–1029. https://doi.org/10.1177/1087054714554934

McQuade, J. D., Vaughn, A. J., Hoza, B., Murray-Close, D., Molina, B. S. G., Arnold, L. E., & Hechtman, L. (2014). Perceived Social Acceptance and Peer Status Differentially Predict Adjustment in Youth With and Without ADHD. *Journal of*

Attention Disorders, *18*(1), 31–43. https://doi.org/10.1177/1087054712437582

Meinzer, M. C., Felton, J. W., Oddo, L. E., Rubin, K. H., & Chronis-Tuscano, A. (2021). Do ADHD Symptoms and Relationship Quality With Mothers and Best Friends Across High School Predict Depressive Symptoms for Adolescents? *Journal of Attention Disorders*, *25*(12), 1699–1711. https://doi.org/10.1177/1087054720923088

Meinzer, M. C., Pettit, J. W., & Viswesvaran, C. (2014). The co-occurrence of attention-deficit/hyperactivity disorder and unipolar depression in children and adolescents: A meta-analytic review. In *Clinical Psychology Review* (Vol. 34, Issue 8, pp. 595–607). Elsevier Inc. https://doi.org/10.1016/j.cpr.2014.10.002

Meinzer, M. C., Pettit, J. W., Waxmonsky, J. G., Gnagy, E., Molina, B. S. G., & Pelham, W. E. (2016). Does Childhood Attention-Deficit/Hyperactivity Disorder (ADHD) Predict Levels of Depressive Symptoms during Emerging Adulthood? *Journal of Abnormal Child Psychology*, *44*(4), 787–797. https://doi.org/10.1007/s10802-015-0065-0

Meyer, A., Kegley, M., & Klein, D. N. (2022). Overprotective Parenting Mediates the Relationship Between Early Childhood ADHD and Anxiety Symptoms : Evidence From a Cross-Sectional and Longitudinal Study. *Journal of Attention Disorders*, *26*(2), 319–327. https://doi.org/10.1177/1087054720978552

Michelini, G., Eley, T. C., Gregory, A. M., & Mcadams, T. A. (2015). Aetiological overlap between anxiety and attention deficit hyperactivity symptom dimensions in adolescence. *Journal of Child Psychology and Psychiatry*, *56*(4), 423–431. https://doi.org/10.1111/jcpp.12318

Mikami, A. Y., Griggs, M. S., Lerner, M. D., Emeh, C. C., Reuland, M. M., Jack, A., & Anthony, M. R. (2013). A randomized trial of a classroom intervention to increase peers' social inclusion of children with attention-deficit/hyperactivity disorder. *Journal of Consulting and Clinical Psychology*, *81*(1), 100–112. https://doi.org/10.1037/a0029654

Mikami, A. Y., & Hinshaw, S. P. (2003). Buffers of peer rejection among girls with and without ADHD: The role of popularity with adults and goal-directed solitary play. *Journal of Abnormal Child Psychology*, *31*(4), 381–397. https://doi.org/10.1023/A:1023839517978

Mikami, A. Y., & Pfiffner, L. J. (2008). Sibling relationships among children with ADHD. *Journal of Attention Disorders*, *11*(4), 482–492. https://doi.org/10.1177/1087054706295670

Mochrie, K. D., Whited, M. H., Cellucci, T., Freeman, T., & Corson, A. T. (2018). ADHD, depression, and substance abuse risk among beginning college students. *Journal of American College Health*, *0*(0), 1–5. https://doi.org/10.1080/07448481.2018.1515754

Modesto-Lowe, V., Yelunina, L., & Hanjan, K. (2011). Attention-deficit/hyperactivity disorder: A shift toward resilience? *Clinical Pediatrics*, *50*(6), 518–524. https://doi.org/10.1177/0009922810394836

Molina, B. S. G., & Pelham, W. E. (2003). *Childhood Predictors of Adolescent Substance Use in a Longitudinal Study of Children With ADHD*. *112*(3), 497–507. https://doi.org/10.1037/0021-843X.112.3.497

Moodie, E. E. M., Delaney, J. A. C., Platt, R. W., Moodie, E. E. M., Delaney, J. A. C., Lefebvre, G., & Robert, W. (2008). Missing Confounding Data in Marginal Structural Models : A Comparison of Inverse Probability Weighting and Multiple Imputation Missing Confounding Data in Marginal Structural Models : A Comparison of Inverse Probability Weighting and Multiple. *The International Journal of Biostatistics*, *4*(1). https://doi.org/10.2202/1557-4679.1106

Müller, J. A. S., Sedgwick, U. M., Adamou, M., Catani, M., Champ, R., Gudjónsson, G., Hank, D., Pitts, M., Young, S., & Asherson, P. (2022). University students with attention deficit hyperactivity disorder (ADHD): a consensus statement from the UK Adult ADHD Network (UKAAN). *BMC Psychiatry*, *22*(292), 1–27. https://doi.org/10.1186/s12888-022-03898-z

Nelson, J. M., & Liebel, S. W. (2018). Anxiety and depression among college students with attention-deficit/hyperactivity disorder (ADHD): Cross-informant, sex, and subtype differences. *Journal of American College Health*, *66*(2), 123–132. https://doi.org/10.1080/07448481.2017.1382499

NHS. (2020). *Mental Health of Children and Young People in England , 2020*. *October*, 1–24.

Northstone, K., Lewcock, M., Groom, A., Boyd, A., Macleod, J., Timpson, N., &

Wells, N. (2019). The Avon Longitudinal Study of Parents and Children (ALSPAC): an update on the enrolled sample of index children in 2019 [version 1; peer review: 2 approved]. *Wellcome Open Research*, *4*, 1–10. https://doi.org/10.12688/wellcomeopenres.15132.1

Oddo, L. E., Knouse, L. E., Surman, C. B. H., & Safren, S. A. (2018). Investigating Resilience to Depression in Adults With ADHD. *Journal of Attention Disorders*, *22*(5), 497–505. https://doi.org/10.1177/1087054716636937

Overgaard, K. R., Aase, H., Torgersen, S., Reichborn-Kjennerud, T., Oerbeck, B., Myhre, A., & Zeiner, P. (2014). Continuity in features of anxiety and attention deficit/hyperactivity disorder in young preschool children. *European Child and Adolescent Psychiatry*, *23*(9), 743–752. https://doi.org/10.1007/s00787-014-0538-7

Paap, M. C. S., Haraldsen, I. R., Breivik, K., Butcher, P. R., Hellem, F. M., & Stormark, K. M. (2013). The Link between Peer Relations, Prosocial Behavior, and ODD/ADHD Symptoms in 7–9-Year-Old Children. *Psychiatry Journal*, *2013*, 1–10. https://doi.org/10.1155/2013/319874

Pagliaccio, D., Pine, D. S., Barch, D. M., Luby, J. L., & Leibenluft, E. (2018). Irritability Trajectories, Cortical Thickness, and Clinical Outcomes in a Sample Enriched for Preschool Depression. *Journal of the American Academy of Child and Adolescent Psychiatry*, *57*(5), 336-342.e6. https://doi.org/10.1016/j.jaac.2018.02.010

Patros, C. H. G., Hudec, K. L., Alderson, R. M., Kasper, L. J., Davidson, C., & Wingate, L. R. (2013). Symptoms of Attention-Deficit/Hyperactivity Disorder (ADHD) Moderate Suicidal Behaviors in College Students With Depressed Mood. *Journal of Clinical Psychology*, *69*(9), 980–993. https://doi.org/10.1002/jclp.21994

Pehlivanidis, A., Papanikolaou, K., Mantas, V., Kalantzi, E., Korobili, K., Xenaki, L. A., Vassiliou, G., & Papageorgiou, C. (2020). Lifetime co-occurring psychiatric disorders in newly diagnosed adults with attention deficit hyperactivity disorder (ADHD) or/and autism spectrum disorder (ASD). *BMC Psychiatry*, *20*(1), 1–12. https://doi.org/10.1186/s12888-020-02828-1

Polanczyk, G. V., Salum, G. A., Sugaya, L. S., Caye, A., & Rohde, L. A. (2015).

Annual research review: A meta-analysis of the worldwide prevalence of mental disorders in children and adolescents. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *56*(3), 345–365. https://doi.org/10.1111/jcpp.12381

Powell, V., Riglin, L., Hammerton, G., Eyre, O., Martin, J., Anney, R., Thapar, A., & Rice, F. (2020). What explains the link between childhood ADHD and adolescent depression ? Investigating the role of peer relationships and academic attainment. *European Child & Adolescent Psychiatry*, *29*(11), 1581–1591. https://doi.org/10.1007/s00787-019-01463-w

Powell, V., Riglin, L., Ng-Knight, T., Norah, K., Katherine, F., Chris, W., Collishaw, S., Shelton, K., Thapar, A., Rice, F., & Powell, V. (2021). Investigating Friendship Difficulties in the Pathway from ADHD to Depressive Symptoms . Can Parent – Child Relationships Compensate ? *Research on Child and Adolescent Psychopathology*, *49*, 1031–1041. https://doi.org/10.1007/s10802-021-00798-w

Quenneville, A. F., Kalogeropoulou, E., Nicastro, R., Weibel, S., Chanut, F., & Perroud, N. (2022). Anxiety disorders in adult ADHD : A frequent comorbidity and a risk factor for externalizing problems. *Psychiatry Research*, *310*. https://doi.org/10.1016/j.psychres.2022.114423

Quinton, D., Pickles, A., Maughan, B., & Rutter, M. (1993). Partners , peers , and pathways : Assortative pairing and continuities in conduct disorder. *Development and Psychopathology*, *5*, 763–783.

Reiss, F. (2013). Socioeconomic inequalities and mental health problems in children and adolescents: A systematic review. *Social Science and Medicine*, *90*, 24–31. https://doi.org/10.1016/j.socscimed.2013.04.026

Reiss, F., Meyrose, A. K., Otto, C., Lampert, T., Klasen, F., & Ravens-Sieberer, U. (2019). Socioeconomic status, stressful life situations and mental health problems in children and adolescents: Results of the German BELLA cohort-study. *PLoS ONE*, *14*(3), 1–16. https://doi.org/10.1371/journal.pone.0213700

Retz, W., Ginsberg, Y., Turner, D., Barra, S., Retz-Junginger, P., Larsson, H., & Asherson, P. (2021). Attention-Deficit/Hyperactivity Disorder (ADHD), antisociality and delinquent behavior over the lifespan. *Neuroscience and*

Biobehavioral Reviews, *120*(October 2020), 236–248. https://doi.org/10.1016/j.neubiorev.2020.11.025

Rice, F., Langley, K., Woodford, C., Davey Smith, G., & Thapar, A. (2018). Identifying the contribution of prenatal risk factors to offspring development and psychopathology: What designs to use and a critique of literature on maternal smoking and stress in pregnancy. *Development and Psychopathology*, *30*(3), 1107–1128. https://doi.org/10.1017/S0954579418000421

Rice, F., Riglin, L., Thapar, A. K., Heron, J., Anney, R., O'Donovan, M. C., & Thapar, A. (2019). Characterizing Developmental Trajectories and the Role of Neuropsychiatric Genetic Risk Variants in Early-Onset Depression. *JAMA Psychiatry*, *76*(3), 306–313. https://doi.org/10.1001/jamapsychiatry.2018.3338

Richardson, M., Moore, D, A., Gwernan-Jones, R., Thompson-Coon, J., Ukoumunne, O., Rogers, M., Whear, R., Newlone-Delgado, T, V., Logan, S., Morris, C., Taylor, E., Cooper, P., Stein, K., Garside, R., & Ford, T. (2015). Non-pharmacological interventions for attention-deficit/hyperactivity disorder (ADHD) delivered in school settings: systematic reviews of quantitative and qualitative research. *Health Technology Assessment*, *19*(45), 1–470. https://doi.org/10.3310/hta19450

Riglin, L., Leppert, B., Dardani, C., Thapar, A. K., Rice, F., O'Donovan, M. C., Davey Smith, G., Stergiakouli, E., Tilling, K., & Thapar, A. (2021). ADHD and depression: Investigating a causal explanation. *Psychological Medicine*, *51*(11), 1890–1897. https://doi.org/10.1017/S0033291720000665

Riglin, L., Shameem, S., Eyre, O., Bevan, R., Wootton, R. E., Thapar, A. K., Collishaw, S., Stergiakouli, E., Langley, K., & Thapar, A. (2021). Investigating the validity of the Strengths and Difficulties Questionnaire to assess ADHD in young adulthood. *Psychiatry Research*, *301*(April), 113984. https://doi.org/10.1016/j.psychres.2021.113984

Riglin, L., Thapar, A. K., Leppert, B., Martin, J., Richards, A., Anney, R., Davey, G., Kate, S., Evie, T., Lahey, B. B., Donovan, M. C. O., Collishaw, S., & Thapar, A. (2020). Using Genetics to Examine a General Liability to Childhood Psychopathology. *Behavior Genetics*, *50*(4), 213–220. https://doi.org/10.1007/s10519-019-09985-4

Riglin, L., Wootton, R. E., Livingston, L. A., Agnew-Blais, J., Arseneault, L., Blakey, R., Agha, S. S., Langley, K., Collishaw, S., O'Donovan, M. C., Davey Smith, G., Stergiakouli, E., Tilling, K., & Thapar, A. (2022). "Late-onset" ADHD symptoms in young adulthood: Is this ADHD? *Journal of Attention Disorders*, *26*(10), 1271–1282. https://doi.org/10.1177/10870547211066486

Rokeach, A., & Wiener, J. (2018). The Romantic Relationships of Adolescents With ADHD. *Journal of Attention Disorders*, *22*(1), 35–45. https://doi.org/10.1177/1087054714538660

Rosenberg, M. (1995). *Review : Self Esteem and the Adolescent Reviewed Work (s): Society and the Adolescent Self-Image by Morris Rosenberg Review by : William Petersen Published by : American Association for the Advancement of Science Stable URL : https://www.jstor.org/stabl*. *148*(3671), 7–8.

Roy, A., Hartman, C. A., Veenstra, R., & Oldehinkel, A. J. (2015). *Peer dislike and victimisation in pathways from ADHD symptoms to depression*. *24*(8), 887–895. https://doi.org/10.1007/s00787-014-0633-9

Rueger, S. Y., Malecki, C. K., & Demaray, M. K. (2010). Relationship between multiple sources of perceived social support and psychological and academic adjustment in early adolescence: Comparisons across gender. *Journal of Youth and Adolescence*, *39*(1), 47–61. https://doi.org/10.1007/s10964-008-9368-6

Russell, A. E., Ford, T., Williams, R., & Russell, G. (2016). The Association Between Socioeconomic Disadvantage and Attention Deficit / Hyperactivity Disorder (ADHD): A Systematic Review. *Child Psychiatry & Human Development*, *47*(3), 440–458. https://doi.org/10.1007/s10578-015-0578-3

Rust, J., Golombok, S., Trickey, G., & Wechsler, D. (2003). *WORD: Wechsler objective reading dimensions*. London: Psychological Corporation.

Rutter, M. (2013). Annual research review: Resilience - Clinical implications. In *Journal of Child Psychology and Psychiatry and Allied Disciplines* (Vol. 54, Issue 4, pp. 474–487). https://doi.org/10.1111/j.1469-7610.2012.02615.x

Rutter, M. (2015). *Resilience: concepts, findings, and clinical implications **.

Rutter, M. (2006). Implications of resilience concepts for scientific understanding. *Annals of the New York Academy of Sciences*, *1094*, 1–12.

https://doi.org/10.1196/annals.1376.002

Rutter, M., Kim-Cohen, J., & Maughan, B. (2006). Continuities and discontinuities in psychopathology between childhood and adult life. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *47*(3–4), 276–295. https://doi.org/10.1111/j.1469-7610.2006.01614.x

Saito, M., Hirota, T., Sakamoto, Y., Adachi, M., Takahashi, M., Osato-Kaneda, A., Kim, Y. S., Leventhal, B., Shui, A., Kato, S., & Nakamura, K. (2020). Prevalence and cumulative incidence of autism spectrum disorders and the patterns of co-occurring neurodevelopmental disorders in a total population sample of 5-year-old children. *Molecular Autism*, *11*(1), 1–9. https://doi.org/10.1186/s13229-020-00342-5

Salsman, J. M., Butt, Z., Pilkonis, P. A., Cyranowski, J. M., Zill, N., Hendrie, H. C., Kupst, M. J., Kelly, M. A. R., Bode, R. K., Choi, S. W., Lai, J. S., Griffith, J. W., Stoney, C. M., Brouwers, P., Knox, S. S., & Cella, D. (2013). Emotion assessment using the NIH Toolbox. *Neurology*, *80*(11 Suppl 3). https://doi.org/10.1212/wnl.0b013e3182872e11

Sampson, R. J., & Laub, J. H. (2005). A life-course view of the development of crime. *Annals of the American Academy of Political and Social Science*, *602*(November), 12–45. https://doi.org/10.1177/0002716205280075

Scandurra, V., Emberti Gialloreti, L., Barbanera, F., Scordo, M. R., Pierini, A., & Canitano, R. (2019). Neurodevelopmental Disorders and Adaptive Functions: A Study of Children With Autism Spectrum Disorders (ASD) and/or Attention Deficit and Hyperactivity Disorder (ADHD). *Frontiers in Psychiatry*, *10*(September), 1–7. https://doi.org/10.3389/fpsyt.2019.00673

Schei, J., Nøvik, T. S., Thomsen, P. H., Lydersen, S., Indredavik, M. S., & Jozefiak, T. (2018). What Predicts a Good Adolescent to Adult Transition in ADHD? The Role of Self-Reported Resilience. *Journal of Attention Disorders*, *22*(6), 547–560. https://doi.org/10.1177/1087054715604362

Schilling, E. A., Aseltine, R. H., & Gore, S. (2007). Adverse childhood experiences and mental health in young adults: A longitudinal survey. *BMC Public Health*, *7*(30), 1–10. https://doi.org/10.1186/1471-2458-7-30

Schuck, S. E. B., Johnson, H. L., Abdullah, M. M., Stehli, A., Fine, A. H., & Lakes, K. D. (2018). The role of animal assisted intervention on improving self-esteem in children with attention deficit/hyperactivity disorder. *Frontiers in Pediatrics*, *6*(November), 1–9. https://doi.org/10.3389/fped.2018.00300

Shaikh, A. (2018). Group Therapy for Improving Self-Esteem and Social Functioning of College Students With ADHD. *Journal of College Student Psychotherapy*, *32*(3), 220–241. https://doi.org/10.1080/87568225.2017.1388755

Shaw-zirt, B., Popali-Lehane, L., Chaplin, W., & Bergman, A. (2005). Adjustment, Social Skills, and Self-Esteem in College Students With Symptoms of ADHD. *Journal of Attention Disorders*, *8*(3), 109–120.

Shaw, M., Hodgkins, P., Caci, H., Young, S., Kahle, J., Woods, A., & Arnold, L. (2012). A systematic review and analysis of long-term outcomes in attention deficit hyperactive disorder. *BMC Medicine*, *10*(99), 1–15. http://0-ehis.ebscohost.com.library.acaweb.org/eds/pdfviewer/pdfviewer?sid=9e2a657b-dbdd-41bd-94c4-70022c641994@sessionmgr13&vid=14&hid=8

Shaw, P., Stringaris, A., Nigg, J., & Leibenluft, E. (2014). Emotion dysregulation in attention deficit hyperactivity disorder. *American Journal of Psychiatry*, *171*(3), 276–293. https://doi.org/10.1176/appi.ajp.2013.13070966

Sibley, M. H., Swanson, J. M., Arnold, L. E., Hechtman, L. T., Owens, E. B., Stehli, A., Abikoff, H., Hinshaw, S. P., Molina, B. S. G., Mitchell, J. T., Jensen, P. S., Howard, A. L., Lakes, K. D., Pelham, W. E., Vitiello, B., Severe, J. B., Eugene Arnold, L., Hoagwood, K., Richters, J., … Stern, K. (2017). Defining ADHD symptom persistence in adulthood: optimizing sensitivity and specificity. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *58*(6), 655–662. https://doi.org/10.1111/jcpp.12620

Sidebotham, P., & Heron, J. (2006). Child maltreatment in the “children of the nineties”: A cohort study of risk factors. *Child Abuse and Neglect*, *30*(5), 497–522. https://doi.org/10.1016/j.chiabu.2005.11.005

Sidebotham, P., Heron, J., & Golding, J. (2002). Child maltreatment in the “Children of the Nineties:” deprivation, class, and social networks in a UK sample. *Child Abuse and Neglect*, *26*(12), 1243–1259. https://doi.org/10.1016/S0145-2134(02)00415-5

Signorini, G., Singh, S. P., Marsanic, V. B., Dieleman, G., Dodig-Ćurković, K., Franic, T., Gerritsen, S. E., Griffin, J., Maras, A., McNicholas, F., O'Hara, L., Purper-Ouakil, D., Paul, M., Russet, F., Santosh, P., Schulze, U., Street, C., Tremmery, S., Tuomainen, H., … de Girolamo, G. (2018). The interface between child/adolescent and adult mental health services: results from a European 28-country survey. *European Child and Adolescent Psychiatry*, *27*(4), 501–511. https://doi.org/10.1007/s00787-018-1112-5

Simon, V., Czobor, P., Bálint, S., Mészáros, Á., & Bitter, I. (2009). Prevalence and correlates of adult attention-deficit hyperactivity disorder: Meta-analysis. *British Journal of Psychiatry*, *194*(3), 204–211. https://doi.org/10.1192/bjp.bp.107.048827

Skuse, D. H., Mandy, W. P. L., & Scourfield, J. (2005). Measuring autistic traits : heritability , reliability and validity of the Social and Communication Disorders Checklist. *British Journal of Psychiatry*, *187*, 568–572.

Smith, D. J., & McVie, S. (2003). Theory and Method in the Edinburgh Study Of Youth Transitions and Crime. *British Journal of Criminology*, *43*(1), 169–195.

Smith, M. (2017). Hyperactive Around the World ? The History of ADHD in Global Perspective. *Social History of Medicine*, *30*(4), 767–787. https://doi.org/10.1093/shm/hkw127

Sonuga-Barke, E. J. S., Auerbach, J., Campbell, S. B., Daley, D., & Thompson, M. (2005). Varieties of preschool hyperactivity: multiple pathways from risk to disorder. In *Developmental Science* (Vol. 8, Issue 2).

StataCorp. (2021). *Stata Statistical Software: Release 17.* (No. 17). StataCorp LLC.

Stergiakouli, E., Martin, J., Hamshere, M., Langley, K., Evans, D., St Pourcain, B., Timpson, N., Owen, M., O'Donovan, M., Thapar, A., & Smith, G. D. (2015). Shared genetic influences between attention-deficit hyperactivity disorder (ADHD) traits in children and clinical ADHD. *Journal of American Academy of Child and Adolescent Psychiatry*, *54*(4), 322–327.

Sterne, J. A. C., White, I. R., Carlin, J. B., Spratt, M., Royston, P., Kenward, M. G., Wood, A. M., & Carpenter, J. R. (2009). Multiple imputation for missing data in epidemiological and clinical research: Potential and pitfalls. *BMJ (Online)*,

339(7713), 157–160. https://doi.org/10.1136/bmj.b2393

Suvisaari, J., Aalto-Setälä, T., Tuulio-Henriksson, A., Härkänen, T., Saarni, S. I., Perälä, J., Schreck, M., Castaneda, A., Hintikka, J., Kestilä, L., Lähteenmäki, S., Latvala, A., Koskinen, S., Marttunen, M., Aro, H., & Lönnqvist, J. (2009). Mental disorders in young adulthood. *Psychological Medicine*, *39*(2), 287–299. https://doi.org/10.1017/S0033291708003632

Thapar, A., & Cooper, M. (2016). Attention deficit hyperactivity disorder. *The Lancet*, *387*(10024), 1240–1250. https://doi.org/10.1016/S0140-6736(15)00238-X

Thapar, A., Cooper, M., Eyre, O., & Langley, K. (2013). Practitioner review: What have we learnt about the causes of ADHD? *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *54*(1), 3–16. https://doi.org/10.1111/j.1469-7610.2012.02611.x

Thapar, A., Cooper, M., & Rutter, M. (2017). Neurodevelopmental Disorders. *Lancet Psychiatry*, *4*, 339–346. https://www.ptonline.com/articles/how-to-get-better-mfi-results

Theule, J., Wiener, J., Rogers, M. A., & Marton, I. (2011). Predicting Parenting Stress in Families of Children with ADHD: Parent and Contextual Factors. *Journal of Child and Family Studies*, *20*(5), 640–647. https://doi.org/10.1007/s10826-010-9439-7

Tully, E., Iacono, W., & McGue, M. (2008). An Adoption Study of Parental Depression as an Environmental Liability for Adolescent Depression and Childhood Disruptive Disorders. *The American Journal of Psychiatry*, *165*(9), 1148–1154. https://doi.org/10.1176/appi.ajp.2008.07091438.An

Van Ameringen, M., Mancini, C., Simpson, W., & Patterson, B. (2011). Adult Attention Deficit Hyperactivity Disorder in an Anxiety Disorders Population. *CNS Neuroscience & Therapeutics*, *17*, 221–226. https://doi.org/10.1111/j.1755-5949.2010.00148.x

Velő, S., Keresztény, Á., Ferenczi-Dallos, G., Pump, L., Móra, K., & Balázs, J. (2021). The association between prosocial behaviour and peer relationships with comorbid externalizing disorders and quality of life in treatment-naïve children and adolescents with attention deficit hyperactivity disorder. *Brain*

Sciences, *11*(4), 1–12. https://doi.org/10.3390/brainsci11040475

Victora, C. G., Hallal, P. C., Araujo, C. L. P., Menezes, A. M. B., Wells, J. C. K., & Barros, F. C. (2008). Cohort Profile : The 1993 Pelotas (Brazil) Birth Cohort Study. *International Journal of Epidemiology*, *37*, 704–709. https://doi.org/10.1093/ije/dym177

Vidal-Ribas, P., Brotman, M. A., Valdivieso, I., Leibenluft, E., & Stringaris, A. (2016). The Status of Irritability in Psychiatry: A Conceptual and Quantitative Review. *Journal of the American Academy of Child and Adolescent Psychiatry*, *55*(7), 556–570. https://doi.org/10.1016/j.jaac.2016.04.014

Visscher, P. M., Wray, N. R., Zhang, Q., Sklar, P., Mccarthy, M. I., Brown, M. A., & Yang, J. (2017). 10 Years of GWAS Discovery : Biology , Function , and Translation. *The American Journal of Human Genetics*, *101*(1), 5–22. https://doi.org/10.1016/j.ajhg.2017.06.005

Wang, B., Brueni, L. G., Isensee, C., Meyer, T., Bock, N., Ravens-Sieberer, U., Klasen, F., Schlack, R., Becker, A., Rothenberger, A., Barkman, C., Bullinger, M., Döpfner, M., Herpertz-Dahlmann, B., Holling, H., Otto, C., Petermann, F., Resch, F., Schneider, S., … Wittchen, H. U. (2018). Predictive value of dysregulation profile trajectories in childhood for symptoms of ADHD, anxiety and depression in late adolescence. *European Child and Adolescent Psychiatry*, *27*(6), 767–774. https://doi.org/10.1007/s00787-017-1059-y

Wang, F. L., Pedersen, S. L., Joseph, H., Gnagy, E. M., Curran, P., Pelham, W. E., & Molina, B. S. G. (2019). Role of ADHD in the Co-Occurrence Between Heavy Alcohol Use and Depression Trajectories in Adulthood. *Alcoholism: Clinical and Experimental Research*, *43*(2), 342–352. https://doi.org/10.1111/acer.13934

Warden, D., & Mackinnon, S. (2003). Prosocial children, bullies and victims: An investigation of their sociometric status, empathy and social problem-solving strategies. *British Journal of Developmental Psychology*, *21*(3), 367–385. https://doi.org/10.1348/026151003322277757

Wechsler, D. (1991). *The Wechsler intelligence scale for children-third edition (WISC-III).* San Antonio, TX: The Psychological Corporation.

Weissman, M. M., Pilowsky, D. J., Wickramaratne, P. J., Talati, A., Wisniewski, S.

R., Fava, M., Hughes, C. W., Garber, J., Malloy, E., King, C. A., Cerda, G., Sood, A. B., Alpert, J. E., Trivedi, M. H., & Rush, A. J. (2006). Remissions in maternal depression and child psychopathology: A STAR*D-child report. *Journal of the American Medical Association*, *295*(12), 1389–1398. https://doi.org/10.1001/jama.295.12.1389

White, I. R., Royston, P., & Wood, A. M. (2011). Multiple imputation using chained equations: Issues and guidance for practice. *Statistics in Medicine*, *30*(4), 377–399. https://doi.org/10.1002/sim.4067

Wichstrøm, L., Belsky, J., & Berg-nielsen, T. S. (2013). Preschool predictors of childhood anxiety disorders : a prospective community study. *Journal of Child Psychology and Psychiatry*, *54*(12), 1327–1336. https://doi.org/10.1111/jcpp.12116

Wichstrøm, L., Belsky, J., & Steinsbekk, S. (2017). Homotypic and heterotypic continuity of symptoms of psychiatric disorders from age 4 to 10 years : a dynamic panel model. *Journal of Child Psychology and Psychiatry*, *58*(11), 1239–1247. https://doi.org/10.1111/jcpp.12754

Wiggins, J. L., Mitchell, C., Stringaris, A., & Leibenluft, E. (2014). Developmental trajectories of irritability and bidirectional associations with maternal depression. *Journal of the American Academy of Child and Adolescent Psychiatry*, *53*(11), 1191-1205.e4. https://doi.org/10.1016/j.jaac.2014.08.005

Wirth, E. Von, Mandler, J., Breuer, D., & Döpfner, M. (2021). The Accuracy of Retrospective Recall of Childhood ADHD : Results from a Longitudinal Study. *Journal of Psychopathology and Behavioral Assessment*, *43*, 413–426.

Wood, A., Kroll, L., & Moore, A. (1995). Properties of the Mood and Feelings Questionnaire in Adolescent Psychiatric Outpatients: A Research Note. *Journal of Child Psychology and Psychiatry*, *36*(2), 327–334. https://doi.org/10.1111/j.1469-7610.1995.tb01828.x

Woods, S., & Wolke, D. (2003). *Does the Content of Anti-Bullying Policies Inform us About the Prevalence of Direct and Relational Bullying Behaviour in Primary Schools ? Relational Bullying Behaviour in Primary*. *23*(4), 381–401. https://doi.org/10.1080/01443410303215

Wray, N., Ripke, S., Mattheisen, M., Trzaskowski, M., Byrne, E., Abdellaoui, A., & Sullivan, P. (2018). Genome-wide association analyses identify 44 risk variants and refine the genetic architecture of major depression. *Nature Genetics*, *50*(5), 668–681. https://doi.org/10.1038/s41588-018-0090-3.Genome-wide

Wright, M. J., & Masten, A. S. (2013). Resilience Processes in Development: Four Waves of Research on Positive Adaptation in the Context of Adversity. In *Handbook of Resilience in Children* (pp. 15–37).

Wymbs, B. T., Canu, W. H., Sacchetti, G. M., & Ranson, L. M. (2021). Adult ADHD and romantic relationships: What we know and what we can do to help. *Journal of Marital and Family Therapy*, *47*(3), 664–681. https://doi.org/10.1111/jmft.12475

Young, S., Murphy, C. M., & Coghill, D. (2011). Avoiding the ‘ twilight zone ’ : Recommendations for the transition of services from adolescence to adulthood for young people with ADHD. *BMC Psychiatry*, *11*(174), 1–8.

Yüce, M., Zoroglu, S, S., Ceylan, M, F., Kandemir, H., & Karabekiroglu, K. (2013). Psychiatric comorbidity distribution and diversities in children and adolescents with attention deficit / hyperactivity disorder : a study from Turkey. *Neuropsychiatric Disease and Treatment*, *9*, 1791–1799.

Zablotsky, B., Bramlett, M. D., & Blumberg, S. J. (2020). The Co-Occurrence of Autism Spectrum Disorder in Children With ADHD. *Journal of Attention Disorders*, *24*(1), 94–103. https://doi.org/10.1177/1087054717713638

Zisook, S., Lesser, I., Stewart, J. W., Wisniewski, S. R., Balasubramani, G. K., Fava, M., Gilmer, W. S., Dresselhaus, T. R., Thase, M. E., Nierenberg, A. A., Trivedi, M. H., & Rush, A. J. (2007). Effect of age at onset on the course of major depressive disorder. *American Journal of Psychiatry*, *164*(10), 1539–1546. https://doi.org/10.1176/appi.ajp.2007.06101757