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Exploring the relationship between depressive symptoms and attainment at school

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Declaration

I, Lucy Riglin, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

Rates of depressive symptoms and disorder increase during adolescence and these are associated with a range of negative outcomes both in adolescence and adulthood. One possible pathway to poor outcomes is via low attainment at school. However the association between depressive symptoms and attainment is poorly understood. This thesis explored this association.

First, a meta-analysis was conducted on associations between depressive symptoms and subsequent attainment (chapter 2). This found small but significant associations, as well as significant heterogeneity of effect sizes between studies. Second, the temporal direction of this association was investigated using a cross-lagged design (chapter 4). This found depressive symptoms to be associated with a decline in attainment over time. Third, possible mediators of this association were investigated in a 3-stage study design (chapter 5). Low school connectedness, concentration problems, and stressful life events were found to mediate associations between depressive symptoms at baseline and low attainment at follow-up. These studies identified gender, co-occurring conduct problems, and cognitive ability as sources of heterogeneity in the association between depressive symptoms and subsequent low attainment.

These sources of heterogeneity were then further investigated. First, latent profile analysis was used to investigate depressive subgroups based on co-occurring conduct problems and symptom severity. Subgroups were identified and there was some evidence of differing associations with attainment and in aetiology. Second, higher cognitive ability was found to buffer the effects of stress on depressive symptoms and disorder in girls (chapter 7) as well as the effects of stress on attainment (chapter 5).

Taken together, these findings advance understanding of the association between depressive symptoms and attainment at school. They also suggest specific

groups with depressive symptoms that may merit special consideration (e.g. pupils with conduct problems or low cognitive ability) and pathways of importance (e.g. school connectedness).

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This thesis is dedicated to everyone in my life who has suffered with depression.

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CHAPTER 1: General Introduction

Depression is a mental health problem involving the core symptoms of depressed mood and loss of interest or pleasure. Major depressive disorder involves episodes lasting at least 2 weeks, and, in addition to the core symptoms, can include a range of symptoms including changes in affect, cognition and neurovegatative functions, specifically, concentration problems, reduced self-esteem, worthlessness, psychomotor disturbances, changes in sleep or appetite, thoughts of death or suicide and suicidal behaviours (American Psychiatric Association, 2013; World Health Organization, 1992).

Depression is estimated to be the leading cause of disability worldwide, and by 2020 is predicted to be the second largest cause of global burden of disease (measured by disability-adjusted life years), second only to heart disease (Lopez & Murray, 1998). Depression is a complex disorder with a multifactorial aetiology (Rutter, 2007) - around 35-60% of the variance is estimated to be explained by non-genetic factors (Brent & Weersing, 2008), although there is considerable aetiological heterogeneity (Rice, 2010). A range of risk factors for depression have been identified, including family conflict, comorbid disorder, negative cognitive style and female gender (e.g. Lewinsohn et al., 1994). One of the strongest identified predictors is stressful life events, which has been found to have a modest causal effect on risk for depression (Kendler & Gardner, 2010).

Adolescence is an important period for the onset of depression and depressive symptoms. Depression in adolescence is associated with a range of debilitating outcomes, including concurrent and future social and educational impairment, unemployment, poor physical health, mental health problems and suicidal behaviours in adult life (Thapar, Collishaw, Pine, & Thapar, 2012). It also shows continuity with depression in adult life (Rutter, Kim-Cohen, & Maughan, 2006). However, there is also substantial heterogeneity in outcomes of depressive

symptoms, with potential sources of variation including gender (Dunn & Goodyer, 2006), comorbidity with conduct problems (Fombonne, Wostear, Cooper, Harrington, & Rutter, 2001b) and cognitive ability (Barnett, Salmond, Jones, & Sahakian, 2006). One important pathway between depression and adverse outcomes is through low academic attainment. The association between depression and attainment at school is the focus of this thesis.

Decline in academic performance can be an initial presentation of depression (Thapar et al., 2012) and there is consistent evidence for an association between depression and low academic achievement (see Kovacs & Goldston, 1991). For example, adolescents with depression have been found to be less likely to graduate from high school (Jonsson et al., 2010; Kessler, Foster, Saunders, & Stang, 1995) and adolescent hospitalization for depression has been associated with low school grades in compulsory education (Jonsson, Goodman, von Knorring, von Knorring, & Koupil, 2012). Cross-sectional studies have also found children who score highly on depression questionnaires to have lower reading and maths ability, perform worse on general achievement tests and be rated by teachers as having poorer work/study habits and academic performance (Lefkowitz & Tesiny, 1985; Nolenhoeksema, Girgus, & Seligman, 1986; Strauss, Forehand, Frame, & Smith, 1984; Tesiny, Lefkowitz, & Gordon, 1980). However, further work is needed to understand the temporal direction, possible pathways, and factors that might be associated with variation in the association between depressive symptoms and low attainment. This thesis sought to address this gap in the literature.

The first section of this chapter presents general background information on the study of depression and depressive symptoms in childhood and adolescence. Research investigating associations between depression and attainment is then briefly discussed. A more comprehensive synthesis of research on this topic is given in chapter 2 which presents a meta-analysis of longitudinal work in this area. Possible reasons for inconsistent findings in research to date, including methodological issues

are discussed and factors that may influence variability in associations between depressive symptoms and attainment considered: specifically, gender, conduct problems, cognitive ability and stress. Finally, aims of the current thesis are outlined.

1.1. Depressive symptoms and disorder in childhood and adolescence

1.1.1. Prevalence rates

Depression is estimated to be one of the most common psychiatric disorders, with one year prevalence rates of major depression disorder around 10% in adulthood (Kessler, 2005). Depression in children is uncommon, with estimated prevalence less than 1% (Kessler, Avenevoli, & Merikangas, 2001; Thapar et al., 2012). However, rates increase across adolescence to one-year prevalence rates of 4-5% and lifetime estimates of up to 20% by late adolescence (Costello, Copeland, & Angold, 2011; Costello, Egger, & Angold, 2005; Hankin, 2009; Thapar et al., 2012). Estimated prevalence rates tend to be higher when using self-reported symptom scales compared to diagnostic interviews, with some reports of 20-50% of children and adolescents exceeding cut-points for depression (Kessler et al., 2001). This may partially reflect an over-reporting of mild difficulties but is also consistent with a substantial proportion of adolescents having sub-threshold symptoms (Angold, Costello, Farmer, Burns, & Erkanli, 1999; Gotlib, Lewinsohn, & Seeley, 1995).

1.1.2. Gender differences

Gender differences in the prevalence of depression are well documented, with around twice as many women as men affected from adolescence onwards (Costello, Erkanli, & Angold, 2006; Green, McGinnity, Meltzer, Ford, & Goodman, 2005; Thapar et al., 2012). A number of theories have been proposed to explain this female preponderance, which include greater proposed biological, cognitive and affective vulnerability for women, with a key role of negative life events (Cyranowski, Frank, Young, & Shear, 2000; Hankin & Abramson, 2001; Hyde, Mezulis, & Abramson,

2008). For example, adolescent depression is thought to be connected to female hormonal changes which sensitise the brain to the negative effects of stress (Thapar et al., 2012) and girls have been found to be more vulnerable to depression following stress (Hankin & Abramson, 2001; McCormick & Mathews, 2007; Stroud, Salovey, & Epel, 2002).

There are two notable exceptions to a female preponderance for depression. Firstly, during childhood, depression is equally found in boys and girls (Thapar et al., 2012). Many of the suggested explanations for the female preponderance for depression relate to biological and social changes associated with puberty, and the rise in prevalence rates during this period. Therefore some key risk factors for depression which are associated with female gender (e.g. female hormone changes) are not as relevant to pre-pubertal depression. In addition, there is evidence to suggest that the association between some risk factors and female gender only emerge in adolescence. For example, the impact of life events on depression has been found to be stronger in pubertal girls than pubertal boys (as well as prepubertal boys and girls; Silberg et al., 1999). Instead, there is some evidence that depressive disorder with an onset in childhood may be associated with different environmental stressors, such as greater adverse family factors (e.g. parent criminality and hostility) compared to adolescent depression (Harrington et al., 1997).

Secondly, depression with co-occurring conduct problems shows neither a female preponderance nor an increase in prevalence during adolescence (Angold & Rutter, 1992). Although there is less research into this, there is some evidence that this is the more common presentation of depression in childhood (Brent & Weersing, 2008) and that this may also be more associated with psychosocial risk factors, such as living with a single parent, than depression which occurs without conduct problems, (Simic & Fombonne, 2001).

1.1.3. Using school samples

Depression can be viewed both as a disorder which is present or absent and as a continuum of severity. The traditional view suggests distinct differences between depressive disorder and subclinical symptoms (Fechner-Bates, Coyne, & Schwenk, 1994). However, there is strong evidence for the validity of using a continuum approach. Sub-threshold symptoms in children and adolescents are associated with significant impairment (Angold, Costello, Farmer, et al., 1999; Gotlib et al., 1995) and with an increased risk of developing a major depressive disorder in the future (Fergusson, Horwood, Ridder, & Beautrais, 2005; Gotlib et al., 1995; Klein, Shankman, Lewinsohn, & Seeley, 2009). The use of community samples which allow the investigation of sub-threshold symptoms is therefore important. The primary sample used in this thesis, described in chapter 3, is a community sample of school children, in which depressive symptoms were investigated.

Schools are an important place to study depressive symptoms. Depression can be particularly hard to identify during adolescence (Thapar et al., 2012) and it has been estimated that under half of British schoolchildren with a depressive disorder have contact with any specialist service (Ford, Hamilton, Meltzer, & Goodman, 2008). Parents are important in the initiation of service use (Wu et al., 1999) and often seek help from schools (Shanley, Reid, & Evans, 2008). Teachers are also often the first point of contact for pupils with mental health problems (Farmer, Burns, Phillips, Angold, & Costello, 2003) and their perceptions of child difficulties have been found to predict specialist service use (Ford et al., 2008).This is reflected in NICE guidelines, which recommends that those in primary care, including teachers, identify symptoms and profile risk (National Institute for Health and Care Excellence, 2015). Investigating depressive symptoms and associations with school based measures such as attainment may help to work towards increasing awareness of depressive symptoms in schools, and to promote the movement towards schools being more involved with mental health (e.g. Wolpert et al., 2011)

1.1.4. Depression and anxiety

It is common for children and adolescents with depression to have a comorbid psychiatric disorder: 2 in 3 have at least one comorbid disorder and 2-3 in 20 have two or more (Ford, Goodman, & Meltzer, 2003; Thapar et al., 2012). The most common comorbid disorder with depression is anxiety, followed by conduct disorder. In addition to depression, anxiety is also one of the most common types of psychiatric disorders in childhood and adolescence (Costello et al., 2011; Kessler, 2005). Unlike depressive disorders, there are a large range of anxiety disorders, including phobias, panic disorder, separation anxiety, school anxiety and generalised anxiety disorder. This thesis will generally focus on symptoms of generalised anxiety, which is comorbid in around 20% of adolescents with depression (Thapar et al., 2012). As well as showing high rates of comorbidity, self-report measures of depression and anxiety also tend to correlate highly (Brady & Kendall, 1992). It has been suggested that depression and anxiety are part of a broader category of internalising (emotional) problems. Some researchers have even conceptualised these as a combined disorder, for example with depression at one end and anxiety the other of a continuum, or as a disorder in which anxiety precedes depression (Costello et al., 2005). However longitudinal studies using latent trait models have found evidence of disorder-specific, as well as common, emotional/internalising components for depression and anxiety and it is generally accepted that they are different disorders (Fergusson, Horwood, & Boden, 2006; Olino, Klein, Lewinsohn, Rohde, & Seeley, 2008). In-line with this, they are given different diagnoses by both the American and International classification systems (American Psychiatric Association, 2013; World Health Organization, 1992). Nevertheless, it is common for studies to use measures of internalising symptoms (e.g. Child Behaviour Checklist (Achenbach, 1991); Strengths and Difficulties Questionnaire (Goodman, 1997)), which may influence findings (see section 1.2.1).

While depression and anxiety do often co-occur, they show notable differences. For example compared to depression, anxiety has a younger average age of onset, with first onset more likely to occur in childhood than depression (Kessler et al., 2005) and there is evidence that different environmental risk factors influence each disorder (Kendler, Neale, Kessler, Heath, & Eaves, 1992; Rice, van den Bree, & Thapar, 2004). Depression and anxiety have also been shown to have different outcomes in later life, both regarding mental and physical health (e.g. Bardone et al., 1998; Reinke & Ostrander, 2008). For example, there is some evidence that children with anxiety show low rates of later impairment if the anxiety does not co-occur with depression (Last, Hansen, & Franco, 1997). In contrast, follow-up studies of depression indicate a range of impairments later in life (e.g. Weissman, Wolk, Goldstein, et al., 1999). It is therefore important when investigating depression in childhood and adolescence to clearly differentiate between depression and anxiety. Investigating combined emotional problems may result in unique associations being masked. In this thesis, the initial chapters which explore associations with, and pathways to, attainment will investigate both depressive and anxiety symptoms for comprehensiveness (chapters 2, 4 and 5). Subsequent chapters investigate more specific aspects of this association, driven by the findings from the previous chapters, and will focus specifically on depressive symptoms (chapters 6 and 7). The term emotional problems will be used in this thesis when statements apply to both depressive and anxiety symptoms.

1.2. Depression and academic attainment

The main aim of this thesis was to explore associations between depressive symptoms and academic attainment. As outlined above, depression is associated with a range of negative disabling outcomes and is a significant global burden (Lopez & Murray, 1998; Thapar et al., 2012). Poor attainment at school is an important way in which depressive symptoms and disorder may

lead to negative social and economic outcomes. Reviewing the literature on education, social status and health, Mirowsky and Ross (2003) note that low attainment is recognised to be associated with poor health and mortality, with the largest effect on health compared to income and occupational status. They state that:

> "It [educational attainment] influences health in ways that are varied, present at all stages of adult life, cumulative, self-amplifying, and uniformly positive… It precedes the other social statuses and substantially influences them, including occupation and occupational status, earnings, personal and household income and wealth, and freedom from economic hardship." (p.1)

Decline in academic performance can be an initial presentation of depression (Thapar et al., 2012) and cross-sectional associations are well established (see above). However, despite considerable research investigating associations between psychopathology and school outcomes, longitudinal research is inconsistent - for example, one study found that findings varied by cohort, as well as gender (Richards & Abbot, 2009). It is therefore not yet clear whether depressive symptoms and disorder are associated with later poor school attainment. Given the wide range of negative outcomes associated with low attainment, investigating associations between depressive symptoms and attainment is important to try and help to reduce the negative adult outcomes associated with depression in childhood and adolescence. Chapter 2 presents a meta-analysis which synthesised research on the association between depression and subsequent attainment at school to-date.

1.2.1. Methodological issues

At least two methodological issues may explain inconsistencies in research findings on associations between depressive symptoms and subsequent school attainment. First, there has been variability in the measurement of attainment.

Some measures utilise a range of sources, such as academic competence, which can include self-, parent- and teacher-reports, as well as school grades (e.g. Obradovic, Burt, & Masten, 2010). Others, such as measures of school burnout (e.g. Salmela-Aro, Savolainen, & Holopainen, 2009) are based on self-reports and are likely to be affected by shared method variance when depressive symptoms are assessed in the same way. For example, academic ability is under-estimated by children with current depressive symptoms compared to teachers and peers (Cole, Martin, Peeke, Seroczynski, & Fier, 1999). This thesis utilised more objective measures of school attainment, which did not include self-ratings, to avoid problems associated with shared method variance. Further, epidemiological studies have tended to examine dichotomous variables of educational achievement or failure (e.g. leaving school without any formal qualifications). However, dichotomous measures of educational failure may fail to capture subtle effects on different aspects of academic attainment. The studies presented in this thesis examined the continuous measure of school grades; the dichotomous measure of school failure was included in addition to school grades in chapter 2, to comprehensively synthesise the existing literature in this field.

Second, the way in which depressive symptoms are conceptualised may also influence the associated relationship with attainment. As discussed above, some studies have examined internalising problems, usually defined as a combination of depression and anxiety, while others have examined associations separately for depression and anxiety. One potential issue with investigating associations with the broad category of internalising problems is that the definition of internalising problems differs across studies. Some studies use measures which include somatic problems (e.g. the Child Behaviour Checklist; Achenbach, 1991), while others combine specific measures of depression and anxiety (e.g. Janosz et al., 2008). Another issue is that

depression and anxiety may have different relationships with subsequent school attainment. Where studies find an association between depressive symptoms and subsequent school attainment, the relationship tends to be a negative one, with higher levels of depressive symptoms associated with lower school attainment (e.g. Needham, 2009). In contrast, for anxiety, both positive and negative associations have been found. One study of anxiety found that groups of pupils with consistently relatively-low or high levels of anxiety had higher grade point averages (GPAs) than non-anxious pupils (Morin, 2011). However, others have found associations between anxiety and lower GPA (e.g. Ansary, McMahon, & Luthar, 2012). Indeed, measured dimensionally, some have suggested that anxiety can be part of an adaptive response to change which has some positive functions such as increasing motivation (e.g. Eysenck, 1982). Null findings between internalising problems and school attainment may therefore mask specific associations for depression (and anxiety). In the meta-analysis presented in chapter 2, associations with school attainment were investigated separately for depression, anxiety and internalising problems. Chapter 4 presents a new study which investigates associations between emotional problems and attainment, which addresses these two methodological issues.

1.2.2. Potential pathways

If an association between depressive symptoms and attainment is established, an important area of investigation is the pathways that link these two variables. Identifying mediators of this association would help to identify how and why depressive symptoms as associated with subsequent low attainment. However, there has been little research into the pathways through which depressive symptoms may lead to low attainment.

Chapter 2 describes a meta-analysis of the relationship between emotional problems and subsequent school attainment during late childhood and adolescence. Of the 26 studies included in that analysis, only 4 considered the role of additional variables beyond behavioural problems and control variables, such as gender, age and social class, in this relationship. Two of these studies included a range of additional variables, but did not explore these as potential mediators, as the association between emotional problems and attainment was not the focus of their research (Birchwood & Daley, 2012; Janosz et al., 2008). The final 2 studies did focus on school outcomes of emotional problems and also controlled for a range of potential confounders, but did not investigate the influence of specific variables on the relationship between emotional problems and attainment (instead controlling for multiple variables simultaneously; Fergusson & Woodward, 2002; Luthar, 1995). None of these studies directly tested additional variables as potential pathways between emotional problems and attainment.

Some studies have investigated whether different areas of competency explain associations between emotional problems and attainment. For example, one study investigated associations between internalising problems, social competence and academic competence (including questionnaire measures of how well pupils are doing in school as well as objective measures of attainment) (Obradovic et al., 2010). However, this investigated cascading effects; for example, whether internalising problems were associated with subsequent low social competence, which in turn was associated with subsequent lower attainment. This did not directly test for mediation, i.e. whether associations between social competence and both internalising problems and attainment accounted for a significant proportion of the association between internalising problems and attainment. The researchers found no evidence of a cascade between internalising problems and academic competence involving social competence. Another study using a similar approach found no evidence of a cascade

between internalising problems and attainment involving peer victimisation, although this study controlled for behavioural problems which may have influenced findings (Vaillancourt, Brittain, McDougall, & Duku, 2013). One recent study did directly assess school involvement as a potential mediating factor of associations between depressive symptoms and attainment (Chow, Tan, & Buhrmester, 2015), and found a significant indirect effect via both pupils' own and their friends' school involvement. However, this study was cross-sectional and therefore the direction of effects cannot be certain.

Research exploring potential longitudinal associations between depressive symptoms and attainment is therefore limited and studies that directly test for mediating effects are needed. Possible pathways include symptoms of depression such as concentration problems and low motivation, which may be required for successful learning (e.g. Ryan & Powelson, 1991). Other potential pathways – variables that are associated with both depression and impairment in cognition or attainment - include negative environmental factors such as stress (Hammen, 1991; Kim & Diamond, 2002), and pupil's relationship with their school (school connectedness) (Maddox & Prinz, 2003; Shochet, Dadds, Ham, & Montague, 2006). Chapter 5 addresses the gap in the literature on mediators of the association between depressive symptoms and attainment, by investigating these potential pathways. Heterogeneity in these pathways based on gender, conduct problems and cognitive ability is also explored. The next section of this chapter discusses these as potential sources of variation, as well as the possible role of stress in the association between depressive symptoms and attainment.

1.3. Factors that may affect associations between depressive symptoms and academic attainment

1.3.1. Gender

As discussed in section 1.1.2, it is well documented that depressive symptoms and disorder are more common in girls than boys (Costello et al., 2006; Green et al., 2005). However, worse functional outcomes for boys, compared to girls, with depression have been suggested by some studies (Diamantopoulou, Verhulst, & van der Ende, 2011; Dunn & Goodyer, 2006). It is currently unclear whether attainment outcomes of depression differ by gender as findings have been inconsistent, with some finding worse outcomes for girls and others for boys (Needham, 2009; Obradovic et al., 2010). As noted previously, one exception to the female preponderance of depression is depression with conduct problems (Angold & Rutter, 1992). Thus, co-occurring conduct problems is one possible explanation for gender differences in attainment outcomes of depression, and also one possible explanation for inconsistent findings (which may vary depending on whether the possible confounding role of conduct problems is considered). Gender differences in both the association between depressive symptoms and attainment, and the aetiology of depressive symptoms are examined in chapters 2 and 4-7.

1.3.2. Conduct problems

Unlike depressive symptoms, research suggests that conduct problems have a stronger and more consistent influence on academic attainment in comparison to emotional problems (Kessler et al., 1995; Richards & Abbot, 2009). Specifically, studies have shown that conduct problems increase the likelihood of underachievement from childhood through adolescence and young adulthood (Hinshaw, 1992; Miech, Caspi, Moffitt, Wright, & Silva, 1999; Moilanen, Shaw, & Maxwell, 2010). Depression and conduct problems co-occur more often than chance, with evidence that depression is almost as strongly related to conduct disorder/oppositional defiant disorder as it is to anxiety (Angold, Costello, & Erkanli, 1999). It is therefore possible that associations between depressive symptoms and

low attainment are due to co-occurring conduct problems. Indeed, research has indicated that depressive symptoms with co-occurring conduct problems are associated with particularly poor outcomes including low academic attainment (Ingoldsby, Kohl, McMahon, & Lengua, 2006). Whether conduct problems influence associations between depressive symptoms and attainment is explored in chapters 4, 5, and 6.

1.3.3. Cognitive ability

Cognitive ability may be another source of heterogeneity in associations between depressive symptoms and attainment. Cognitive ability is defined in this thesis by intelligence. Individuals with higher cognitive ability are advantaged in cognitive resources and processes in areas including verbal comprehension, abstract reasoning, working memory and processing speed (e.g. WISC; Wechsler, 2003). Individual differences in cognitive ability may therefore contribute to heterogeneous outcomes of depression. Specifically, individuals with higher cognitive ability may have greater resources which protect them against functional impairment associated depressive symptoms, including attainment. This is the concept of cognitive reserve (Barnett et al., 2006; Koenen et al., 2009).

Models of cognitive reserve propose that individual differences in brain processing efficiency (active/'software' models) or in the density of neurons/synapses (passive/'hardware' models), result in differences in individual functioning following pathology. Existing research provides some support for this (Koenen et al., 2009). For example, higher verbal memory in schizophrenic patients predicts better occupational functioning, social functioning and problem solving skills (Green, 1996) and there is evidence that higher childhood IQ may predict better functional outcomes in schizophrenic patients with similar levels of pathology (Barnett et al., 2006; Munro, Russell, Murray, Kerwin, & Jones, 2002). Applied to the topic of this thesis, this suggests that varying levels of cognitive ability may result in heterogeneous

attainment outcomes of depressive symptoms. Specifically, individuals with higher cognitive ability may show better attainment in the face of depressive symptoms. For example, this may result from greater capacity and efficiency of the cognitive system, which allow greater recruitment of compensatory networks to protect against the adverse effects of depressive symptoms on cognition.

Whether cognitive ability influences associations between depressive symptoms and attainment is explored in chapter 5. Associations between cognitive ability and depressive symptoms both with and without co-occurring conduct problems are also explored in chapter 6. Finally, in addition to protecting against depressive functional impairment, whether higher cognitive ability protects against depressive symptoms associated with stress (discussed further in section 1.3.4.2), is explored in chapter 7.

1.3.4. Stress

A final important factor considered in this thesis is stress. Stress likely plays multiple roles in the onset and outcomes of depression and a variety of these are explored in this thesis. Stress may also help to explain some of the processes through which outcomes vary based on gender, conduct problems and cognitive ability. This section will first discuss the generation of stressful life events in those with depressive symptoms. The causal role of stress for depression will then briefly be considered.

1.3.4.1. Stress generation

Many stressful life events are uncontrollable, such as the death of a loved one and do not result from characteristics of the individual. However, exposure to some types of stressful life events can be partly dependent on behaviour (termed behaviour-dependent), such as getting into a fight, or being injured (Kendler & Baker, 2007) (more examples of behaviour-dependent and behaviour-independent stressful life events can be seen in Table 3.4). Individuals with depression may create or evoke

these types of (behaviour-dependent) stressful life events – this is called stress generation. This is detailed in the stress generation hypothesis (Hammen, 1991), which emphasises a range of mechanisms through which depressed individuals may generate stressful life events. These include personality and interpersonal vulnerabilities, negative cognitive styles, past stress and an increased likelihood of being in high risk and unstable social circumstances (Hammen, 1991; Liu & Alloy, 2010). For example, low mood, anhedonia and lack of energy may increase relationship problems and increase the likelihood of getting into arguments. Behaviour-dependent negative life events increase from childhood to adolescence, and that there is evidence that the same genetic factors may influence both stressful life events and depressive symptoms (Rice, Harold, & Thapar, 2003).

Stress impairs cognitive processing in areas such as memory and learning (Kim & Diamond, 2002), which are important for attainment. For example, interference from thoughts and memories of stressful life events may interfere with cognitive resources needed for on-task demands (Klein & Boals, 2001). Chronic and perceived stress has also been associated with impairments in attentional set-shifting and activity in associated brain regions (Liston, McEwen, & Casey, 2009; Liston et al., 2006). Stress may therefore predict low academic attainment. Further, behaviour-dependent stressful life events which are associated with depression may be one pathway through which depression is associated with subsequent low attainment.

If the generation of stressful life events does partially explain associations between depression and attainment, this may also explain why outcomes vary by gender, conduct problems and cognitive ability. Regarding gender, it has been suggested that girls experience more stressful life events than boys (Thapar et al., 2012), including behaviour-dependent stressful-life events (Liu & Alloy, 2010). It has also been suggested that stress may have a more detrimental effect on learning in girls compared to boys (Oldehinkel & Bouma, 2011). Associations between depression and attainment via stress may therefore be stronger for girls compared to

boys. Depression-related stress generation may also be greater in those with higher conduct problems. Stress generation appears to be specific to depression and is not observed for other disorders, including conduct disorder (Wingate & Joiner, 2004). However, there is evidence suggesting that stress-generation may be greater for depression with co-occurring disorders (Daley et al., 1997; Liu & Alloy, 2010) including externalising disorders (e.g. conduct disorder; Rudolph et al., 2000). Thus associations between depression and attainment may be stronger for those with higher conduct problems, due to increased stressful life events.

Finally, cognitive ability may also influence associations between depressive symptoms and attainment via stress, specifically the association between stressful life events and attainment. As discussed above, the concept of cognitive reserve suggests that those with higher cognitive ability may protect against the adverse effects of depressive symptoms on cognition (Barnett et al., 2006; Koenen et al., 2009). The same concept may apply to the adverse effects of stressful life events on cognition, with those of higher cognitive ability less likely to show impairment in attainment as a result of stress. This is issue explored in chapter 5.

It is also important to highlight that, as mentioned above, research suggests that stress generation is specific to depression. Specifically, studies have failed to find support for stress generation in anxiety (Joiner, Wingate, Gencoz, & Gencoz, 2005; Wingate & Joiner, 2004). Thus, stressful life events may explain stronger, or more consistent, associations with attainment for depression compared to anxiety. This is also explored in chapter 5.

1.3.4.2. The causal role of stress

Despite stress generation in depression, there is also evidence of a modest causal role of stressful life events on depression (Kendler & Gardner, 2010). Individual differences in associations between stress and depression are explored in chapter 7. This is driven, in part, from findings of the study presented in chapter 5. This is

relevant to the general theme of heterogeneity of depression discussed throughout this thesis, specifically regarding cognitive ability and gender. As discussed above, higher cognitive ability may protect against the adverse effects of both depression and stress on attainment. It may also protect against the adverse effects of stress on depression. Gender may be another factor: as discussed in section 1.1.2. There is some evidence that girls may be more sensitive to the negative effects of stress than boys (Juster et al., 2011) and more vulnerable to depression following social stress than boys (McCormick & Mathews, 2007; Stroud et al., 2002), which may make them more vulnerable to depressive symptoms following stress.

1.4. Aims of the current thesis

1.4.1. Thesis format

The subsequent chapters in this thesis are briefly introduced below.

In chapter 2 I present a meta-analysis of longitudinal studies investigating associations between emotional problems and attainment. Studies looking at depression, anxiety or internalising problems in children and adolescents were included. School grades and school failure (failing to complete school) were the outcome variables. Twenty-six studies were included. Heterogeneity in associations was investigated, including the potential moderating effects of age, gender and follow-up period.

In chapter 3 I describe the samples and measures used in the studies presented in chapters 4, 5, 6 and 7.

In chapter 4 I present a longitudinal study which investigates associations between emotional problems and attainment. The emotional problems of depressive symptoms, general anxiety and school anxiety in late childhood were included. School grades approximately 6 months later were the outcome variables. This extended findings from chapter 2 by using crossed-lagged models to investigate associations between each measure of emotional problems and attainment, controlling for within

construct continuity and cross-sectional associations. Models therefore tested for associations between emotional problems and change in attainment. Gender was investigated as a possible moderator of associations.

In chapter 5 I present a longitudinal study which investigates potential pathways between emotional problems and attainment, thus extending the findings from chapters 2 and 4. The emotional problems of depressive symptoms and general anxiety in late childhood were included. School grades approximately 1 year later were the outcome variables. The potential pathways of low concentration, low motivation, stressful life events and low school connectedness were investigated. The moderating effects of gender, conduct problems and cognitive ability on these pathways were also investigated. This chapter identified important areas for future study which guided the subsequent two chapters.

In chapter 6, I present a study investigating aetiological heterogeneity in child and adolescent depressive symptoms based on co-occurring conduct problems. Data were analysed in two independent samples of children and adolescents. It was hypothesised that latent profile analysis would identify distinct profiles of depressive symptoms, distinguished by the presence or absence of co-occurring conduct problems. Based on previous research, it was hypothesised that these profiles would show differing associations with attainment and risk factors such as gender and stress.

In chapter 7 I present a study investigating higher cognitive ability as a buffer against stress-related depressive symptoms. This was based on the discussion in chapter 5, which identified this as an important area for future study. Data were analysed in two child/adolescent datasets with differing levels of stress exposure. It was hypothesised that cognitive ability would moderate the effect of stress on depressive symptoms. It was also hypothesised that the moderating effect of cognitive ability would be stronger in girls than boys.

Findings from the five empirical studies presented in this thesis are summarised in chapter 8, where limitations, implications and possible future research questions are also considered.

1.4.2. Research questions

Thus, the current thesis primarily set out to answer the following research questions:

1. Does existing research provide evidence for an association between depressive symptoms and subsequent low attainment in school?
2. Are depressive symptoms associated with subsequent low attainment when controlling for baseline levels of attainment?
3. What are the pathways through which depressive symptoms lead to lower attainment?
4. Which factors are associated with variation in associations between depressive symptoms and attainment? Specifically: a) gender; b) conduct problems; c) cognitive ability

Based on findings from the investigation of these questions, the following aetiological questions were also investigated:

a) Are depressive symptoms differentially associated with attainment and risk factors including gender, cognitive ability and stress when they co-occur with conduct problems?
b) Does high cognitive ability buffer stress-related depressive symptoms?

These questions further examined issues surrounding sources of heterogeneity in the association between depressive symptoms and attainment, and therefore aimed to give further insights to this field of study. The overall aim of this thesis was to gain further understanding of associations between depressive symptoms and subsequent attainment.

CHAPTER 2: The relationship between emotional problems and subsequent school attainment - a meta-analysis

Longitudinal studies have provided mixed findings regarding the relationship between emotional problems and subsequent poor school attainment. The present chapter describes a meta-analysis of 26 community-based studies of children and adolescents. Results revealed a prospective association between emotional problems and poor school attainment. More consistent associations were found for depression than anxiety. Moderator analyses indicated that some of the heterogeneity between studies may be due to age and gender, with reduced heterogeneity particularly notable for school grades during early adolescence and for anxiety by gender. Findings suggest that early identification and provision of support for young people with emotional problems may be helpful for improving outcomes such as school attainment.

2.1. Introduction

As discussed in Chapter 1, anxiety and depression are two of the most common psychiatric disorders in childhood and adolescence (Costello et al., 2005), with rates increasing during adolescence, particularly for depression (Costello et al., 2011). Emotional problems in childhood and adolescence show continuity with emotional problems in adult life (Rutter et al., 2006) and are associated with impaired functioning in adulthood, such as impairment in work and parenting (Weissman, Wolk, Wickramaratne, et al., 1999). One important way in which emotional problems may lead to adverse social and economic outcomes in adult life is through poor school attainment, which deleteriously impacts adult life chances (Mirowsky & Ross, 2003; U.S. Department of Education, 2005).

There has been a significant body of research documenting the relationship between psychopathology and school outcomes. Findings of associations between behavioural problems and subsequent school attainment have been consistent (e.g. Hinshaw, 1992; Mirowsky & Ross, 2003; Richards & Abbot, 2009). However, while emotional problems are associated with concurrently assessed school attainment (e.g. Puig Antich, 1985; Strauss, 1987) longitudinal research is inconsistent (e.g. Richards & Abbot, 2009). It is not yet clear whether emotional problems are associated with later poor school attainment.

This chapter aimed to clarify whether associations between emotional problems and school attainment are found in longitudinal studies. Further, it aimed to investigate whether heterogeneity between studies could be explained by a number of routinely collected potential moderators: specifically, age, gender and duration of follow-up period.

2.1.1. Potential moderators

2.1.1.1. Age.

Across childhood, adolescence and adulthood emotional problems show different prevalence rates and may be associated with different risk factors (Cohen et al., 1993; Jaffee et al., 2002; Rice, 2010). The influence of emotional problems on school attainment may therefore also vary with age. Indeed, Obradovic et al. (2010) found that, controlling for social competence, emotional problems during childhood, but not during adolescence, predicted lower subsequent academic competence. Thus, inconsistent results from existing studies may be attributable to variations in sample age range.

2.1.1.2. Gender.

As discussed in chapter 1, gender differences in the prevalence of emotional problems are well documented (Costello et al., 2006; Green et al., 2005). Girls also outperform boys in school attainment from the elementary school years to adolescence (DCSF, 2008; Snyder & Dillow, 2012). Nevertheless, the extent to which associations between emotional problems and school outcomes differ for boys and girls is not clear. Needham (2009) found that depressive symptoms predicted failure to complete high school for girls but not boys, whereas Obradovic et al. (2010), controlling for externalising problems, found that internalising problems predicted lower school competence for boys but not girls. Thus, it is important to consider whether gender may moderate the association between emotional problems and school attainment.

2.1.1.3. Follow-up period.

Given that emotional problems show cross-sectional associations with school attainment, yet longitudinal associations are unclear, the duration of follow-up is a

potential moderator of the strength of longitudinal relationships. Studies of clinically-depressed groups indicate long lasting impairment in school attainment (Harrington, Fudge, Rutter, Pickles, & Hill, 1990), though this may apply specifically to depression, rather than anxiety (Last et al., 1997). In contrast, in a community sample, Masten et al. (2005) failed to find a longitudinal association between internalising problems and subsequent academic attainment. They suggested that emotional problems may influence academic achievement only within short follow-up periods (less than 3 years) with the implication that associations would not be found across longer follow-up periods. Indeed, given that emotional problems tend to be episodic, the influence on academic attainment may be short-term.

2.1.2. Measurement

As discussed in chapter 1, the way in which emotional problems and school outcomes are conceptualised may also influence the associated relationship with school attainment. Some studies examine internalising problems and others associations for depression or anxiety specifically. However, the definition of internalising problems differs across studies and depression and anxiety may have different relationships with subsequent school attainment. Therefore, in this study, associations with school attainment were investigated separately for depression, anxiety and internalising problems. This study also focussed on the objective measures of school grades and school failure (as assessed by failure to complete compulsory education), to avoid problems associated with shared method variance which may arise when measures are rated by the same informant.

2.1.3. The present study

Six meta-analyses of studies investigating the longitudinal association between emotional problems and subsequent school attainment were performed. These analyses assessed the associations between: (1a) depression and school failure, (1b)

internalising problems and school failure, (1c) anxiety and school failure, (2a) depression and school grades, (2b) internalising problems and school grades, and (2c) anxiety and school grades.

2.2. Method

2.2.1. Literature search procedure

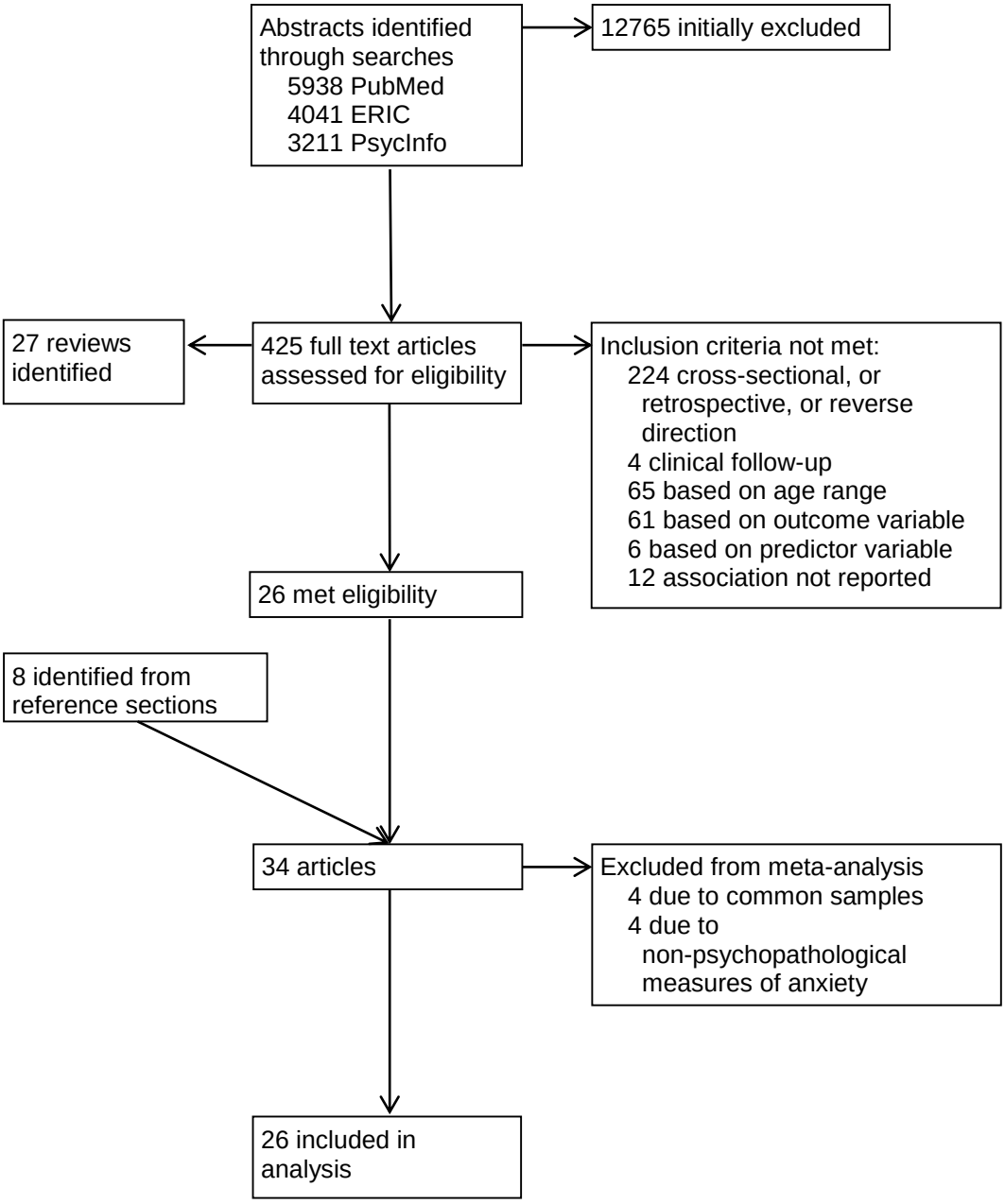
Several search strategies were used to identify published studies examining the longitudinal association between emotional problems and school attainment written in English. The search was limited to published studies, as this provides a level of quality control. First, systematic searches were conducted using PubMed and ERIC. All combinations of the key words, found in any field, in the following groups were used: (a) emotional problems, internalising/internalizing, depression/depressive, (b) childhood/ adolescence, (c) education, school/scholastic, functioning/functional. Weekly updates were also checked (concluding October 2012). Searches were repeated in PsycInfo, using the same search terms, with key words searched for in the fields: abstract, heading word, key concepts, original title, table of contents, tests & measures, and title.[1] Finally, manual searches of reference lists from studies, review articles and book chapters identified through the above methods were carried out.

Figure 2.1 illustrates the search and exclusion process. Studies were selected where the predictor variable was a measure of depression, internalising problems or anxiety and the outcome variable was either school grades or failing to complete compulsory education. So as to best reflect performance in school, rather than intelligence, general ability test scores were not included. Five additional criteria were

[1] I initially carried out searches in PubMed and ERIC, which was followed by two additional independent searches by research assistants. I also conducted searches in PsycInfo in September 2013, for studies published up to and including the year 2012, which was followed by an independent search by a research assistant. Consistency in identification of studies which met the inclusion criteria (see Figure 2.1 and inclusion criteria below) was 75%.

set. First, participants were 8-18 years at start of study, so as to include school-age children and adolescents and because cognitive symptoms of depression are thought to be unlikely prior to 8 years of age (Kovacs & Devlin, 1998). Second, the study had to be longitudinal and prospective. This was to minimise the likelihood of reverse causation (school attainment predicting later emotional problems). Third, the sample had to be community-based (rather than clinical), allowing greater generalisability. Due to possible variation in the operationalisation of emotional problems in community samples, diagnostic versus dimensional/symptom measurement of emotional problems was investigated as a potential moderator. Fourth, no intervention/treatment occurred as part of the study on the included sample. This was to ensure that the measured relationship was the natural association, and not one influenced by the study. Fifth, data on the association between emotional problems and school attainment were presented.

Figure 2.1. Flowchart illustrating the search and exclusion process



Where two studies were based on the same sample, measuring the same association, only one study was included in the meta-analysis. In these instances, the study that included both genders, had a longer follow-up period, and presented greater detail was included. Four additional studies were excluded as they measured maths or test anxiety only and were therefore not comparable to other included studies.

The study characteristics coded were: school outcome (school failure, school grades); emotional problem (anxiety, depression, internalising problems); number of participants; country; gender ratio; age range at study commencement; mean follow-up period; measure of emotional problems.[2] Following the identification of studies it was noted that the majority were carried out in the USA and therefore country of study (USA versus other) was added post-hoc as a potential moderator.

2.2.2. Analysis

Pearson's product-moment correlation coefficient (*r*) was used as the common effect size. Due to the variability in study characteristics, a random effects design was used. Individual effect sizes were transformed to Fisher's Z_r before combining. Where studies did not report *r*, and authors did not respond to requests to provide this (N=2) or data could not be provided (N=2), effect sizes were calculated based on available data (subgroup correlations; contingency tables; beta value). Where only beta coefficients were available (N=1) these were used, as recommended by Peterson and Brown (2005). Corrections for dichotomisation of emotional problems were applied through the Hunter and Schmidt (1990) formula, using available information. Where effect sizes were only available for subgroups (e.g. males and females, N=2) or where multiple associations were measured (physiological anxiety and social anxiety, N=1),

[2] I initially coded school outcome, emotional problem, age and follow-up period; these were then independently coded by my primary supervisor Frances Rice; discrepancies were discussed until agreement was met (initial agreement was 92%).

these were combined by fixed effects meta-analysis, as suggested by Borenstein, Hedges, Higgins, and Rothstein (2009).

Q and I^2 were used to analyse homogeneity in the distribution of effect sizes. *Q* assesses the variation in effect sizes between studies; a significant *Q* value indicates heterogeneity. I^2 indicates the proportion of this variance which reflects genuine heterogeneity in the effect sizes, as opposed to within-study variance.

Three assessments were used to identify possible publication bias, which occurs because studies with significant results are more likely to be published (e.g. Dickersin & Min, 1993). First, the Egger test of funnel plot asymmetry (Sterne & Egger, 2005) which calculates 'small study effects' bias, based on the premise that larger sample sizes should show increased precision in estimating effect size. This test therefore checks whether effect sizes differ by sample sizes. Where this was significant, the trim and fill procedure was used (Duval & Tweedie, 2000). This estimates the number of studies missing from analysis based on funnel plots and calculates a new effect size with the inclusion of these in the analysis. Where significant effect sizes were found, the Rosenthal (1979) fail-safe number was calculated to test for file-drawer effects. This estimates the number of unpublished studies omitted from the analysis which, if included, would produce a non-significant effect size and is compared to a critical number. Publication bias is indicated when the fail-safe number does not exceed the critical value. All analyses were conducted in Mix 2.0 (Bax, 2011) unless otherwise stated.

2.2.2.1. Moderator analyses.

The effect of age, gender, country and measurement were investigated using subgroup analysis. For age, studies were grouped into three age groups: childhood (elementary school; age 8-12 years), early adolescence (junior high; 12-15 years) and late adolescence (senior high; 15-18 years). Where sample ages crossed groups, the mean/median age was used to classify the sample's age group. Gender-specific

analyses were run using studies where effect sizes were available separately for boys and girls. Differences in sub-group effect sizes were calculated using a *Z*-test (see Borenstein et al., 2009). For age, childhood and late adolescent subgroups were compared to the early adolescent subgroup.

The effect of follow-up period on the strength of association between emotional problems and school outcomes was investigated by maximum likelihood random effects meta-regression using macros in SPSS (Lipsey & Wilson, 2001; Wilson, 2005). *β* describes this effect size. For the school failure analyses, positive and negative *β*s would indicate a stronger association for longer and shorter follow-up periods respectively. For *lower* school grades, these would indicate a stronger association for shorter and longer follow-up periods respectively. *Z* is presented as a significance test of the slope.

2.3. Results

In total, twenty-six studies were included in the meta-analysis (see Figure 2.1 for details). An overview of the studies is presented in Table 2.1. Ten studies measured school failure, fifteen measured school grades, and one measured both. Eighteen of the twenty-six studies were North American. Five studies included predominantly children, eleven early adolescents, nine late adolescents and one included both children and early adolescents. Follow-up periods ranged from 4 months to 120 months with a median of 30 months. Fifteen effect sizes were available for school failure: nine for depression, two for internalising problems and four for anxiety. Twenty effect sizes were available for school grades: eight for depression, six for internalising problems and six for anxiety. Sample sizes for these individual effect sizes ranged from 138 to 10,988 with a median of 424. In total, participant sample size was 24,353.

Table 2.1. Overview of characteristics of included studies

Study	School outcome	Emotional problem	*n*	Country	% male	Age range at start	Mean follow-up (months)	Emotional problems measure	Effect size (*r*)
Ansary et al. (2012)	Grades	Anxiety	595	USA	50	11-12[1]	24	CMAS-R	0.08
	Grades	Depression	595	USA	50	11-12[1]	24	CDI	0.04
Birchwood and Daley (2012)	Grades	Anxiety	324	UK	48	15-16[3]	6	HADS	-0.18
	Grades	Depression	324	UK	48	15-16[3]	6	HADS	-0.31
Capaldi and Stoolmiller (1999)	Failure	Depression	201	USA	100	11-14[2]	60	CEDS	0.29
Chalita et al. (2012)	Failure	Anxiety	237	Mexico	38	12-15[2]	12	SCARED[a]	0.10
	Failure	Depression	237	Mexico	38	12-15[2]	12	DSRS[a]	0.39
Chen et al. (2003)	Grades	Internalising	147	China	55	11-12[1]	24	CBCL	-0.07
Fergusson and Woodward (2002)	Failure	Depression	964	NZ	49	15-16[3]	60	DIS[a]	0.13
Flook, Repetti, and Ullman (2005)	Grades	Internalising	188	USA	50	10-11[1]	12	TRF	-0.30
Fredricks and Eccles (2008)	Grades	Depression	903	USA	49	12-13[2]	48	CDI[b]	-0.05
Fredricks and Eccles (2010)	Grades	Internalising	727	USA	49	13-14[2]	36	CBCL	-0.08
Giaconia, Reinherz, Paradis, Hauf, and Stashwick (2001)	Failure	Depression	344	USA	50	18[3]	36	DIS	0.19

Note: Internalising=internalising problems; Failure=school failure; Grades=school grades; NZ = New Zealand; CBCL=Child Behaviour Checklist; CEDS=Centre for Epidemiological Studies Depression Scale; CDI=Children's Depressive Inventory; CMAS-R=Revised Children's Manifest Anxiety Scale; DIS=Diagnostic Interview Schedule; DSRS=Depression Self Rating Scale; HADS=The Hospital Anxiety & Depression Scale; SCARED=The Screen for Child Anxiety Related Emotional Disorders; TRF=Teacher Report Form; [1]Coded as childhood [2]Coded as early adolescence [3]Coded as late adolescence [a]Reduced version [b]Based on a modified version of the scale.

Table 2.1. Overview of characteristics of included studies, continued

Study	School outcome	Emotional problem	*n*	Country	% male	Age range at start	Mean follow-up (months)	Emotional problems measure	Effect size (*r*)
Gore, Farrell, and Gordon (2001)	Grades	Depression	1036	USA	42	14-17[3]	72	CES-D	-0.10
Janosz et al. (2008)	Grades	Internalising	1104	Canada	52	11-15[2]	12	BAI	-0.06
Kandel and Davies (1986)	Failure	Depression	924	USA	45	15-17[3]	108	[ca]	0.11
Laursen, Pulkkinen, and Adams (2002)	Grades	Anxiety	181	Finland	53	8[1]	72	[d]	-0.19
Luthar (1995)	Grades	Anxiety	138	USA	45	14-16[2]	6	CMAS-R	0.11
	Grades	Depression	138	USA	45	14-16[2]	6	CDI	-0.04
	Grades	Internalising	138	USA	45	14-16[2]	6	YSR	0.10
McLeod and Kaiser (2004)	Failure	Depression	424	USA	n/a	14-16[2]	72	CES-D	0.03
	Failure	Internalising	424	USA	n/a	10-12[1]	120	CBCL[e]	0.18
Miech et al. (1999)	Failure	Anxiety	942	NZ	52	15[2]	72	DISC-C[a]	0.02
	Failure	Depression	942	NZ	52	15[2]	72	DISC-C[a]	0.08
Morin (2011)	Failure	Anxiety	989	Canada	n/a	12-13[2]	68	BAI	0.09
	Grades	Anxiety	592	Canada	n/a	12-13[2]	56	BAI	0.06
Needham, Crosnoe, and Muller (2004)	Grades	Depression	10988	USA	53	12-17[3]	12	CES-D	-0.15
Owens, Shippee, and Hensel (2008)	Grades	Depression	894	USA	46	14-15[2]	60	CDI	-0.08

Note: Internalising=internalising problems; Failure=school failure; Grades=school grades; n/a=not available; NZ = New Zealand; BAI=Becks Anxiety Inventory; CBCL=Child Behaviour Checklist; CDI=Children's Depressive Inventory; CES-D=Centre for Epidemiological Studies Depression Scale; CMAS-R=Revised Children's Manifest Anxiety Scale; DISC-C=Diagnostic Interview Schedule for Children; YSR=Youth Self-Report. [1]Coded as childhood [2]Coded as early adolescence [3]Coded as late adolescence [a]Reduced version [c]Symptom endorsement [d]A 6 item scale [e]Three items rated by teachers and peers.

Table 2.1. Overview of characteristics of included studies, continued

Study	School outcome	Emotional problem	*n*	Country	% male	Age range at start	Mean follow-up (months)	Emotional problems measure	Effect size (*r*)
Schwartz, Gorman, Nakamoto, and Toblin (2005)	Grades	Depression	199	USA	63	8-10[1]	12	CDI	-0.32
Sharma (1970)	Grades	Anxiety	700	India	52	15-17[3]	4	[f]	-0.05
Smokowski, Mann, Reynolds, and Fraser (2004)	Failure	Depression	801	USA	50	16[3]	72	[g]	0.11
Suldo, Thalji, and Ferron (2011)	Grades	Internalising	300	USA	37	11-14[2]	12	YSR	-0.16
van Oort et al. (2007)	Failure	Internalising	654	NL	49	11-15[2]	120	YSR	0.18
Vander Stoep, Weiss, McKnight, Beresford, and Cohen (2002)	Failure	Anxiety	174	USA	51	13-17[3]	30	DIS[a,h]	0.43
	Failure	Depression	174	USA	51	13-17[3]	30	DIS[a,h]	0.35

Note: Internalising=internalising problems; Failure=school failure; Grades=school grades; NL=The Netherlands; CDI=Children's Depressive Inventory; DIS=Diagnostic Interview Schedule; YSR=Youth Self-Report. [1]Coded as childhood [2]Coded as early adolescence [3]Coded as late adolescence [a]Reduced version [f]An anxiety scale in Hindi [g]3 items from a student survey [h]Dichotomous.

Results of the six meta-analyses are presented in Table 2.2, illustrating the number of studies, participants and effect sizes. It also provides information on heterogeneity, publication bias and moderation which are described in more detail below.

2.3.1. School failure

2.3.1.1. Depression.

Nine studies (*n*=5011) were included in the meta-analysis of depression and school failure (Table 2.2). The overall effect size was heterogeneous (*Q*=41.66, *p*<.001). Depression was associated with school failure, with an effect size of *r*=.17 (*p*<.001). There was no evidence of publication bias according to Rosenthal's failsafe number (fail-safe number=801, critical value=55). The Egger test showed a significant risk publication bias (intercept=5.49, *t*=3.28, *p*<.05), although a trim and fill analysis estimated that no studies were missing from the analysis. There were no studies examining childhood; subgroup analysis compared early and late adolescence found no difference in effect sizes (*Z*=-.41, *p*>.05; *r*=.19 and *r*=.16 respectively) (Table 2.3). Gender-specific analyses found no difference in effect sizes for boys and girls (*Z*=1.58, *p*>.05; *r*=.03 and *r* =.19 respectively) (Table 2.4). There was a stronger association between depression and school failure for shorter compared to longer follow-up periods (*β*=-.75, *p*<.01) (Table 2.5).

2.3.1.2. Internalising problems.

Two studies (*n*=1078) were included in the meta-analysis of internalising problems and school failure (Table 2.2). The overall effect size was not heterogeneous (*Q*=<.001, *p*>.05). Internalising problems were associated with school failure, yielding a meta-analysis effect size of *r*=.18 (*p*<.001). There was no evidence of publication bias according to Rosenthal's failsafe number (fail-safe number=51, critical

value=20). The Egger test and moderator analyses could not be calculated as there were too few studies.

2.3.1.3. Anxiety.

Four studies (*n*=2342) were included in the meta-analysis of anxiety and school failure (Table 2.2). The overall effect size was heterogeneous (*Q*=28.65, *p*<.001). Anxiety was associated with school failure, with an effect size of *r*=.15 (*p*<.05). There was no evidence of publication bias according to the Egger test (intercept=5.82, *t*=1.67, *p*>.05) or Rosenthal's failsafe number (fail-safe number=113, critical value=30). Insufficient data were available for subgroup analysis for age. Gender-specific analyses found larger effect sizes in girls than boys (*Z*=5.23, *p*<.001; *r* =.20 and *r*=-.03 respectively) (Table 2.4). Meta-regression results revealed no effect of follow-up period on the association between anxiety and school failure (*β*=-.47, *p*>.05) (Table 2.5).

Table 2.2. Effect sizes for school failure and school grades

			Main effects			Evidence from main effects		Evidence of moderation[a]		
	k (USA[b])	*n*	Effect size (*r*)	*Q*	I^2	Heterogeneity[c]	Publication bias[d]	Age	Gender	Follow-up period
School failure										
Depression	9 (6)	5011	.17***	41.66***	80.80	Yes	No[e]	No	No	Yes
Internalising	2 (1)	1078	.18***	<.001	<.001	No[f]	No	[g]	[g]	[g]
Anxiety	4 (1)	2342	.15*	28.65***	89.53	Yes	No	[g]	Yes	No
School grades										
Depression	8 (7)	15077	-.12***	52.01***	86.54	Yes	No	Yes[h]	No	No
Internalising	6 (4)	2604	-.10*	16.78**	70.20	Yes	No	No	No	No
Anxiety	6 (2)	2530	-.03	25.67***	80.52	Yes	No	Yes[h]	No	No

Note. *p<.05 **p<.01 ***p<.001. *k*=number of studies. [a] Based on moderator analyses details in Tables 3, 4 and 5. [b] Number of USA studies. [c] Indicated by significant *Q* and large I^2 (values of 25%, 50% and 75% have been suggested to be low, moderate and high, respectively Higgins, Thompson, Deeks, & Altman, 2003). [d] Indicated by Rosenthal's failsafe number and the Egger test. [e] Significant Egger test but trim and fill analysis estimated that no studies were missing from the analysis. [f] Indicated by Rosenthal's failsafe number only as insufficient data to perform the Egger test. [g] Insufficient data. [h] Significant different between early adolescence and late adolescence

Table 2.3. Results of age subgroup analyses

	Childhood (8-12 years)				Early adolescence (12-15 years)				Late adolescence (15-18 years)				Comparisons to early adolescence	
	k	*r*	*Q*	I^2	*k*	*r*	*Q*	I^2	*k*	*r*	*Q*	I^2	*Z* childhood	*Z* late adolescence
School failure														
Depression	[a]	[a]	[a]	[a]	4	.19*	29.99***	90.00	5	.16***	11.66*	65.70	[a]	-.41
School grades														
Depression	2	-.14	20.80***	95.19	3	-.06***	.55	<.01	3	-.17***	11.38***	82.42	.39	-2.37*
Internalising	2	-.19	4.81*	79.22	4	-.07†	6.58†	54.41	[a]	[a]	[a]	[a]	.02	[a]
Anxiety	2	-.05	10.10**	90.10	2	.07†	.34	<.01	2	-.11†	3.83†	73.86	.81	-2.31*

Note: †p<.10 *p<.05 **p<.01 ***p<.001. *k*=number of studies. [a] Insufficient data.

Table 2.4. Results of gender subgroup analyses

	Boys				Girls				Comparison
	k	*r*	*Q*	I^2	*k*	*r*	*Q*	I^2	*Z*
School Failure									
Depression	6	.03	38.80*	87.11	6	.19*	61.94***	91.93	1.58
Anxiety	3	-.03	1.39	<.01	3	.20***	.049	<.01	5.23***
School Grades									
Depression	6	-.06	61.97***	91.93	6	-.10	167.61***	97.02	-.25
Internalising	4	-.08	9.13*	67.13	4	-.19***	9.92*	69.77	-1.42
Anxiety	3	-.06	3.75	46.62	3	-.10†	4.73†	57.72	-.54

Note. †p<.10 *p<.05 **p<.01 ***p<.001. *k*=number of studies

Table 2.5. Results of follow-up period analyses

	k	*β*	*Z*	*Q*
School failure				
Depression	9	-.75	-3.43**	21.10**
Anxiety	4	-.47	-1.13	5.76
School grades				
Depression	8	.39	1.26	10.31
Internalising	6	-.01	-.01	7.19
Anxiety	6	-.12	-.31	6.27

Note. *p<.05 **p<.01 ***p<.001. *k*=number of studies

2.3.2. School grades

2.3.2.1. Depression.

Eight studies (*n*=15077) were included in the meta-analysis of depression and school grades (Table 2.2). The overall effect size was heterogeneous (*Q*=52.01, *p*<.001). The meta-analysis produced an effect size of *r*=-.12 (*p*<.001). Depression was associated with lower school grades. There was no evidence of publication bias according to the Egger test (intercept=.87, *t*=.55, *p*>.05) or Rosenthal's failsafe number (fail-safe number=318, critical value=50). Subgroup analysis found effect sizes in early adolescence to be smaller than in late adolescence (*Z*=-2.37, *p*<.05; *r*=-.17 and *r*=-.06 respectively) but no different from childhood (*Z*=.39, *p*>.05; childhood r=-.14) (Table 2.3). Gender-specific analyses found no difference in effect sizes for boys and girls (*Z*=-.25, *p*>.05; *r* =-.06 and *r*=-.10 respectively) (Table 2.4). Meta-regression results revealed no effect of follow-up period on the association between depression and school grades (*β*=.39, *p*>.05) (Table 2.5).

2.3.2.2. Internalising problems.

Six studies (*n*=2604) were included in the meta-analysis of internalising problems and school grades (Table 2.2). The overall effect size was heterogeneous (*Q*=16.78, *p*<.001). Internalising problems were associated with lower school grades, yielding

an effect size of r=-.10 (p<.05). There was no evidence of publication bias according to the Egger test (intercept=-.90 t=-.43, p>.05) or Rosenthal's failsafe number (fail-safe number=73, critical value=25). Subgroup analysis found no difference in effect sizes for childhood and early adolescence samples (Z=.02, p>.05; r=-.19 and r=-.07 respectively); there were no studies in late adolescence (Table 2.3). Gender-specific analyses found no difference in effect sizes for boys and girls (Z=-1.42, p>.05; r =-.08 and r=-.19 respectively) (Table 2.4). Meta-regression results revealed no effect of follow-up period on the association between internalising problems and school failure (β=-.01, p>.05) (Table 2.5).

2.3.2.3. Anxiety.

Six studies (n=2530) were included in the meta-analysis of anxiety and school grades (Table 2.2). The overall effect size was heterogeneous (Q=25.67, p<.001). Anxiety was not associated with lower school grades (r=-.03, p>.05). There was no evidence of publication bias according to the Egger test (intercept=-2.22. t=-.63, p>.05). Subgroup analysis found effect sizes in early adolescence to be smaller than in late adolescence (Z=-2.31, p<.05; r=.07 and r=-.11 respectively), but not different from childhood (Z=.81, p>.05; childhood r=-.05) (Table 2.3). Gender-specific analyses found no difference in effect sizes for boys and girls (Z=-.54, p>.05; r =-.06 and r=-.10 respectively) (Table 2.4). Meta-regression results revealed no effect of follow-up period on the association between anxiety and school failure (β=-.12, p>.05) (Table 2.5).

2.3.3. Country and diagnosis

Subgroup analyses comparing USA studies to other countries were only possible for three of the possible six comparisons due to insufficient data. Effect sizes did not vary for depression and school failure (Z=.29, p>.05) or for internalising problems and school grades (Z=-.76, p>.05). For anxiety and school grades, subgroup analyses

revealed a difference in direction of effect size between USA and non-USA samples (Z=2.46, p<.05; r=.08 and r=-.08 respectively), indicating an association between anxiety and better school grades in USA samples and worse school grades in non-USA studies.

Subgroup analyses comparing studies using a clinical diagnosis of emotional problem compared to others were only possible for one of the possible six comparisons due to insufficient studies using clinical diagnoses. For depression and school failure, effect sizes did not differ (Z=-1.32, p>.05).

2.3.4. Summary

There were small but significant effect sizes for all associations between emotional problems and school attainment (r range ±.10 to ±.18) with the exception of anxiety and school grades (r=-.03). There was significant heterogeneity between studies (Q range 16.78 to 52.01) which appears to be attributable to genuine differences between studies rather than within-study variance (I^2 range 70.20 to 89.53). The exception to this is for internalising problems and school failure where there was not significant heterogeneity (Q and I^2<.001), which is probably due to the small number of studies (2). Moderator analyses indicated that some of this heterogeneity may be due to age and gender, with reduced heterogeneity particularly notable for school grades during early adolescence and for anxiety by gender. Subgroup analyses revealed that associations between emotional problems and school grades were stronger in late than early adolescence, with no significant difference between early adolescence and childhood. For school failure, comparisons were limited to early and late adolescence for depression, for which effect sizes did not differ. Gender-specific analyses indicated larger effect sizes for girls than boys, although this was only significant for the association between anxiety and school failure.

2.4. Discussion

The meta-analysis described in the current chapter provides evidence of relationships between emotional problems and subsequent school attainment. Small but significant associations were found between depression, internalising problems, anxiety and school failure. For lower school grades, associations were found with higher depression and internalising problems. An association between lower school grades and anxiety was only found when investigating moderators, specifically, age and country. This is consistent with the suggestion that in some instances anxiety can have positive functions (Lucey & Reay, 2000), and highlights the importance of investigating effects of depression and anxiety separately and examining potential moderators. However, the evidence base is more robust for depression than anxiety with a greater number of studies and participants (17 studies, 20,064 participants versus 9 studies, 4,142 participants, respectively). Therefore conclusions regarding the association between anxiety and school attainment should be considered more speculative than those relating to depression. The moderators, age, gender, follow-up period and country, are discussed separately below.

2.4.1. Age

The majority of subgroup analyses by age were not significant and for many there were insufficient data to analyse, particularly for childhood data. However, analyses did indicate that depression and anxiety are more detrimental to school grades in later adolescence compared to early adolescence. One possible explanation is that a sub-sample of older adolescents may have had depressive and anxiety symptoms for a prolonged period of time, which is consistent with the considerable homotypic continuity found for depressive disorders (Moffitt et al., 2007; Rutter et al., 2006). Further, greater impairment in late adolescence may result from more severe symptoms being endorsed or from academic work being more demanding at this age.

2.4.2. Gender

Gender-specific analyses indicated larger effect sizes for girls than boys, although this was only significant for one of five comparisons, which indicated that anxiety was more strongly associated with school grades for girls than boys. One possible reason for gender differences may be differing trajectories of emotional problems across childhood and adolescence, with girls tending to show a greater increase in symptoms of anxiety across this period compared to boys (Hale, Raaijmakers, Muris, van Hoof, & Meeus, 2008; Hankin, 2009). Associations between baseline emotional problems and subsequent school attainment may therefore be intensified for girls relative to boys, due to an increase in symptoms over the follow-up period. Further, homotypic and heterotypic continuity of anxiety is stronger for girls than boys (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003) thus greater impairment may result from more prolonged symptoms in girls. Gender differences were not found for associations between depression and school attainment, this may reflect the fact that although prevalence of depression is greater in girls, some observations suggest worse functional outcomes for boys with depression (Diamantopoulou et al., 2011; Dunn & Goodyer, 2006).

2.4.3. Follow-up period

Meta-regression analyses found a significant moderation by follow-up period for one of five comparisons, with associations between depression and school failure (but not grades) stronger for shorter follow-up periods. Although it has been suggested that emotional problems may only have an influence on academic outcomes in the short-term (Masten et al., 2005), the results of this study are not consistent with this interpretation since no moderation was observed for school grades. Instead, it seems likely that this may be due to the fact that studies of school failure included longer

follow-up periods (12-108 months) than those for school grades (6-72 months). Depression may influence later school grades and school failure via different pathways. For example, predicting poor school grades through short-term reductions in concentration, and school failure through absences due to poor motivation. Follow-up period did not moderate the associations between anxiety and school attainment, although range was limited (12-72 months and 4-72 months for school failure and school grades respectively). Possible pathways to school failure for anxiety also include absences, for example due to school phobia (Bernstein & Garfinkel, 1986). No moderation effect was found for internalising problems and school grades, although again this is likely due to the limited range of follow-up periods (ranging 6 to 36 months). This could not be tested for school failure (both studies had the same follow-up period).

2.4.4. Country

Analyses comparing USA studies to non-USA studies found no differences for depression or internalising problems. However, there was some indication that anxiety was associated with better school grades in samples from the USA, and worse grades outside of the USA. This suggests that the school system and classroom environment in the USA may be better academically suited for pupils with anxiety, perhaps fostering the potential associations between anxiety and motivation (Eysenck, 1982; Lucey & Reay, 2000; Tallis & Eysenck, 1994). When looking at individual study effect sizes, two USA studies and one Canadian study showed an association between anxiety and better school grades (one significantly so), while studies conducted in the UK, Finland and India show associations between anxiety and lower school grades (two significantly so). This suggests that the distinction in findings for anxiety may vary between North America and Europe and Asia. One possible reason for differences between countries is school climate, which has been associated with pupil attainment (Battistich, Schaps, & Wilson, 2004; Thomas,

Sammons, Mortimore, & Smees, 1997). For example, international research has shown the USA to have one of the highest student ratings of teachers supportiveness for individual learning (OECD, 2004), which may help to create a more positive learning environment for anxious pupils.

2.4.4. Limitations and further research

There are a number of limitations of the meta-analysis described in this chapter which merit discussion. Firstly, results are limited by the studies included in the analysis, particularly with regard to the moderator analyses. For age, a limited number of studies meant that only eleven of the possible eighteen sub-group analyses could be conducted. For example, there were no studies of associations between depression or anxiety and school failure during childhood and no studies of internalising problems with either outcome in late adolescence. Studies which use multiple waves of assessment across childhood and adolescence are required for clarification of the developmental patterns of the associations between emotional problems and school attainment, and possible gender differences in these. Secondly, the generalisability of findings is limited by the large proportion (73%) of included studies being based in North America. Studies based in other countries with different educational systems are needed to see whether this pattern of results is confirmed, particularly given the different findings observed for anxiety and school grades when comparing USA to non-USA studies. Community studies using clinical diagnoses of emotional problems are also encouraged given that there were too few to adequately test whether this effected associations.

Thirdly, prior school attainment was not controlled for in the meta-analyses as only 10 of the 26 studies included associations controlling for a baseline measure of school attainment, and these measures were too varied to allow meta-analysis. While the analyses provide evidence for a longitudinal association between emotional problems and subsequent school attainment, this does not necessarily suggest that

changes in emotional problems lead to changes in school attainment. The possibility cannot be ruled out that these longitudinal associations are a combination of cross-sectional associations and high stability in emotional problems and school attainment. Nevertheless, these findings do show that emotional problems are associated with poor school attainment later in life, and therefore highlight the importance of identifying pupils with emotional problems in order to interrupt a developmental sequence where emotional problems may result in other difficulties (Petrides, Frederickson, & Furnham, 2004). Other potential confounders such as childhood socioeconomic status and potentially important co-occurring problems such as behavioural problems were also not addressed, due to the limited number of studies that controlled for such factors. It is possible that covariance between emotional problems and such factors could influence the association between emotional problems and subsequent school attainment, which will be addressed in chapter 4.

Finally, it is beyond the scope of this meta-analysis to provide evidence for the possible pathways through which emotional problems may lead to low school attainment. Now that this association has been established, important future directions include examining potential moderator and mediator variables, using a prospective longitudinal design. Subsequent chapters explore these areas of research, following a description of the samples and measures used, which is presented in the next chapter. A better understanding of these pathways may aid the development of effective school-based intervention programmes aimed at improving emotional and academic outcomes.

2.4.5. Conclusion

In conclusion, the meta-analysis described in this chapter found emotional problems to be associated with later poor school attainment. Findings were more consistent for depression than anxiety. Associations with school grades were stronger in late adolescence than early adolescence and associations between anxiety and school

failure were stronger in girls. There was some indication that associations may also differ by country for anxiety and by follow-up period for depression. The findings highlight the need to identify pupils with emotional problems early and to provide assistance aimed at improving school attainment as well as mental health. Longitudinal research spanning childhood to adolescence, using multiple measures and multiple time-points, is needed for a clearer understanding of the impact of emotional problems on school outcomes. Further, investigation into possible pathways between emotional problems and school attainment would help to better understand these associations.

CHAPTER 3: Samples and measures

This chapter describes the samples and measures used in chapters 4, 5, 6 and 7. Four samples are included in this thesis. The main sample that I analyse is from the School Transition & Adjustment Research Study (STARS). I oversaw the running of the longitudinal project, recruited the schools and managed and participated in data collection. Data from STARS is analysed in chapters 5, 6 and 7. Prior to this, a pilot study was conducted, for which I collected data as part of a larger group. Chapter 4 analyses data from this sample, which I worked on while running STARS. Chapters 6 and 7 use additional, well established datasets, which I used as resources to replicate the findings found in STARS.

3.1. The pilot study

The analyses in chapter 4 use data from a pilot study (of the School Transition and Adjustment Research Study, see below). The pilot study was a longitudinal study focussing on children's psychological adjustment in the first year of secondary school. Participants were pupils from two mixed, non-selective secondary schools in Buckinghamshire, UK. In-class questionnaire data were collected in two phases: during the autumn term of year 7 (start of year 7 at age 11 years) and roughly 6 months later in the summer term of year 7 (end of year 7). In the first questionnaire assessment, there were 262 pupils (143 boys), with a mean age of 11.25 years (SD=0.44). At the second assessment, there were 202 reassessed pupils (113 boys), with a mean age of 11.78 years (SD=0.74). Reasons for non-participation at time 2 were pupil absence (n=27), opting out (n=14), and leaving the school (n=17). Students' demographic information was not available so these characteristics could not be investigated for selective drop-out, as is for the study described below. Instead, evidence of selective drop-out based on specific study variables is discussed in

chapter 4. The study protocol was reviewed and approved by the university ethics committee.

3.2. The School Transition and Adjustment Research Study (STARS)

The analyses in chapters 5, 6 and 7 use data from a school based sample of children and adolescence collected from a larger study: The School Transition and Adjustment Research Study (STARS). STARS is a three stage longitudinal study focussing on children's psychological adjustment in the first year of secondary school.

3.2.1. Data collection

3.2.1.1. School recruitment.

STARS aimed to recruit 2000 pupils from mixed, non-selective secondary schools in South-East England, UK. In October/November 2011, 70 schools were contacted regarding participation in the study. Schools were randomly selected based on suitable location (N=60) or were identified based on previous contact with the research team or other educational psychologists known to the team (N=10). Schools that wished to participate in the study (N=17) were asked to complete a questionnaire asking how many pupils they expected to start in September 2012 and about the demographics of their pupils. Specifically, schools were asked what percentage of pupils received free schools meals (an index of deprivation), did not have English as their first language, had Special Educational Needs, and what the ethnic composition of pupils was. Based on this demographic information and the schools' pupil academic achievement at age 16 years (indicated by school GCSE results available online at www.education.gov.uk), 10 schools were selected to be broadly representative of South-East England, with a predicted intake of around 2000 pupils in September 2012.

3.2.1.2. Procedure.

Questionnaire data was collected at three stages of the study and 6-month intervals. The procedure for collecting questionnaire data is shown in Figure 3.1. For the first stage of the study, parents of year 6 pupils (aged 10-11 years old) who were due to attend one of the 10 participating secondary schools were sent postal packs in May 2012, containing questionnaires for pupils and parents. Parents were given the opportunity to opt their children out of the study and informed pupil assent was obtained. Overall pupil response rate was 35% (total 750). For the second and third stages of the study, questionnaire data from pupils was collected via in-school assessments in November 2012 and June 2013. Parents were informed of the data collection by post and were given the opportunity to opt their children out of the study. Pupil completion rates were 87% and 85% for the second and third stage respectively (total 1712 and 1653 respectively). Details of overall participation can be seen in Figure 3.2.

At all stages parents were sent postal questionnaires and at the third stage were additionally given the option to complete the questionnaire at school parents' evenings. Parental response for the first, second and third stage was 34%, 28% and 48% respectively (total 745, 544 and 939 respectively). One of the ten schools did not participate in the second and third stages of the study due to a change in senior management; pupils and parents from this school who had participated in the first stage of the study were sent postal questionnaires as per the first stage. At each stage, when parental permission was given, teachers were given questionnaires to complete. For the first stage of the study, primary school teachers were written to if parents gave details of their child's primary school and teacher. At the second and third stage, this involved teachers from the recruited secondary schools; response rate was 66%, 75% and 85% for the first, second and third stages respectively (total 505, 1372 and 1594 respectively). School records data were also collected when

parental permission was given. The study protocol was reviewed and approved by the university ethics committee.

Figure 3.1. STARS questionnaire data collection

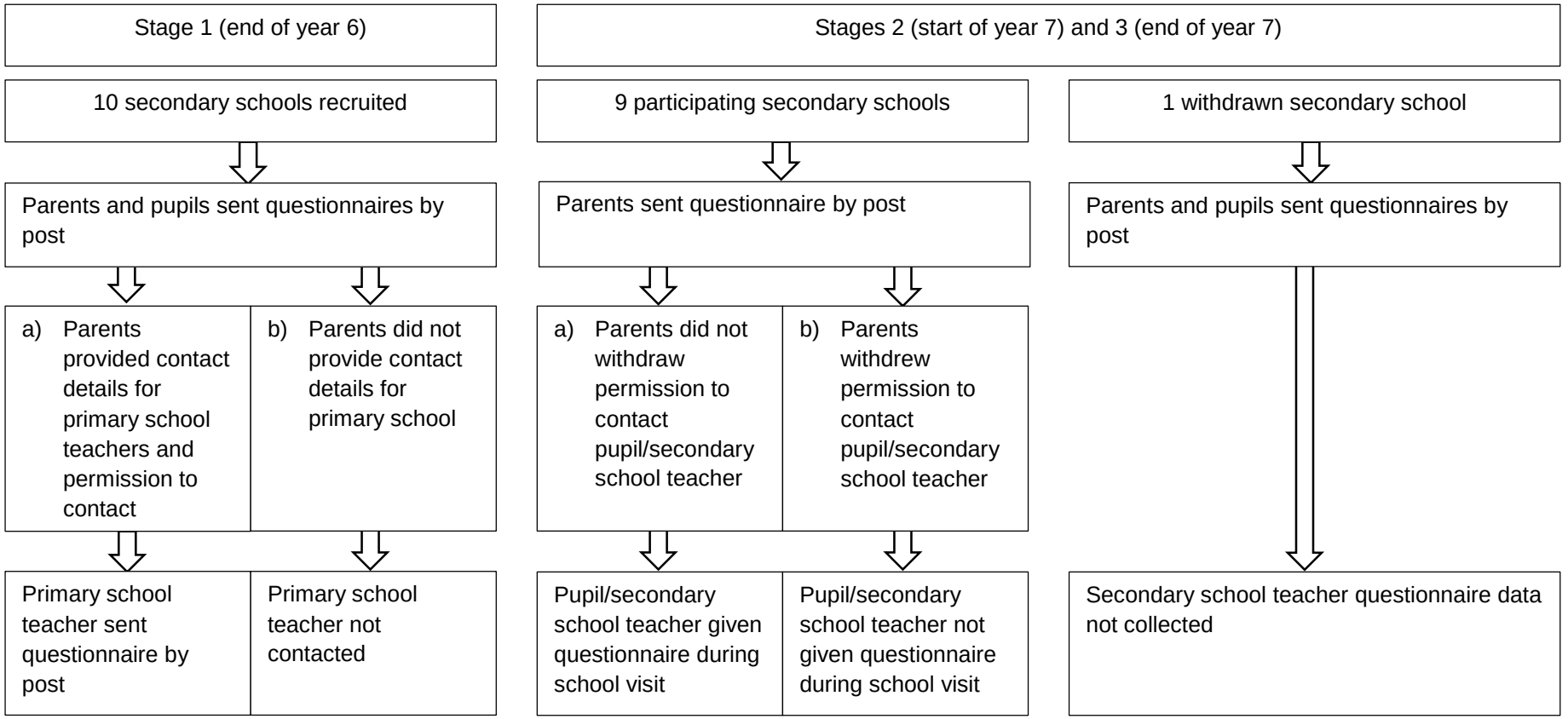
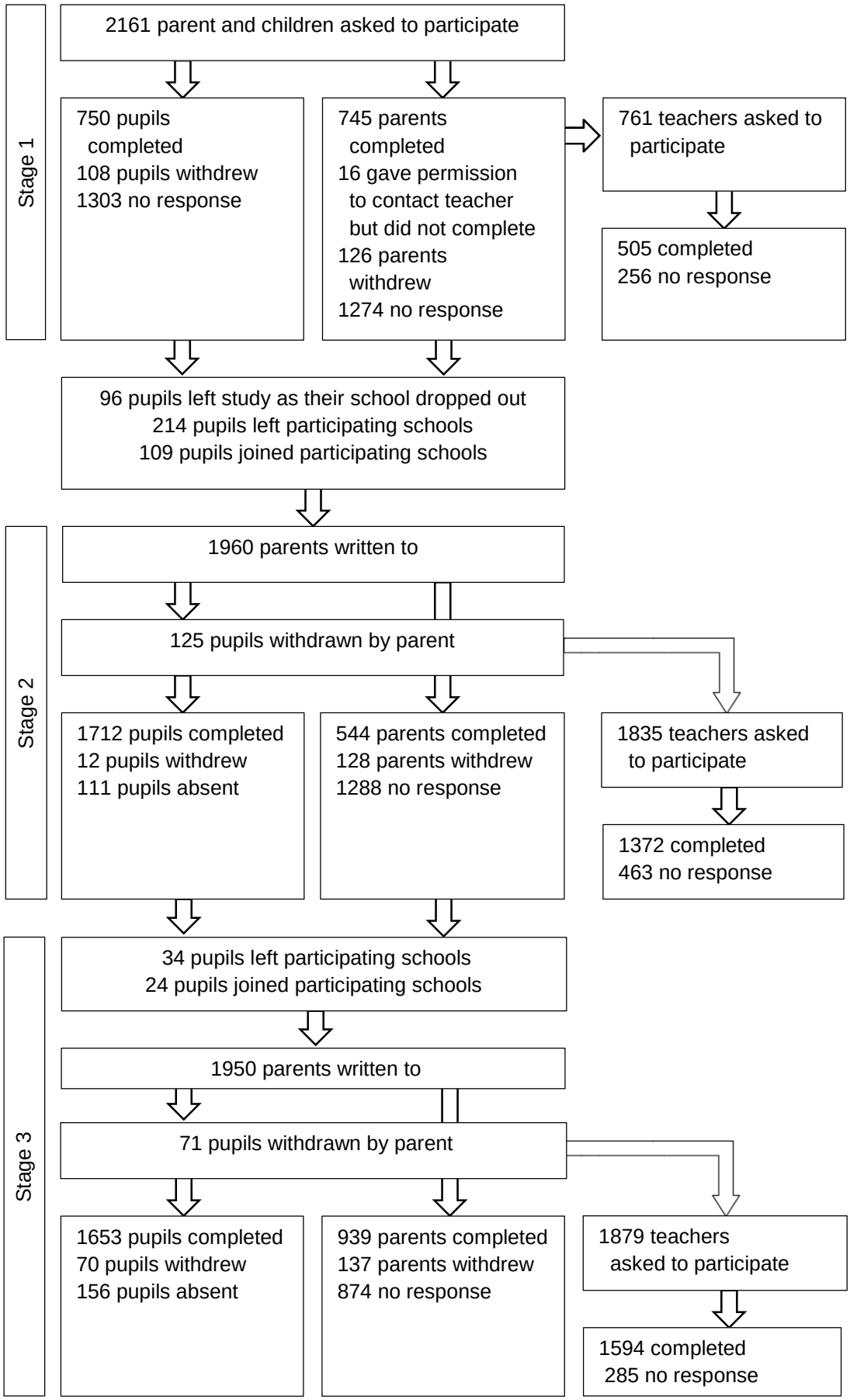


Figure 3.2. STARS participation



3.2.2. Sample characteristics

Data from school records were available on pupil demographics including gender, free schools meals (FSM) eligibility, whether the pupil had a special educational needs (SEN) statement, had English as an additional language (EAL) and was from a Black and Minority Ethnic (BME) group, as well as Maths and English attainment measured by Key Stage 2 level. These sample characteristics, are presented in Table 3.1, as well as the national averages (Department for Education, 2012a, 2012b, 2012c). This information was available for the majority of potential participants (71-99.9% across variables and stages), allowing comparison between participants and non-participants at each stage, also presented in Table 3.1.

At all stages participants included roughly equal numbers of boys and girls (51-53% male). At stages 2 and 3, rates of FSM eligibility and SEN statement were comparable to the National average, although these were somewhat lower at stage 1. Rates of EAL and BME were somewhat higher than the national average, which reflects the inclusion of London schools which is the most ethnically diverse region in England and Wales (ONS, 2012). The proportion of pupils achieving the recommended key stage 2 level 4 in Maths and English were similar to the national average (STARS 88-89% compared to 84-85% national average).

Comparing participants to non-participants, where data was collected via a postal mail-out, participants at stage 1 were more likely than those who did not participate to be female and not eligible for FSM ($\chi^2(1)=4.33$ and 4.54 respectively; critical value = 3.84 for all related analyses) but did not differ from non-participants in terms of the proportion with SEN, EAL, BME, or achieving the recommended level in Maths or English ($\chi^2(1)<3.84$). At stage 2, where data was collected via in-school assessments, participants did not differ from those who did not participate in any of these measures ($\chi^2(1)<3.84$). Finally, at stage 3, where data was also collected via in-school assessments, participants did not differ from non- participants in gender, FSM eligibility, EAL or BME ($\chi^2(1)<3.84$). However, they were less likely to have SEN

and more likely to have achieved the recommended attainment levels in Maths and English ($\chi^2(1)$=11.66, 11.71 and 12.37 respectively). This was due to a higher proportion of pupils with SEN and not achieving key stage 2 level 4 in Maths and English being absent from school at the assessment ($\chi^2(1)$ =7.46, 5.02 and 5.03 for SEN, Maths and English respectively) rather than the parent withdrawing the child from the study ($\chi^2(1)$= 2.42, 3.63 and 3.12 for SEN, Maths and English respectively) or the child withdrawing themselves ($\chi^2(1)$=.88, 1.76 and 2.70 for SEN, Maths and English respectively). Thus it is possible that some students with SEN and lower attainment had started avoiding school or truanting at this stage.

The analyses in chapters 6 and 7 primarily use data from stage 2 of the study, because (a) this stage included the highest number of pupil questionnaires; (b) this stage showed no response bias on the pupil demographics described above; (c) this age represents the onset of adolescence, a period of increased risk for depressive symptoms (Thapar et al., 2012). Data from other stages of the study are used where specific measures were not available at stage 2. In chapter 5, where mediation analyses were run, emotional problems at stage 1 were used. This was to allow temporal precedence between the predictor variable (emotional problems), the mediator (measured at stage 2) and the dependent variable (measured at stage 3) (as recommended by Cole & Maxwell, 2003). Emotional problems at stage 2 were used as missing data correlates in this for these analyses (see section 5.2.2.1 for further details). Details of the measures used are given in section 3.4.

Table 3.1. STARS (School Transition & Adjustment Research Study) sample characteristics (%)

	2012	Stage 1 participation (35%)			Stage 2 participation (83%)			Stage 3 participation (81%)		
	National average	Yes (N=750)	No (N=1411)	Difference (χ^2 (*df*=1))	Yes (N=1712)	No (N=248)	Difference (χ^2 (*df*=1))	Yes (N=1653)	No (N=297)	Difference (χ^2 (*df*=1))
Male gender		50.7	55.3	4.33*	53.3	55.9	.78	52.8	55.6	.68
Free schools meals (FSM) eligibility	16	13.5	17.4	4.51*	15.7	22.1	2.47	16.0	17.3	.21
Special Educational Needs (SEN) statement	1.9	1.5	2.6	2.24	2.2	3.5	.63	1.8	5.8	11.66**
English as an Additional Language (EAL)	12.9	28.3	28.5	<.001	28.6	30.2	.11	28.3	28.3	0
Black and Minority Ethnic (BME)	23.2	38.0	41.3	1.75	40.0	44.6	.68	40.2	36.8	.82
Maths attainment level 4+	84	89.4	87.7	1.14	88.2	81.0	3.65	88.9	80.1	11.71**
English attainment level 4+	85	88.5	87.2	.64	87.5	82.3	1.85	88.4	79.1	12.37**

Note. Maths/English attainment = key stage 2. *p<.05 **p<.01 ***p<.001

3.3. Replication samples

In addition to using data from STARS, in chapters 6 and 7 data were also used from a twin dataset (chapter 6) and a high-risk dataset (chapter 7) to replicate findings (both chapters) and to investigate genetic aetiology (chapter 6).

3.3.1. The twin sample

The twin sample was an existing, well-established dataset from The Greater Manchester Twin Register (Thapar, Harrington, Ross, & McGuffin, 2000), established in 1996. The register was created through the Community Child Health Databases for 9 health districts in Greater Manchester and Lancashire, England, based on all twins born between 1980 and 1991. Originally 3089 twin pairs were identified, of whom 243 were excluded because: a) it was inappropriate to contact the family (e.g. local authority care, 19 pairs); b) the families had emigrated (12 pairs); c) one of the twins had died (9 pairs), or; d) because the family could not be traced (203 pairs). The remaining 2846 pairs, traced via the UK National Health Service Framework, were sent parental postal questionnaires; parental response rate was 73% (total 2082 pairs). Where parental consent was given teachers were also sent postal questionnaires; response rate was 91.5% (total 1470 pairs). In 2000, when twins were aged 11-18 years old, parents were mailed questionnaires, including additional participants born in Wales (The Cardiff Study of All Wales and North West of England Twins (CaStANET): van den Bree et al., 2007). Overall response rate was 65% (Rice, Harold, & Thapar, 2002b), of which 1023 (70%) twin pairs were from the original Greater Manchester Twin Register. Previous work has reported the social class make-up of the twins' families to be similar to those expected from Greater Manchester (Rice et al., 2002b).

In chapter 6, twin pairs were included if there was complete data on depressive symptoms for both twins (1003 pairs). Parent reports on a twin similarity questionnaire were used to assign zygosity, which previous work has found to be over

90% accurate compared to blood typing (Cohen, Dibble, Grawe, & Pollin, 1975; a similar questionnaire has been found to be 95% accurate against DNA assignment; Price et al., 2000). Where incomplete responses did not allow zygosity assignment, responses from the previous questionnaires (collected in 1996) were used (Thapar et al., 2000). The sample consisted of 424 monozygotic (MZ) twin pairs and 579 dizygotic (DZ) twin pairs.

3.3.2. The high-risk sample

The high-risk sample was another existing, well-established dataset from The Early Prediction of Adolescent Depression Study (EPAD) which consisted of recurrently depressed parents and their offspring (Mars et al., 2012). Parents were confirmed to have had at least 2 previous episodes of DSM-IV major depressive disorder by interview using the Schedules for Clinical Assessment in Neuropsychiatry (SCAN; Wing et al., 1990). Parents were recruited from general practices in South Wales UK (78%), from a previous database of adults with recurrent unipolar depression (19%) and from advertisements in primary care (3%). Following initial exclusions due to the parent having had a previous bipolar or psychotic diagnosis, not being biologically related to the child, or the adolescent had an IQ<50, 469 families were recruited to take part. Full assessments were carried out for 337 families: 116 families changed their mind prior to assessment, 11 assessments were incomplete, 2 assessments were not completed due to bipolar diagnosis (with personality disorder in 1 case), 2 withdrew post assessment due to bipolar diagnosis and 1 child was unable to complete the assessment due to learning disabilities. Of the 337 index parents, 24% met the DSM-IV criteria for a major depressive disorder at the time of the initial assessment (American Psychiatric Association, 1994). Previous work has reported that the family composition was similar to those found for the UK (Mars et al., 2012), but that prevalence rates of children's psychiatric disorders were higher than in the

general population (23.2% compared to 11.5%; Green et al., 2005; Sellers et al., 2013).

In chapter 5, 335 of the 337 EPAD families were included in the analyses because 2 families were later excluded as the affected parent was re-diagnosed with bipolar disorder. This sample included 139 boys and 196 girls aged 9-17 years old; 313 of the index parents were mothers and 22 were fathers. Data used was from the first stage of the three-stage study when necessary variables were available.

3.4. Measures

Details of the measures used in chapters 4-7 are given below; an overview of the main study variables used in these chapters is presented in Table 3.2.

3.4.1. Depression (chapters 4-7)

This thesis includes data from multiple datasets, which included a number of different raters on various measures. It was therefore important to consider which rater to use where multiple raters were available. Both child (self-) and parent-reports of depressive symptoms have been found to provide clinically useful information, although self-reports may be more sensitive for certain depressive symptoms, such as suicide ideation (Rice, Lifford, Thomas, & Thapar, 2007). Generally, self-reports of emotional problems were used. This was particularly appropriate for STARS, where there was considerably more self- than parent-report data (stage 2 pupil response rate 87% compared to 28% for parents) and the pilot study where only self-report data on emotional problems were available. In chapter 6, the twin sample was used to investigate previously reported heterogeneity in heritability estimates for parent-rated depressive symptoms (Rice et al., 2002b). Parent-reported depressive symptoms were therefore used for this sample to allow comparability with previous research. For the high-risk sample, included as a replication sample in chapter 7, unlike the other sample used in this thesis, interview data on depressive symptoms were available,

which was used to allow greater generalisability to a clinical diagnosis of depression. For this sample, combined parent-child reports were used as this is the established approach used for this sample and is most akin to what would be done clinically (Mars et al., 2012).

In the pilot study and STARS, depressive symptoms were measured using the Short Mood and Feeling Questionnaire (SMFQ; Angold, Costello, Messer, & Pickles, 1995). The SMFQ (Angold et al., 1995) consists of 13 items designed to cover core symptoms of DSM-III-R depression (American Psychiatric Association, 1987) for children and adolescents. Items are presented in Table 3.3. The questionnaire asks about symptoms during the past 3-months on a 3-point scale: true (2); sometimes true (1) and not true (0). Items are summed to produce a total score (possible range 0-26). Internal reliability was α=.84 and α=.90 the pilot study at time 1 and time 2 respectively and α=.89 for STARS, which is comparable to that reported by Angold et al. (1995) of α=.85. A clinical cut point of 11 has been proposed for this measure (Angold, Erkanli, Silberg, Eaves, & Costello, 2002).

In the twin sample, depressive symptoms were measured using the long version of the Moods and Feelings Questionnaire (MFQ; Costello & Angold, 1988). The scales consists of 34 items designed to cover core symptoms of DSM-III-R depression (American Psychiatric Association, 1987) for children and adolescents. Items are also presented in Table 3.3. As with the SMFQ, items ask about symptoms during the past 3-months on a 3-point scale: true (2); sometimes true (1) and not true (0), summed to produce a total score. Internal consistency was α=.93, comparable to that reported by Angold et al. (1995) of α=.90. A clinical cut-point of 21 has been suggested for the MFQ (Wood, Kroll, Moore, & Harrington, 1995).

In the high-risk sample, depressive symptoms were measured using parent and child reports from the Child and Adolescent Psychiatric Assessment (CAPA; Angold & Costello, 2000). The CAPA is a semi-structured diagnostic interview used to assess depressive disorders, as well as other psychiatric disorders. The total

number of DSM-IV major depressive symptoms assessed are presented in Table 3.3 (American Psychiatric Association, 1994). Score were based on combined scores, whereby a symptom was coded as present if endorsed by either child or parent (possible range 0-9). For analyses focusing on Major Depressive Disorder (MDD), adolescents were classified as affected if this diagnosis was present at any of the 3 assessment stages (follow-up period 29 months, SD=5.39) of the EPAD study (7 boys and 30 girls met this criteria).

Table 3.2. Main thesis variables

	Pilot sample Chapter 4	STARS sample Chapters 5, 6 and 7	Twin sample Chapter 6	High-risk sample Chapter 7
Depressive symptoms	Self-report SMFQ (Angold et al., 1995)	Self-report SMFQ (Angold et al., 1995)	Parent-report long MFQ (Costello & Angold, 1988)	Self- & parent-report CAPA (Angold & Costello, 2000).
Anxiety symptoms	Self-report SCARED (Birmaher et al., 1997)	Self-report SCARED (Birmaher et al., 1997)	n/a	n/a
Conduct problems	Self-report SDQ (Goodman, 2001) with peer-reported behaviours	Self- and teacher-report SDQ (Goodman, 2001)	Parent- and teacher-report Rutter A/B scales (Rutter, Tizard, & Whitmore, 1970)	n/a
Academic attainment	National tests (time 1); Teacher assessment scores (time 2)	Teacher assessment scores	n/a	n/a
Cognitive ability	n/a	CAT3 (Lohman et al., 2001)	WISC-IV (Wechsler, 2003)	
Stress	n/a	Self-report Life Events Checklist (Johnson & McCutcheon, 1980)	Parent-report Life Events Checklist (Johnson & McCutcheon, 1980)	Self- & parent-report Life Events Checklist (Johnson & McCutcheon, 1980)

Note. SMFQ = Short Mood and Feeling Questionnaire; MFQ = Mood and Feeling Questionnaire; CAPA = Child and Adolescent Psychiatric Assessment; SCARED = Screen for Child Anxiety Related Emotional Disorders; SDQ = Strengths and Difficulties Questionnaire; CAT3 = Cognitive Abilities Test; WISC-IV = Wechsler Intelligence Scale for Children.

Table 3.3. Depressive symptoms

Short Moods and Feelings Questionnaire (self-reported version) (Angold et al., 1995)
1. I felt miserable or unhappy
2. I didn't enjoy anything at all
3. I felt so tired I just sat around and did nothing
4. I was very restless
5. I felt I was no good anymore
6. I cried a lot
7. I found it hard to think properly or concentrate
8. I hated myself
9. I felt I was a bad person
10. I felt lonely
11. I thought nobody really loved me
12. I thought I could never be as good as other kids
13. I did everything wrong
Moods and Feelings Questionnaire additional items (parent-reported version) (Costello & Angold, 1988)
1. Was less hungry than usual
2. Ate more than usual
3. Was moving and walking more slowly than usual
4. Blamed him/herself for things that weren't his/her fault
5. It was hard for him/her to make up his/her mind
6. Felt grumpy and cross with his/her parents
7. Felt like talking less than usual
8. Was talking more slowly than usual
9. Thought there was nothing good for him/her in the future
10. Thought that life wasn't worth living
11. Thought about death or dying
12. Thought his/her family would be better off without him/her
13. Thought about killing him/herself
14. Didn't want to see his/her friends
15. Thought bad things would happen to him/her
16. Thought s/he looked ugly
17. Worried about aches and pains
18. Didn't have any fun at school
19. Didn't sleep as well as s/he usually sleeps
20. Slept a lot more than usual
21. Wasn't as happy as usual, even when s/he was praised or rewarded

Child and Adolescent Psychiatric Assessment (Angold & Costello, 2000)	
1.	Low mood or irritability
2.	Loss of interest
3.	Change in appetite
4.	Sleep disturbance
5.	Agitation or retardation
6.	Loss of energy
7.	Worthlessness or guilt
8.	Inefficient thinking/indecisiveness
9.	Suicidal thoughts/plans/behaviour

3.4.2. Anxiety (chapters 4 and 5)

In the pilot study and STARS, general anxiety and school anxiety were measured using self-report subscales of the Screen for Child Anxiety Related Emotional Disorders (Birmaher et al., 1997) consisting of 9 general anxiety items (e.g. 'I worry about people liking me') and 4 school anxiety items (e.g. 'I get headaches when I am at school') on a 3-point scale from not true (0) to true (2), summed to give a total score (possible range 0-18 and 0-8 respectively). Internal reliability in the pilot for general anxiety was α= .86 and α= .92 for time 1 and time 2 respectively; for school anxiety internal reliability was α= .69 and α= .75 for time 1 and time 2 respectively. Internal reliability for general anxiety in STARS was α= .88.

3.4.3. Conduct problems (chapters 4, 5 and 6)

Conduct problems were measured using the Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001) and Rutter A and B scales (Rutter et al., 1970). The measures are very similar, highly correlated and cover the key domains of conduct problems (Goodman, 1997). The 5-item Strength and Difficulties Questionnaire conduct problems subscale consists of 5 items (e.g. 'I get very angry and often lose my temper'). The Rutter scales include 6 antisocial behavioural items covering stealing, destructiveness, fighting, disobedience, lying and bullying. Both measures are on a 3-point scale from not true/doesn't apply (0) to true/certainly applies (2), summed to give a total score (possible ranges: SDQ 0-10; Rutter 0-12).

The ratings of two informants were combined for conduct problems as it had been suggested that multiple informants are required for a comprehensive assessment of child conduct problems, with additional informants providing additional information (Loeber, Green, Lahey, & Stouthamer-Loeber, 1989). Combining self/parent reports with teacher/school-peers reports aimed to capture conduct problems at both home and school. In STARS conduct problems were measured using self- and teacher-reports of the SDQ (see above; Goodman, 2001) and in the

twin sample conduct problems were measured using parent- and teacher-reports of Rutter A and B scales respectively (Rutter et al., 1970). The highest of the two raters' score for each item was used to calculate the total score. Internal consistency was α=.65 in STARS and α=.82 in the twin sample, which are slightly superior to those reported by Goodman (2001) for the self-reported SDQ conduct scale of α=.60.

In the pilot sample conduct problems were measured using self-reports of the SDQ (Goodman, 2001). However, initial internal consistency values were low (time 1 α=.50), therefore two peer-reported measures were also included. Peer nominations using the Guess Who assessment measure used by Coie and Dodge (1988), adapted to allow unlimited nominations. Pupils identified who, from a list of classmates, fitted behavioural descriptors Bully ('this person often picks on other people or hits them or teases them or does other nasty things to them for no good reason') and Disruptive ('this person has a way of upsetting everything when he or she gets in a group. They don't share and try to get everyone to do things their way'). The proportion of classmates nominating each child as fitting the descriptors was the outcome (Frederickson & Graham, 1999). Summing the standardised seven items provided the total conduct problem score. Internal validity was α=63 at time 1 and α=.72 at time 2.

3.4.4. Academic attainment (chapters 4, 5 and 6)

In the pilot sample, attainment data at time 1 were scores on the National Tests of English, Maths and Science, which are administered in schools in England at the end of the last year in primary school (age 10-11). At time 2, the attainment data collected were the Teacher Assessment scores for English, Maths and Science which schools in England are required to obtain for each pupil and report to parents. Scores for time 2 were on National Curriculum attainment levels where each level has three subdivisions: (a, b, c, where a is the highest (has reached the top of the level) and c the lowest (has started working at that level). For analysis, these levels were

transformed into a continuous scale where levels were transformed to integers so that 2c = 1, 2b = 2… 7c = 16. Standardised scores for English, Maths and Science were summed to give a total current attainment score. (Internal reliability α= .83 time 1; α= .77 time 2). Attainment data at times 1 and 2 were available for 86% and 88% of pupils respectively. Missing attainment data was due to pupils sitting tests out of the area (Time 1, N=37) and pupils leaving the school (Time 2, N=32).

In STARS academic attainment was also measured by Teacher Assessment scores for English, Maths and Science at the third stage of the STARS study. For 7 of the 9 participating schools at stages 2 and 3, these were National Curriculum levels (N=1362), where each level has three subdivisions (see above). For 2 schools attainment was measured by International Middle Years levels (N=197) which are scored pass/credit/merit/distinction. Levels for each subject were transformed into a continuous score, standardised by school to allow the use of both curriculum scores, and summed to give a total attainment score, internal consistency was α=.85.

3.4.5. Cognitive ability (chapter 5, 6 and 7)

Two measures of cognitive ability were used: the Cognitive Abilities Test (CAT3; Lohman et al., 2001) in STARS and the Wechsler Intelligence Scale for Children (WISC-IV; Wechsler, 2003) in the high risk sample. The CAT3 is a standardised assessment which measures verbal reasoning, quantitative reasoning and non-verbal reasoning. The three scores were averaged to produce a cognitive ability score with higher scores indicating higher ability. CAT scores have been found to be highly reliable in terms of test-retest correlations and internal consistency estimates, and have strong predictive validity with later school performance (Strand, 2006). The WISC-IV consists of 10 subscales designed to measure verbal comprehension, perceptual reasoning, working memory and processing speed. The scale has also shown high reliability and validity (WISC-IV; Wechsler, 2003).

3.4.6. Stressful life events (chapters 5, 6 and 7)

Stress was measured in STARS, the twin sample and EPAD using versions of the Life Events Checklist (Johnson & McCutcheon, 1980), which asks about stressful life events which have occurred during the past year. As shown in Table 3.4, in chapters 5 and 6, the checklist consisted of 19 binary items, measured in STARS and in the twin-sample. STARS life events data at stage 3 were used in these chapters as they investigate future and current stressful life events respectively (relative to depressive symptoms at stages 1 and 2 respectively). In chapter 7, 19 predominantly overlapping items that were measured in STARS at stage 1 and in the high-risk sample were included. STARS life events data at stage 1 were used in this chapter as it investigated previous stressful life events (relative to depressive symptoms at stage 2). Items were summed to give a total score (possible range 0-19; higher scores indicating more stressful life events). Life events were measured using child report for STARS, parent report for the twin sample and combined parent and child reports (coded as present if endorsed by either rater) for the high-risk sample.

As outlined in the introductory chapter, stressful life events can be partly dependent on behaviour, (e.g. getting into a fight) while others cannot (e.g. death of a grandparent (Kendler & Baker, 2007)). Life events which could not be the result of characteristics of the participant (e.g. serious illness in a family member) were coded as behaviour-independent (Table 3.4), for the purposes of chapter 7. Life events which would simultaneously have occurred to siblings within the same family (e.g. death of a grandparent) were coded as shared life-events in the twin sample, for the purposes of chapter 6. Minor differences between study questionnaires were present whereby a) the *serious illness to you* item included *serious injury* in the twin sample but not the high-risk sample; b) the twin sample included the item *Failing to be picked for a school or club team, band or orchestra* whereas the high-risk sample included the item *being bullied*. STARS stage 1 and 3 were coded in-line with the appropriate replication sample (the high-risk and twin samples respectively).

Table 3.4. Stressful life events

Life Events Checklist (amended; Johnson & McCutcheon, 1980)
1. Serious illness in family member*
2. Increased quarrelling between parents
3. Death of parent/brother/sister*[S]
4. Death of grandparent*[S]
5. Death of close friend*
6. Serious illness/injury to close friend*
7. Parent in trouble with police*[S]
8. Parent going to prison*[S]
9. Doing badly in an exam
10. Parents being less interested/loving
11. Parents nagging/picking on you more
12. Doing badly in (school) work
13. Close friend moves away*
14. Losing a close friend through arguments
15. Death of a pet*
16. Mother losing job*[S]
17. Father losing job*[S]
18. Serious illness(/injury[†]) to you*
19. a) Failing to be picked for a school or club team, band or orchestra[†]
19. b) Being bullied[#]

Note. [*]Behaviour-independent life events (chapter 7) [S]Shared life event (chapter 6, twin sample) [†]Chapters 5 and 6 [#]Chapter 7.

3.4.7. Chapter specific variables

3.4.7.1. Concentration problems (chapter 5)

Concentration problems were measured based the sum of standardised scores from single items from (a) the Short Mood and Feeling Questionnaire (SMFQ; Angold et al., 1995) 'I found it hard to think properly or concentrate' (response scale 0-2); (b) the Brief Self-Control Scale (Tangney, Tangney, Baumeister, & Boone, 2004) 'I have trouble concentrating' (response scale 1-5), and; (c) the hyperactivity subscale of the SDQ (Goodman, 2001) 'I am easily distracted, I find it difficult to concentrate' (response scale 0-2).). Internal reliability was α= .73.

3.4.7.2. Motivation (chapter 5)

Motivation was measured using Wentzel's (1998) learning goal pursuit scale, consisting of 4 items (e.g. 'How often do you try to learn something new even when you don't have to?') on a 5-point scale from never (1) to always (5), summed to give a total score (possible range 4-20). Internal reliability was α= .76.

3.4.7.3. School connectedness (chapter 5)

School connectedness was measured using Resnick and colleagues' (1997) 6-item scale. This asked pupils to what extent they agreed with statements about their current school (e.g. 'You feel close to people at school') on a 5-point scale from strongly disagree (1) to strongly agree (5), summed to give a total score (possible range 6-30). Internal reliability was α= .83.

3.4.7.4. Parent-child relationship (chapter 6)

Parent-child relationship was measured in STARS by maternal hostility. Maternal hostility was measured using child ratings of parental behaviour in the past month using the 4-item subscale of the Iowa Youth and Families Project (IYFP) Interaction Rating Scales (Melby et al., 1993) on a 7-point scale from never (1) to always (7)

(possible range 7-49) (e.g. ‘How often did your mum get angry with you?’) Internal reliability was α=.79. Scores for pupils who had not been in touch with their mother in the last month were excluded.

3.4.7.5. Coping efficacy (chapter 7)

Coping efficacy was measured in STARS using the Pearlin Mastery Scale (Pearlin & Schooler, 1978) and using The General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995) in the high-risk sample. The Pearlin Mastery Scale (Pearlin & Schooler, 1978) asks to what extent seven statements describe participants (e.g. ‘There is really no way I can solve some of the problems I have’) on a 5-point scale ranging from strongly disagree (1) to strongly agree (5). Items were reverse scored and summed to produce a total score (possible range 7-35). Internal reliability was α=.60. The General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995) asks participants to what extent ten statements describe themselves (e.g. ‘I can always manage to solve difficult problems if I try hard enough’) on a 4-point scale ranging from not at all true (1) to exactly true (4). Items were summed to produce a total score (possible range 10-40). Internal reliability was α=.85.

3.4.7.6. Sensitivity to environmental stressors (chapter 7)

Sensitivity to environmental stressors was measured by sensitivity to the environment in STARS and stress sensitivity in the high-risk sample. Sensitivity was measured in STARS using a self-report version of the Highly Sensitive Child Questionnaire, Short Form (Aron & Aron, 1997). The scale contained eight items (e.g. ‘I am annoyed when people try to get me to do too many things at once’) on a 7-point scale: not at all (1); moderately (4); extremely (7). Items were summed to produce a total score (possible range 8-56). Internal reliability was α=.63. Stress sensitivity was measured in the high-risk sample using a version of the Life Events Checklist (see above, Johnson & McCutcheon, 1980). Participants were asked to rate the severity of each event which

they stated having occurred on a 5-point scale from very unpleasant (1) to very pleasant (5). Scores were reversed so that a higher score indicates greater perceived severity and a score of 0 allocated if the event was not experienced. Items were summed to produce a total score (possible range 0-95).

CHAPTER 4: A longitudinal study of the associations between emotional problems and academic attainment

This longitudinal study of children in the first year of secondary school examined the relationship between psychopathology at the beginning of year 7 with attainment, roughly 6 months later, at the end of year 7. Data were analysed in a school sample of 262 children aged 11-12 years (from the Pilot Study). Separate cross-lagged models controlling for within construct continuity and cross-sectional associations found that depressive symptoms, but not anxiety, predicted lower attainment across time. The effects of depressive symptoms on later attainment were stronger for boys compared to girls. Conduct problems also predicted lower attainment. Associations between depressive symptoms and attainment held when controlling for conduct problems for boys.

4.1. Introduction

Chapter 2 established that previous research provides evidence for longitudinal associations between depressive symptoms and academic attainment. There is also some evidence for an association between anxiety and academic attainment, although this is less consistent. Finally, as discussed in chapter 1, there is consistent evidence for an association between conduct problems and attainment. The study presented in the current chapter sought to extend this research by investigating associations between emotional problems and academic attainment, specifically school grades. Associations were investigated a) controlling for temporal stability in emotional problems and attainment, and for cross-sectional associations between these, and b) controlling for conduct problems. Existing research and gaps in the field are briefly outlined below, before outlining the study aims.

4.1.1. Depressive symptoms

Despite providing evidence for an association between depressive symptoms and attainment, prior attainment could not be controlled for in the meta-analysis presented in chapter 2. Therefore, this does not necessarily suggest that changes in depressive symptoms lead to changes in attainment. The possibility cannot be ruled out that those longitudinal associations are a combination of cross-sectional associations and high stability in depressive symptoms and attainment. The study presented in this chapter sought to investigate this.

A number of studies have found an association between depressive symptoms and attainment across adolescence both within and across time, controlling for baseline attainment (e.g. Frojd et al., 2008; Steele, Armistead, & Forehand, 2000). However, the temporal direction of effects remains unclear with other studies reporting that lower attainment predicts increases in depressive symptoms (Pomerantz, Altermatt, & Saxon, 2002). Research generally focuses on adolescent depression and examines academic outcomes in late adolescence or

early adulthood. However, there are developmental differences in the prevalence, risk factor profile and aetiology of depressive symptoms during childhood, adolescence and adulthood (Jaffee et al., 2002; Rice, 2010). Findings from chapter 2 also indicated age differences in the associations between depressive symptoms and attainment. Examining the relationship between depressive symptoms and attainment in late childhood may give a different pattern of results. Identifying an association during this period would also highlight the importance of putting interventions in place prior to adolescence which is associated with a marked increase in the prevalence of depressive symptoms to try and interrupt this association and subsequent negative outcomes later in life.

4.1.2. Anxiety symptoms

The meta-analysis presented in chapter 2 also provided some evidence for associations between anxiety and lower attainment, although this was less consistent than for depressive symptoms. For anxiety and school grades, no overall association was found; with a trend for early and late adolescence (where associations were strongest), but not childhood. There was also some evidence of associations between anxiety and higher school grades, specifically for USA studies.

The studies in chapter 2 generally focussed on generalised anxiety; however, there are several different types of anxiety, which may show differing associations with attainment. Given the school context of attainment, the present study investigates associations with attainment for school anxiety as well as generalised anxiety.

4.1.3. Conduct problems

In contrast to emotional problems, the association between conduct problems and later academic attainment is well documented (e.g. Richards & Abbot, 2009). As discussed in the chapters 1 and 2, emotional problems, particularly, depression, and

conduct problems co-occur more often than chance (Angold, Costello, & Erkanli, 1999). Covariance between emotional problems and conduct problems could influence the association between emotional problems and subsequent school attainment. Indeed depressive symptoms have also been associated with particularly poor outcomes, including low academic attainment, when they co-occur with conduct problems (Ingoldsby et al., 2006). The present study investigated whether controlling for conduct problems attenuated associations between emotional problems and attainment.

4.1.4. Gender differences

As noted in chapter 2, gender differences in the prevalence of emotional problems are well documented and girls also outperform boys in school attainment from the elementary school years to adolescence (Costello et al., 2006; DCSF, 2008; Green et al., 2005; Snyder & Dillow, 2012). However, the extent to which associations between emotional problems and school attainment differ for boys and girls is not clear. In chapter 2, a meta-analysis of community studies did not find significant gender differences in associations between depression and attainment. However, some observations have suggested worse functional outcomes for boys with depression (Diamantopoulou et al., 2011; Dunn & Goodyer, 2006). It is possible that the null finding in the meta-analysis (chapter 2) was due to the fact that stability in depressive symptoms and attainment were not controlled for in the analyses. For example, the association from depressive symptoms to lower attainment may be stronger for boys, but the association from low attainment to depressive symptoms stronger for girls. Using a cross-lagged approach which controls for the stability in depressive symptoms and attainment, as well as cross-sectional associations, is therefore important to understand these gender differences. The meta-analysis in chapter 2 did find larger effect sizes between baseline anxiety and follow-up

attainment for girls than boys, although this may have been due to a greater increase in symptoms over time for girls.

Conduct problems may also play an important role in gender differences for associations between depressive symptoms and attainment. There is evidence that depression that co-occurs with conduct problems does not show a female preponderance or the observed increase in rates during adolescence usually found for depression (Angold & Rutter, 1992). If co-occurring conduct problems influence the association between depression and attainment, and this co-occurrence is more common in boys, this may explain previous findings that suggest worse functional outcomes for depressed boys compared to depressed girls.

4.1.5. The present study

The aim of this study was to examine the temporal relationships between emotional problems and academic attainment using a prospective, longitudinal research design. The main research hypotheses were: (1) depressive symptoms, but not anxiety would be associated with a decline in attainment; (2) these associations would attenuate when controlling for conduct problems; (3) the associations between depressive symptoms and a decline in attainment would be greater for boys than for girls.

4.2. Method

4.2.1. Measures

Measures are briefly outlined below; for a more detailed description see chapter 3.

Depressive symptoms were measured using the self-reported Short Mood and Feeling Questionnaire (Angold et al., 1995) (possible range 0-26; time 1 α=.84; time 2 α=.90).

Anxiety symptoms were measured using the self-reported general and school anxiety subscales of the Screen for Child Anxiety Related Emotional Disorders

(Birmaher et al., 1997) (possible range 0-18 and 0-8 respectively; general anxiety: time 1 α=.86; time 2 α=.92; school anxiety: time 1 α=.69; time 2 α=.75).

Conduct problems were measured by the sum of standardised scores from self-reported subscale of the Strengths and Difficulties Questionnaire (Goodman, 2001) and peer unlimited Guess Who nominations of the descriptors Bully and Disrupts (Coie & Dodge, 1988) (time 1 α=.63; time 2 α=.72).

Academic Attainment was measured by the sum of the standardised continuous scores for National Curriculum tests (time 1) and Teacher Assessments (time 2) of English, Maths and Science (time 1 α=.83; time 2 α=.77).

4.2.2. Data analysis

Associations between attainment and (i) depression, (ii) general anxiety, (iii) school anxiety, and (iv) conduct problems were first investigated using cross-lagged models which adjust for stability in each construct across time and the cross-sectional associations between constructs. Cross-lagged models were then run to assess whether associations between emotional problems and attainment held when controlling for conduct problems. Gender differences in associations between emotional problems at time 1 and attainment at time 2 were investigated by subgroup comparison tests ($\Delta\chi^2$ critical value (df=1) = 3.84).

4.2.2.1. Missing data

As some students did not participate in the follow-up assessment, there was 12-29% missing data for time 2 measures. There were no differences between pupils who remained in the study and pupils who dropped out on study variables measured at baseline (depressive symptoms $t(257)= -0.08$, $p=.93$; general anxiety $t(256)=-.02$, $p=.99$; school anxiety $t(256)=-.30$, $p=.76$; conduct problems $t(241)= .20$, $p=.84$); attainment ($t(229)= 1.59$, $p=.11$).

Structural equation models were estimated using full information maximum likelihood estimation (FIML) in Mplus (Mplus version 7; Muthén & Muthén, 1998-2012) using a robust maximum likelihood parameter estimator as this is robust to non-normality. FIML estimation fits the model to the non-missing values for each observation, allowing the use of all cases including those with missing data and is appropriate for use when the amount of missing data is moderate or large (Widaman, 2006).

4.3. Results

4.3.1. Descriptive statistics

Table 4.1 shows means and standard deviations for psychopathology variables and academic attainment scores. Gender differences were in the expected directions: boys showed higher levels of conduct problems and girls showed greater general and school anxiety.

The correlation matrix between all study variables is shown in Table 4.2. At time 1 there were significant associations between academic attainment and both school anxiety and conduct problems. At time 2, there were significant associations between academic attainment and both depressive symptoms and conduct problems. Depressive symptoms, school anxiety and conduct problems at time 1 showed significant associations with academic attainment at time 2.

Table 4.1. Descriptive statistics for psychopathology and academic achievement

	Time 1				Time 2			
	Total	Boys	Girls	Gender differences	Total	Boys	Girls	Gender differences
	Mean (SD)	Mean (SD)	Mean (SD)	*t*-value	Mean (SD)	Mean (SD)	Mean (SD)	*t*-value
Depressive symptoms	4.49 (4.23)	4.20 (3.86)	4.84 (4.62)	-1.22	5.02 (5.57)	4.45 (5.64)	5.73 (5.43)	-1.62
General anxiety	4.99 (4.38)	4.31 (4.01)	5.80 (4.67)	-2.74**	4.60 (4.86)	3.92 (4.61)	5.44 (5.04)	-2.21*
School anxiety	1.46 (1.69)	1.16 (1.59)	1.81 (1.74)	-3.09**	1.57 (1.81)	1.23 (1.67)	1.98 (1.89)	-2.91**
Conduct problems	-.18 (3.78)	.84 (4.02)	-1.31 (3.13)	4.56***	-.02 (4.32)	.89 (4.63)	-1.17 (3.60)	3.33**
Attainment	-.01 (2.60)	-.03 (2.56)	.03 (2.67)	-.17	.09 (2.49)	-.11 (2.34)	.34 (2.64)	-1.36

*p<.05 **p<.01 ***p<.001

Table 4.2. Correlation matrix for all study variables at time 1 and time 2

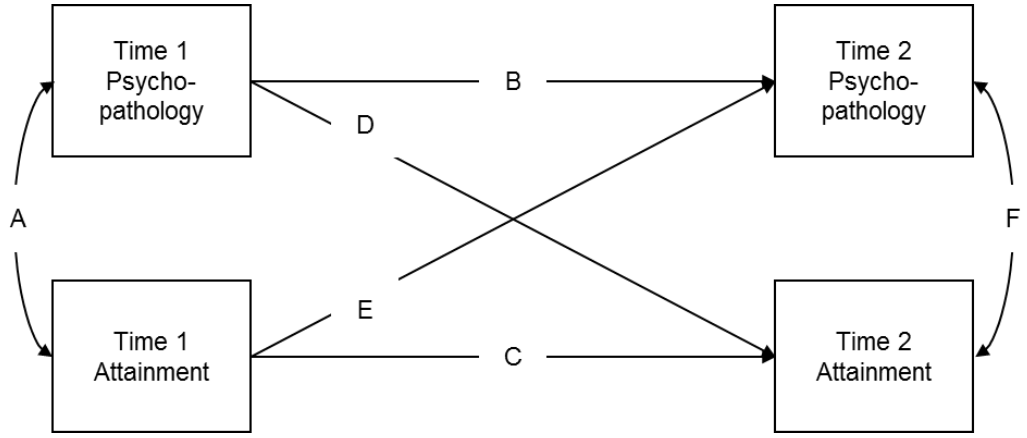
		1.	2.	3.	4.	5.	6.	7.	8.	9.
1.	Depressive symptoms T1									
2.	General Anxiety T1	**.69**								
3.	School Anxiety T1	**.57**	**.56**							
4.	Conduct Problems T1	**.29**	.05	.12						
5.	Attainment T1	-.13	-.12	**-.20**	**-.26**					
6.	Depressive symptoms T2	**.65**	**.58**	**.45**	**.30**	**-.17**				
7.	General Anxiety T2	**.54**	**.64**	**.50**	**.15**	-.11	**.65**			
8.	School Anxiety T2	**.51**	**.48**	**.65**	**.19**	-.16	**.60**	**.62**		
9.	Conduct Problems T2	**.39**	.14	**.23**	**.73**	**-.16**	**.43**	**.19**	**.28**	
10.	Attainment T2	**-.21**	-.10	**-.19**	**-.34**	**.76**	**-.17**	-.03	-.12	**-.31**

T1 = time 1; baseline assessment at year 7 entry (mean age 11.25), T2 = time 2; follow-up assessment at year 7 end (mean age 11.78). Correlations in bold are significant at $p<.05$.

4.3.2. Two variable cross-lagged model results

Figure 4.1 illustrates the first cross-lagged model used to examine the relationship between psychopathology and academic attainment. Table 4.3 illustrates results of the cross-lagged model tests. All models showed strong continuity in academic attainment (β= .69 to .82). The measures of psychopathology also showed moderate stability over time (β= .63 to .75). There were significant cross-lagged effects of time 1 depressive symptoms (β= -.09, *p*<.05) and conduct problems (β= -.17, *p*<.01) on academic attainment at time 2. Gender differences were found in the association between time 1 depressive symptoms and time 2 academic attainment, with a significant effect for boys but not girls (β= -.21, β= .03 respectively; $\Delta\chi^2(1)=12.83$, p<.001).

Figure 4.1. A conceptual model showing the two wave, two variable cross-lagged model of the relationship between psychopathology and attainment



Note. A = Time 1 correlation between constructs, B = Stability in psychopathology across time, C = Stability in attainment across time, D = Cross-lagged association time 1 psychopathology to time 2 attainment, E = Cross-lagged association time 1 attainment to time 2 psychopathology, F = Time 2 residual correlation between constructs.

Table 4.3. Standardised beta coefficients from cross-lagged models of psychopathology and academic attainment

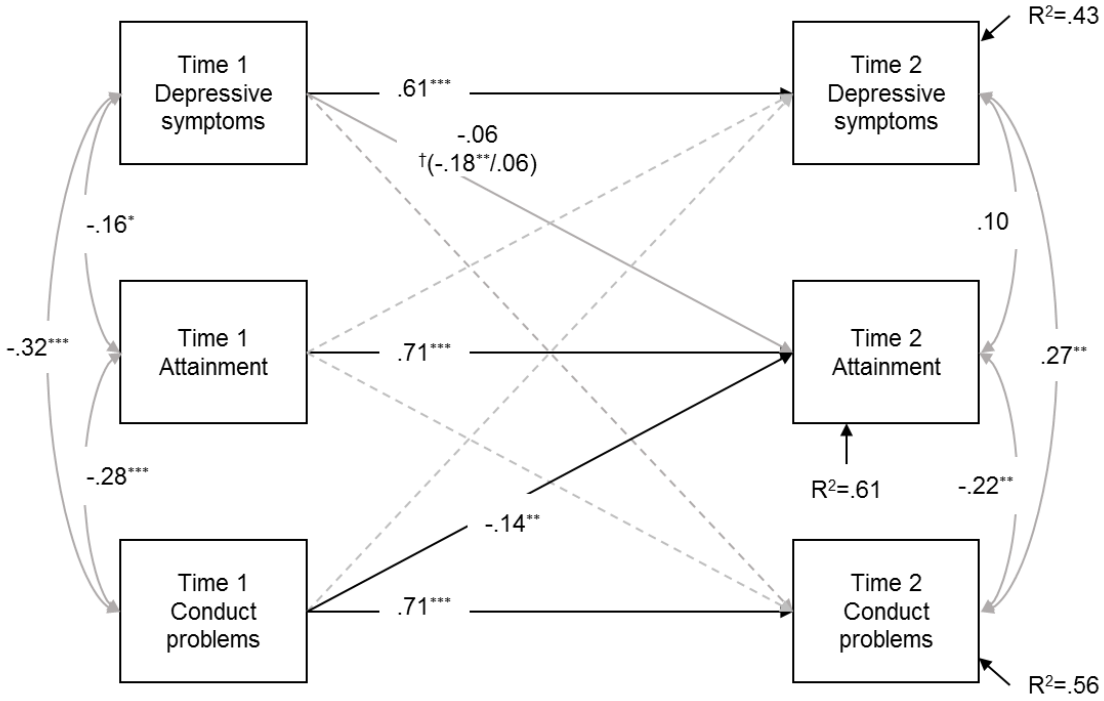
Path	A	B	C	D	E	F
Depressive symptoms	-.16*	.63***	.74***	-.09*†	-.09	.10
Boys	-.13	.54***	.69**	-.21***	-.09	-.04
Girls	-.21*	.73**	.82**	.03	-.10	.25*
General anxiety	-.13*	.63***	.76***	-.01	.02	.08
School anxiety	-.20**	.63***	.75***	-.04	-.02	-.01
Conduct problems	-.28***	.75***	.71***	-.17**	.002	-.22**

Note. Each row reflects the results of a different model. A = Time 1 correlation between constructs, B = Stability in psychopathology across time, C = Stability in attainment across time, D = Cross-lagged association time 1 psychopathology to time 2 attainment, E = Cross-lagged association time 1 attainment to time 2 psychopathology, F = Time 2 residual correlation between constructs. $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$, †Significant gender difference.

4.3.3. Cross-lagged model results controlling for conduct problems

Multivariate cross-lagged models controlling for conduct problems were run for the variable showing significant cross-lagged associations, i.e. depressive symptoms; results are shown in Figure 4.2. The model showed strong continuity in academic attainment (β= .71), depressive symptoms (β= .61) and conduct problems (β= .71). Time 1 conduct problems were associated with decreased time 2 academic attainment (β=-.14, p<.01). Having controlled for the effects of conduct problems and across time stability in academic attainment, depressive symptoms were not associated with academic attainment (β=-.06, p>.05). However, the gender difference identified for depressive symptoms with later academic attainment was maintained, whereby a relationship was identified for boys but not girls when controlling for conduct problems (β= -.18, p<.01 and β= .06, p>.05 respectively; $\Delta\chi^2(1) = 6.57$, p<.05).

Figure 4.2. Cross-lagged model of relationships between depressive symptoms, conduct problems and academic attainment



NB. *p< 05, **p<.01, ***p<.001, †Significant gender differences (boys/girls).

4.3.4. Gender differences

Following results indicating gender difference in the association between depressive symptoms and academic attainment, a set of post-hoc analyses were carried out to examine gender differences in the manifestation of depressive symptoms. Using the proposed clinical cut point (11; Angold et al., 2002), boys and girls who met the clinical cut-point for depression at time 1 were compared; 5.7% of boys and 11.0% of girls reached the cut-point. Girls reaching the cut point were somewhat more likely to endorse the item 'I cried a lot' ($\chi^2(1)=5.58$, $p<.10$) and had somewhat lower co-occurring conduct problems ($t(18)=1.91$, $p<.10$) than boys reaching the clinical cut point. When using a lower suggested cut-point of 8 identified by Thapar & McGuffin (1998), this pattern of results replicated and was significant ($\chi^2(1)=6.59$, $p<.05$ and $t(46)=2.94$, $p<.01$ respectively).

4.4. Discussion

4.4.1. Emotional problems and academic attainment

The study described in the current chapter set out to examine the temporal relationships between emotional problems and academic attainment. Results supported the first hypothesis that depressive symptoms, but not anxiety symptoms, would be associated with decreased academic attainment over the 6 month follow-up period. This is consistent with the meta-analysis described in chapter 2, which found associations between depressive symptoms, but not anxiety, and subsequent school grades. This is also consistent with a number of studies that have found an association between depressive symptoms and attainment across adolescence both within and across time, controlling for baseline attainment (e.g. Frojd et al., 2008; Steele et al., 2000). It also provides evidence regarding the temporal direction of these effects – suggesting that depressive symptoms are associated with a decline in attainment, rather than the other way round

(e.g. Pomerantz et al., 2002). This is consistent with the observation that decline in academic performance can be an initial presentation of depression (Thapar et al., 2012).

The present chapter extends the findings presented in chapter 2's meta-analysis by controlling for prior attainment. Inspection of the correlation matrix finds an association between baseline school anxiety and attainment at both baseline and follow-up. Therefore, the previously identified associations between anxiety and subsequent attainment may have reflected a combination of cross-sectional associations and high levels of stability in anxiety and attainment. The age range of participants included in the study is also important here. The present study found that, unlike depression, anxiety does not appear to be associated with *change* in attainment in childhood. This is in-line with findings from the meta-analysis, which found some evidence for an association between anxiety and low school grades in adolescence but not in childhood. This highlights the importance of investigating associations for depression and anxiety separately.

4.4.2. Conduct problems

Results also support the second hypothesis that the association between depressive symptoms and academic attainment would attenuate when controlling for conduct problems. Consistent with previous findings, the strongest association between baseline psychopathology and decline in attainment was for conduct problems (Kessler et al., 1995; Richards & Abbot, 2009). For the whole sample, associations between depressive symptoms and a decline in attainment were no longer significant when controlling for conduct problems. This is in-line with findings that depressive symptoms have particularly poor outcomes, including low academic attainment, when they co-occur with conduct problems (Ingoldsby et al., 2006).

4.4.3. Gender differences

Finally, results support the third hypothesis that the association between depressive symptoms and a decline in attainment would be greater for boys than for girls. Depressive symptoms predicted a decline in attainment for boys but not girls. As with differential associations for depressive symptoms compared to anxiety, a number of study characteristics are noteworthy here, particularly the age of the participants under investigation and the length of follow-up. The present study observed gender differences in the association between depressive symptoms in childhood and school grades over a short-term follow-up period. In contrast, the meta-analysis presented in chapter 2, which did not find gender differences, predominantly included studies of early or late adolescence (75%) which included much larger follow-up periods (up to 72 months, compared to 6 months investigated in the present study). Nevertheless, finding a stronger association between depressive symptoms and school grades for boys compared to girls is consistent with clinical observations which show that although the prevalence of emotional problems tends to be lower in boys, boys with depressive symptoms and disorder may have worse outcomes, including academic attainment, self-esteem, behavioural problems and persistent depression (Diamantopoulou et al., 2011; Dunn & Goodyer, 2006). One possible explanation for this is that depression may manifest differently in boys and girls. This study found some preliminary evidence for gender differences in the presentation of depression, with boys with high levels of depressive symptoms showing higher levels of conduct problems and lower levels of crying. Differences in depressive symptoms with and without co-occurring conduct problems, including gender differences and associations with attainment are investigated in chapter 6. The present study found that for boys, when controlling for conduct problems the association between depressive symptoms and attainment remained, but was attenuated. The role of conduct problems in the associations between depressive

symptoms and attainment in boys therefore merits further investigation. While conduct problems may be a better target for interventions at transition across both genders, depressive symptoms in boys are also a potential marker for subsequent academic problems. The influence of gender and conduct problems on pathways between depressive symptoms and attainment are explored in the next chapter.

4.4.4. Strengths and limitations

Novel aspects of this study included: (1) the use of a cross-lagged panel design which controlled for prior attainment and psychopathology, (2) the simultaneous measurement of emotional problems and conduct problems to investigate whether associations between emotional problems and attainment are due to co-occurring conduct problems.

Potential limitations of the study include the use of questionnaire measures to assess psychopathology, as opposed to clinical interview measures. This approach may mean that some of the associations reported here do not extend to young people with clinical disorders. There was some attrition across the course of the study, although there was no evidence of selective drop out. The study also had a short time-lag. For example, Masten et al. (2005) suggest that emotional problems could affect academic competence within short follow-up periods but not over longer periods of time (whereas the effects of conduct problems tend to be found for both). The meta-analysis presented in chapter 2 found evidence for stronger associations between depression and attainment for shorter follow-up periods for school failure, but not for school grades (although the present study examined a shorter follow-up period of 6 months, compared to studies included in the meta-analysis, which had follow-up periods of up to 9 years). Nevertheless, it is possible that the associations between depressive symptoms and attainment found in the current chapter were due to the short follow-up period.

Two features of the research design warrant discussion. First, the cross-lagged coefficients are open to the influence of measurement error. Associations in the cross-lagged paths may indicate stronger effects where one variable has greater stability and/or more reliable measurement. However, all measures showed relatively high stability and findings are consistent with previous research (Richards & Abbot, 2009).

4.5.5. Summary

Depressive symptoms and conduct problems, but not anxiety, predicted lower attainment across time having controlled for the temporal stability in both psychopathology and attainment and for cross-sectional associations. The effects of depressive symptoms on later attainment were significantly stronger for boys compared to girls. Associations between depressive symptom and attainment for boys attenuated but remained significant when controlling for conduct problems. There was some evidence for differences in the manifestation of depressive symptoms according to gender, with boys showing higher rates of co-occurring conduct problems.

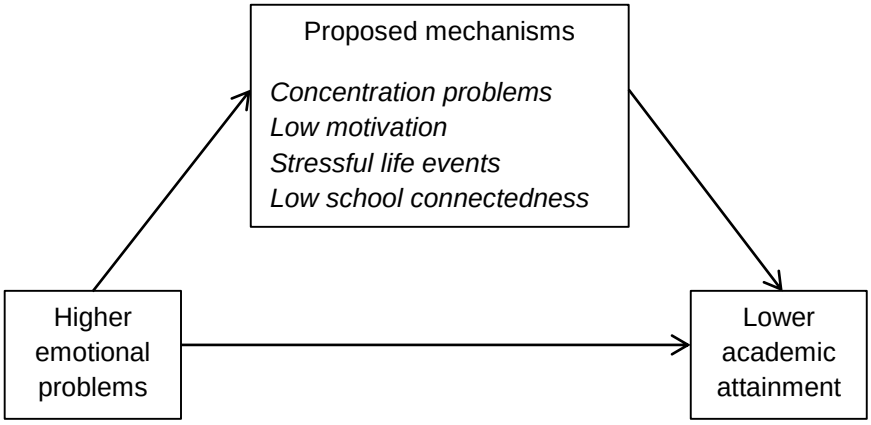
CHAPTER 5: **A longitudinal study exploring pathways between emotional problems and academic attainment**

This longitudinal study of children across a one year period examined potential pathways that might explain links between emotional problems and attainment. Data were analysed in a school sample of 1751 children aged 10-11 years (from the School Transition & Adjustment Research Study: STARS). For both depressive and anxiety symptoms, associations with attainment were mediated by concentration problems, stressful life events and low school connectedness. Associations between anxiety and attainment were also somewhat mediated by low motivation. This study also found some evidence that the associations between emotional problems, particularly depressive symptoms via concentration problems and stressful life events were stronger for those of lower cognitive ability. None of the tested pathways were moderated by gender.

5.1. Introduction

As shown in chapters 2 and 4, there is evidence for longitudinal associations between emotional problems and academic attainment. While this is more consistent for depressive symptoms, there is also some evidence for longitudinal associations for anxiety. Identifying different pathways through which emotional problems can lead to lower attainment would be informative for identifying potential targets for work developing interventions that might be able to improve both emotional and academic outcomes. This chapter investigated these possible pathways, specifically concentration problems, low motivation, stressful life events and low school connectedness. The focus of this chapter was therefore to investigate potential mediators of the association between emotional problems and low attainment (Figure 5.1).

Figure 5.1. Conceptual figure of potential mediators of the association between emotional problems and low attainment



5.1.1. Concentration problems

One possible pathway through which emotional problems may lead to low attainment is concentration problems. Impairments in concentration, attention and working memory have been found in depression and anxiety (Castaneda, Tuuio-Henriksson, Marttunen, Suvisaari, & Lonnqvist, 2008; Christopher & MacDonald, 2005; Hartlage, Alloy, Vazquez, & Dykman, 1993). Indeed, difficulty concentrating and restlessness are included in the diagnostic criteria for depression and generalised anxiety (American Psychiatric Association, 2000). Depression-related impairments in a range of domains including cognitive ability have been suggested to be due to reduced cognitive capacity and the narrowing of attention to focus of depression-relevant information (Hartlage et al., 1993). Associations between anxiety and decreased cognitive capacity, and attentional biases due to heightened attention to threatening stimuli are well documented (Dalgleish & Watts, 1990; Mathews & Macleod, 1994). Cross-sectional studies of school-age children provide support for concentration problems as one pathway between emotional problems and low attainment. One study found that difficulties in concentrating and paying attention to teaching were associated with depression (Frojd et al., 2008) and another that associations between anxiety and academic performance were mediated by both worry and executive functioning; there was also a trend for this mediation for depression (Owens, Stevenson, Hadwin, & Norgate, 2012). However, one study of healthy adults found that while trait anxiety and depressive symptoms were both associated with cognitive functioning, the patterns of association were different. There was a linear association between depressive symptoms and reduced cognitive functioning. However, for anxiety the association was quadratic, with intermediate levels of trait anxiety associated with the best performance compared to low or high levels of anxiety (Salthouse, 2012). This is consistent with experimental work which has found that anxiety is associated with better performance on easy tasks, though poor performance on hard

tasks (see Eysenck, 1982) and with the more consistent associations with attainment for depression than anxiety found in chapters 2 and 4. In summary, decreased concentration is one possible pathway by which depression and anxiety may result in low attainment. This association may be stronger for depressive symptoms, given evidence that moderate levels of anxiety may be associated with increased concentration.

5.1.2. Motivation

Low motivation is another possible mechanism through which emotional problems may lead to low attainment. Motivation has been highlighted as important requirement for successful learning (e.g. Ryan & Powelson, 1991) and been associated with both academic attainment and negative affect (Wentzel, Weinberger, Ford, & Feldman, 1990). Symptoms of depression include reduced interest or pleasure and pessimistic views about the future, and depression has long been associated with negative explanatory styles, thought to decrease expectations for future success as well as decrease persistence and initiation of tasks (Abramson, Seligman, & Teasdale, 1978). In contrast, some research has noted that anxiety is associated with increased motivation (Lucey & Reay, 2000). Indeed the processing efficiency theory (Eysenck & Calvo, 1992) suggests that motivation to decrease anxious state can result in increased effort and this compensates for potential decreased performance due to anxiety related working memory impairments. More recently it has been proposed that anxiety does not necessarily impair processing effectiveness (quality of performance) because it can lead to compensatory strategies such as enhanced effort, although it may impair processing efficiency (the resources required to attain a given performance level) (Eysenck, Derakshan, Santos, & Calvo, 2007). Thus, motivation may mediate associations with low attainment for depressive, but not anxiety symptoms.

5.1.3. Stressful life events

Another possible pathway between depressive symptoms and attainment is stressful life events. Stress impairs processing in aspects of cognition that make important contributions to cognitive ability including memory and learning (Kim & Diamond, 2002). Stressful life events are associated with poorer working memory performance, which may be due to interference from thoughts and memories of the stressful event with the on-task demands for cognitive resources (Klein & Boals, 2001). Moreover, chronic imposed stress (exam preparation) and perceived stress are associated with impairments in attentional set-shifting and functional connectivity of the dorsolateral prefrontal cortex with areas of the fronto-parietal attention network (Liston et al., 2009). Similar behavioural results (attentional set-shifting difficulties) have been reported in rodents following chronic restraint stress and this is associated with reductions in dendritic spine density and arborisation in medial prefrontal cortex (Liston et al., 2006). Stress is therefore a likely predictor of low academic attainment as there is evidence to suggest it impairs attention.

As noted in chapter 1, associations between stress and depression are well documented (Hammen, 2005) and those with depression may also create or evoke behaviour-dependent stressful life events (Hammen, 1991). Several studies have found evidence to support this stress generation in depression (Liu & Alloy, 2010). This appears to be specific to depression, with similar findings not found for anxiety (Joiner et al., 2005; Wingate & Joiner, 2004). Thus, stressful life events may mediate associations between depressive symptoms - but not anxiety - and attainment.

5.1.4. School connectedness

Finally, pupils' relationships with school may also be important in the association between emotional problems and attainment. Pupils' low connectedness to school, conceptualised as attachment and commitment to school (close relationships with those at school; investment in school and doing well; Catalano, Haggerty, Oesterle, Fleming, & Hawkins, 2004), has been linked to both higher emotional problems (Shochet et al., 2006) and lower attainment (Maddox & Prinz, 2003). A related concept, school engagement (sometimes used interchangeably with school connectedness, see O'Farrell & Morrison, 2003), has also been found to differentiate both school completers from school dropouts, and pupils who achieve acceptable grades compared to poor grades (Finn & Rock, 1997). A longitudinal study has also found that decreasing trajectories of low emotional school engagement (relationships with school, teachers and classmates) and of behavioural school engagement (such as attending school, completing homework) were associated with both higher levels of depression and lower school grades (Li & Lerner, 2011). Finally, school-based interventions aimed at increasing school connectedness/engagement, have found positive effects on both pupil psychological functioning and attainment up to four years later (The Child Development Project, Battistich et al., 2004; Raising Healthy Children and the Seattle Social Development Project, Catalano et al., 2004). Thus school connectedness is a potential mediator between both depressive and anxiety symptoms, and low attainment.

5.1.5. Moderators

Concentration problems, low motivation, stressful life events and low school connectedness are all potential mediators of the association between emotional problems and attainment. However, these potential pathways may also vary based on different pupil characteristics, including gender, conduct problems and cognitive ability.

5.1.5.1. Gender

As discussed in the previous chapters, gender differences in levels of emotional problems and attainment are well documented (Costello et al., 2006; DCSF, 2008; Green et al., 2005; Snyder & Dillow, 2012). The previous chapters have also provided evidence of gender differences in associations between emotional problems and attainment. Specifically, in chapter 2, a meta-analysis of community studies found larger effect sizes between baseline anxiety during childhood and adolescence and follow-up attainment for girls than boys. Whereas in chapter 4, a short-term longitudinal study found stronger associations between childhood depressive symptoms and a decline in attainment for boys compared to girls. Differences in the proposed pathways may partially explain these gender differences. For example, gender differences in the manifestation of depressive and anxiety symptoms may result in differing associations with concentration problems, motivation, stressful life events and school connectedness.

5.1.5.2. Conduct problems

Depressive symptoms have been associated with particularly poor outcomes when they co-occur with conduct problems, including low academic attainment, low social competence and substance use (Ingoldsby et al., 2006). In-line with this, chapter 4 found that the association between depressive symptoms and academic attainment attenuated when controlling for conduct problems. Clinical observations have also indicated that depression may vary in aetiology and associated correlates when it co-occurs with conduct problems (Angold & Rutter, 1992; Fombonne, Wostear, Cooper, Harrington, & Rutter, 2001a; Simic & Fombonne, 2001). Therefore, some of these potential pathways may only mediate associations between depressive symptoms and attainment when levels of conduct problems are low or high. Evidence of the co-occurrence with conduct

problems is less strong for anxiety than depression and there has been less research into outcomes of this co-occurrence of symptoms; however, it is also possible that correlates of anxiety may vary based on conduct problems (Zoccolillo, 1992).

5.1.5.3. Cognitive ability

Finally, the proposed pathways between emotional problems and attainment may vary based on pupil cognitive ability. As discussed above, studies generally report an inverse association between cognitive ability and emotional problems both in childhood and adulthood (Castaneda et al., 2008; Christopher & MacDonald, 2005; Collishaw, Maughan, & Pickles, 2004; Franz et al., 2011; Hartlage et al., 1993), which is consistent with higher cognitive ability being a resilience factor against emotional problems. Those with higher cognitive ability may have greater capacity and efficiency of the cognitive system and therefore may be less likely to show functional impairment associated with emotional problems (Barnett et al., 2006). Given that anxiety has been suggested to impair processing efficiency but not processing effectiveness, because it can lead to enhanced effort (Eysenck et al., 2007; see above), associations between anxiety and motivation may be moderated by cognitive ability. If additional resources are required to maintain a given performance level, then anxiety may impair motivation for those with a lower cognitive ability but not with a higher cognitive ability.

5.1.6. The present study

The aim of the study was to identify pathways through which emotional problems may lead to low attainment, i.e. mediators of this association (Figure 5.1).The main research hypotheses were: (1) concentration problems would mediate associations with attainment for both depressive and anxiety symptoms; (2) low motivation would mediate associations for depressive, but not anxiety symptoms; (3) stressful life events would

mediate associations for depressive, but not anxiety symptoms; (4) low school connectedness would mediate associations between both depressive and anxiety symptoms and low attainment. The moderating effects of gender, conduct problems and cognitive ability on these pathways were also investigated.

5.2. Method

5.2.1. Measures

Measures are briefly outlined below; for a more detailed description see chapter 3.

Depressive symptoms were measured using the self-reported Short Mood and Feeling Questionnaire, (Angold et al., 1995) (possible range 0-26; α=.89).

Anxiety symptoms were measured using the self-reported general anxiety subscale of the Screen for Child Anxiety Related Emotional Disorders (Birmaher et al., 1997) (possible range 0-18; α=.88).

Academic Attainment was measured by the sum of the standardised continuous scores for Teacher Assessments of English, Maths and Science (α=.85).

Concentration problems was measured by the sum of standardised scores from self-reported single items from the Short Mood and Feeling Questionnaire (Angold et al., 1995), the Brief Self-Control Scale (Tangney et al., 2004), and the hyperactivity subscale of the Strength and Difficulties Questionnaire (Goodman, 2001) (α=.73).

Motivation was measured using the self-reported learning goal pursuit scale Wentzel's (Wentzel, 1998) (possible range 4-20; α=.76).

Stressful life events was measured using a version of the self-reported Life Events Checklist (Johnson & McCutcheon, 1980) (possible range 0-21).

School connectedness was measured using the self-reported school connectedness scale (Resnick et al., 1997) (possible range 6-30; α=.83).

Conduct problems were measured using the self- and teacher-reported subscale of the Strengths and Difficulties Questionnaire (Goodman, 2001) (possible range 0-10; α=.65).

Cognitive ability was measured using the Cognitive Abilities Test (CAT3; Lohman et al., 2001), with measures of verbal reasoning, quantitative reasoning and non-verbal reasoning averaged to produce total score (α=.86).

5.2.2. Data analysis

In order to test the proposed mediators, structural equation models were tested to evaluate indirect effects of emotional problems on attainment via each of the potential mediators in Mplus (Muthén & Muthén, 1998-2012). It has been suggested that a mediator must sequentially follow the independent variable and precede the dependent variable (Cole & Maxwell, 2003). Therefore, data on emotional problems, potential mediators and attainment were measures at STARS stages 1, 2 and 3 respectively. The only exception was stressful life events, which measured past year events at stage 3 (therefore covering the period of time spanning stages 1-3 of the study).

Analyses testing for moderated mediation were conducted to investigate whether the mediation of the associations between depressive symptoms and attainment by the potential pathways differed by (a) gender, (b) conduct problems, (c) cognitive ability. These analyses were run using multiple group analyses, using a Z test to evaluate the difference in magnitude of the indirect association between emotion problems and attainment via the mediator between the two groups. Participants were grouped as having high conduct problems if they were in the 90th percentile, in-line with the Strengths and Difficulties Questionnaire recommendations (www.sdqinfo.com); cognitive ability was categorised as low/high based on median split.

5.2.2.1. Missing data

Data on depressive and general anxiety symptoms were available for 744 children at wave 1 where there was some evidence of selective participation, however at stage 2 data were available on depressive symptoms for 1648 children and on general anxiety symptoms for 1632 children, where there was no evidence of selective participation (see chapter 3). Children were included in the present analyses when data on any of these measures of emotional problems were available (N=1751). Analyses were run using full information maximum likelihood (FIML) estimation, which uses all available information available to calculate estimates, to provide less biased estimates than excluding participants with missing data from analyses (Schafer & Graham, 2002). Where variables have missing data (e.g. emotional problems at stage 1), the use of additional variables that are highly correlated with these variables (e.g. emotional problems at stage 2) can provide unbiased estimates (Graham, 2009). Depressive and anxiety symptoms at wave 2 were therefore used as missing data correlates for the analyses involving depressive and anxiety symptoms at stage 1 respectively. Missing data for conduct problems and cognitive ability resulted in N=908 and 1078 respectively for these specific moderated mediation analyses.

5.3. Results

5.3.1. Descriptive statistics

Table 5.1 shows means, standard deviations and correlations between all study variables. Depressive and anxiety symptoms at stage 1 showed small but significant associations with attainment at stage 3 (r=-.11 and -.09 respectively). Both emotional problems were also associated with all potential mediators (r=±.11 to ±.41). All potential mediators were associated with attainment (r=±.07 to ±.19). Both emotional problems were associated with higher conduct problems and lower cognitive ability; anxiety but not

depressive symptoms were associated with female gender. Depressive and anxiety symptoms were highly correlated (*r*=.66).

Table 5.1. Descriptive statistics

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Depressive symptoms										
2. Anxiety symptoms	**.66**									
3. Concentration	**.41**	**.33**								
4. Motivation	**-.22**	**-.11**	**-.28**							
5. Stressful life events	**.29**	**.20**	**.32**	**-.09**						
6. School connectedness	**-.28**	**-.15**	**-.30**	**.38**	**-.22**					
7. Gender[#]	.02	**.08**	**-.11**	**.05**	-.01	**-.06**				
8. Conduct problems	**.29**	**.20**	**.56**	**-.24**	**.29**	**-.29**	**-.24**			
9. Cognitive ability	**-.15**	**-.12**	**-.15**	.03	**-.12**	**.13**	-.004	**-.24**		
10. Attainment	**-.11**	**-.09**	**-.19**	**.07**	**-.12**	**.14**	**.14**	**-.29**	**.83**	
Mean	4.17	3.89	-.008	15.19	1.93	24.38	.47	2.08	101.87	.03
(SD)	(4.36)	(3.76)	(2.39)	(2.86)	(2.14)	(3.78)	(.50)	(1.92)	(11.93)	(.86)

Note. Significant correlations at $p<.05$ indicated in bold. [#]0=boys, 1=girls. Statistics derived using FIML with depressive and anxiety symptoms at stage 2 as missing data correlates. N=1751.

5.3.2. Mediation analyses

The tested pathways for the mediation analyses are presented in in Figure 5.2 and results presented in Table 5.2. Within these models, depressive and anxiety symptoms were both associated with lower concentration, motivation and school connectedness at stage 2, and higher stressful life events measures at stage 3 of the study (Table 5.2. column A). Concentration problems, stressful life events and low school connectedness predicted low attainment; there was also a trend for motivation to predict low attainment in the anxiety model (Table 5.2. column B). Concentration problems, stressful life events and lower school connectedness mediated associations with attainment for both depressive and anxiety symptoms, indicated by significant indirect pathways between emotional problems and attainment via these variables (Table 5.2. column D). There was also a trend for lower motivation to mediate associations between anxiety and attainment. The remaining direct pathway between emotional problems and attainment were all somewhat lower than direct correlations, where mediation pathways were not controlled for (r=-.11 and -.09 for depressive and anxiety symptoms respectively), although these were still significant for models involving motivation (Table 5.2 column C).

Figure 5.2. Conceptual figure of the tested pathways

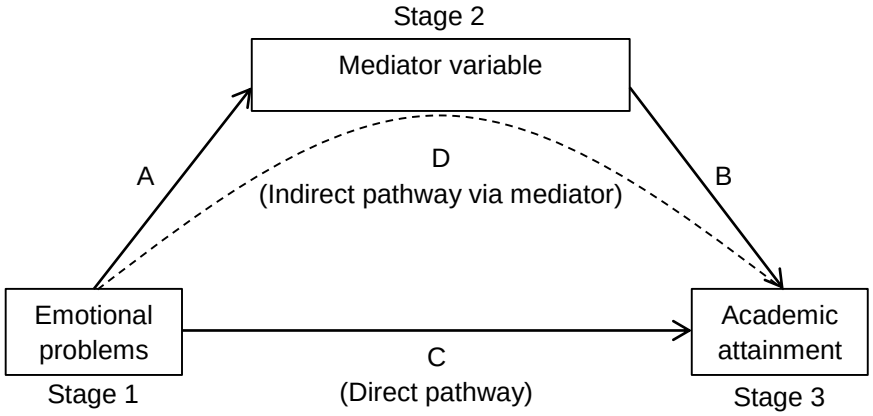


Table 5.2. Mediation analyses

	Mediation (β)					Moderated mediation (Z)		
Depressive symptoms	A	B	C	D	95% CI for D	Gender	Conduct problems	Cognitive ability
Concentration problems	.41***	-.18***	-.03	-.07***	-.11, -.03	.31	-1.97*	-1.96†
Motivation	-.22***	.05	-.09*	-.01	-.03, .01	-.05	-.95	-1.31
Stressful life events	.28***	-.08*	-.08†	-.02*	-.05, .003	-.72	-.71	-1.87†
School connectedness	-.28***	.12***	-.07	-.03**	-.06, -.01	-.11	.28	-.90
Anxiety symptoms								
Concentration problems	.34***	-.17***	-.03	-.06***	-.09, -.02	.30	-1.87†	-1.52
Motivation	-.11**	.06†	-.08*	-.01†	-.02, .003	.11	-.25	-1.34
Stressful life events	.20***	-.09**	-.07†	-.02*	-.04, .002	-.47	-.02	-1.76†
School connectedness	-.15***	.13***	-.07†	-.02**	-.03, -.003	-.90	.45	.22

Note. A=emotional problems → mediator variable; B=mediator variable→attainment, C= direct association between emotional problems and attainment, D= indirect association between emotional problems and attainment via mediator variable. †p<.10 *p<.05 **p<.01 ***p<.001.

5.3.4. Moderated mediation

Gender, conduct problems and cognitive ability were investigated as possible moderators of this mediation; results are shown in Table 5.2. Gender did not moderate any of the mediation pathways.

Conduct problems moderated the mediation by concentration problems for depressive symptoms, and somewhat for anxiety symptoms. Specifically, the mediation was stronger for those with lower, compared to higher, conduct problems (depressive symptoms Z=-1.97; anxiety symptoms Z=-1.87). For those with lower conduct problems, emotional problems at stage 1 were associated with higher concentration problems at stage 2 (depressive symptoms β=.41, p<.001; anxiety symptoms β=-35, p<.001) which mediated the association with attainment (depressive symptoms β=-.04, p=.04, CI=-.09, .01; anxiety symptoms β=-.03, p=.06, CI=-.07, .01). In contrast for those with high levels of conduct problems, emotional problems were not associated with concentration problems and did not mediate the association with attainment (depressive symptoms β=-.17, p=.27; depressive mediation β=.02, p=.48, CI=-.04, .08; anxiety symptoms β=-.20, p=.19; anxiety mediation β=.01, p=.76, CI=-.06, .07). Conduct problems did not moderate mediations by motivation, stressful life events or school connectedness.

There was a trend for cognitive ability to moderate the association between depressive symptoms and attainment via concentration problems. Specifically, the mediation was somewhat stronger for those with lower compared to higher cognitive ability (Z=-1.96), although the mediation was present for both groups (low cognitive ability β=-.12, p<.001, CI=-.21, -.03; high cognitive ability β=-.05, p=.005, CI=-.10, -.004).

There was also a trend for the mediation of the association between both depressive and anxiety symptoms with attainment via stressful life events to be stronger for those with lower, compared to higher, cognitive ability (depressive symptoms Z=-1.87; anxiety symptoms Z=-1.76). For those with lower cognitive ability,

emotional problems at stage 1 were associated with more stressful life events at stage 2 (depressive symptoms β=.36, *p*<.001; anxiety symptoms β=.34, *p*<.001) which mediated the association with attainment (depressive symptoms β=-.06, *p*=.04, CI=-.14, .01; anxiety symptoms β=-.05, *p*=.06, CI=-.11, .02). While emotional problems were also associated with stressful life events for those with higher cognitive ability (depressive symptoms β=.19, *p*=.01; anxiety symptoms β=.14, *p*=.05), this did not mediate the association with attainment (depressive symptoms β=-.01, *p*=.55, CI=-.03, .02; anxiety symptoms β=-.002, *p*=.74, CI=-.02, .02). Mediations by motivation or school connectedness were not moderated.

5.4. Discussion

The study described in this chapter set out to examine pathways through which emotional problems may lead to low attainment. It was predicted that concentration problems and school connectedness would mediate associations for both depressive and anxiety symptoms, while low motivation and more stressful life events would mediate associations for depression. Based on suggestions that functional impairment associated with emotional problems may vary based on gender, conduct problems and cognitive ability (chapters 2 and 4; Barnett et al., 2006; Ingoldsby et al., 2006), these were investigated as possible moderators of the tested mediation pathways.

5.4.1. Concentration problems

The results support the first hypothesis whereby concentration problems mediated associations between both depressive and anxiety symptoms and attainment. While some work has suggested that intermediate levels of trait anxiety are associated with the best performance (Salthouse, 2012), the mediation models presented here found associations between both depressive and anxiety symptoms and concentration problems. While associations with concentration problems were somewhat larger for

depressive than anxiety symptoms (β=.41 and β=.34 respectively), the magnitude of the mediation of associations with attainment was similar (β=.07 and β=.06 respectively). Thus concentration problems appear to be one pathway throughout which emotional problems are associated with subsequent low attainment.

The indirect pathways between emotional problems - particularly depressive symptoms - and attainment via concentration problems was moderated by conduct problems. Greater indirect associations were found for pupils with low conduct problems (indirect effect β=-.04 and β=.02 for low and high conduct problems respectively). This is in-line with clinical observations indicating that depression may vary in aetiology and associated correlates when it co-occurs with conduct problems (Angold & Rutter, 1992; Fombonne et al., 2001a; Simic & Fombonne, 2001). Thus, pathways to poor attainment appear to differ for depressive symptoms with or without co-occurring conduct problems. Research indicates that depressive symptoms are associated with particularly poor attainment when they co-occur with conduct problems (Ingoldsby et al., 2006). Findings from the study presented here suggest that this is not due to increased concentration problems when conduct problems co-occur, with a significant mediating effect of concentration problems found for those with low conduct problems.

While a mediating effect was not found to those with high conduct problems, this may be due to reduced variance, with higher concentration problems and depressive symptoms in those with high compared to low conduct problems (Z=-2.96, *p*=.003 and Z=-2.23, *p*=.026 respectively). Indeed, while this pattern of moderated mediation replicated when conduct problems were categorised as high based on the 80th (instead of 90th) percentile (Z=-2.07, *p*=.039), the moderated mediation was not found when this was relaxed further to the 70th percentile (Z=-1.33, *p*=.18) or a median split (Z=-1.01, *p*=.32). One possibility is that pupils with depressive symptoms and conduct problems already have concentration problems, and therefore, a conservative mediation design which requires the mediator to be temporally

sequential to the independent variable would not capture this. To investigate this possibility, analyses were re-run using concentration measured at stage 1. This revealed a significant mediation effect (B=-.17, SE=.03, p<.001), which was not moderated by conduct problems (Z=-.50, p=.62). There was also no difference in levels of time 1 concentration problems in those with high compared to low conduct problems (Z=-1.29, p=.20). Thus, for pupils with depressive symptoms, current concentration problems appear to impair school performance both for those with and without conduct problems. Further work into differences in depressive symptoms with and without co-occurring conduct problems is therefore warranted. This topic is investigated in the next chapter.

Finally, there was evidence that the association between depressive symptoms and poor attainment via concentration problems was somewhat moderated by cognitive ability with a greater indirect effect for those of lower cognitive ability. This is consistent with those of higher cognitive ability having greater cognitive reserve and therefore greater capacity and efficiency of the cognitive system resulting in less functional impairment (Barnett et al., 2006). Again, further work into this is warranted (see below).

5.4.2. Motivation

The results presented here were inconsistent with the second hypothesis that motivation would mediate associations between depressive symptoms, but not anxiety, and attainment. Instead, there was some evidence that motivation mediated associations for anxiety but not depressive symptoms. Depressive symptoms were associated with motivation, but this did not mediate associations with attainment. A mediating effect for anxiety had not been predicted, given suggestions that although anxiety can lead to decreased performance because of working memory impairments, this can be compensated for by the increased effort which is also a product of anxiety, resulting from motivation to minimise anxious state (Eysenck et

al., 2007). Instead, this study had considered the possibility that motivation would mediate the association between anxiety and attainment only for those of lower cognitive ability, with those of higher cognitive ability processing additional resources, allowing the use of additional effort to maintain effectiveness levels. However, cognitive ability was not found to moderate this association. However, it is possible that the null finding for motivation is due to the measure used, which specifically assessed intrinsic learning motivation, i.e. learning because it is enjoyable/interesting (e.g. Ryan & Deci, 2000). Motivation is multifaceted (e.g. Ryan & Deci, 2000) and different types of motivation are likely to show different patterns of results in the investigation of pathways between depressive symptoms and attainment. For example extrinsic motivation (behaving to gain a reward or avoid a punishment) has been associated with greater anxiety and lower task/academic performance compared to intrinsic motivation (Miserandino, 1996). While school motivation has been associated with school performance (Wentzel et al., 1990), other types of motivation may be better candidates to explain associations between depressive symptoms and attainment. Specifically, aspects of motivation that have been closely linked to depression, such as negative explanatory styles (Abramson et al., 1978), may play a more important role in this pathway.

5.4.3. Stressful life events

Findings also did not support the third hypothesis, with a mediating effect of stressful life events found for both types of emotional problem, rather than being specific to depressive symptoms. It is also consistent with the stress generation hypothesis that associations between depression and stress are, in part, due to people with depression generating stressful conditions (Hammen, 1991). However, previous work had suggested that this is specific to depression, and is not found for anxiety (Joiner et al., 2005; Wingate & Joiner, 2004). One possible explanation for this is that the measure of stressful life events used here covered a period of time that included when

emotional problems were measured. It is therefore possible that some of the stressful life events were concurrent to the emotional problems. The direction of effects therefore cannot be certain. Future work would be needed to clarify this, although this finding does provide some evidence that stressful life events may be involved in the association between emotional problems and attainment.

The indirect association between emotional problems and attainment via stressful life events was somewhat moderated by cognitive ability, with stronger association found for those of lower cognitive ability. Emotional problems were associated with more stressful life events for those of both lower and higher cognitive ability. However, stressful life events only mediated the associations between emotional problems and attainment for those of lower cognitive ability. This is again consistent with the cognitive reserve hypothesis, that those with higher cognitive ability have greater capacity and efficiency of the cognitive system, which serves to protect them from some of the adverse effects of stress. Future research is needed to investigate whether this buffering effect of higher cognitive ability is found for stress involved in the onset/prediction of depressive symptoms as well as those resulting from stress-generation. This topic is investigated in chapter 7.

5.4.4. School connectedness

Finally, results supported the fourth hypothesis, whereby school connectedness mediated associations between both depressive and anxiety symptoms and attainment. This is consistent with previous findings that school connectedness is associated with both types of emotional problems and school attainment (Maddox & Prinz, 2003; Shochet et al., 2006). The mediating effects of school connectedness were not moderated by gender, conduct problems or cognitive ability. Given that school-based interventions aimed at increasing school connectedness/engagement, have found positive effects on both pupil psychological functioning and attainment (The Child Development Project, Battistich et al., 2004; Raising Healthy Children and

the Seattle Social Development Project, Catalano et al., 2004), this may be a promising target for school-level interventions that aim to reduce depressive symptoms and increase school performance.

5.4.5. Gender

The study presented in this chapter found no evidence of gender differences in the explored pathways between emotional problems and attainment. The previous chapters provided evidence of gender differences in associations between emotional problems and attainment. In particular, in chapter 4, there was evidence that a decline in attainment was associated with depressive symptoms for boys but not girls. The potential pathways addressed in this chapter do not help to explain this association. Thus, future work is needed that explores other possible explanations for gender differences in associations between depression and attainment. For example, the possibility that there are greater levels of co-occurrence of conduct problems in boys compared to girls, leading to lower attainment; this is addressed in the next chapter.

5.4.6. Strengths and limitations

This study is unique in examining possible pathways between emotional problems and attainment. Investigating mediators is an important area of research to enable a better understanding of this association, which is often overlooked. A major strength of this study was the use of a 3-stage longitudinal design which allowed analyses to be run using mediator variables that both sequentially followed the independent variable and preceded the dependent variable, allowing increased confidence in the direction of effects (Cole & Maxwell, 2003) (although this was not the case for stressful life events). Nevertheless, a number of limitations of this study merit discussion.

Firstly, results are limited by the measures used. As was the case for chapter 4, the use of questionnaire measures to assess psychopathology, as opposed to

clinical interview measures may mean that findings do not extend to young people with clinical disorders. The use of self-reports for both emotional problems and the potential mediators also means that associations between these variables may have been affected by shared method variance. Although measures of attainment were not self-report measures, shared method variance between the predictor and mediator variables may have inflated the mediation estimates. Specific measures may also have influenced findings, as with the motivation measure, discussed above.

Secondly, the result may have been influenced by the specific sample used. As in chapter 4, it is possible that the findings of the study presented in this chapter are specific to this developmental period. In addition, unlike other chapters in the thesis the utilisation of the 3-stage STARS design in this chapter meant the use of stage 1 data. Due to a different data collection technique at stage 1 compared to stages 2 and 3, there was notable levels of missing pupil data at this stage (overall pupils response rate of 35% compared to 87% and 85% at stages 2 and 3 respectively), with some evidence of selective participation (see chapter 3). While the recommended analytical approach was used – whereby data on depressive and anxiety symptoms at stage 2 (where there was no evidence of selective participation) were used as missing data correlates to provide less biased estimates (Graham, 2009; Schafer & Graham, 2002) - a more complete dataset would have been optimal. Additional limitations of the analytical methods used also merit discussion. It is noteworthy that unlike the previous chapter, but in-line with the meta-analysis presented in chapter 2, prior attainment was not controlled for in the analyses. It was felt that a large correlation between attainment at stages 1 and 3 (r=.79) would have prohibited the investigation of pathways between emotional problems and subsequent attainment, given the relatively small amount of remaining variation in attainment to account for. However, this does mean that the analyses in this chapter do not reflect associations between emotional problems and change in attainment.

Another limitation of the analyses is that depressive and anxiety symptoms were investigated separately. Given that these measures were highly correlated (*r*=.66), this may have led to misleading results. One approach to this is to control for anxiety when investigating possible pathways for depressive symptoms and vice versa. These analyses were conducted and are presented in appendix 5.1. Results found that while pathways between depressive symptoms and attainment remained fairly consistent, pathways for anxiety were no longer significant. This suggests that pathways between anxiety and attainment via concentration problems, stressful life events and school connectedness are likely driven by co-occurring depressive symptoms.

5.5.7. Summary

The study presented in this chapter found evidence that associations between emotional problems and low attainment are mediated by concentration problems, stressful life events, low school connectedness, and for anxiety, somewhat by low intrinsic learning motivation. There was also some evidence that the associations between emotional problems, particularly depressive symptoms via concentration problems were stronger for those of lower cognitive ability and possibly for those with lower conduct problems. Indirect associations via stressful life events were also somewhat stronger for those with lower cognitive ability. None of the tested pathways were moderated by gender. School connectedness appears to merit consideration in future research which aims to identify targets for school-based interventions aimed at improving pupil emotional and academic outcomes. Additional important areas for future study are a) whether the meaning of depressive symptoms changes when they co-occur with conduct problems, b) whether higher cognitive ability buffers the negative effect of stress involved in the onset/prediction of depressive symptoms as well as those resulting from stress-generation, and c) why associations between

depressive symptoms and a decline in attainment have been found to be stronger for boys than girls. These issues are explored in the next 2 chapters.

CHAPTER 6: **Profiling depression in childhood and adolescence - the role of conduct problems**

Depression is typically more common in females and rates rise around puberty. However, studies of children and adolescents suggest that depression accompanied by conduct problems may represent a different subtype not characterised by a female preponderance, with differing risk factors and genetic architecture compared to pure-depression. The present chapter describes a study that aimed to identify distinct profiles of depressive symptoms, distinguished by the presence or absence of co-occurring conduct problems. Latent profile analysis was conducted on a school sample of 1648 children (11-12 years) and replicated in a sample of 2006 twins (8-17 years). In both samples pure-depressive and conduct-depressive profiles were identified. The pure-depressive profile was associated with female gender, while the conduct-depressive profile was associated with lower cognitive ability, but not with gender. A sub-threshold depressive symptoms profile was also identified, which was associated with female gender. All depressive profiles were associated with stressful life events and parental hostility. The conduct-depressive profile and sub-threshold profiles were associated with low attainment; the pure-depressive profile was not. Twin analyses indicated possible differences in genetic aetiology, providing further evidence for heterogeneous depressive subtypes.

6.1. Introduction

As described in the previous chapters, co-occurring conduct problems appear to increase associations between depressive symptoms and attainment. This may at least partially explain why the association between depressive symptoms and attainment observed in chapter 4 was stronger for boys compared to girls. An outstanding research question is whether co-occurring conduct problems defines a distinct subgroup of child and adolescent depressive symptoms, which differ in associated risk factors and attainment at school.

6.1.1. Subgroups of depression

Consistent with the view that depression is a complex multifactorial disorder (Rutter, 2007) there is considerable aetiological heterogeneity in child and adolescent depression (Rice, 2010). For instance, heritability estimates vary widely (Rice, Harold, & Thapar, 2002a) and both heterotypic and homotypic continuity with psychiatric disorders in adult life has been reported (Thapar et al., 2012). Further, genome-wide association studies have so far found no significant associations for major depressive disorder, which has been suggested is partly due to high heterogeneity in the disorder (Sullivan, Daly, & O'Donovan, 2012). This raises the possibility that there may be distinct subgroups of child and adolescent depression with differing aetiologies. Such a possibility may have implications for associations between depressive symptoms and attainment.

6.1.2. Depression with co-occurring conduct problems

One potential source of heterogeneity in childhood and adolescent depression is whether or not depressive symptoms co-occur with conduct problems. Chapter 4 found that the associations between depressive symptoms and attainment attenuated when controlling for conduct problems, with a significant association observed only

for boys. Depressive symptoms may therefore differ when they co-occur with conduct problems, particularly regarding associations with attainment.

Previous research also gives some suggestion of differences between depressive symptoms and disorder that do co-occur with conduct problems compared to those that do not. Depressive symptoms and disorder are more common in girls compared to boys from mid-puberty onwards (Thapar et al., 2012) but there is evidence that depression that co-occurs with conduct problems does not show a female preponderance or the observed increase in rates during adolescence found for 'pure' depression (Angold & Rutter, 1992). Whilst it is known that depression is strongly associated with psychosocial adversity such as stressful life events and family conflict (e.g. Lewinsohn et al., 1994), clinical studies that directly compare depression with and without conduct problems have found some risk factors, including low IQ and adverse family environments (e.g. parental hostility and institutional/foster care), to be more strongly associated with depression that co-occurs with conduct problems (Fombonne et al., 2001a; Simic & Fombonne, 2001). Other studies have also found depressive symptoms to be associated with particularly poor outcomes when they co-occur with conduct problems, including low academic attainment, low social competence and substance use (Ingoldsby et al., 2006).

6.1.3. Depression in childhood compared to adolescence

Clinical observations suggest that when depression arises in children the presentation typically also involves conduct problems (Brent & Weersing, 2008). Unlike adolescent depression, this shows low levels of continuity with adolescent and adult depression, instead showing heterotypic continuity with disorders such as conduct disorder and alcohol abuse/dependence (Weissman, Wolk, Wickramaratne, et al., 1999). Also unlike adolescent depression, childhood depression is equally common in boys and girls (Thapar et al., 2012). Finally, while there is strong evidence for an association between stress and depression (Hammen, 2005), there is some

evidence that depressive disorder with an onset in childhood (where co-occurring conduct problems are more likely) may be associated with different environmental stressors, specifically, greater adverse family factors, such as family discord and parental hostility compared to adolescent depression (Harrington et al., 1997). Taken together, this suggests aetiological heterogeneity and is consistent with the highly variable heritability estimates that have been reported from twin studies of childhood and adolescent depressive symptoms. One particularly reliable finding from twin studies is that genetic factors are less important in the aetiology of depressive symptoms in childhood but make a contribution to the aetiology of depressive symptoms in adolescence similar in magnitude to that seen for major depressive disorder in adults (Rice et al., 2002b). If depressive symptoms and disorder that co-occur with conduct problems are more common in childhood and differ aetiologically from depressive symptoms without conduct problems, this may explain the age-related genetic heterogeneity observed to date.

6.1.4. The present study

The study described in this chapter used latent profile analysis to derive depressive subgroups and hypothesised: (1) depressive subgroups would be identified and defined by the absence and presence of co-occurring conduct problems; (2) these profiles would show differing associations with validators of the profiles, specifically the pure-depressive profile would be associated with female gender and stress, while the conduct-depressive profile would be associated with lower cognitive ability, attainment and parent hostility; (3) these profiles would also differ in genetic aetiology, with genetic factors less important in the aetiology of the conduct-depressive compared to the pure-depressive profile.

6.2. Method

6.2.1. Measures

Measures are briefly outlined below; for a more detailed description see chapter 3.

Depressive symptoms in the school sample were measured using the self-reported Short Mood and Feeling Questionnaire (Angold et al., 1995) (possible range 0-26; α=.89). In the twin sample depressive symptoms were measured using the parent-reported (full) Mood and Feeling Questionnaire (Costello & Angold, 1988) (possible range 0-68; α=.90).

Conduct problems in the school sample were measured using the self- and teacher-reported subscale of the Strengths and Difficulties Questionnaire (Goodman, 2001) (possible range 0-10; α=.65). In the twin sample conduct problems were measured using 6 antisocial behaviour items of the Rutter A and B scales (Rutter et al., 1970) (possible range 0-12; α=.82).

Cognitive ability was measured using the Cognitive Abilities Test (CAT3; Lohman et al., 2001), with measures of verbal reasoning, quantitative reasoning and non-verbal reasoning averaged to produce total score (α=.86).

Academic Attainment was measured by the sum of the standardised continuous scores for Teacher Assessments of English, Maths and Science (α=.85).

Stressful life events was measured using a version of the Life Events Checklist (Johnson & McCutcheon, 1980) (possible range 0-19). Self-report was using in the school sample and parent-report in the twin sample.

Parent-child relationship was measured by child-reported maternal hostility, assessed by the 4-item subscale of the Iowa Youth and Families Project (IYFP) Interaction Rating Scales (Melby et al., 1993) (possible range 7-49; α=.79).

6.2.2. Data analysis

6.2.2.1. Identifying depressive subgroups

Latent profile analysis (LPA) was used to investigate possible depressive subgroups based on the presence or absence of conduct problems. LPA is a person-centred

approach that aims to group similar individuals into categories and is useful for when data include heterogeneous groups of people. It aims to describe the associations between observed variables (in this case, depressive symptoms and conduct problems) using the smallest number of categories **(**Muthen & Muthen, 2000). Categories (profiles) with differing mean levels of the investigated variables may account for skewness in variables within the whole sample. Interpretation of whether profiles represent genuinely distinct categories or simply a single, non-normal distribution, should be based on interpretation in light of additional (validator) variables and theory (Muthen, 2006). LPA was conducted on depressive symptoms and conduct problems using Mplus version 7 (Muthén & Muthén, 1998-2012). A robust maximum likelihood parameter estimator was used as this is robust to non-normality. Starting with a single *k*-profile solution, *k*+1 solutions were extracted until the optimum number of profiles was reached (i.e. the fewest number of profiles that describe associations between depressive symptoms and conduct problems). As recommended, a number of criteria were used to determine the optimum number of profiles: 1) improved model fit for *k*+1 compared to *k* solutions according to the bootstrap likelihood ratio test (BLRT) or a robust chi-square difference test (for twin data; see below) and the Bayesian information criterion (BIC) (Nylund, Asparouhov, & Muthen, 2008); 2) high entropy values (>=.80; Clark & Muthén, 2009); 3) the extent to which profiles were theoretically meaningful (Muthen & Muthen, 2000). For fitting latent profile models to twin data, a two-level approach was used which accounts for twin non-independence. This involves modelling two latent profile variables (one for 'Twin a' and one for 'Twin b', to which individuals from each twin pair were randomly assigned) for which the parameters are held equal but where the probabilities for Twin a are not influenced by the probabilities for Twin b and vice versa (Muthen, Asparouhov, & Rebollo, 2006). The BLRT cannot be computed for two-level models, instead a robust chi-square difference test was used (Satorra & Bentler, 2001).

6.2.2.2. Validators

Associations between hypothesised risk factors and the depressive profiles were examined in the school sample using R3STEP analysis, which predicts latent profile membership (all profiles relative to the normative profile) from the risk factors, using a multivariate approach. Profile probabilities (i.e. the probability of an individual being in each profile) are used to take into account profile measurement error. Investigating associations between profiles and risk factors after establishing the best profile solution corrects for biasing in standard errors that can arise if the risk factors are included in the same model as the LPA (Asparouhov & Muthén, 2013). Measures of cognitive ability and academic attainment were highly correlated (*r*=.831) and therefore not simultaneously entered into the analyses. Analyses were conducted separately entering gender, parental hostility and either academic attainment or cognitive ability. Associations between the depressive profiles and risk factors in the twin sample were analysed in Stata using a multinomial logistic regression with robust standard error estimators (Williams, 2000), as R3STEP analysis is not possible with multiple categorical latent variables, as is the case for the twin analysis.

6.2.1.3. Genetic aetiology

Twin data were used to estimate genetic (A), shared environment (C) and nonshared environment (E) influences of depressive symptoms in Mplus (Muthén & Muthén) with chi-square used to evaluate goodness of fit. Depressive symptoms were log transformed to allow comparability to previous work (Rice et al., 2002b) and reduce skewness. For the depressive profiles, models were run on (continuous) profile probabilities for each of the four depressive profiles using a robust maximum likelihood parameter estimator as these were highly skewed. Using profile probabilities as the model parameters avoids classifying individuals into the most likely profile, which can result in biased estimates and standard errors (Muthen et al.,

2006). The twin design relies on the observation that identical (monozygotic; MZ) twins share all their genes whilst fraternal (dizygotic; DZ) twins, on average, share half of their genes in common. Phenotypic variation is decomposed into additive genetic factors (A), shared environmental factors (C), which are non-genetic influences that serve to make members of a twin pair similar to each other and nonshared environmental factors (E) which impact uniquely on one member of a twin pair and serve to make twins dissimilar from each other.

6.2.1.4. Types of depressive symptoms

Finally, we sought to investigate whether the conduct-depressive profile and pure-depressive profile exhibited different types of depressive symptoms. Exploratory analyses of differences in depressive symptoms endorsed in the pure-depressive and conduct-depressive profiles were conducted using logistic regression. The outcome variable was dummy coded conduct-depressive profile, with the pure-depressive profile as the reference group. The predictor variables were 12 depressive symptoms which mapped onto the DSM-IV-TR criteria for major depressive disorder (depressed mood; irritability; anhedonia; diminished appetite; insomnia; hypersomnia; psychomotor agitation; psychomotor retardation; fatigue; worthlessness; diminished concentration; thoughts of death or dying) (APA, 2000), entered individually. Symptoms were coded as present if reported to be at least sometimes true. A robust standard error estimator was used for the twin sample.

6.2.4.5. Missing data

Data were used from STARS stage 2, where there was no evidence of selective participation (see chapter 2 for more detail). For both samples, children/adolescents were included when data on depressive symptoms were available (school sample N=1648; twin sample N=2006). Data on conduct problems was available for 906 children in the school sample and 1649 twins; despite this level of missingness,

missing data analysis revealed this was not associated with level of depressive symptoms (Little's MCAR test $\chi^2(1)=.01$, $p=.93$; $\chi^2(1)=.01$, $p=.91$ respectively). Analyses were therefore run using full information maximum likelihood (FIML) estimation, which uses all available information to calculate estimates, to provide less biased estimates than excluding participants with missing data from analyses (Schafer & Graham, 2002).

6.3. Results

6.3.1. Descriptive statistics

Descriptive statistics and correlations between variables are presented in Table 6.1. Depressive symptoms and conduct problems were correlated with each other and with all validators, with the exception that age was not associated with depressive symptoms in the twin sample. Depressive symptoms were associated with female gender and conduct problems were associated with male gender in both samples.

Table 6.1. Descriptive statistics and correlations between variables

A) School sample	1.	2.	3.	4.	5.	6.	7.	
1. Depressive symptoms (SMFQ)								
2. Conduct problems symptoms	**.37**							
3. Gender[#]	**.05**	**-.24**						
4. Cognitive ability	**-.09**	**-.22**	.01					
5. Academic attainment	**-.11**	**-.27**	**.08**	**.83**				
6. Stressful life events	**.37**	**.26**	-.003	**-.12**	**-.10**			
7. Maternal hostility	**.43**	**.37**	**-.07**	-.02	**-.10**	.31		
Mean	4.02	2.06	**.47**	102.17	.004	1.91	10.62	
(SD)	(4.67)	(1.92)	(.50)	(11.83)	(.87)	(2.14)	(4.98)	

B) Twin sample	1.	2.	3.			6.		8.
1. Depressive symptoms (MFQ)								
2. Conduct problems symptoms	**.24**							
3. Gender[#]	**.05**	**-.16**						
6. Stressful life events	**.36**	**.18**	-.004					
8. Age (months)	.04	**-.12**	.02			-.02		
Mean	9.16	1.82	.54			1.48		155.08
(SD)	(8.93)	(2.33)	(.50)			(1.47)		(28.48)

Note. Significant correlations at $p<.05$ indicated in bold. SMFQ = Short Mood and Feelings Questionnaire; MFQ = Moods and Feelings Questionnaire (long version) [#]0=boys, 1=girls

6.3.2. Latent profiles

Model comparisons for both samples are shown in Table 6.2. In both samples, a significant improvement in model fit from 1 to 9 profiles was indicated by BLTR or χ^2 change. However BIC and loglikelihood values evened out from 8 to 9 profiles. This suggests that fewer than 8 profiles did not adequately describe associations between depressive symptoms and conduct problems in either sample. Thus an 8 profile solution was selected for both samples.

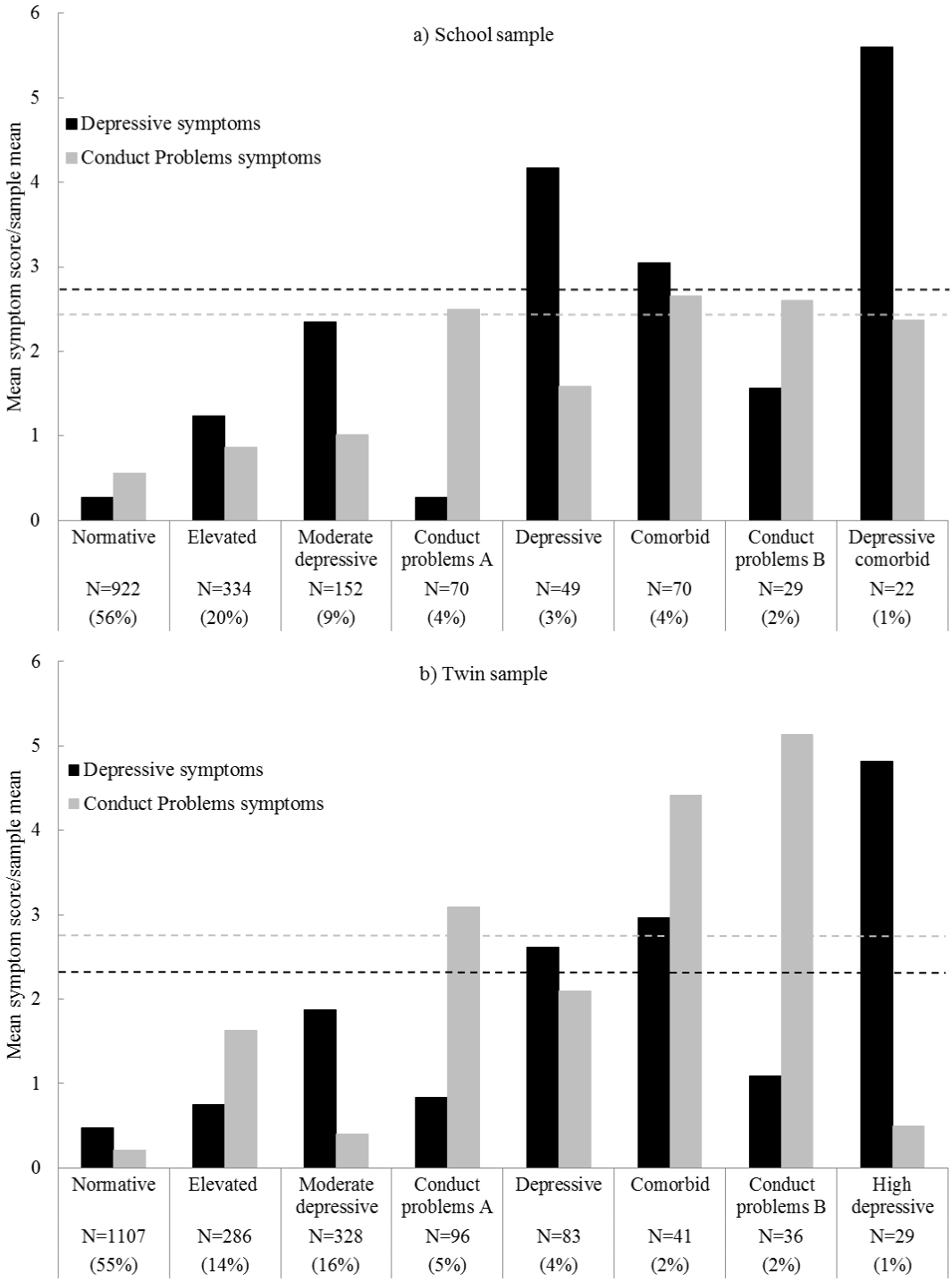
In both samples the eight profiles comprised of two profiles with relatively low levels of all symptoms, two characterised by conduct symptoms without depressive symptoms and four characterised by depressive symptoms (with and without co-occurring conduct problems). Figure 6.1 shows mean depressive symptoms and conduct problems for each profile (to allow comparability across both samples, profile means are presented divided by the sample mean). Results described in text focus on the depressive profiles given the focus of the hypotheses. In both samples the depressive profiles were: moderate depressive; depressive; comorbid; depressive comorbid/high depressive. *The moderate depressive profile* (9% and 16% prevalence in the school and twin sample respectively) was defined by moderate levels of depressive symptoms in the absence of conduct symptoms. *The depressive profile* (3% and 4%) was defined by mean level depressive symptoms which met a clinical cut-point in the absence of conduct symptoms. *The comorbid profile* (4% and 2%) was defined by mean level depressive symptoms which met a clinical cut-point with co-occurring high symptoms of conduct problems. Finally, the fourth profile (1% prevalence in both samples) was defined by particularly high levels of depressive symptoms, scoring more than double the clinical cut-points. In the school sample this was accompanied by co-occurring moderate symptoms of conduct problems and therefore labelled *depressive comorbid* whereas in the twin sample it was not accompanied by symptoms of conduct problems and thus labelled *high depressive*.

Table 6.2. Model comparisons for latent profile analyses

Profiles	Free parameters	Loglikelihood value	BIC	Entropy	BLTR: 2 times the loglikelihood difference
School sample					
1	6	-6751.38	13532.39		
2	10	-6417.84	12887.54	.91	667.07*
3	14	-6272.89	12619.85	.91	289.91*
4	18	-6187.19	12470.68	.89	171.40*
5	22	-6126.07	12370.65	.91	122.25*
6	26	-6083.87	12308.47	.91	84.40*
7	30	-6054.29	12271.54	.86	59.15*
8	34	-6022.60	12230.39	.84	63.38*
9	38	-6005.21	12217.83	.84	34.78*
Profiles	Free parameters	Loglikelihood value	BIC	Entropy	Satorra-Bentler Scaled Chi-Square
1	8	-10557.40	21170.08		
2	10	-10215.97	20501.04	.88	146.75*
3	15	-10007.17	20118.00	.86	193.01*
4	21	-9829.09	19803.31	.82	425.87*
5	28	-9721.91	19637.32	.82	33.97*
6	36	-9610.10	19469.00	.83	-140.00#
7	45	-9528.77	19368.53	.82	-1047.41#
8	55	-9455.86	19291.80	.83	223.93*
9	66	-9412.59	19281.28	.83	69.09*

Note. *p<.0001 #p values not computed for negative values. BIC = Bayesian Information Criterion, BLTR = bootstrap likelihood ratio test.

Figure 6.1. Depressive symptoms and conduct problems for the 8 profiles



Note. Mean depressive symptoms and conduct problems for each profile are presented divided by the sample mean for comparability across samples. Dashed lines represent the equivalent suggested clinical cut-points for depressive symptoms (11 for the school sample and 21 for the twin sample; Angold et al., 2002; Wood et al., 1995) and the 90th percentile for conduct problems.

Associations between these profiles and risk factors are given in Table 6.3. The moderate depressive, depressive and high depressive profiles included more girls than boys (school sample: 57 - 61% female; twin sample: 53 - 68%), whereas the comorbid and depressive-comorbid profiles did not (school sample: 43 - 47% female; twin sample: 49%). Multivariate analyses presented in Table 6.3 indicated that: a) female gender somewhat predicted membership of the moderate depressive and depressive profiles in the school sample and of the moderate depressive profile in the twin sample; b) low attainment and cognitive ability predicted membership of the comorbid profile; c) low attainment also predicted membership of the moderate depressive profile; d) stress and maternal hostility predicted membership of all depressive profiles; e) in the twin sample there was a trend for a relationship between younger age and membership of the comorbid profile.

Table 6.3. Associations between depressive profiles and risk factors

A: School sample (N=1504)	Moderate depressive (9%)	Depressive (3%)	Comorbid (4%)	Depressive comorbid (1%)
	B (SE)	B (SE)	B (SE)	B (SE)
Gender proportions	57% female	61% female	47% female	43% female
Gender[#]	.45 (.24)[†]	.68 (.38)[†]	-.08 (.39)	-.55 (.65)
Attainment	-.32 (.15)[*]	-.07 (.25)	-.74 (.23)[**]	.12 (.47)
Cognitive ability[##]	-.01 (.01)	.04 (.03)	-.06 (.03)[*]	-.01 (.03)
Stress	.30 (.06)[*]	.40 (.07)[***]	.32 (.09)[***]	.42 (.10)[***]
Maternal hostility	.19 (.03)[***]	.29 (.04)[***]	.21 (.04)[***]	.51 (.06)[***]
B: Twin sample (N=2001)	Moderate depressive (18%)	Depressive (4%)	Comorbid (2%)	High depressive (1%)
	B (SE)	B (SE)	B (SE)	B (SE)
Gender proportions	62% female	53% female	49% female	68% female
Gender[#]	.26 (.15)[†]	-.05 (.26)	-.24 (.34)	.52 (.48)
Stress	.41 (.06)[***]	.65 (.07)[***]	.79 (.09)[***]	.70 (.11)[***]
Age (months)	.003 (.003)	-.004 (.005)	-.01 (.01)[†]	.01 (.01)

[†]$p<.1$ [*]$p<.05$ [**] $p<.01$ [***] $p<.001$. The normative profile is the reference group, analyses included all 8 profiles. [#] 0=boys 1=girls [##]Cognitive ability was included in a separate model to attainment as these were highly correlated ($r=.83$). Results for the cognitive ability model, shown in appendix 6.1 (opposed to the attainment model presented here), revealed the same pattern of results for gender, stress and maternal hostility in both models. The exception was that gender was no longer significantly associated with the moderate depressive profile in the cognitive ability model, although the estimates were similar (B=.37), whereas the depressive profile was associated with gender at $p<.05$ (B=1.91).

6.3.3. Genetic contributions to depressive symptoms

Genetic model fitting results and concordance rates are given in Table 6.4. For depressive symptoms, results indicated the contribution of genetic, shared environment and nonshared environment factors were 25%, 51% and 24% respectively, in line with previous reports that included the current sample plus additional participants (Rice et al., 2002b). For the depressive profiles, estimated genetic influence was modest for the moderate depressive and conduct-depressive profiles (32% and 17% respectively), but larger for the pure-depressive profile and the high depressive profiles (52% and 54% respectively). Larger shared environment influence was estimated for the moderate depressive profile (46%) compared to the pure-depressive, conduct-depressive and high depressive profiles (0%). Finally, nonshared environment estimated influence was largest for the conduct-depressive profile (83%) compared to the moderate depressive, pure-depressive and high depressive profiles (22%, 48% and 46% respectively). Thus, there was some indication that genetic factors were most important for the pure-depressive and high depressive profiles, shared environment for the moderate depressive profile and nonshared environment for the conduct-depressive profile. Finally, we restricted analyses to older twins (aged 11-17; N=1542) given reports that the genetic contribution to depressive symptomatology is greater in this age group. Genetic influence was estimated to be 23% in the moderate depressive profile, 48% in the pure-depressive profile, 6% in the conduct-depressive profile and 47% in the high depressive profile.

Table 6.4. Genetic model fitting

					Parameter estimates			Model fit
					A (%; 95% CI)	C (%; 95% CI)	E (%; 95% CI)	χ^2 (*df*=6)
Depressive symptoms								
Whole sample N=2006					25 (11-38)	51 (39-63)	24 (20-29)	3.63(6), *p*=.727
	Number affected		Proband concordance rate		Parameter estimates			Model fit
	MZ	DZ	MZ	DZ	A (%; 95% CI)	C (%; 95% CI)	E (%; 95% CI)	χ^2 (*df*=6)
Profiles N=2006								
Moderate depressive	132	196	.80	.69	32 (1-63)	46 (22-72)	22 (11-32)	8.73, *p*=.190
Pure-depressive	37	46	.43	.17	52 (29-74)	0 (0-0)	48 (26-71)	.87, *p*=.990
Conduct-depressive	15	26	.13	0	17 (0-43)	0 (0-0)	83 (57-100)	4.74, *p*=.578
High depressive	11	18	.55	.11	54 (5-100)	0 (0-0)	46 (0-95)	6.87, *p*=.330

6.3.4. Depressive symptoms

The only significant predictor of the conduct-depressive compared to pure-depressive profile was fewer self-reported *thoughts of death or dying* in the school sample (Odds Ratio (OR)=.34, $p<.05$), which was also found at trend level for self-reported symptoms in the twin sample (OR=.39, $p<.1$). No parent-reported symptoms were significant.

6.4. Discussion

This study aimed to identify distinct depressive profiles based on co-occurrence with conduct symptoms. It was predicted that pure-depressive and conduct-depressive profiles would be identified, defined by the absence and presence of co-occurring conduct problems respectively. It was hypothesised that these profiles would be differentially associated with validator variables and would differ in genetic aetiology.

6.4.1. Pure-depressive and conduct-depressive profiles

The results from both samples support the first hypothesis in that distinct pure-depressive (prevalence estimates 3-4%) and conduct-depressive (prevalence estimates 2-4%) profiles were identified. The results also generally supported the second hypothesis: (i) female gender was associated with the pure-depressive profile but not the conduct-depressive profile, (ii) lower cognitive ability and academic attainment were associated with the conduct-depressive but not the pure-depressive profile (parent hostility and stress were associated with both profiles). These results comparing risk factors for pure- and conduct-depressive profiles therefore show similarity with those reported in clinical samples (Angold & Rutter, 1992; Fombonne et al., 2001a). If depression accompanied by conduct problems is the more common presentation in boys, lower cognitive ability may partially explain reports of worse functional outcomes for depressed boys than depressed girls (Dunn & Goodyer, 2006). Future work assessing the long-term outcomes associated with the different

depressive profiles, and the potential role of low cognitive ability, is needed to investigate this suggestion.

Based on some evidence that depressive disorder with an onset in childhood (where co-occurring conduct problems are more likely) may be associated with different environmental stressors, specifically, greater adverse family factors, such as family discord and parental hostility compared to adolescent depression (Harrington et al., 1997), it had been predicted that the pure-depressive profile would be associated with stressful life events, whereas the conduct-depressive profile would be associated with parental hostility. However, both profiles were associated with both validators. This is consistent with the causal role of stressful life events in depression (Kendler, Thornton, & Gardner, 2000). Given associations with cognitive impairments in the conduct-depressive profile, it may also be consistent with the possibility of gender specific pathways to depression, via failure to meet internal self-worth and achievement demands for males compared to deficiencies in social relationships for females (Kendler & Gardner, 2014). The findings that stress and parent hostility were associated with both the pure-and comorbid-depressive profiles may suggest that these are generalist risk factors that increase risk for both/all forms of depression. In contrast, gender and cognitive ability may be specialist risk factors that increase risk to specific subgroups of depression. The concept of generalist genes and specialist environments has been suggested for risk of psychopathology, whereby genes increase risk non-specifically for various forms of disorder, whereas environmental risks differentiate susceptibility for different disorders (Lahey, Van Hulle, Singh, Waldman, & Rathouz, 2011; Lahey & Waldman, 2012). Investigation into whether this extends to different subgroups of disorders, and whether different environmental risks are generalist or specialist is warranted (e.g. Kounali et al., 2014).

In support of the third hypothesis, there was some evidence of differences in genetic aetiology. Genetic factors were estimated to be less important for the conduct-depressive than the pure-depressive profile (17% and 52% respectively), which

instead was estimated to have greater nonshared environmental influence (83%; although confidence intervals were overlapping). One possible explanation for this finding is that the conduct-depressive profile included younger twins. Indeed, conduct problems typically show a younger age of onset than depressive symptoms (Kessler et al., 2005) and the conduct-depressive profile was somewhat associated with younger age. However, genetic models for older twins only gave the same pattern of results. A larger proportion of depressive symptoms with co-occurring conduct problems in childhood compared to adolescence, may partially explain why genetic factors are found to be less important during childhood (Rice et al., 2002b). Further research is needed to investigate why conduct-depression might be less heritable than pure-depression. For this profile, nonshared environmental risk factors appear to play a particularly important role. These are environmental factors that serve to make twins dissimilar from each other and might include differential treatment by parents and peers.

Finally, the exploratory analyses found evidence of differences in types of depressive symptoms exhibited in the conduct-depressive compared to pure-depressive profiles: specifically, fewer (self-rated) thoughts of death and dying. This differs from a clinical follow-up study of children with major depressive disorder which found increased suicide attempts for those with conduct disorder than without (Fombonne et al., 2001b). However, thoughts of death and dying may not be equivocal to suicide attempts. The findings of the study described here are consistent with work on adult populations which suggests that core cognitive symptoms including suicide ideation may have separate genetic and environmental influences to core mood symptoms such as mood and anhedonia (Kendler, Aggen, & Neale, 2013). Again, the findings presented here require replication to establish whether different types of depressive symptoms are present in conduct-depression to pure-depression and whether these differences may result in the observed differences in genetic aetiology.

In summary, the findings suggest that heterogeneity in the aetiology of childhood and adolescent depressive symptoms and disorder may partially be due to the presence or absence of co-occurring conduct problems. This has implications for nosology given that the ICD-10 and DSM-V classify depression with conduct disorder differently (there is a separate code for combined depression and conduct problems in the ICD-10 (Depressive conduct disorder; WHO, 1992) which would be given two different diagnoses by the DSM-5 (APA, 2013)). Whilst we find evidence of aetiological differences, further research is required to investigate the validity of considering pure and conduct depressive disorders separately (Taylor & Rutter, 2008) (Fombonne et al., 2001a).

6.4.2. Additional depressive profiles: symptom severity

Two additional depressive profiles were identified in both samples which were differentiated by depressive symptom severity rather than the presence or absence of conduct problems. Firstly, a 'sub-threshold' depressive profile, which was somewhat similar to the pure-depressive profile in being associated with female gender and not with cognitive ability. However, this profile was associated with low academic attainment, consistent with work highlighting the importance of addressing sub-threshold symptoms (Angold, Costello, Farmer, et al., 1999; Thapar et al., 2012) and the meta-analysis presented in chapter 2, which found that depressive symptoms were associated with subsequent school grades. This also suggests that depressive symptoms are associated with a risk of low academic attainment in the absence of conduct problems. Differing prevalence rates for this profile in the school and twin samples (9% and 16% respectively), is likely due to the differing age ranges, with the latter including more adolescents (Thapar et al., 2012). Secondly, a profile with very high depressive symptoms was identified, comprising 1% of participants. This was an additional conduct-depressive profile in the school sample but pure-depressive in the twin sample. This may be due to the age differences of the samples.

There was evidence of genetic heterogeneity based on symptom severity. Specifically, lower levels of depressive symptoms were estimated to have a smaller genetic influence than those with higher depressive symptoms (32% compared to 52-54% in the pure/high-depressive profiles; although confidence intervals overlapped) and larger influence of shared environment (32% compared to 0%). A similar finding was reported in a previous twin study of young people, which found shared environmental influences for a broader phenotype of sadness and/or anhedonia but not for major depressive disorder (Glowinski, Madden, Bucholz, Lynskey, & Heath, 2003). Twin studies of hospital ascertained major depressive disorder in adults also report high heritability estimates consistent with the idea that severity may be an important influence on the magnitude of genetic estimates (McGuffin, Katz, Watkins, & Rutherford, 1996; Thapar et al., 2012). However, high depressive symptom scores in children and adolescents have tended to be influenced by shared environmental factors rather than genetic factors (Rice, 2010). Findings described in this chapter extend those results and indicate that there is likely to be heterogeneity in high symptom scores based on the co-occurrence of conduct problems. Thus, findings from the present study suggest two sources of variation in heritability estimates: a) the co-occurrence of conduct problems, which leads to reduced heritability estimates and increased estimates of nonshared environment, and, b) symptom severity, with lower levels of symptoms leading to reduced heritability estimates and increased estimates of shared environment.

6.4.3. Strengths and limitations

A number of aspects of latent profile analysis are important to note in considering the strengths and limitations of the study presented in this chapter. First, latent profile analysis is a data-driven approach whereby the number of profiles extracted is determined by data in the analysed sample, rather than specific hypotheses. The use of a-priori hypotheses and replication samples is therefore particularly important. A

strength of the study is therefore the broad replication of the latent profiles across the two samples, despite varying age ranges and informants of depressive symptoms (self-reported in the school sample and parent-reported in the twin sample - because these show age-related variation in genetic aetiology). Another difference is that data on symptoms of conduct problems were collected roughly 4 years before the depressive symptoms in the twin sample but concurrently in the school sample.

A limitation of latent profile analysis is that there is not one specific criterion that can be used to decide on the optimum number of profiles. Instead, a number of different criteria are recommended to be considered as well as assessing the extent to which profiles are theoretically meaningful (Muthen & Muthen, 2000; Nylund et al., 2008). In the present study, analyses indicated an 8-profile solution, which resulted in some rare profiles that included a small number of informative individuals (see below). Nevertheless, the recommended criteria indicated that at least eight profiles were required to describe associations between depressive symptoms and conduct problems in both samples. Further, differing associations with risk factors validated these as distinct profiles (Muthen, 2006).

As with previous chapters, the study findings may be influenced by the use of questionnaires as opposed to clinical interview measures. While this allowed the use of large, representative samples and the investigation of sub-threshold symptoms, the depressive profiles identified may not extend to clinical disorders. The analyses were also based on largely unaffected community samples. Therefore, despite the relatively large sample sizes (1648 and 2006), analyses looking at validators and genetic aetiology were limited in power due to the relatively small sizes of the depressive profiles (1-4% for the pure/conduct-depressive profiles). This is likely to have been an issue for the high depressive profile. It is also important to note that the confidence intervals for genetic and environmental estimates for pure and conduct-depressive profiles overlapped. Thus, while these observations provide some insight into heterogeneity in associated factors and the genetic aetiology of depressive

symptoms, they merit replication. Finally, it is possible that profiles identified are specific to the developmental period investigated. Future work could investigate the stability of these profiles and whether they replicate at different ages.

6.4.4. Summary

This study indicates that there are distinct depressive profiles distinguished by the presence or absence of co-occurring conduct problems. In a school sample, a pure-depressive profile was associated with female preponderance whereas a conduct-depressive profile was associated with low cognitive ability. Both profiles were associated with higher levels of stressful life events and parent hostility and a 'sub-threshold' depressive profile was associated with female gender. The conduct-depressive and sub-threshold subgroups were associated with low attainment, which the pure-depressive subgroup was not. The pure-depressive and conduct-depressive profiles were replicated in a twin sample, which found some evidence of different genetic aetiologies. The findings also suggest that inconsistencies in risk factors, heritability estimates and outcomes of childhood and adolescent depressive symptoms and disorder may be due to different depressive subgroups.

CHAPTER 7: Higher cognitive ability buffers stress-related depressive symptoms in adolescent girls

Stress has been shown to have a causal effect on risk for depression. The present chapter describes a study that investigated the role of cognitive ability as a moderator of the effect of stressful life events on depressive symptoms and whether this varied by gender. Data were analysed in a school sample of children aged 11-12 years (n=460) and replicated in a sample at increased familial risk of depression aged 9-17 years (n=335). In both datasets, a three-way interaction was found whereby for girls, but not boys, higher cognitive ability buffered the association between stress and greater depressive symptoms. The interaction was replicated when the outcome was a diagnosis of major depressive disorder. This buffering effect in girls was not attributable to coping efficacy. However, a small proportion of the variance was accounted for by sensitivity to environmental stressors. Results suggest that this moderating effect of cognitive ability in girls is largely attributable to greater available resources for cognitive operations which offer protection against stress-induced reductions in cognitive processing and cognitive control which in turn reduces the likelihood of depressive symptomatology.

7.1. Introduction

7.1.1. Stress and depression

Chapter 5 found that stressful life events mediated associations between depressive symptoms and attainment, but that higher cognitive ability buffered the association between stressful life events and attainment. An outstanding research question is whether higher cognitive ability also buffers associations between stressful life events and depression.

As discussed in chapter 1, there is strong evidence for an association between stress and depression (Hammen, 2005), with stressful life events exerting a modest causal effect on the risk for major depressive disorder even when accounting for person effects on the environment (i.e. where individuals elicit stressful life events) (Kendler & Gardner, 2010). Stress appears to have a more important role in precipitating first episodes rather than recurrent episodes of depression (Kendler et al., 2000; Monroe & Harkness, 2005; NICE, 2015). Adolescence is a period of vulnerability for depression with first episodes often emerging at this time and the prevalence of depressive symptoms increasing markedly, particularly among girls. The role of stress as a predictor of depression may therefore be of particular importance during this period. Indeed, it has been suggested that stress experienced during adolescence can have long-lasting effects on the development of brain areas involved in the regulation of stress via glucocorticoid exposure (Lupien, McEwen, Gunnar, & Heim, 2009).

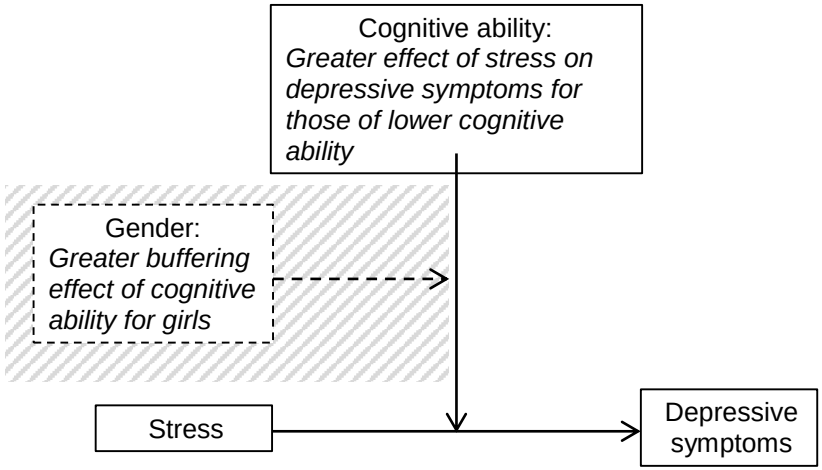
7.1.2. Resilience and cognitive ability

Despite the strong associations between stress and depression, resilience work highlights that not all adolescents show negative outcomes following adversity. In particular, various authors suggest that higher cognitive ability (i.e. intelligence) is associated with more positive social, academic and mental health outcomes following a range of stressors including adverse life events (Masten et al., 1999) and recurrent

depression in a parent (Pargas, Brennan, Hammen, & Le Brocque, 2010; Tiet et al., 1998). As discussed in the introductory chapter, cognitive ability tests include tasks that assess verbal comprehension, abstract reasoning, working memory and processing speed (e.g. WISC; Wechsler, 2003) and thus index a wide-range of cognitive resources and processes including semantic memory, working memory and executive functioning. Individuals with higher cognitive ability may have resources such as greater cognitive reserve which serve to protect them against some of the adverse effects of stress whilst individuals with lower cognitive ability may be more vulnerable to depression following stressful life events because they are less equipped to cope with them (Barnett et al., 2006; Koenen et al., 2009). Thus, cognitive ability may moderate the association between stress and depression. Specifically, higher cognitive ability may buffer (reduce) the association between stressful life events and depression (Figure 7.1, panel a). Stress exerts a modest causal effect on depression and has also been shown to impair memory for neutral material, executive processing and neuronal processes that subserve cognition such as dendritic arborisation in the hippocampus (Goodyer, 2008; Klein & Boals, 2001; Liston et al., 2009; Lupien et al., 2009). Potential explanations of a possible interaction between cognitive ability and stress in predicting depression include that there is greater capacity and efficiency of the cognitive system in more able individuals which serves to protect them from some of the adverse effects of stress. Another is that more cognitively able individuals have greater capacity to profit from information acquired as a result of stressful situations, find meaning in them and positively reframe them – tendencies which have been associated with stress resilient outcomes (Southwick, Vythilingam, & Charney, 2005).

Figure 7.1. Conceptual figure of the tested models

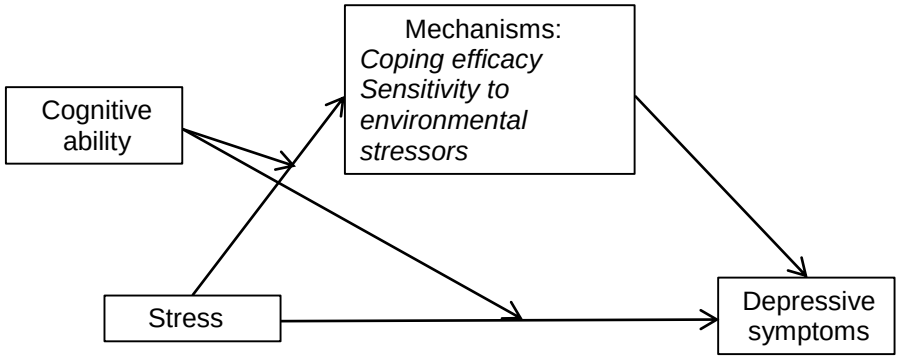
a) Cognitive ability moderates the effect of stress on depressive symptoms



i) Moderation (Hypothesis 1)

ii) Moderation greater in girls than boys (Hypothesis 2)

b) Mediators of the moderating effect of cognitive ability on stress-related depressive symptoms



Mediated moderation (following Hypothesis 2)

7.1.3. Gender

Studies generally report an inverse association between cognitive ability and depression both in childhood and adulthood (e.g. Collishaw et al., 2004; Franz et al., 2011; Hartlage et al., 1993), which is consistent with higher cognitive ability being a resilience factor against depression. Some research suggests that this association may be stronger in girls compared to boys (Glaser et al., 2011; Hatch et al., 2007). Regarding gender differences in depression, higher prevalence rates in girls compared to boys are well documented from mid-puberty onwards (Angold, Costello, & Worthman, 1998; Costello et al., 2006; Green et al., 2005). Two explanations for the development of these gender differences are, firstly, that girls experience more negative life events than boys (Thapar et al., 2012), and secondly, that girls are more likely than boys to experience depression following these stressors (Hankin & Abramson, 2001). Given that associations between stress and depression are stronger for girls than boys, the buffering effect of higher cognitive ability proposed here may also be greater in girls than in boys (Figure 7.1, panel a). Cognitive ability has been suggested to play an important role in protecting against the damaging effects of stress (Boyce & Ellis, 2005) and girls appear to be more vulnerable to stress-related depressive symptoms (Hankin & Abramson, 2001), Thus, girls with higher cognitive ability may benefit more than boys from a greater ability to process information under stress without impairing functioning, due to greater capacity and efficiency of the cognitive system.

7.1.4. Mechanisms

Potential mechanisms through which higher cognitive ability may buffer stress-related depressive symptoms include greater coping efficacy and lower sensitivity to environmental stressors (i.e. these mechanisms may mediate the moderating effect of cognitive ability on stress-related depressive symptoms in girls: mediated moderation; Figure 7.1, panel b). Cognitive processes such as active coping have

been suggested to decrease the likelihood of developing disorders following stress, for example by preventing fear conditioning (Southwick et al., 2005). This is consistent with the elaborated cognitive vulnerability-transactional stress theory (Hankin & Abramson, 2001), which proposes that the likelihood of stress leading to depression is moderated by generic cognitive vulnerabilities. This theory also suggests that these cognitive vulnerabilities are greater in girls, making them more vulnerable to depression following stress. Therefore, coping efficacy may mediate the moderating effect of cognitive ability on stress-related depressive symptoms, a process that may be particularly relevant in girls. Another potential mechanism is environmental sensitivity. The biological-sensitivity-to-context theory (Boyce & Ellis, 2005) suggests that individuals differ in their biological sensitivity to the environment, with those of higher sensitivity (for example, those showing elevated cortisol response to stress) more likely to suffer negative outcomes following stress (Feder, Nestler, & Charney, 2009). Evidence from both animal and human studies suggests that females may perceive social stress as more stressful (Juster et al., 2011) and be more vulnerable to depression following social stress than males (McCormick & Mathews, 2007; Stroud et al., 2002). Thus, sensitivity to environmental stressors may be another mechanism through which cognitive ability buffers stress-related depressive symptoms, particularly in girls.

7.1.5. The present study

The aim of the study described in this chapter was to test the potential moderating effects of cognitive ability on the association between stress and depressive symptoms. Following some evidence that associations between cognitive ability and depressive symptoms may differ between high- and low-risk samples (Pargas et al., 2010), a high-risk sample of the adolescent offspring of depressed parents was included in addition to the school sample (STARS). The main research hypotheses were: (1) cognitive ability would moderate the effect of stress on depressive

symptoms; and, (2) the moderating effect of cognitive ability would be stronger in girls than boys. It was also explored whether coping efficacy and sensitivity to environmental stressors were mediators of the predicted moderating effect of cognitive ability on the association between stress and depressive symptoms (i.e. mediated moderation).

7.2. Method

7.2.1. Measures

Measures are briefly outlined below; for a more detailed description see chapter 3.

Depressive symptoms were measured using the self-reported Short Mood and Feeling Questionnaire (Angold et al., 1995) in STARS (possible range 0-26; α=.89). In the high-risk sample, depressive symptoms were measured using parent and child reports of 9 symptoms from the Child and Adolescent Psychiatric Assessment (CAPA; Angold & Costello, 2000) (possible range 0-9).

Cognitive ability was measured using the Cognitive Abilities Test in STARS (CAT3; Lohman et al., 2001) and the Wechsler Intelligence Scale for Children (WISC-IV; Wechsler, 2003) in EPAD.

Stressful life events was measured using a version of the self-reported Life Events Checklist (Johnson & McCutcheon, 1980) (possible range 0-19; independent life events possible range 0-11).

Coping efficacy was measured using self-reports of the Pearlin Mastery Scale (Pearlin & Schooler, 1978) and The General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995) in the EPAD (possible ranges of 7-35 and 10-40; α=.60 and α=.85 respectively).

Sensitivity to environmental stressors was measured by self-reports of the Highly Sensitive Child Questionnaire, Short Form (Aron & Aron, 1997) in STARS (α=.63) and a version of the Life Events Checklist (see above, Johnson & McCutcheon, 1980) in EPAD (possible ranges 8-56 and 0-95 respectively).

7.2.2. Sample characteristics

As expected, the two datasets differed on a number of family stressors, as shown in Table 7.1. Specifically, the EPAD sample included higher proportions of participants that came from single parent households, had mothers with no formal educational qualifications and had a family income of below £10,000. In addition, the EPAD sample included a wider age and pubertal range (although modal pubertal status was the same).

Table 7.1. Sample characteristics

	STARS	EPAD
Age	11-12 years old	9-17 years old
Modal pubertal status (range)	Late pubertal (Pre pubertal – late pubertal)	Late pubertal (Pre pubertal – post pubertal)
Single parent household	14.7%	28.8%
Mothers with no formal educational qualifications	4.7%	16.0 %
Gross annual family income below £10,000	8.5%	13.6%

Note. STARS = School Transition & Adjustment Research Study; EPAD = The Early Prediction of Adolescent Depression Study.

7.2.3. Statistical analysis

The association between cognitive ability and depressive symptoms was analysed using a series of multiple regression analyses with centred independent variables (Cohen, Cohen, Stephen, & Leona, 2003). The dependent variable was depressive symptoms. The first step entered stress as a single predictor variable, followed by cognitive ability in the second step. The interaction of cognitive ability x stress was added in the third step. Finally, the fourth step tested for moderation by stress and gender, which included gender, all possible additional two-way interaction terms and the interaction of cognitive ability x stress x gender. Significant interactions were followed-up with simple slopes analyses (Dawson & Richter, 2006) where low and high cognitive ability and stress were plotted as the sample mean ± one standard deviation. A final set of analyses exploring potential mediators of the hypothesised moderation was carried out with mediated moderation using Process, model 8, in SPSS (Hayes, 2013). Specifically, these analyses estimated the indirect effect of the cognitive ability x stress interaction term (*XW*) on depressive symptoms (*Y*) through the mediator (coping efficacy or sensitivity to environmental stressors; *M*). This is quantified as the effect of *XW* on *M* and of *M* on *Y*, keeping *X* and *W* (and *XW*) constant (Hayes, 2013). A 95% confidence interval (CI) was generated using N=5000 bootstrap samples. This tested the extent to which the hypothesised moderation of the association between stress and depressive symptoms by cognitive ability was attributable to coping efficacy or sensitivity to environmental stressors.

For the STARS data, children were included in the present analysis when data were available on depressive symptoms and cognitive ability at stage 2 and stressful life events at stage 1 (where there was some evidence of selective drop-out; see chapter 2). In previous chapters, when stage 1 variables were used (chapter 5), the equivalent stage 2 variables were used as missing data correlates so that full information maximum likelihood (FIML) estimates could be used. However, this was not appropriate for the present analyses as information about stressful life events at

subsequent stages would not necessarily provide information about former stressful life events (e.g. death of a relative; correlation between stressful life events at stage 1 and stage 3 was r=.33). Thus, data were analysed using listwise deletion in SPSS (N=460). The analysed sample with complete data did not differ from the rest of the sample in terms of depressive symptoms (t(1646)= 1.73, p=.08) or stressful life events (t(743)= -0.36, p=.72), but had higher cognitive ability scores (t(1157)= -4.37, p<.001).

7.3. Results

7.3.1. Descriptive statistics

Table 7.2 presents descriptive data with gender differences and correlations by gender. Mean levels of stressful life events were higher in EPAD than STARS (3.40 and 1.21 respectively). The proportion of participants meeting either the clinical cut-point for depression (STARS) or diagnostic criteria for major depressive disorder (EPAD) was also higher in EPAD reflecting the fact that EPAD was selected on the basis of elevated familial risk for depression (13.6% compared to 7.6% based on the suggested clinical cutpoint, Angold et al., 2002). Mean cognitive ability scores were 104 in STARS and 95 in EPAD. Independent-sample t-tests showed girls had higher levels of depressive symptoms than boys in both datasets, higher cognitive ability than boys in the EPAD data and more stressful life events and sensitivity than boys in the STARS data. There were no gender differences for coping efficacy or independent life events. Bivariate correlations for each sample showed that depressive symptoms were associated with stressful life events in both datasets (STARS r=.34, p<.001; EPAD r=.32, p<.001) and with cognitive ability in the EPAD data (r=-.13, p=.02) but not the STARS data (r=-.01, p=.88). Stressful life events were also associated with cognitive ability in the EPAD data (r=-.16, p=.004) but not the STARS data (r=.04, p=.37).

Table 7.2. Descriptive statistics and correlations

	Whole sample	Boys	Girls	Gender differences	Correlations					
	Mean (SD)	Mean (SD)	Mean (SD)	*t* (*df*)	1.	2.	3.	4.	5.	6.
STARS (School Transition & Adjustment Research Study)										
1. Depressive symptoms (SMFQ)	3.70	3.08	4.30	3.00**		.04	.26***	-.24***	.28***	.07
	(4.35)	(3.69)	(4.83)	(446)						
2. Cognitive ability	103.51	103.71	103.32	-.35	-.04		-.08	.28***	.19*	.07
	(11.98)	(12.48)	(11.48)	(458)						
3. Stressful life events	1.21	1.08	1.35	2.12*	.36***	-.01		-.25***	.20**	.65***
	(1.39)	(1.20)	(1.54)	(456)						
4. Coping efficacy	27.24	27.45	27.04	-.95	-.35***	.20**	-.45***		-.07	-.02
	(4.65)	(4.70)	(4.61)	(453)						
5. Sensitivity to the environment	33.08	31.62	34.43	3.68***	.29***	.05	.16*	-.26***		.15*
	(7.65)	(7.49)	(7.57)	(389)						
6. Behaviour-independent life events	.62	.55	.69	1.93	.19**	.08	.76***	-.26***	.09	
	(.78)	(.69)	(.86)	(456)						

Note. Correlations for boys lie above the diagonal, correlations for girls lie below the diagonal. *p<.05, **p<.01, ***p<.001.

Table 7.2. Descriptive statistics and correlations, continued

	Whole sample	Boys	Girls	Gender differences							
	Mean (SD)	Mean (SD)	Mean (SD)	*t* (*df*)	1a.	1b.	2.	3.	4.	5.	6.
EPAD (Early Prediction of Adolescent Depression Study)											
1a. Depression (MDD)	.14	.06	.18	2.86**		.60***	-.24*	.29**	-.26*	.33**	.24*
	(.34)	(.25)	(.39)	(270)							
1b. Depressive symptoms (CAPA)	1.69	1.38	1.91	2.59*	.38***		-.09	.37***	-.20	.29**	.16
	(1.86)	(1.54)	(2.04)	(329)							
2. Cognitive ability	94.92	93.22	96.15	2.05*	-.19*	-.17*		-.20*	.24*	-.15	-.15
	(12.86)	(11.34)	(13.75)	(328)							
3. Stressful life events	3.40	3.35	3.44	.33	.31***	.29***	-.14		-.03	.79***	.69***
	(2.37)	(2.44)	(2.33)	(316)							
4. Coping efficacy	27.73	27.82	27.67	-.23	-.19*	-.25**	.21*	-.14		-.06	-.002
	(4.78)	(4.74)	(4.82)	(245)							
5. Sensitivity to the environment	8.28	7.37	9.00	1.70	.34***	.36***	-.21**	.69***	-.09		.65***
	(8.10)	(7.50)	(8.47)	(295)							
6. Behaviour-independent life events	1.25	1.22	1.28	.46	.20*	.11	-.07	.70***	-.02	.53***	
	(1.21)	(.10)	(1.26)	(316)							

Note. Correlations for boys lie above the diagonal, correlations for girls lie below the diagonal. *p<.05, **p<.01, ***p<.001.

7.3.2. Cognitive ability moderating the effect of stress on depressive symptoms and disorder

Findings testing the hypothesised moderating effects of cognitive ability on the association between stress and depressive symptoms are presented in Table 7.3. The first step of the analyses showed an association between stress and depressive symptoms (STARS β=.34, p<.001; EPAD β=.30, p<.001). The second step showed that this association remained when cognitive ability was entered into the model (STARS β=.34, p<.001; EPAD β=.29, p<.001) with no main effect of cognitive ability on depressive symptoms (STARS β=.0004, p=.92; EPAD β=-.07, p=.21). The third step showed no evidence of cognitive ability moderating the effects of stress on depressive symptoms, (interaction terms: STARS β=-.04, p=.34; EPAD β=-.07, p=.18) with a main effect of stress (STARS β=.33, p<.001; EPAD β=.29, p<.001) but not cognitive ability (STARS β=.004, p=.94; EPAD β=-.07, p=.21) on depressive symptoms. Further analyses revealed a three-way interaction between stress, cognitive ability and gender (Model 4; three-way-interaction terms: STARS β=.13, p=.03; EPAD β=.17, p=.01). When the samples were split by gender, two-way interactions of stress and cognitive ability were present in girls (STARS β=-.12, p=.05; EPAD β=-.17, p=.02) but not in boys (STARS β=.08, p=.21; EPAD β=.10, p=.27).

Table 7.3. Associations between cognitive ability and depressive symptoms: total stressful life events

	STARS					EPAD				
	Model change		Coefficients			Model change		Coefficients		
	R^2 change	*p*	*β*	*B (S.E.)*	*p*	R^2 change	*p*	*β*	*B (S.E.)*	*p*
Step I: stress										
Intercept				3.70 (.19)	<.001				1.69 (.10)	<.001
Stress			.34	1.04 (.14)	<.001			.30	.24 (.04)	<.001
Step 2: stress and cognitive ability	<.001	.93				.01	.21			
Intercept				3.70 (.20)	<.001				1.69 (.10)	<.001
Stress			.34	1.04 (.14)	<.001			.29	.23 (.04)	<.001
Cognitive ability			.0004	.002 (.02)	.92			-.07	-.01 (.01)	.21
Step 3: moderation by stress	.002	.34				.01	.18			
Intercept				3.69 (.20)	<.001				1.67 (.10)	<.001
Stress			.33	1.03 (.14)	<.001			.29	.23 (.04)	<.001
Cognitive ability			.004	.001 (.02)	.94			-.07	-.01 (.01)	.21
Cognitive ability x Stress			-.04	-.01 (.01)	.34			-.07	-.004 (.003)	.18

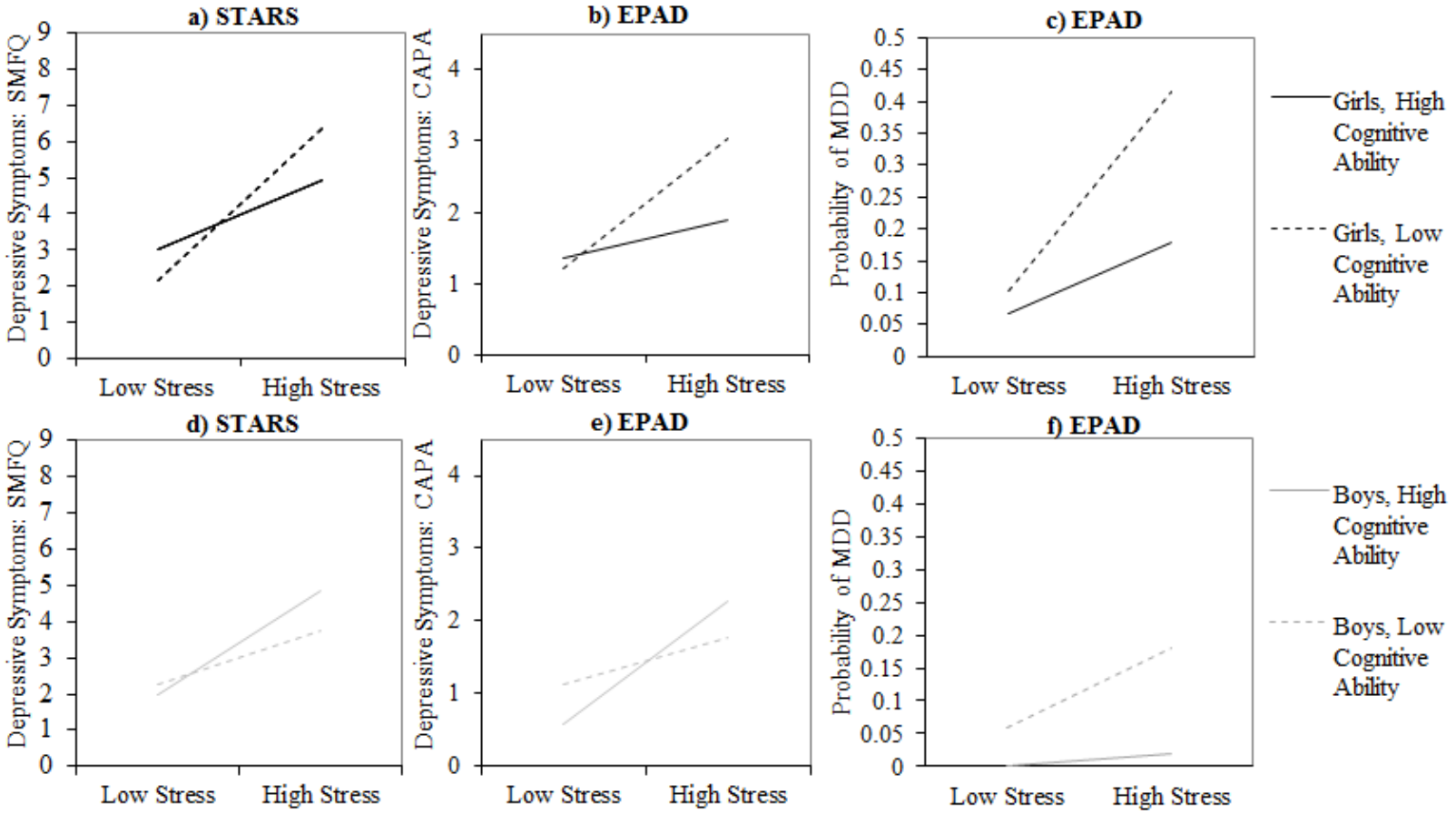
Table 7.3. Associations between cognitive ability and depressive symptoms: total stressful life events, continued

	STARS					EPAD				
	Model change		Coefficients			Model change		Coefficients		
	R^2 change	*p*	*β*	*B (S.E.)*	*p*	R^2 change	*p*	*β*	*B (S.E.)*	*p*
Step 4: Moderation by stress and gender	.03	.01				.04	.004			
Intercept				4.12 (.27)	<.001				1.87 (.13)	<.001
Stress			.35	1.10 (.18)	<.001			.32	.25 (.06)	<.001
Cognitive ability			-.03	-.01 (.02)	.62			-.13	-.02 (.01)	.05
Gender[#]			-.10	-.90(.39)	.02			-.12	-.44 (.21)	.03
Cognitive ability x Stress			-.13	-.04 (.02)	.03			-.17	-.01 (.004)	.01
Cognitive ability x Gender			.06	.03 (.03)	.39			.07	.02 (.02)	.28
Stress x Gender			-.06	-.30 (.29)	.30			-.002	-.002 (.09)	.98
Cognitive ability x Stress x Gender			.13	.06 (.03)	.03			.17	.02 (.01)	.01

[#]0=girls, 1=boys

Simple slopes analyses were used to follow-up the three-way interaction and revealed a buffering effect of higher cognitive ability for girls (Figure 7.2, panels a and b) with a significantly stronger association between stress and depressive symptoms for girls of lower cognitive ability compared to girls of higher cognitive ability (STARS t=-2.18, p=.03; EPAD t=-2.86, p=.01). For boys, there was no significant difference between lower and higher cognitive ability in the association between stress and depressive symptoms (Figure 7.2, panels d and e; STARS t=1.10, p=.27; EPAD t=1.23, p=.22). Associations between stress and depression were stronger for girls with lower cognitive ability compared to boys of lower cognitive ability (STARS t=-2.38, p=.02; EPAD t=-1.96, p=.05). In contrast, there was some indication that associations between stress and depression were marginally stronger for boys of higher cognitive ability compared to girls of higher cognitive ability in the high risk sample only (STARS t=-.88, p=.38; EPAD t=1.88, p=.06). There was no difference between slopes comparing boys of high cognitive ability and girls of low cognitive ability (STARS t=-.31, p=.76; EPAD t=.58, p=.56) or comparing boys of low cognitive ability and girls of high cognitive ability (STARS t=-1.16, p=.25; EPAD t=-.52, p=.61). In summary, higher cognitive ability was found to buffer the association between stress and depressive symptoms in girls, but not in boys.

Figure 7.2. Simple slopes analysis: associations between cognitive ability and depressive symptoms/MDD for girls and boys



Note. Low and high stress and cognitive ability and are plotted as the mean ± 1SD for the two datasets. All predictor variables are centred. STARS = School Transition & Adjustment Research Study; EPAD = The Early Prediction of Adolescent Depression Study.

Logistic regression analyses (EPAD only) showed that the three-way cognitive ability x stress x gender interaction replicated when a diagnosis of MDD was the outcome variable (*Exp(B)*=1.04, *p*=.04), along with main effects of stress (*Exp(B)*=1.36, *p*=.002) and gender (*Exp(B)*=.06, *p*=.02), but not cognitive ability (*Exp(B)*=.97, *p*=.09), and no significant two-way interactions (cognitive ability x stress: *Exp(B)*=.99, *p*=.38; cognitive ability x gender: *Exp(B)*=.86, *p*=.05; stress x gender: *Exp(B)*=1.55, *p*=.14); results for girls are shown in Figure 7.2 panel c and for boys in Figure 7.2 panel f. When the sample was split by gender, two-way interactions of stress and cognitive ability were not significant, although these showed the same direction of associations as was found for depressive symptoms in EPAD (girls: *Exp(B)*=.99, *p*=.38; boys: *Exp(B)*=1.04, *p*=.06).

7.3.3. Behaviour-independent life events

Restricting the analysis to independent life events outside the control of the individual allowed the study to test the possibility that the interaction was driven by cognitive ability influencing levels of stress exposure. Tests of the moderating effect of cognitive ability on the association between stress and depressive symptoms replicated when restricting the measurement of stress to behaviour-independent life events (Table 7.4).

Table 7.4. Associations between cognitive ability and depressive symptoms: behaviour-independent stressful life events

	STARS					EPAD				
	Model change		Coefficients			Model change		Coefficients		
	R^2 change	*p*	*β*	*B (S.E.)*	*p*	R^2 change	*p*	*β*	*B (S.E.)*	*p*
Step I: stress										
Intercept				3.70 (.20)	<.001				1.68 (.11)	<.001
Stress			.15	.85 (.26)	.001			-.11	.17 (.09)	.06
Step 2: stress and cognitive ability	.0004	.67				.01	.06			
Intercept				3.70(.20)	<.001				1.67 (.11)	<.001
Stress			.16	.86 (.26)	.001			.10	.16 (.09)	.08
Cognitive ability			-.02	-.01 (.02)	.67			-.11	-.02 (.01)	.06
Step 3: moderation by stress	.01	.05				.01	.11			
Intercept				3.72 (.20)	<.001				1.67 (.11)	<.001
Stress			.17	.93 (.26)	.001			.10	.16 (.09)	.08
Cognitive ability			-.02	-.01 (.02)	.61			-.11	-.02 (.01)	.06
Cognitive ability x Stress			-.09	-.05 (.02)	.05			-.09	-.01 (.01)	.11

Table 7.4. Associations between cognitive ability and depressive symptoms: behaviour-independent stressful life events, continued

	STARS					EPAD				
	Model change		Coefficients			Model change		Coefficients		
	R^2 change	*p*	*β*	*B (S.E.)*	*p*	R^2 change	*p*	*β*	*B (S.E.)*	*p*
Step 4: Moderation by stress and gender	.03	.01				.04	.01			
Intercept				4.25 (.28)	<.001				1.91 (.14)	<.001
Stress			.20	1.12 (.33)	.001			.10	.16 (.11)	.17
Cognitive ability			-.06	-.02 (.03)	.35			-.17	-.02 (.01)	.02
Gender			-.13	-1.16 (.41)	.01			-.14	-.52 (.21)	.02
Cognitive ability x Stress			-.16	-.08 (.03)	.01			-.17	-.02 (.01)	.01
Cognitive ability x Gender			.06	.03 (.04)	.35			.07	.02 (.02)	.34
Stress x Gender			-.09	-.81 (.54)	.14			.04	.10 (.19)	.62
Cognitive ability x Stress x Gender			.12	.09 (.05)	.05			.14	.03 (.02)	.03

[#]0=girls, 1=boys

7.3.4. Mediated moderation analyses

Follow-up mediated moderation analyses were conducted to test whether the observed moderating effect of cognitive ability on the association between stress and depressive symptoms for girls was accounted for by coping efficacy or sensitivity to environmental stressors. There was no evidence of mediated moderation for coping efficacy in either sample (STARS *b*=-.001, SE=.004, CI [-.01, .01]; EPAD *b*=-.001, SE=.001, CI [-.004, .0002]). There was some indication of mediated moderation for sensitivity to environmental stressors in both samples (STARS *b* =-.01, SE=.004, CI [-.02, -.001]; EPAD *b*=-.002, SE=.001, CI [-.01, -.0001]). That is, there was a small but significant indirect effect of the interaction between cognitive ability and stress on depressive symptoms for girls through environmental sensitivity. This suggests that higher cognitive ability in girls may be associated with fewer depressive symptoms partly via decreased sensitivity to environmental stressors when exposed to stressful life events. However, this only accounted for a small proportion of the observed interaction.

7.4. Discussion

The study described in this chapter set out to examine the relationship between stress, cognitive ability and depressive symptoms, with the specific prediction that higher cognitive ability promotes resilience to stressful life events. The role of cognitive ability as a moderator of the association between stressful life events and depressive symptoms was examined in two adolescent samples where the degree of stress exposure was expected to differ. Based on the suggestion that individuals of lower cognitive ability may be less equipped to cope with stressful life events and thus be more vulnerable to their depressogenic effects (Barnett et al., 2006; Koenen et al., 2009), it was predicted that higher cognitive ability would buffer the effect of stress on depressive symptoms. Given the increased vulnerability to depression following

stress found in adolescent girls (Hankin & Abramson, 2001), it was also predicted that the buffering effect of cognitive ability might be stronger in girls than boys.

7.4.1. Cognitive ability as a buffer against stress-related depressive symptoms

The data supported the first hypothesis that higher cognitive ability moderated the effect of stress on depressive symptoms, although this was specific to girls. The observation that higher cognitive ability buffers against the depressogenic effects of stressful life events at least in adolescent girls is consistent with previous work which has found that those with higher cognitive ability show more positive outcomes such as academic, behavioural, social and psychiatric competence following stress (e.g. Masten et al., 1999; Pargas et al., 2010; Tiet et al., 1998). These study findings illustrated that higher cognitive ability was associated with resilience to life stress both in a sample of adolescents at increased familial risk of depression and a community sample of adolescents. One possible explanation is that those of higher cognitive ability may show greater self-regulation under stress. Indeed, it has been suggested that cognitive ability may enable faster and more flexible responses to the environment (Boyce & Ellis, 2005). For instance, a range of cognitive processes which are at least partly indexed by the broad measure of cognitive ability, (such as working memory capacity and executive functions such as cognitive flexibility) may enable individuals to utilise controlled, effortful processing and thus generate strategic, flexible emotional responses under conditions of stress (Barrett, Tugade, & Engle, 2004). Thus, those of higher cognitive ability may be better able to inhibit negative behavioural and cognitive responses to stress. Consistent with resilience work which highlights cognitive ability as a predictor of better mental health particularly in those at high familial risk (Pargas et al., 2010), bivariate associations were found between cognitive ability and depression in the sample of children of depressed parents, but not in the community sample. Nevertheless, this association did not remain when controlling for exposure to stressful life events. Thus, rather than having a direct

association, higher cognitive ability appears to be a protective factor for depression in the context of stressful life events. This is important when considering the role of cognitive ability in the aetiology of depression, suggesting that lower cognitive ability is not in itself a risk factor for depressive symptoms. It also suggests that girls of lower cognitive ability are a vulnerable group that may merit special consideration for supportive interventions.

Exposure to stressful life events can be controllable and partly dependent on behaviour (e.g. getting into a fight and being injured) or uncontrollable and independent of behaviour (e.g. death of a loved one) (Kendler & Baker, 2007). Thus, it is possible that individuals influence stress exposure through their own behaviour. It was tested whether results replicated when stress exposure was restricted to independent life events and found the same pattern of results. The fact that results replicated gives greater confidence in the interpretation that cognitive ability modifies the influence of stress on the individual as opposed to influencing stress exposure (Hammen, 1991; Rice et al., 2003).

7.4.2. Gender differences

The data also supported the second hypothesis that the moderating effect of cognitive ability would be greater for girls than boys. The finding that higher cognitive ability buffers the association between stress and depressive symptoms in girls only, is somewhat consistent with previous studies showing associations between higher cognitive ability and fewer depressive symptoms in girls but not boys (e.g. Hatch et al., 2007). It is also consistent with data showing that from adolescence onwards, girls experience more social stressors and are more likely to develop depressive symptoms following social stressors (Thapar et al., 2012). Suggestive evidence of an opposite effect in boys was also observed (that higher cognitive ability may be associated with increased stress-related depressive symptoms), at least in those at high risk. Some researchers have suggested that higher cognitive ability may be

associated with a greater sensitivity to the environment, including stressors, although those studies did not test that explanation (Luthar, 1991; Zigler & Farber, 1985). It may be that the effect of cognitive ability on stress processing is different in boys and girls and that different cognitive processes may need to be targeted in boys and girls. These results are preliminary and will require replication, particularly given the small number of boys with major depressive disorder in the EPAD sample (6.4%). Nonetheless, prevalence rates were higher than typically reported (Costello et al., 2006), given that the analysis of MDD focussed on a high-risk sample.

7.4.3. Mechanisms

Coping efficacy was tested as a possible mediator for the moderating effect found in girls. This was based on reports of associations between cognitive reappraisal and resilience to stress-related depression (Southwick et al., 2005), and of suggestions that such cognitive vulnerabilities result in an increased risk of depression in girls (Hankin & Abramson, 2001). No evidence of mediated moderation was found. Sensitivity to environmental stressors was also explored as a possible mediator of this moderation following suggestions that girls may find social stress more stressful, and be more vulnerable to depression following social stress than males (Juster et al., 2011; McCormick & Mathews, 2007; Stroud et al., 2002). The study found some evidence of mediated moderation, with higher cognitive ability in girls leading to fewer depressive symptoms under stress at least partly via reduced environmental sensitivity. Thus, girls of higher cognitive ability may be better able to process information without impairing functioning under stress compared to girls of lower cognitive ability. In particular, these study findings are consistent with 'hardware' interpretations that the observed buffering effect of higher cognitive ability may be due to greater cognitive capacity and efficiency (Brewin & Smart, 2005; Ellis, 1990). Under stress, controlled attentional/cognitive resources are reduced. However higher cognitive ability, in particular executive processes including working memory

capacity, mental flexibility and inhibition, may increase resistance to the attentional capture of negative information (Barrett et al., 2004; Cohen-Gilbert & Thomas, 2013; Joormann & Gotlib, 2010). It is also possible that girls of higher cognitive ability show lower biological stress responses but evidence to date is inconclusive (Flegr et al., 2012; Power, Li, & Hertzman, 2008; Slattery, Grieve, Ames, Armstrong, & Essex, 2013; Stawski et al., 2011). Moreover, the mediation effect was small, which may be partially due to measurement characteristics of the indices of environmental sensitivity. Despite being well established, internal validity was relatively low for the measure used in STARS and relied on having been exposed to stressful life events in EPAD. Future work looking at mechanisms of this association which would inform prevention programmes is therefore encouraged.

7.4.4. Strengths and limitations

This study has a number of strengths; particularly the use of independent datasets which differed on background stress levels. One sample included the offspring of depressed parents, a group known to differ from the general population on exposure to stress (Goodman & Gotlib, 1999). Findings replicated across both samples, with varying age ranges, measures of cognitive ability and measure of depressive symptoms and disorder, suggesting the findings are reliable. Although modal pubertal status was equivalent in both samples, the wider age range of the high risk sample could have been an issue, as this represents the entire range of puberty, whereas important gender differences in depression emerge at the onset of puberty (Thapar et al., 2012). However, replication of the findings in this sample suggests that the observed buffering effect of higher cognitive ability against stress-related depressive symptoms is not limited to this pubertal period. A limitation is that in this study it was not possible to investigate the possibility of shared genetic risk between cognitive ability, stress and depression. However, the pattern of results replicated when using behaviour-independent stressful life events. It is therefore unlikely that the observed

interaction is due to life events exposure arising from the characteristics of the individual, including genetically influenced characteristics (e.g. Hammen, 1991; Rice et al., 2003). Thus, observed results for independent stressful life events are inconsistent with shared genetic risk for stress and either cognitive ability or depressive symptoms. An alternative possibility is that associations are due to the confounding effects of deprivation, which may be associated with cognitive ability, stress and depression (Collishaw et al., 2004). However, our results replicated when we repeated our analyses controlling for socioeconomic status (indexed by free-school meals eligibility in STARS and the 2000 Standard Occupational Classification for EPAD) suggesting that this is not the case (see appendices 7.1 and 7.2). Another consideration is the inference of causality. It is argued that girls of higher cognitive ability are at a lower risk of depressive symptoms increasing following stress. The results do not exclude the possibility of reverse causation. However, as noted, the results replicated for behaviour-independent life events. Cognitive ability shows high stability from childhood to old age (Deary, Whalley, Lemmon, Crawford, & Starr, 2000) and thus lower cognitive ability is a better candidate for an antecedent of, rather than a result of, depressive symptoms. Finally, the study findings provide useful insight into the aetiology of depression during adolescence. This is particularly important given that this is a period of vulnerability for depression and long-lasting effects of stress (Lupien et al., 2009; Thapar et al., 2012). To investigate whether the buffering effects of higher cognitive ability are specific to this developmental period, future work could investigate the relationship between cognitive ability, stress and depression during childhood and adulthood.

7.4.5. Summary

The findings of this study suggest that low cognitive ability is not a significant vulnerability factor for depressive symptoms in itself. Instead, cognitive ability acts indirectly, with higher cognitive ability showing a buffering effect in girls consistent

with the view that cognitive ability is one resilience promoting factor in the context of stress both in adolescents at low and high familial risk for depression. As well as buffering the association between depression and attainment via stress, higher cognitive ability appears to buffer the effect of stress on depression.

Chapter 8: General discussion

8.1. Overview

Adolescence is associated with an increase in depression, and depressive symptoms and disorder during this period are associated with concurrent functional impairment, including low academic attainment, as well as a range of negative long term outcomes (Rutter et al., 2006; Thapar et al., 2012). Low attainment at school has been identified as a major predictor of unemployment, low income, poor health and mortality (Mirowsky & Ross, 2003; U.S. Department of Education, 2005). Thus, low attainment may be one pathway through which depression in adolescence leads to adverse outcomes later in life and is an important area for research aimed at preventing an escalating cycle of functional impairment. However, while consistent cross-sectional associations have been found between depression and low attainment, (e.g. Kovacs & Goldston, 1991; Puig Antich, 1985), longitudinal research has been inconsistent (e.g. Richards & Abbot, 2009). This thesis primarily aimed to gain a better understanding of associations between depressive symptoms and subsequent attainment, including reasons for inconsistencies across studies, the mechanisms involved in this association and the factors associated with variation in associations - focussing on gender, conduct problems and cognitive ability.

The primary research questions of this thesis were:

1. Does existing research provide evidence for an association between depressive symptoms and subsequent low attainment in school?
2. Are depressive symptoms associated with subsequent low attainment when controlling for baseline levels of attainment?
3. What are the pathways through which depressive symptoms lead to lower attainment?

4. Which factors are associated with variation in associations between depressive symptoms and attainment?

   Specifically: a) gender; b) conduct problems; c) cognitive ability

Exploring these primary research questions identified two issues surrounding sources of heterogeneity in the association between depressive symptoms and attainment, which led to the investigation of two further research questions:

a) Are depressive symptoms differentially associated with attainment and risk factors including gender, cognitive ability and stress when they co-occur with conduct problems?
b) Does high cognitive ability buffer stress-related depressive symptoms?

These research questions were investigated in the five empirical studies presented in chapters 2, 4, 5, 6 and 7 of this thesis. The findings, limitations and implications of these studies in relation to the primary and additional research questions are discussed below, as well as suggestions for future research.

8.2. Primary research questions

8.2.1. Does existing research provide evidence for an association between depressive symptoms and subsequent low attainment in school?

The first aim of this thesis was to synthesise existing research on the association between depressive symptoms and subsequent attainment, and to investigate possible reasons for heterogeneity in findings. This was investigated in Chapter 2, which presented a meta-analysis of longitudinal studies investigating associations between emotional problems and attainment. This identified 26 longitudinal studies which investigated associations between depression, internalising problems or anxiety and school attainment as measured by school grades or school failure (failing to complete school). Specifically, 17 studies were identified which investigated

associations between depression and school attainment, which included a total of 20,064 participants. The meta-analysis found small but significant associations between higher depressive symptoms and both subsequent lower school grades (*r*=-.12) and subsequent higher school failure (*r*=.17). Significant heterogeneity in effect sizes was found. Specifically, there was an indication that associations between depression and attainment varies based on age and follow-up period, but not gender, country or assessment of depression (diagnosis vs. dimensional/symptoms).

The meta-analysis found that associations between depression and attainment varied by age, with stronger associations in later adolescence compared to early adolescence. This may be because older adolescents may have had depressive symptoms for longer, because more severe symptoms are endorsed at this age, or because school work is more demanding at this age. Associations also varied by follow-up period, with associations between depression and school failure (but not grades) stronger for shorter follow-up periods. This is consistent with work that suggests that emotional problems may only have an influence on academic outcomes in the short-term (Masten et al., 2005). However, follow-up periods for this analysis varied from 1 to 9 years, suggesting that the influence of depression on school attainment may last a number of years. Thus, length of follow-up is one factor which may explain some of the inconsistencies in reported associations between depressive symptoms and attainment in previous literature.

In summary, the meta-analysis described in chapter 2 suggests that existing research does provide evidence for an association between depressive symptoms and subsequent low attainment in school. However, prior school attainment was not controlled for in these analyses and therefore this does now establish an association between depression and a reduction in school attainment over time. This was explored next.

8.2.2. Are depressive symptoms associated with subsequent low attainment when controlling for baseline levels of attainment?

Having established that existing research provides evidence for an association between depressive symptoms and attainment, this thesis next sought to investigate whether depressive symptoms were associated with a reduction in attainment over time. This was addressed in chapter 4, which presented a 6 month longitudinal study which investigated associations between emotional problems and attainment. The study utilised a cross-lagged design to investigate associations between depressive symptoms and a change in attainment over time, by controlling for both within construct continuity and cross-sectional associations. Results provided evidence that depressive symptoms are associated with a reduction in attainment over time. Thus, along with the findings from chapter 2, this provides evidence of a longitudinal association between depressive symptoms and low attainment. Further, it provides insight into the direction of this association; specifically, there was no evidence of an association between baseline levels of attainment and change in depressive symptoms, suggesting that this association is unidirectional.

This study also extended the findings of chapter 2 by investigating whether co-occurring conduct problems may account for the observed association between depressive symptoms and a reduction in attainment. Three notable findings emerged here. Firstly, conduct problems were associated with a reduction in attainment and showed stronger associations than were found for depressive symptoms, which is consistent with previous research (Kessler et al., 1995; Richards & Abbot, 2009). Secondly, associations between depressive symptoms and subsequent attainment were moderated by gender, with significant associations for boys only. Thirdly, when conduct problems were included in a cross-lagged model with depressive symptoms and attainment, associations between depressive symptoms and subsequent attainment attenuated. This is in-line with research which has found that depressive symptoms with co-occurring conduct problems have particularly poor outcomes,

including low attainment (Ingoldsby et al., 2006). Gender and conduct problems, as factors which may moderate associations between depressive symptoms and attainment, are discussed in section 8.2.4.

In summary, the study described in chapter 4 provided evidence that depressive symptoms are associated with a reduction in attainment over time. However, this did not give insight into the mechanisms though which this occurs, which was explored next.

8.2.3. What are the pathways through which depressive symptoms lead to lower attainment?

Having established that depressive symptoms are associated with a decline in attainment over time, this thesis next investigated possible mechanisms involved in this association. This was addressed in chapter 5, which presented a 1 year longitudinal study investigating potential pathways between emotional problems and attainment. Associations between depressive symptoms and attainment were found to be mediated by concentration problems, stressful life events and low school connectedness, but not by low motivation. Potential moderators of this association were also investigated: specifically gender, conduct problems and cognitive ability.

School connectedness was found to mediate associations between depressive symptoms and attainment. This is consistent with findings that a low attachment and commitment to school is associated with both higher depressive symptoms and school grades (Finn & Rock, 1997; Li & Lerner, 2011; Maddox & Prinz, 2003; Shochet et al., 2006). However the mediation finding extends this work by providing evidence that school connectedness links these variables, with low levels of school connectedness one pathway through which high depressive symptoms may lead to low attainment. Unlike the other potential pathways identified, the pathway between depressive symptoms and attainment via school connectedness was not

affected by any of the proposed moderator variables (gender, conduct problems or cognitive ability).

Concentration problems and stressful life events were also found to mediate association between depressive symptoms and subsequent attainment. This is consistent with findings that depression is associated with difficulties in concentrating and paying attention to teaching (Frojd et al., 2008) and with stress (which can be generated as a result of depressive symptoms; Hammen, 1991) impairing learning processes (Kim & Diamond, 2002). However, there was evidence that the pathways via concentration problems and stressful life events were stronger for those of lower cognitive ability. Cognitive ability as a potential contributor to heterogeneity in associations between depression and attainment is discussed in section 8.2.4.4. Finally, consistent with previous research, low motivation was associated with both depressive symptoms and low attainment (Wentzel et al., 1990). However, this measure of intrinsic learning motivation did not mediate the association between the two.

In summary, the study described in chapter 5 provided evidence that concentration problems, stressful life events and low school connectedness are three pathways through which depressive symptoms may lead to lower attainment. However, two of these pathways - concentration problems and stressful life events - varied based on individual differences, with evidence that the pathways were stronger for those of low cognitive ability. This is consistent with the finding of heterogeneity in effect sizes for the association between depression and attainment identified in chapter 2. Moderators of the association between depressive symptoms and attainment are explored in the next section.

8.2.4. Which factors are associated with variation in associations between depressive symptoms and attainment?

In addition to identifying possible mechanisms through which depressive symptoms may lead to low attainment, this thesis also sought to identify individuals most at-risk of low attainment following depressive symptoms. Specifically, gender, conduct problems and cognitive ability were investigated as possible sources of heterogeneity in the association between depressive symptoms and attainment. These are discussed below.

8.2.4.1. Gender

This thesis provided evidence that gender is an important factor that may contribute to heterogeneity in associations between depressive symptoms and attainment. The meta-analysis presented in chapter 2 found gender was not a source of heterogeneity in studies investigating associations between depressive symptoms and subsequent attainment. However, when prior attainment was controlled for - thus allowing an association between depressive symptoms and a decline in attainment to be examined - chapter 4 did find gender differences. Specifically, depressive symptoms in childhood were associated with a decline in school grades over the next 6 months for boys but not for girls. This is consistent with previous observations that boys with depression may have worse functional outcomes compared to girls with depression, including academic attainment, self-esteem, behavioural problems and persistent depression (Diamantopoulou et al., 2011; Dunn & Goodyer, 2006).

There are a number of possible explanations for gender differences only emerging when controlling for prior attainment. This could reflect stronger cross-sectional associations between depressive symptom and attainment for girls, given that both depressive symptoms and attainment show strong continuity over time. Cross-sectional associations could result from low attainment being a risk factor for depressive symptoms, although chapter 4 did not find evidence of this pathway.

Alternatively they could result from a third variable which is associated with both depressive symptoms and attainment to a greater extent in girls than boys. This discrepancy in findings regarding gender differences identified in the cross-lagged study presented in chapter 4, but not in the meta-analysis presented in chapter 2, could be due to other study characteristics. For example, chapter 4 investigated depressive symptoms in childhood and had a short follow-up period of 6 months. In contrast, the meta-analysis analysis included studies which predominantly investigated depressive symptoms in early or late adolescence and included much larger follow-up periods. For girls, associations between depressive symptoms and attainment may intensify during adolescence, or for boys associations may attenuate over time, showing a similar magnitude to that found in girls.

Chapter 5 explored whether pathways between depressive symptoms and subsequent attainment varied based on gender. However, the study presented found no evidence of gender differences, with significant mediation by concentration problems, stressful life events and school connectedness for both boys and girls, and no evidence of mediation by motivation for either gender. Thus these mediators did not shed light on the increased risk of decline in attainment for boys compared to girls as found in chapter 2. An alternative explanation, that gender differences in the manifestation of depression - specifically, that boys may show a higher co-occurrence of conduct problems - was suggested in chapter 4. The role of conduct problems as a source of heterogeneity in associations between depression and attainment is discussed below, and related specifically to gender in section 8.2.4.3.

8.2.4.2. Conduct problems

Conduct problems was another important factor identified by this thesis as a contributor to heterogeneity in associations between depressive symptoms and attainment. Evidence for this came from chapters 4, 5 and 6.

Depression and conduct problems co-occur more often than chance (Angold, Costello, & Erkanli, 1999) and there are well established associations between conduct problems and low attainment (Kessler et al., 1995; Richards & Abbot, 2009). Thus, in the study presented in chapter 4, once an association between depressive symptoms and a decline in attainment was established, it was investigated whether this association held when controlling for conduct problems. The association between depressive symptoms and decline in attainment was no longer significant (although the association did hold for boys, discussed in section 8.2.4.3), suggesting that co-occurring conduct problems may underlie the association between depressive symptoms and attainment.

Chapter 5 further explored whether conduct problems moderated pathways between depressive symptoms and attainment. Associations between depressive symptoms and attainment via stressful life events and school connectedness were found for those with high and low levels of conduct problems. There was some evidence that an indirect pathway via concentration problems was present only for those with low conduct problems. However, this appeared to be likely because of reduced variance of concentration problems in the high conduct problems group, who had higher concentration problems. Thus, the pathways between depressive symptoms and attainment investigated in chapter 5 did not explain differences in the association between depressive symptoms and attainment dependent on levels of conduct problems.

In chapter 6, latent profile analysis identified a subgroup of individuals with high levels of depressive symptoms and co-occurring conduct problems. Consistent with the cross-lagged study presented in chapter 4, this co-occurrence was associated with lower attainment, while depressive symptoms of a similar level without co-occurring conduct problems were not. In isolation, this suggests that associations between depressive symptoms and attainment may be due to co-occurring conduct problems. However, the latent profile analysis also identified a

subgroup of individuals with sub-threshold depressive symptoms, in the absence of conduct problems, which also showed lower attainment, (although to a lesser extent than those in the co-occurring conduct problems subgroup). This suggests that depressive symptoms can be associated with low attainment in the absence of conduct problems, and that conduct problems appear to affect the magnitude of this association. A more detailed discussion of aetiological differences, including genetic aetiology, in depressive symptoms with and without co-occurring conduct problems and the relevance of this to associations with attainment is given in section 8.4.1.

8.2.4.3. Gender differences and conduct problems

This thesis identified that associations with low attainment are stronger for depressive symptoms with co-occurring conduct problems and for boys compared to girls. The cross-lagged study in chapter 4 found that of pupils with high levels of depressive symptoms, boys showed higher levels of conduct problems. Further, the latent profiles study presented in chapter 6 provided evidence that depressive symptoms with co-occurring conduct problems does not show the female preponderance usually associated with depression (also consistent with previous clinical observations; Angold & Rutter, 1992). Taken together, this suggests that co-occurring conduct problems may explain the increased risk of decline in attainment associated with depressive symptoms found for boys compared to girls. However, it is important to note that in the cross-lagged study presented in chapter 4, associations between depressive symptoms and decline in attainment for boys attenuated when controlling for conduct problems, but remained significant. Thus, the increased likelihood of co-occurring conduct problems in boys compared to girls with high depressive symptoms appears to partially – but not fully – explain why associations between depressive symptoms and decline in attainment are stronger for boys compared to girls.

8.2.4.4. Cognitive ability and stress

Cognitive ability is another factor identified in this thesis as a contributor to individual differences in school attainment outcomes of depressive symptoms. Chapter 5 investigated whether pathways through which depressive symptoms were associated with subsequent attainment varied depending on cognitive ability. Results suggests that depressive symptoms were more likely to lead to low attainment due to concentration problems and stressful life events for those with lower, compared to higher, cognitive ability. This is consistent with the cognitive reserve hypothesis that individuals with greater cognitive efficiency will show less disorder-related functional impairment (Barnett et al., 2006; Koenen et al., 2009). This hypothesis suggests that those with greater cognitive reserve have greater processing efficiency or density of neurons/synapses. Thus, those of higher intelligence may show greater recruitment of compensatory networks following competing cognitive demands resulting from both depressive symptoms (e.g. increased attention to depression-relevant information; Hartlage et al., 1993) and associated stress generation (which otherwise impairs cognitive processing; Kim & Diamond, 2002). Similarly, greater efficiency of the cognitive system in those with higher cognitive ability may enable a certain level of additional resources to be allocated to these additional demands without impairing functioning. Given the strong association between cognitive ability and attainment (r=.83 in STARS), this group may merit particular consideration for targeting the decline in attainment associated with depressive symptoms. The role of cognitive ability and stressful life events in the aetiology of depression was investigated in chapter 7 and is discussed in section 8.4.2.

8.3. Findings regarding anxiety

As was discussed in the first chapter of this thesis, depression and anxiety often co-occur, and self-report measures are highly correlated (Brady & Kendall, 1992; Thapar et al., 2012). It is common for research to study combined measures of internalising

problems covering both depressive and anxiety symptoms (e.g. Achenbach, 1991; Goodman, 1997), including studies investigating associations with attainment (e.g. Janosz et al., 2008; Suldo et al., 2011; van Oort et al., 2007). However, some work suggests that anxiety in childhood shows low rates of later impairment if it does not co-occur with depression (Last et al., 1997). Therefore associations with attainment may be different for depression and anxiety. Thesis chapters that investigated the primary research questions regarding associations between depressive symptoms and attainment therefore also investigated associations between anxiety and attainment; findings are outlined below.

The meta-analysis presented in chapter 2 found less consistent associations between anxiety and subsequent attainment compared to associations between depression and attainment. Unlike depression, associations between anxiety and attainment were dependent on moderator variables. Associations with lower school grades were dependent on age and country, whereby an association was only found for late adolescent samples and for samples outside of the USA. In fact, for samples within the USA, there was some evidence of an association between anxiety and better school grades, suggesting that under certain circumstances, increased levels of anxiety may be somewhat adaptive (Eysenck, 1982; Lucey & Reay, 2000; Tallis & Eysenck, 1994).

The study presented in chapter 4 did find a longitudinal association between baseline school anxiety and lower attainment 6 months later. However, unlike for depressive symptoms, this association did not hold when controlling for construct continuity and cross-sectional associations; i.e. anxiety was not associated with a reduction in attainment over the subsequent 6 months. Thus, this research suggests that anxiety is not associated with a decline in attainment, but may be a marker for subsequent low attainment.

Finally, the study presented in chapter 5, investigated possible pathways between symptoms of anxiety and subsequent low attainment. A longitudinal

association between baseline anxiety and lower subsequent attainment (in this case 1 year later) was identified. There was some overlap in mediators for depressive and anxiety symptoms, with associations with subsequent attainment found to be mediated by concentration problems, stressful life events and school connectedness for both. This suggests that although associations with subsequent low attainment are stronger and more consistent for depression compared to anxiety, there may be similar mechanisms involved. However, analyses controlling for depressive symptoms indicated that these pathways may have been due to co-occurring depressive symptoms. Unlike depressive symptoms, unexpectedly this study also provided some evidence that the association between anxiety and attainment was also mediated by learning motivation. Learning motivation may therefore be a factor worth monitoring in pupils showing anxiety symptoms. Moderators of these pathways were also similar for anxiety and depression. One exception was that, unlike for depressive symptoms, the pathways between anxiety and attainment via concentration problems was not moderated by cognitive ability. Thus, while higher cognitive ability appears to somewhat buffer functional impairment associated with depressive symptoms, the same does not apply to anxiety symptoms. It is possible that anxiety does not require the same level of cognitive efficiency to avoid impairment as depression; it may be that anxiety does not increase cognitive demands and result in associated functional impairment to the same extent as depression.

In summary, the thesis provides evidence to support investigating functional outcomes of depressive and anxiety symptoms separately. Both types of symptoms are associated with subsequent low attainment, which likely results from similar mechanisms. However, the direction of effect was clearer for depressive symptoms, which, unlike anxiety, was associated with a decline in attainment over time. Associations between anxiety and subsequent attainment more likely result from cross-sectional associations and strong continuity over time.

8.4. Additional research questions

Having investigated the primary research aims of this thesis, chapter 5 identified important areas for future research regarding sources of heterogeneity in the association between depressive symptoms and attainment. These are discussed below.

8.4.1. Are depressive symptoms differentially associated with attainment and risk factors including gender, cognitive ability and stress when they co-occur with conduct problems?

As discussed in section 8.2.4.2, conduct problems appear to play an important role in the association between depressive symptoms and attainment and may also partially explain why boys show poorer academic outcomes following depression than girls. Chapter 5 identified the investigation of whether depressive symptoms that co-occur with conduct problems differ in associated factors as an important area for future study. This research question was investigated in chapter 6, which presented a study investigating subgroups of depressive symptoms in child and adolescent depressive symptoms based on the presence or absence of co-occurring conduct problems.

This study provided evidence from two independent samples of children and adolescents of distinct profiles of depressive symptoms based on the co-occurrence of conduct problems and symptom severity. In particular, high levels of depressive symptoms which did not co-occur with conduct problems (which were present in 3-4% of the samples) were associated with a female preponderance but not lower cognitive ability or attainment. In contrast, depressive symptoms which co-occurred with conduct problems (2-4% of the samples) were associated with lower cognitive ability and attainment, but not with a female preponderance. There was also some evidence of differences in genetic aetiology, although these analyses were limited in power. Specifically, genetic factors estimated to be less important for depressive symptoms with, compared to without, co-occurring conduct problems. Instead,

nonshared environmental influence was estimated to be larger when conduct problems co-occurred with depressive symptoms. In addition to differences in aetiology, some similarities were also observed: both depressive symptoms with and without co-occurring conduct problems were associated with stressful life events and parental hostility.

The results of this study can also be viewed in the context of the association between depressive symptoms and attainment. As discussed in section 8.2.4.2, associations with attainment were found both for a subgroup with high depressive symptoms with co-occurring conduct problems and a subgroup with sub-threshold depressive symptoms. However, low cognitive ability was specifically associated with the depressive group that had co-occurring conduct problems. Thus, low cognitive ability may be one mechanism that leads to poorer school outcomes specifically when depressive symptoms co-occur with conduct problems. Further, given that depressive symptoms with co-occurring conduct problems may be the more common presentation in boys, lower cognitive ability may also contribute to the greater decline in attainment associated with depressive symptoms for boys compared to girls.

Another interesting observation from the study presented in chapter 6 is that the subgroups associated with low attainment were estimated to have lower genetic influence than the subgroup which was not associated with attainment (i.e. genetic influence was estimated to be higher in the subgroup with high depressive symptoms without co-occurring conduct problems, than in the subgroup with co-occurring conduct problems and the subgroup with sub-threshold symptoms). It is therefore possible to speculate that associations between depressive symptoms and attainment are due to environment risk factors that influence both.

8.4.2. Does high cognitive ability buffer stress-related depressive symptoms?

Another important area for investigation identified during the investigation of the association between depressive symptoms and attainment was the role of higher

cognitive ability as a buffer against the negative effects of stress. Chapter 5 found that pupils with lower cognitive ability were more likely to show low attainment following stressful life events associated with depressive symptoms. Chapter 7 investigated whether higher cognitive ability also buffers the negative effect of stress on depressive symptoms. Whether this buffering effect was greater in girls was also investigated, given that adolescent girls are at increased vulnerability to depression following stress (Hankin & Abramson, 2001). Finally, coping efficacy and sensitivity to environmental stressors were investigated as potential mediators of this buffering effect.

The study results indicated that in two independent samples of children and adolescents of differing levels of stress exposure, higher cognitive ability buffered the effects of stress on depressive symptoms. This is again consistent with the cognitive reserve hypothesis that higher cognitive ability protects against functional impairment (Barnett et al., 2006; Koenen et al., 2009). This buffering effect of cognitive ability was partly via reduced environmental sensitivity.

The buffering effect of higher cognitive ability was specific to girls. Taken together with the findings from chapters 5 and 6, this indicates that cognitive ability may play multiple roles in both the aetiology of depression and the association between depression and attainment. For girls, rather than showing a direct association with depressive symptoms, higher cognitive ability appears to buffer stress-related depressive symptoms. Secondly, it was speculated in section 8.4.1 that low cognitive ability might be involved in the association specifically between depressive symptoms with co-occurring conduct problems and low attainment.

8.5. Limitations

This thesis provided insights into the association between depressive symptoms and attainment at school. However, these findings should be viewed in the context of a

number of limitations. Those specific to particular studies presented in the thesis are outlined in the relevant chapters. Broader limitations are discussed below.

First, findings may be specific to the measures of depressive symptoms and attainment used. The thesis predominantly relied on questionnaire measures of depressive symptoms, instead of clinical interview measures. As discussed in chapter 3, which outlined the samples and measures used in this thesis, child and adolescent depressive symptoms reported by self and parent provide clinically useful information (Rice, Lifford, Thomas, & Thapar, 2007). In practical terms, the use of questionnaire data also has a number of advantages. In particular, this allows the data collection of large numbers of participants, which was utilised in the studies presented in this thesis. It also allows the investigation of sub-threshold symptoms, which is important because a substantial proportion of adolescents have sub-threshold symptoms and these are associated with significant impairment and subsequent major depressive disorder (Angold, Costello, Farmer, et al., 1999; Fergusson et al., 2005; Gotlib et al., 1995; Klein et al., 2009). Indeed, the study presented in chapter 6 identified a profile of sub-threshold symptoms which was associated with lower attainment. Nevertheless, it is possible that some of the findings reported in the thesis do not extend to clinical disorders. The exception to the use of questionnaire measures was in chapter 7, where the buffering effect of higher cognitive ability against stress was investigated. In this study, the second sample was a high-risk sample where interview data on depressive symptoms were available; results replicated in this sample.

On a similar note, in chapters 4-6, attainment was measured using school grades. However, the meta-analysis presented in chapter 2 indicated that there might be some differences in associations between depressive symptoms and school grades compared to school failure. For example, there was evidence of an increase in the magnitude of the association between depressive symptoms and attainment with age for school grades, but not school failure. Associations with depressive symptoms were also found to be stronger for shorter follow-up period for school failure

but not school grades. It is possible that the advances in understanding of the association between depressive symptoms and attainment provided by this thesis only applies to school attainment within the normal rage of school grades, and does not extend to the extreme end of this such as failing to complete compulsory education.

Second, findings from this study may be specific to other features of the studies used, including age and follow-up period. This thesis investigated the association between depressive symptoms in late childhood/early adolescence and subsequent attainment using the relatively short follow-up periods of 6 and 12 months (chapters 4 and 5 respectively). Some previous work has suggested that while behavioural problems influence attainment over long periods of time, the influence of emotional problems is only short-term (Masten et al., 2005). The meta-analysis presented in chapter 2 did not find evidence that the association between depressive symptoms and school grades varied dependent on follow-up period (within studies spanning 6-72 months). This suggests that the findings from the current thesis may extend to longer follow-up. However, the meta-analysis did find that within studies that varied in follow-up period from 1 to 9 years, associations between depression and failure to complete compulsory education were stronger for those with shorter follow-up periods. The association between depression and attainment is likely at least somewhat dependent on length of follow-up period. Specific aspects of this relationship investigated here, such as the pathways connecting depressive symptoms and attainment, may also be specific to shorter-term effects. For example, it is possible that school connectedness may mediate associations between depressive symptoms and subsequent low attainment in the short-term but not the long-term. Further, findings regarding factors that are associated with variation in associations between depressive symptoms and attainment (gender, conduct problems and cognitive ability) may also be specific to this short-term follow-up period – studies with longer follow-up periods are required to test this.

In addition to the follow-up period, findings may also be specific to the developmental period under investigation. In particular, chapters 4 and 5 investigated associations between depressive symptoms in pupils aged 10-12 years old and attainment at age 6-12 months later. There are developmental differences in the prevalence, risk factor profile and aetiology of depressive symptoms during childhood, adolescence and adulthood (Jaffee et al., 2002; Rice, 2010) and so the relationship between depressive symptoms and attainment may differ across developmental periods. Indeed, the meta-analysis presented in chapter 2 found evidence that the association between depression and school grades was stronger in late- compared to early-adolescence. Therefore, the associations between depression and attainment identified in chapters 4 and 5 may be smaller than would be identified in older samples. The pathways through which depressive symptoms may lead to low attainment identified in chapter 5 also may not generalise to older (or younger samples). Again, this may also be true to the differences in associations observed by gender and levels of conduct problems and cognitive ability. Chapters 6 and 7 included replication samples with wider age ranges (11-18 and 9-17 years old), which allows generalisability to a broader period of adolescence, although these aetiological findings do not necessarily generalise to adulthood.

Third, throughout the thesis observed effect sizes have been relatively small. In the meta-analysis, associations between depressive symptoms and school failure/grades were r=.17 and -.12 respectively. In-line with this, associations between depressive symptoms and subsequent attainment were found to be r=-.21 in chapter 4 (6 month time-lag) and r=-.11 in chapters 5 and 6 (12 month time lag). These effect sizes indicate that depressive symptoms account for a small proportion of the variance in subsequent attainment at school. This is also true of the mediators explored in chapter 5; while significant mediators of the association between depressive symptoms and attainment were identified, these explained a small proportion of this relationship. However, attainment at school is associated with a

wide range of negative outcomes and may explain some of the poor adult outcomes associated with depression.

Finally, it is important to note the limitations of the study design – specifically, using a longitudinal (correlational) design. Implied throughout this thesis is the notion that depressive symptoms are in some way causally associated with subsequent lower attainment. However, causal inference cannot be inferred from using a longitudinal correlational design. Three conditions are generally accepted to be required to infer causal inference: a) relationship; b) time precedence; c) nonspuriousness (e.g. Kenny, 2004). The first of these – establishing a relationship between depressive symptoms and attainment can be established by any correlational design. Indeed, as discussed in the introductory chapter of this thesis, a cross-sectional association between depressive symptoms and low attainment has been well established. This criterion was met by chapters 2 and 4-6 where evidence of the presence of an association between higher levels of depressive symptoms and lower levels of attainment was found. The second criteria of causal inference – time precedence - was met by the meta-analysis presented in chapter 2 and the studies presented in chapters 4-6, as they investigated associations between depressive symptoms and subsequent attainment. This is a clear advantage of longitudinal over cross-sectional designs. The cross-lagged design used in chapter 4 also provided the additional advantage of being able to simultaneously test for the reciprocal relationship between attainment and subsequent depressive symptoms – which was not found to be present. This provides evidence that the relationship found between depressive symptoms and low attainment is more likely driven from depressive symptoms to low attainment than vice versa. The third condition for inferring causality – nonspuriousness – requires that a third variable does not explain the association between depressive symptoms and attainment. Correlational designs allow the formal testing of whether third variables account for the association between two variable through the inclusion of control variables. For example, in chapter 4, the association

between depressive symptoms and attainment remained (for boys) when controlling for conduct problems, suggesting that conduct problems do not fully account for the association between these variables. In chapter 6, gender, stress and parental hostility were also controlled for in investigating associations with attainment. However, correlational designs cannot rule out the possibility that unmeasured third variables account for the association between the investigated variables – such as individual characteristics of pupils who have both high levels of depressive symptoms and low levels of attainment (e.g. family history of psychopathology). Thus, this thesis establishes depressive symptoms as a risk factor – but not necessarily a causal risk factor - for low attainment at school (Kraemer, Stice, Kazdin, Offord, & Kupfer, 2001).

An experimental design in which participants are randomly allocated to either a control or experimental condition would be required to try and rule out spuriousness. However, participants cannot randomly be allocated to a high or low depressive symptoms condition. One possibility would be to measure attainment as an outcome of randomised control trials targeting depressive symptoms, and assess whether decline in depressive symptoms associated with treatment as also associated with an increase in attainment.

8.6. Implications for schools

The findings from this thesis have a number of potential implications for schools. While these have been discussed in the relevant chapters, implications of the key thesis findings are discussed below.

The first key finding with implications for schools is that depressive symptoms are associated with subsequent low attainment at school. This highlights the important role of mental health in attainment and is consistent with the movement for schools to be more involved with mental health (Wolpert et al., 2011). Thus, addressing decline in attainment as well as targeting other symptoms of depression may help to prevent some of the long term negative outcomes associated with

depressive symptoms and disorder. The association with low attainment appears not to be limited to clinically high levels of depressive symptoms; pupils with sub-threshold symptoms are also at risk of low attainment. This highlights the importance of monitoring pupils who show moderate levels of depressive symptoms and suggests that they too may benefit from additional support in school.

The second key finding is that low school connectedness was identified as a mediator through which depressive symptoms may lead to low attainment for a wide range of pupils including boys and girls, regardless of levels of co-occurring conduct problems and cognitive ability. Previous work has found benefits to both pupil mental health and attainment from targeting school connectedness (Battistich et al., 2004; Catalano et al., 2004). Given that pupils with moderate levels of depressive symptoms are also at-risk of low attainment, schools may wish to consider methods for increasing school connectedness as an approach to enhance both pupil psychological and academic adjustment. However, more work would be needed to provide a strong empirical base for this, as discussed in the limitations section above.

The third key finding is the identification of factors that influence the association between depressive symptom and attainment. Specifically boys, pupils with co-occurring conduct problems and those with low cognitive ability appear to be most at-risk of low attainment following depressive symptoms. Thus, the academic progress of these pupils may particularly merit monitoring. Results of this thesis suggest that targeting concentration problems may be a way of reducing poor school outcomes for pupils with depressive symptoms and low cognitive ability.

The investigation of the aetiology of depressive symptoms in the latter 2 chapters of this thesis also has some practical implications for schools. Findings from the investigation of heterogeneity in depressive symptoms based on co-occurring conduct problems suggest that low cognitive ability may be involved in the decline in attainment associated with this group. It was also noted that associations between depressive symptoms and attainment may result from overlapping environmental risk

factors. This highlights the importance of risk-profiling pupils, as recommend by NICE (National Institute for Health and Care Excellence, 2015). Where pupils show increased levels of depressive symptoms, teachers and practitioners should consider possible environmental causes as the same factors may also result in a decline in attainment. This thesis also adds to the evidence base that stressful life events, low cognitive ability and female gender are important risk-factors for adolescent depression.

8.7. Future research

Several important areas of future research are suggested by the research in this thesis. Firstly, to address the limitations discussed in section 8.5, more longitudinal studies investigating the association between depression and attainment are encouraged which include clinical measures of depression, span longer follow-up periods, and cover different developmental periods. This is necessary in order to clarify whether the results found in this thesis are specific to the methodological design used. For example, work is needed to establish whether the finding from chapter 4, that depressive symptoms were associated with a greater decline in attainment for boys compared to girls, are specific to childhood and to short follow up periods.

Future research suggestions specific to the studies presented in this thesis are outlined in the appropriate chapters. However, one particular outstanding research question merits discussion here. Specifically, this thesis found that depressive symptoms were associated with a greater risk for decline in attainment for boys compared to girls; however, it is not yet clear why. An increased likelihood for depressive symptoms to co-occur with conduct problems likely partially explains this, but not fully. Further, exploring potential pathways between depressive symptoms and attainment did not shed light on this gender difference. A female preponderance for depressive symptoms and depression from adolescence onwards is well

documented, and the investigation of gender differences in risk factors for depression tends to focus on (or at least result in identifying) factors that increase risk for girls. However, depression in boys can be associated with worse outcomes than girls (Dunn & Goodyer, 2006) and this thesis provides evidence that the same is true of depressive symptoms and attainment at school. Future work investigating risk factors for depression in boys, and reasons for this greater risk of impairment is encouraged. Research which focusses on exceptions to the female preponderance for depression may be particularly helpful, namely, pre-pubertal depression and depression with co-occurring conduct problems.

8.8. Conclusions

Existing research has established an association between depression and subsequent low attainment at school. This thesis extends this work by firstly establishing an association between depressive symptoms in early adolescence and a reduction in attainment over time. Secondly, it identifies concentration problems, stressful life events and school connectedness as pathways through which depressive symptoms may result in low attainment. Thirdly, it identifies male gender, conduct problems and low cognitive ability as factors that may be associated with an increased risk of low attainment outcomes following depressive symptoms. This thesis also notes that associations with subsequent low attainment are less consistent for anxiety than for depressive symptoms, highlighting the importance of studying these separately.

Finally, this thesis explored aetiological issues surrounding sources of heterogeneity in the association between depressive symptoms and attainment. This research found evidence that depressive symptoms are somewhat differentially associated with attainment and risk factors when they co-occur with conduct problems and identified higher cognitive ability as a buffer against stress-related depression symptoms in girls.

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Appendices

Appendix 5.1. Mediation analyses, controlling for depressive/anxiety symptoms

Mediation analyses for depressive and anxiety symptoms, controlling for the other measure of emotional problems are shown below. Pathways between depressive symptoms and attainment via concentration problems, stressful life events and school connectedness all remained significant. None of the mediation pathways between anxiety and attainment remained significant. Moderated mediations by conduct problems and cognitive ability were no longer significant, although Z-scores showed a similar pattern of results. One exception was that for the pathway between anxiety and attainment via concentration problems, the moderation by conduct problems was considerably attenuated. Finally, a trend level moderation by gender emerged for the pathways between anxiety and attainment via school connectedness. However, the mediation was not significant in either group (boys β=.02, *p*=.13, CI=-.01, .05; girls β=-.01, *p*=.37, CI=-.03, .01).

	Mediation (β)					Moderated mediation (Z)		
Depressive symptoms	A	B	C	D	95% CI for D	Gender	Conduct problems	Cognitive ability
Concentration problems	.35***	-.17***	-.03	-.06***	(-.10, -.02)	.67	-1.50	-1.64
Motivation	-.27***	.05	-.07	-.01	(-.03, .01)	-.004	-1.14	-.92
Stressful life events	.28***	-.08*	-.07	-.02*	(-.05, .01)	-.63	-.14	-1.23
School connectedness	-.32***	.12***	-.05	-.04**	(-.07, -.01)	.62	-.47	-1.47
Anxiety symptoms								
Concentration problems	.09	-.17***	-.01	-.02	(-.04, .01)	-.85	-.90	.01
Motivation	.07	.05	-.03	.003	(-.004, .01)	-.27	.64	-.07
Stressful life events	.003	-.08*	-.02	<.001	(-.01, .01)	-.06	.41	-1.26
School connectedness	.06	.12***	-.04	.01	(-.01, .02)	-1.75†	.09	1.67

Note. A=emotional problems → mediator variable; B=mediator variable→attainment, C= direct association between emotional problems and attainment, D= indirect association between emotional problems and attainment via mediator variable. †$p<.10$ *$p<.05$ **$p<.01$ ***$p<.001$

Appendix 6.1. Associations between depressive profiles and risk factors (β), including cognitive ability rather than attainment

A: School sample (N=1016)	Moderate depressive (9%)	Depressive (3%)	Comorbid (4%)	Depressive comorbid (1%)
	B (SE)	B (SE)	B (SE)	B (SE)
Gender proportions	57% female	61% female	47% female	43% female
Gender[#]	.37 (.30)	1.91 (.86)[*]	.07 (.54)	-.40 (.68)
Cognitive ability	-.01 (.01)	.04 (.03)	-.06 (.03)[*]	-.01 (.03)
Stress	.32 (.08)[***]	.61 (.11)[***]	.45 (.11)[***]	.53 (.12)[***]
Maternal hostility	.23 (.03)[***]	.54 (.06)[***]	.23 (.05)[***]	.54 (.06)[***]

[†]$p<.1$ [*]$p<.05$ [**] $p<.01$ [***] $p<.001$. The normative profile is the reference group, analyses included all 8 profiles. [#] 0=boys 1=girls

Appendix 7.1. Associations between cognitive ability and depressive symptoms: total stressful life events, controlling for deprivation

	STARS					EPAD				
	Model change		Coefficients			Model change		Coefficients		
	R^2 change	*p*	*β*	*B (S.E.)*	*p*	R^2 change	*p*	*β*	*B (S.E.)*	*p*
Moderation by stress	.002	.36				.01	.24			
Intercept				3.65 (.21)	<.001				1.16 (.21)	<.001
Deprivation			.03	.33 (.61)	.59			.16	.13 (.05)	.01
Stress			.33	1.03 (.14)	<.001			.33	.26 (.05)	<.001
Cognitive ability			.01	.003 (.02)	.87			-.01	-.002 (.01)	.81
Cognitive ability x Stress			-.04	-.01 (.01)	.36			-.07	-.004 (.003)	.24
Moderation by stress and gender	.03	.02				.07	<.001			
Intercept				4.08 (.28)	<.001				1.38 (.21)	<.001
Deprivation			.02	.28 (.60)	.65			.16	.13 (.05)	.01
Stress			.35	1.09 (.18)	<.001			.40	.31 (.06)	<.001
Cognitive ability			-.03	-.01 (.02)	.67			-.11	-.02 (.01)	.13
Gender[#]			-.10	-.90 (.39)	.02			-.12	-.45 (.21)	.003
Cognitive ability x Stress			-.13	-.04 (.02)	.03			-.20	-.01 (.004)	.03
Cognitive ability x Gender			.05	.03 (.03)	.41			.12	.03 (.02)	.07
Stress x Gender			-.06	-.30 (.29)	.30			-.04	-.05 (.09)	.60
Cognitive ability x Stress x Gender			.13	.06 (.03)	.03			.23	.03 (.01)	.001

[#]0=girls, 1=boys

Appendix 7.2. Associations between cognitive ability and depressive symptoms: behaviour-independent stressful life events, controlling for deprivation

	STARS					EPAD				
	Model change		Coefficients			Model change		Coefficients		
	R^2 change	*p*	*B*	*B (S.E.)*	*p*	R^2 change	*p*	*β*	*B (S.E.)*	*p*
Moderation by stress	.01	.05				.003	.33			
Intercept				3.67 (.22)	<.001				1.08 (.22)	<.001
Deprivation			.03	.43 (.64)	.50			.19	.15 (.05)	.003
Stress			.17	.93 (.26)	<.001			.11	.18 (.10)	.07
Cognitive ability			-.02	-.01 (.02)	.68			-.05	-.01 (.01)	.46
Cognitive ability x Stress			-.09	-.04 (.02)	.05			-.06	-.01 (.01)	.33
Moderation by stress and gender	.03	.02				.05	.01			
Intercept				.24 (.63)	<.001				1.33 (.23)	<.001
Deprivation			.02	.24 (.63)	.71			.19	.16 (.05)	.002
Stress			.20	1.11 (.33)	.001			.11	.18 (.13)	.16
Cognitive ability			-.06	-.02 (.03)	.39			-.14	-.02 (.01)	.06
Gender[#]			-.13	-1.15 (.41)	.01			-.15	-.54 (.22)	.02
Cognitive ability x Stress			-.16	-.08 (.03)	.01			-.13	-.02 (.01)	.06
Cognitive ability x Gender			.06	.03 (.04)	.36			.12	.03 (.02)	.10
Stress x Gender			-.09	-.79 (.54)	.14			.05	.11 (.20)	.57
Cognitive ability x Stress x Gender			.12	.09 (.05)	.06			.13	.03 (.02)	.06

[#]0=girls, 1=boys