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The development of depression in children and adolescents with ADHD

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CHAPTER 6

Peer problems and depressive outcomes in children with ADHD: a review and literature synthesis of developmental pathways and pathway differences based on ADHD-subtype and gender

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ABSTRACT

This review aims to provide a mechanistic model that explains the developmental progression from ADHD to peer problems and further on to depression. To this end we provide a synthesis of two separate bodies of literature on: the association of ADHD with peer problems and the association of peer problems with depression. Results indicate that apart from the symptoms of ADHD, peer difficulties also arise due to behaviour problems, anxiety, cognitive deficits, social skill deficits, and positive illusory biases. Friendship difficulties, negative peer assessments, and victimisation are the common peer difficulties faced by children with ADHD and these are likely to increase the risk for depression. The pathways from ADHD to peer problems and further on to depression differ amongst the three subtypes of ADHD, and the two genders. Results also show that particular subgroups of children with ADHD are at a greater risk for developing peer problems and depression. These subgroups include children who develop additional disruptive-aggressive behaviour problems, children with the ADHD-inattentive subtype, girls, and children with persistent ADHD. We conclude that peer relationship difficulties play a role in the ADHD- depression relationship. Recognition of the pathways that lead to peer problems and further on to depression, can assist in early diagnosis and development of newer therapeutic interventions.

Keywords: Attention Deficit Hyperactivity Disorder (ADHD); Depression; Peer problems; Children; Adolescents

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD), a common neurodevelopmental problem (American Psychiatric Association, 2013), is often associated with comorbid depression (Angold, Costello, & Erkanli, 1999; Chronis-Tuscano et al., 2010; Jensen, Shervette, Xenakis, & Richters, 1993). The development of comorbid depression is influenced by many factors, one such important factor being problematic peer relationships. It is not yet understood through which pathways peer problems may develop in children with ADHD and further give rise to depression. This review aims to provide a mechanistic model that explains the developmental progression from ADHD to peer problems and further on to depression.

Peer problems are more common and severe in ADHD than in any other psychiatric illness (Gresham, MacMillan, Bocian, Ward, & Forness, 1998b; Wheeler & Carlson, 1994). The chance of encountering peer problems remains high throughout childhood and adolescence in those with ADHD (Hinshaw, 2002). Once developed, these problems are pervasive (Bagwell, Molina, Pelham Jr, & Hoza, 2001) and continue even after ADHD itself may have ceased (Bagwell et al., 2001; Kolko & Pardini, 2010). Moreover, they are worse in those whose ADHD persists into adolescence than those whose symptoms remit during childhood (Bagwell et al., 2001; Biederman, Mick, & Faraone, 1998b; St Pourcain et al., 2011).

Literature outside the context of ADHD has shown that peer problems lead to several negative outcomes in the long term (Patterson & Capaldi, 1990), the commonest being depression (Faubert, Forehand, Long, Burke, & Faust, 1987; Lefkowitz & Tesiny, 1985). Being part of a social group and feeling related to others is a basic emotional requirement, which if unfulfilled leads to depression (Baumeister & Leary, 1995). Apart from a direct effect on depression, peer problems can induce the development of depressogenic cognitions (Gibb & Alloy, 2006; Gibb et al., 2006; Gibb & Abela, 2008), and a tendency to blame oneself for the peer relationship difficulties (Barchia & Bussey, 2010; Sinclair et al., 2012), which in turn increase the risk for depression (Abramson, Metalsky, & Alloy, 1989). Not only can peer problems cause depression, depression also furthers peer problems, and hence the two factors may mutually reinforce each other, resulting in a maladaptive spiral (McLaughlin & Nolen-Hoeksema, 2012; Reijntjes, Kamphuis, Prinzie, & Telch, 2010).

Thus far, nine studies have assessed the role of peer problems in the ADHD-depression relationship (Becker, McBurnett, Hinshaw, & Pfiffner, 2013; Drabick, Gadow, & Sprafkin, 2006; Humphrey, Storch, & Geffken, 2007; Humphreys et al., 2013; McQuade et al., 2014; Mikami & Hinshaw, 2003; Mrug et al., 2012; Ostrander, Crystal, & August, 2006; Roy, Hartman, Veenstra, & Oldehinkel, 2015) (see Table 6.1 for summary). Results show that peer relationship problems are likely to increase the risk for depressive outcomes in children with ADHD (Humphrey et al., 2007; Humphreys et al., 2013; Ostrander et al., 2006; Roy et al., 2015). Furthermore, these relationships were found to be moderated by gender. According to two studies, girls with ADHD were more likely to develop depression as a result of peer problems than boys (Becker et al., 2013; Mikami & Hinshaw, 2003). Contrary to this, Drabick et al. (2006) reported that social problems predicted depressive outcomes in boys, but not girls with ADHD. According to McQuade et al. (2014), self-perceived social competence moderated the association between ADHD and depression. Lastly, Mrug et al. (2012) did not find a relationship of peer problems with depressive outcomes; they reported that peer rejection in ADHD predicted global impairment but not depressive outcomes in specific. Overall thus, eight of the nine available studies (Becker et al., 2013; Drabick et al., 2006; Humphrey et al., 2007; Humphreys et al., 2013; McQuade et al., 2014; A. Y. Mikami & Hinshaw, 2003; Ostrander et al., 2006; Roy et al., 2015) suggest that peer difficulties play a major role in the ADHD-depression relationship.

The above-mentioned studies draw attention to the importance of peer problems in children with ADHD and the consequent risk for depressive outcomes. Nine studies are, however, not sufficient for drawing detailed insights into the numerous ways in which peer problems may link the ADHD-depression relationship. In addition, the varying study designs (retrospective, cross-sectional and prospective), sample characteristics, and models (tested prediction, mediation, moderation) add to the difficulty of reviewing and summarising this evidence. Here we review two separate bodies of literature; the first concerning the development of peer problems in children with ADHD, and the second on the development of depressive symptoms in children and adolescents facing peer problems. Results from these two research areas are described and include findings on the development of peer problems in children with ADHD, the types of peer problems associated with ADHD, and the development of depression from peer problems. In addition, we present results on possible variations that may occur in these pathways due to differences in ADHD-subtype or gender. This review concludes with a proposed model that may explain the step-wise progression from ADHD to peer problems and further to depression.

METHODS

We conducted two separate literature searches: first, on the association of ADHD with peer problems, and second, on the association of peer problems with depression. The searches were conducted using the PubMed database for English language studies up to 03-03-2015. For the first literature search (association of ADHD with peer problems), the search terms included all possible variants of ‘Attention Deficit Hyperactivity Disorder’, ‘social problems’, ‘social behaviour’, ‘peer’, ‘friends’, ‘bullying’, and ‘interpersonal relations’. For the second literature search (depressive outcomes of peer problems), the search terms included ‘social problems’, ‘social behaviour’, ‘peer’, ‘friends’, ‘bullying’, ‘interpersonal relations’, ‘depressive disorder’, ‘depression’, and their possible variants. The terms ‘social problems’ and ‘social behaviour’ were operationalized broadly in order to be comprehensive. We included only studies on peer relationship problems; family or teacher relationship difficulties, school adjustment and academic problems, anti-social delinquent behaviour, or other adjustment problems were not considered. In addition, the search was restricted to only epidemiological studies.

The following inclusion criteria were applied to all studies retrieved from the search: (1) English language; (2) participants between 0-18 years of age; and (3) variables on peer relationship problems. Using these criteria and the above-mentioned search terms, titles and abstracts of relevant studies were selected.

In the next step, full texts of the eligible studies were screened to include only those relevant. For abstracts retrieved in the first search the selection criteria were: (1) inclusion of cross-sectional or longitudinal studies on the association of ADHD with (subsequent) peer problems; and (2) exclusion of prospective studies on the development of ADHD as a consequence of peer problems. Selection criteria for abstracts retrieved in the second search were: (1) inclusion of studies on only those peer problem variables that were ascertained as being associated with ADHD in the first part of the review; (2) cross-sectional or longitudinal studies on the association of peer problems with (subsequent) depression; and (3) no prospective studies on the development of peer problems as a consequence of depression. In the last step, the references listed in all relevant studies were checked for additional literature.

RESULTS

Literature reviews were conducted using the criteria described above. A total of 3177 studies were retrieved using the search criteria; 971 on the association of ADHD with peer problems, and 2206 on the association of peer problems with depression. After inspecting the titles and abstracts of the retrieved studies on peer problems and ADHD, 102 were selected for further scrutiny. After a thorough scrutiny of the entire text, 56 were considered relevant to this review and hence included. Reference lists of these studies revealed an additional 11 relevant studies that were also included in this review. Of the 2206 articles retrieved on the association of peer problems with depression, 163 were selected based on screening of titles and abstracts. At the next stage, full texts of these studies were scrutinized using the criteria described above and a total of 82 articles were included. Based on reference lists of these 82 studies, another 14 studies were found relevant to this review and included. In sum, a total of 163 studies were reviewed and included (Please see Appendix 6 for an overview of the included studies).

The below-described findings are divided into five sections, and *all* studies are discussed in one or more of these sections according to their relevance. First, we report the possible pathways through which peer relationship problems may arise in children with ADHD. Second, we describe the specific peer problems associated with ADHD. Third, we report results on the pathways from these peer problems to depression. Fourth, we present results on differences among ADHD-subtypes in these pathways; and fifth, we report on possible gender differences.

Development of peer problems in children with ADHD

This section includes results from thirty-seven studies and presents the factors and pathways that may lead to peer problems. Included studies focus on the associations of ADHD diagnosis/ADHD symptoms (thirteen), behaviour problems (ten), cognitive functioning (nine), social skill deficits (eleven) and/or positive illusory bias (six) with peer problems. A majority of these included DSM diagnoses of ADHD (twenty-four studies) while the remainder included assessments of ADHD symptoms using parent (two studies), teacher (five studies), or a combination of parent, self or teacher reports (six studies).

A diagnosis of ADHD is a risk factor for peer relationship difficulties (Bagwell et al., 2001; Erhardt & Hinshaw, 1994; B. Hoza et al., 2005). Studies in both normative and clinical samples have revealed that inattentive, hyperactive, and impulsive symptoms predict concurrent as

well as future peer problems (Bellanti & Bierman, 2000; Connors, Connolly, & Toplak, 2012; Diamantopoulou, Henricsson, & Rydell, 2005; Diamantopoulou, Rydell, Thorell, & Bohlin, 2007; Lee, Lahey, Owens, & Hinshaw, 2008; Schwartz, McFadyen-Ketchum, Dodge, Pettit, & Bates, 1999; St Pourcain et al., 2011; Stormshak, Bierman, Bruschi, Dodge, & Coie, 1999). Of the three symptom domains, inattention is a particularly strong predictor of later peer problems, regardless of past peer difficulties (Connors et al., 2012). A sluggish cognitive tempo, common in children with ADHD and inattention symptoms, also gives rise to peer difficulties (Becker, 2014).

ADHD is frequently comorbid with social behaviour problems, i.e. disruptive and aggressive behaviours (Andrade & Tannock, 2013; Erhardt & Hinshaw, 1994; Frankel & Feinberg, 2002; Murray- Close et al., 2010; E. Taylor, Chadwick, Heptinstall, & Danckaerts, 1996; Zalecki & Hinshaw, 2004), as well as anxiety (Roy, Oldehinkel, Verhulst, Ormel & Hartman, 2015). As reported by Bellanti & Bierman (2000), inattention, in particular, is strongly associated with socially aggressive behaviours. Both behaviour problems and anxiety are well-known risk factors for peer relationship problems (Erhardt & Hinshaw, 1994; Schwartz et al., 1999; Sciberras et al., 2014; Taylor et al., 1996; Zalecki & Hinshaw, 2004) and both lead to a low self-perceived social competence in children with ADHD (Bagwell et al., 2001). Social behaviour problems predict immediate peer difficulties even in new and unfamiliar settings (Mrug, Hoza, Pelham, Gnagy, & Greiner, 2007). Further, the relationships of behaviour problems and ADHD symptoms with peer difficulties may depend on classroom composition. Stormshak et al. (1999), report that children with hyperactive, impulsive, or inattentive symptoms always face peer difficulties, even in classrooms where these symptoms are normative. In contrast, children with disruptive and aggressive behaviours do not necessarily face peer problems, especially in classrooms where such behaviours are common (Stormshak et al., 1999).

ADHD is associated with difficulties in regulating emotions and cognitive functioning (Biederman et al., 2004; Sjowall & Thorell, 2014). Emotion regulation problems, especially difficulties in regulating anger, increase the risk for peer problems in children with ADHD (Sjowall & Thorell, 2014). Cognitive difficulties, in general, lead to problematic peer relations (Bellanti & Bierman, 2000; Semrud- Clikeman, Walkowiak, Wilkinson, & Minne, 2010; Wilson, 2003), but their role in the ADHD-peer problems relationship is not straightforward. Three studies revealed an association of cognitive difficulties with peer problems in children with ADHD (Andrade, Brodeur, Waschbusch, Stewart, & McGee, 2009; Chiang & Gau, 2014; Fine, Semrud-Clikeman, Butcher, &

Walkowiak, 2008). According to Chiang & Gau (2014), working memory problems and planning difficulties lead to peer problems in children with ADHD. Andrade et al. (2009) found that sustained but not selective attention problems predicted peer problems, also after controlling for hyperactive behaviour. In a study by Rinsky and Hinshaw (2011), response inhibition and planning difficulties predicted long-term peer difficulties, regardless of ADHD status. In contrast Biederman et al. (2004), in a study on parent-rated peer outcomes in children with ADHD, reported no association of cognitive deficits with peer problems. Likewise, Wåhlstedt, Thorell, and Bohlin (2008) reported that ADHD symptoms predicted peer problems independent of cognitive deficits in their study.

Social skill deficits, often seen in children with ADHD, may underlie the peer relationship problems faced by them (Andrade & Tannock, 2013; Gresham, MacMillan, Bocian, Ward, & Forness, 1998a; Y. Lin, Lai, & Gau, 2012; Murray-Close et al., 2010; Wheeler Maedgen & Carlson, 2000). Social skill deficits may arise from developmental delays in children with ADHD (Deane & Young, 2014; Murray-Close et al., 2010). Inattention symptoms, in particular, predict poor social abilities (Bellanti & Bierman, 2000), and poor social abilities in turn hinder social interactions (Taylor et al., 1996). Furthermore, children with ADHD show a reduced ability to understand social situations and solve problematic social situations, which further threatens their peer standing (Wheeler Maedgen & Carlson, 2000). Social skill deficits may also lead to the development of aggressive and disruptive behaviour problems (Rosen et al., 2014). According to a study by Biederman et al. (1998b), social functioning worsens with time in children and adolescents with persistent ADHD. The authors speculate that the increasing complexity of adolescent social interactions is particularly challenging for those with persistent ADHD, due to their lack of social skills (Biederman et al., 1998b). Social skill deficits are not only a cause of peer relationship problems but can also result from these problems, leading to vicious circles of peer functioning difficulties (Murray-Close et al., 2010). Prosocial abilities may have a beneficial influence on peer relationship outcomes in ADHD; there is some evidence that engaging in prosocial behaviours increases positive friendship ratings of children with ADHD (Erhardt & Hinshaw, 1994).

Compared to others, children with ADHD are more likely to have a high opinion of their peer standing (Hoza, Pelham, Milich, Pillow, & McBride, 1993; Murray-Close et al., 2010; Smith, Pelham Jr, Gnagy, Molina, & Evans, 2000). This discrepancy between actual and self-assessed social desirability is termed positive illusory bias. Doubts persist on the existence of such a bias in children with ADHD (Gresham, MacMillan, Bocian, Ward, & Forness, 1998a), and there is

evidence suggesting that ADHD medications improve the ability to provide accurate self-assessments of social standing (Smith et al., 2000). Proponents of the theory suggest that children with ADHD lack insights into their actual social functioning and overestimate their peer standing (B. Hoza et al., 1993; Murray-Close et al., 2010; Smith et al., 2000). This leads to inappropriate social conduct such as brash, dominating, and aggressive behaviour (Hoza, Murray-Close, Arnold, Hinshaw, & Hechtman, 2010) which in turn increases negative peer appraisals and peer problems (Murray-Close et al., 2010). One study found that actual self-competence, rather than the positive illusory bias, was associated with peer problems in girls with ADHD (Swanson, Owens, & Hinshaw, 2012).

Types of peer problems faced by children with ADHD

This section includes results from twenty-two studies that describe the types of peer problems that may be faced by children with ADHD. Broadly, these problems can be classified as: friendship difficulties (twelve studies), negative assessments by peers (nine studies), and victimisation (seven studies). Twelve studies included DSM diagnoses of ADHD while the remainder included ADHD symptoms assessed with parent- (two), teacher (three), or a combination of parent-, teacher, and/or self-reports (seven).

Of the ten studies on friendship difficulties, three included sociometric assessments and two included observations of friend interactions. The remaining studies included teacher- (one study), self- (four studies) or parent- and self-reported (one study) assessments of friendships. Results show that children with ADHD have difficulties interacting with peers (Hubbard & Newcomb, 1991), and consequently have fewer friends than other children (Blachman & Hinshaw, 2002; Deane & Young, 2014; Taanila, Hurtig, Miettunen, Ebeling, & Moilanen, 2009; Taylor et al., 1996). The few friendships that these children may enjoy are marred by negative relationship features such as conflicts and dissatisfaction, which ultimately reduce the quality of the friendships (Blachman & Hinshaw, 2002; Normand et al., 2011; Normand et al., 2013). In addition, children with ADHD are likely to affiliate with other maladjusted children (Elkins, Malone, Keyes, Iacono, & McGue, 2011; Hinshaw & Melnick, 1995; Marshal, Molina, & Pelham Jr, 2003; Normand et al., 2011; Normand et al., 2013; Taylor et al., 1996) and form peer groups that indulge in unconventional activities such as alcohol and drug abuse (Bagwell et al., 2001; Lacourse et al., 2006; Marshal et al., 2003).

Six of the nine studies on negative peer assessments included sociometric measures, of which four studies included additional assessments from parents, teachers, self-ratings or observations of social interactions. The remaining three studies evaluated negative peer assessments through a combination of teacher-, and self-, or teacher- and parent-reports. Peer evaluations of children with ADHD suggest that they face rejection (Efron et al., 2014; Hinshaw & Melnick, 1995; Hinshaw, 2002; Mikami & Hinshaw, 2006; Pardini & Fite, 2010), have a low status in their classrooms (Elkins et al., 2011; Hinshaw, 2002), are disliked by peers instantly and rated negatively, even in new peer settings (Erhardt & Hinshaw, 1994). Especially, popular peers are likely to rate children with ADHD negatively (Hoza et al., 2005). Treatments for ADHD do not seem to moderate negative assessments by peers (Hoza et al., 2005). Children with ADHD have an intact ability to assess others (Hoza et al., 2005); they have been found to give similar reasons for liking or rejecting peers as children without ADHD (Hinshaw & Melnick, 1995). Nevertheless, children with ADHD rate others with ADHD slightly better than comparison children do (Hinshaw & Melnick, 1995).

Peer difficulties of children with ADHD include problems of being victimised by bullies (Connors et al., 2012; Deane & Young, 2014; Elkins et al., 2011; Runions, 2014). From all studies retrieved, we gather that victimisation was studied less often than friendship problems and negative peer assessments: only six retrieved studies focussed on victimisation, of which two used peer-nominated assessments, four included self-reports of victimisation and one assessed victimisation with teacher-reports. Victimisation is predicted by inattention symptoms (Moura, Cruz, & Quevedo, 2011), and early symptoms of ADHD (Schwartz et al., 1999). The relationship of ADHD with victimisation is mediated by peer rejection, and moderated by friendships (Cardoos & Hinshaw, 2011; Schwartz et al., 1999). There is also some evidence to suggest that children with ADHD may bully other children (Ismail, Jaafar, Sidi, Midin, & Shah, 2014).

Progression to depression from peer problems

This section includes results from ninety studies on the associations of peer difficulties with depression. Studies included pertain to only those peer problem variables that were ascertained as being associated with ADHD in the first part of the review (excluded peer problems were: being a bully-victim, being a victim or perpetrator of physical/sexual violence in the classroom context, peer victimisation based on racial differences, cyberbullying). A majority of the studies (seventy-three) included self-reported depressive symptoms, of which twelve additionally included parent-

or teacher-reported depression while eight included assessments of anxiety symptoms additionally. The remaining sixteen studies included either DSM/ICD diagnoses of depression (six), teacher-reported depressive symptoms (four), parent- and teacher-reports of depression (one), peer-nominated depression (one), depressogenic cognitions (one), or self-reported loneliness (four).

Fourteen of the retrieved studies focussed on associations of friendship difficulties with depression. Results indicate that a lack of friends and a poor quality of friendships lead to depressive outcomes (Barchia & Bussey, 2010; Brendgen, Lamarche, Wanner, & Vitaro, 2010; Cole, Martin, Powers, & Truglio, 1996; Goodyer & Altham, 1991; Goodyer, Herbert, Tamplin, Secher, & Pearson, 1997; Goodyer, Wright, & Altham, 1990; Goodyer, Wright, & Altham, 1989; Goodyer, Wright, & Altham, 1990; Hill, Pettit, Lewinsohn, Seeley, & Klein, 2014; Lin et al., 2008; Meland, Rydning, Lobben, Bredablik, & Ekeland, 2010; Pelkonen, Marttunen, & Aro, 2003; Schwartz, Gorman, Duong, & Nakamoto, 2008). A poor choice of peers, such as friendships with aggressive peers, also predicts depressive outcomes (Mrug, Hoza, & Bukowski, 2004). Depressive symptoms either develop directly from a lack of friends or from the negative peer assessments and victimisation that follow a lack of friendship networks (Ciairano, Rabaglietti, Roggero, Bonino, & Beyers, 2007; Juvonen, Graham, & Schuster, 2003; Oldehinkel, Rosmalen, Veenstra, Dijkstra, & Ormel, 2007). In combination with other peer problems, friendship difficulties exacerbate depressive outcomes (Bukowski, Laursen, & Hoza, 2010b; Hodges, Boivin, Vitaro, & Bukowski, 1999). Furthermore, friendship difficulties hinder effective coping and recovery from depression (Bond et al., 2007; Goodyer, Germany, Gowrusankur, & Altham, 1991; Meland et al., 2010). The effects of friendship difficulties on outcomes may be timing dependent; poor friendships during prepuberty lead to anxious-depressed symptoms while post-pubertal friendship problems lead only to depression (Goodyer et al., 1989).

Twenty-eight studies assessed the relationships of negative peer assessments with depression. These studies reveal that negative peer assessments, which include peer rejection and a low peer standing, predict concurrent and future depressive symptoms (Auerbach, Bigda-Peyton, Eberhart, Webb, & Ho, 2011; Boivin, Poulin, & Vitaro, 1994; Boivin, Hymel, & Bukowski, 1995; Bukowski, Laursen, & Hoza, 2010a; Chen, Huang, Wang, & Chang, 2012; Comiskey et al., 2012; Kornienko & Santos, 2014; Ladd, 2006; MacPhee & Andrews, 2006; Nolan, Flynn, & Garber, 2003; Oldehinkel et al., 2007; Panak & Garber, 1992; Patterson & Stoolmiller, 1991; Pedersen,

Vitaro, Barker, & Borge, 2007; Rueger, Malecki, & Demaray, 2010; Shochet, Smith, Furlong, & Homel, 2011; Sontag, Graber, & Clemans, 2011). Negative peer assessments reduce self-esteem and create loneliness, both of which lead to depression (Asher & Wheeler, 1985; L. Bond et al., 2007; Buhs & Ladd, 2001; Fontaine et al., 2009; Qualter et al., 2010; Qualter, Brown, Munn, & Rotenberg, 2010). In addition, negative assessments can bring about depression by producing depressogenic cognitions (Braet, Van Vlierberghe, Vandevivere, Theuwis, & Bosmans, 2013; Prinstein & Aikins, 2004), increasing interpersonal stress and conflicts (Auerbach et al., 2011; Mercer & DeRosier, 2008), or impairing cognitive abilities such as reward processing (Casement et al., 2014). The relationship of negative peer assessments and depression is moderated by friendships (Bukowski et al., 2010b) and low friendship valuing (Martin, Cole, Clausen, Logan, & Strosher, 2003).

Thirty of the studies retrieved focused on the association of victimisation with depressogenic cognitions and depressive outcomes (Abada, Hou, & Ram, 2008; Barchia & Bussey, 2010; L. Bond et al., 2007; L. Bond, Carlin, Thomas, Rubin, & Patton, 2001; Braet et al., 2013; Desjardins & Leadbeater, 2011; Fekkes, Pijpers, & Verloove-Vanhorick, 2004; Fekkes, Pijpers, Fredriks, Vogels, & Verloove-Vanhorick, 2006; Fleming & Jacobsen, 2009; Gibb, Stone, & Crossett, 2012; Hanley & Gibb, 2011; Kaltiala-Heino, Fröjd, & Marttunen, 2010; Kumpulainen, Räsänen, & Henttonen, 1999; McLaughlin, Hatzenbuehler, & Hilt, 2009; Meland et al., 2010; Rothon, Head, Klineberg, & Stansfeld, 2011; Saluja et al., 2004; Sinclair et al., 2012; Snyder et al., 2003; Sourander, Helstelä, Helenius, & Piha, 2000; Storch & Masia-Warner, 2004; H. Sweeting, Young, West, & Der, 2006; Turner, Finkelhor, & Ormrod, 2010). Although incidents of victimisation decline with age (Kumpulainen et al., 1999), the risk for depressive outcomes does not decline concurrent to this age-related drop in victimisation (Rudolph, Troop-Gordon, Hessel, & Schmidt, 2011). Victimised children are likely to develop anxiety problems (Juvonen, Graham, & Schuster, 2003; Kochenderfer-Ladd & Skinner, 2002; Sourander, Helstela, Helenius, & Piha, 2000; Storch & Masia-Warner, 2004), a low-self-esteem (Hawker & Boulton, 2000; Sapouna & Wolke, 2013) and emotion regulation difficulties (McLaughlin, Hatzenbuehler, & Hilt, 2009), which in turn can lead to depressive outcomes. In addition, victimised children face greater difficulties in peer interaction and friendship formation than other children (Juvonen et al., 2003; Snyder et al., 2003), which add to the risk for depression. Victimization also mediates paths from depression to further peer problems, especially at mid-adolescence (Sweeting, Young, West, & Der, 2006) thereby ensuring the

continuity of peer difficulties and further depressive problems (Hoglund & Chisholm, 2014; Kochel, Ladd, & Rudolph, 2012).

In addition to the above-mentioned peer problems, poor social competence (Blechman, McEnroe, Carella, & Audette, 1986; Cole, 1990; Crick, Ostrov, & Werner, 2006; Fauber et al., 1987; Pedersen et al., 2007; Ross, Shochet, & Bellair, 2010; Rubin, Hymel, & Mills, 1989; Gregory et al., 2007; Kistner, David-Ferdon, Repper, & Joiner Jr, 2006; Lee, Hankin, & Mermelstein, 2010; Zimmer-Gembeck, Hunter, Waters, & Pronk, 2009) and social behaviour problems (Fite, Rubens, Preddy, Raine, & Pardini, 2014; Hoglund & Chisholm, 2014; Kamper & Ostrov, 2013; Morgan, Shaw, & Forbes, 2013; Yang, Chen, & Wang, 2014) also predict depression. Further, one study found that a discrepancy in social-skills appraisals by children (high) and their parents (low) also predicts depression (Taylor & Wood, 2013).

Differences among ADHD subtypes in development of peer problems

Amongst the three subtypes of ADHD, the inattentive form (ADHD-I) is the most common followed by, respectively, the combined subtype (ADHD-C) and the hyperactive/impulsive subtype (ADHD-H/I). Studies on subtype differences in peer problems mostly focus on the two more prevalent forms, that is, ADHD-I and ADHD-C. In total, thirteen studies provided information on subtype differences, with eleven studies including DSM-III-R or DSM-IV diagnoses of ADHD and two studies with teacher- or parent- reported ADHD symptoms. Three of the eleven studies reported that children with ADHD-I and ADHD-C have similar social skill deficits (Bauermeister et al., 2005; Hinshaw, Owens, Sami, & Fargeon, 2006; Hodgens, Cole, & Boldizar, 2000). Despite their similar social skills (Efron et al., 2014), the subtypes differ in their social behaviours. While ADHD-C is typically associated with aggressive behaviours, withdrawn and passive behaviours are more common to ADHD-I (Wheeler Maedgen & Carlson, 2000). Children with ADHD-I have difficulties interpreting social cues (Fine et al., 2008), are less likely to initiate social contact and are less assertive in their interactions than children with ADHD-C (Bauermeister et al., 2005). According to Wan Ismail et al. (2014), children with hyperactive or inattentive symptoms, but not with ADHD-combined type, are likely to be bullies.

Differences between these two subtypes in the amount of peer problems faced are less clear-cut. While five studies demonstrated fewer peer problems in children with ADHD-I subtype (Hinshaw, 2002; Hinshaw et al., 2006; Kolko & Pardini, 2010; Pardini & Fite, 2010; Wheeler

Maedgen & Carlson, 2000), two others reported no differences between children with ADHD-I and ADHD-C (Hodgens et al., 2000; Riley et al., 2008), and one reported a trend towards more peer problems in those with ADHD-I (Owens, Hinshaw, Lee, & Lahey, 2009).

Other differences between ADHD-C and ADHD-I relate to the onset of peer problems. Due to their aggressive behaviours, children with ADHD-C are rejected immediately in new peer settings (Hodgens et al., 2000). Children with ADHD-I, on the other hand, only face rejection after longer periods of interactions (Blachman & Hinshaw, 2002; Hodgens et al., 2000). Maintaining a long-term consistent friendship relationship is also difficult for children with ADHD-I, while for those with ADHD-C, difficulties are present especially during initial stages of friendship formation (Hinshaw, 2002).

Gender differences in risk of peer problems and depressive outcomes

Eleven studies retrieved provided information on gender differences in pathways from ADHD to peer problems, of which six included DSM diagnoses and five parent- or teacher-reported ADHD symptoms. Results show that both boys and girls with ADHD have similar social skill deficits (Bellanti & Bierman, 2000; Greene et al., 2001; Hoza, Mrug et al., 2005). Nevertheless, gender differences exist in the peer problems faced by children with ADHD. Girls seem to be more likely to face problems of negative peer assessments, victimisation (one study reported no gender differences in the association of ADHD with victimisation [Runions, 2014]) and a poor quality of friendships (Berry, Shaywitz, & Shaywitz, 1985; Elkins et al., 2011; Schwartz et al., 1999; Young, Chadwick, Heptinstall, Taylor, & Sonuga-Barke, 2005; Young, Heptinstall, Sonuga-Barke, Chadwick, & Taylor, 2005), while boys are more likely to lack friends or associate with deviant peer groups (Elkins et al., 2011; Taanila et al., 2009). The friendship difficulties of boys are often attributed to their aggressive behaviours (Carlson, Tamm, & Gaub, 1997).

Information on gender differences in pathways from peer problems to depression was provided by twenty-five studies. Of these, twenty-three focussed on depressive symptoms and two on sadness and depressogenic cognitions. For ease of discussion we first present results from the twelve studies on gender differences in the effects of friendship difficulties and negative assessments. In general, girls are more sensitive to peers' appraisals than boys are (Cole, 1991; Cole, Martin, & Powers, 1997; Paquette & Underwood, 1999) and develop depressogenic cognitions in response to peer problems more easily (Cole, 1990). Girls are also more likely to face

interpersonal stresses and more vulnerable to their negative effects (Hankin, Mermelstein, & Roesch, 2007; Prinstein & Aikins, 2004). Studies on gender differences in negative peer assessments have consistently shown that, girls are more susceptible to depression following peer rejection than boys (Cole, 1991; Hankin et al., 2007; Moksnes, Espnes, & Haugan, 2013; Oldehinkel et al., 2007; Reijntjes, Stegge, & Meerum Terwogt, 2006; Shochet et al., 2011), although the coping skills used to deal with rejection are the same for both genders (Reijntjes et al., 2006). The effects of gender on the pathways from rejection to depression may be further complicated by pubertal influences; Sontag et al. (2011) in their study found that early puberty in girls and late puberty in boys worsened depressive outcomes following rejection. MacPhee and Andrews (2006) found evidence for greater depression in boys following peer problems; low popularity predicted depression in boys but not in girls.

Thirteen studies retrieved provided information on gender differences in pathways from victimisation to depression, with mixed findings. Of the thirteen studies, one found that both genders are equally susceptible to victimisation (Rothon et al., 2011), a second one that girls are less likely to be victimised than boys (Fleming & Jacobsen, 2009), and a third one that girls are more susceptible to victimisation than boys (Moore et al., 2014). An age related reduction in victimisation has been reported in girls but not in boys (Kumpulainen et al., 1999). Following victimisation, girls are more likely to develop aggressive behaviours, which can aggravate peer problems (Rudolph et al., 2011). Girls, as compared to boys, are likely to utilize peer support to cope with the victimisation (Hunter, Boyle, & Warden, 2004; Kochenderfer-Ladd & Skinner, 2002). Nevertheless, the risk of depressive outcomes following victimisation may or may not be worse for girls. While six studies report worse depressive outcomes in girls following victimisation (Abada et al., 2008; Fleming & Jacobsen, 2009; Paquette & Underwood, 1999; Rudolph et al., 2011; Sapouna & Wolke, 2013; Stange, Hamilton, Abramson, & Alloy, 2014), two other studies found a greater depressive risk in boys facing victimisation (Rothon et al., 2011; Sinclair et al., 2012). Further differences between boys and girls relate to the type of victimisation commonly faced. Girls are more likely to face relational victimisation while boys may be more susceptible to physical victimisation (Crick & Nelson, 2002; Sinclair et al., 2012). We found only one study on gender differences that accounted for the type of victimisation. According to Desjardins and Leadbeater (2011), the severity of depressive outcomes following relational victimisation is similar in both girls and boys.

DISCUSSION

Peer relationship problems in ADHD can be ascribed to the symptoms of ADHD, presence of additional behaviour problems, anxiety, cognitive dysfunction, social skill deficits, or a positive illusory bias. These factors may give rise to peer problems through at least two pathways. First, social skills deficits (probably arising due to developmental delays) and cognitive deficits lead to difficulties in expressing socially appropriate behaviours and consequently to peer relationship problems. Second, the symptoms of ADHD lead to peer problems directly, bypassing the involvement of cognitive and social skill deficits (Figure 1). There is mixed evidence on the impact of cognitive deficits in children with ADHD, and two of the studies reviewed found that cognitive dysfunction did not necessarily lead to peer problems (Biederman et al., 2004; Wåhlstedt et al., 2008). In light of this information, we may say that the second pathway is more probable than the first.

We further postulate that disruptive and aggressive behaviours develop secondarily in the pathways described above and in Figure 1. Facing peer problems may, in the long term, prompt children to respond in disruptive and aggressive manners in order to either achieve prominence or avoid further social failures. Being predictors of peer problems themselves, these behaviours create a self-persisting cycle wherein ADHD symptoms initially set the cascade of events in motion. The role of ADHD symptoms in triggering this cycle of events is supported by Stormshak et al.'s (1999) study on peer acceptance of ADHD and behaviour problems. Results from this study suggest that disruptive and aggressive children do not face peer difficulties in classrooms where these behaviours are normative. In comparison, children with ADHD face peer difficulties even in classrooms that have a high proportion of affected children with ADHD. (Stormshak et al., 1999). Thus, ADHD symptoms seem to cause more aversion in peers than disruptive or aggressive behaviours, which makes these symptoms a likely initial trigger for peer problems. Because behaviour problems compound the peer difficulties faced in ADHD, their development, and consequent self-perpetuation warns steadily worsening peer relations.

We surmise that positive illusory bias, similar to behaviour problems, develops secondarily in the developmental pathways from ADHD to peer problems (Figure 1). The development of positive illusory bias is a self-protective mechanism for maintaining self-esteem when facing social defeat chronically (B. Hoza et al., 2010). This indicates that a positive illusory bias may develop when children experience repeated social failures, and may not feature in ADHD early on. Children with ADHD have an accurate understanding of social norms and expectations (Nijmeijer et al.,

2008). Positive illusory bias may thus be a natural outcome of the social and cognitive deficits in ADHD combined with an intact knowledge of social norms. That is, children with ADHD may attempt to perform according to the social rules, but be hampered by deficits in social skill and cognition. These children therefore assess their social standing positively without realising their inability to interact pro-socially. The development of positive illusory bias in turn may further enhance the peer-relationship problems.

The two pathways described above lead to friendship difficulties, negative peer assessments, and victimisation in children with ADHD (Figure 1). Based on the reviewed literature, we postulate that negative peer assessments increase gradually over time. According to (Hoza et al., 2005), popular classmates are more likely to rate children with ADHD negatively than less popular ones. Other classmates may emulate the opinions of their popular peers and start rejecting children with ADHD as well. It is conceivable that, over time, more and more classmates assess children with ADHD negatively, resulting in an increase in problematic relationships. Furthermore, negative assessments and the resulting lack of support from popular classmates turn children with ADHD into potential victims of bullying, because these conditions give bullies an easy target. Negative assessments by other peers only increase the chances of victimisation. We therefore propose that problems of negative assessments feature in the peer relationships of children with ADHD first, followed by victimisation, which builds up later (Figure 6.1). This temporal order is supported by a study conducted by Schwartz et al. (1999), who found that pathways to victimisation in ADHD were mediated by peer rejection.

The reviewed results suggest that assessments of classmates made by children with and without ADHD are similar, in that children with ADHD also prefer popular classmates to those rejected and with a low status (Hoza et al., 2005). Nevertheless, peer groups of children with ADHD are composed of classmates with peer problems themselves or otherwise maladjusted classmates. As explained by Hoza et al. (2005), with time and after many unsuccessful attempts to form friendships with non-rejected peers, children with ADHD are compelled to approach other similarly rejected classmates despite disliking them. This lack of choice could explain the higher conflicts and lower dissatisfaction in the friendships of children with ADHD (Blachman & Hinshaw, 2002).

Peer problems that develop in children with ADHD may lead to depressive outcomes, probably through development of a low self-esteem, loneliness, depressogenic attribution styles, emotion regulation problems, interpersonal stresses, anxiety, and deficient reward processing

abilities. The reviewed studies revealed a strong relationship of negative peer assessments and victimisation with depressive outcomes. Friendship difficulties such as a lack of friends and a poor quality of friendships also increase the risk for depression, but we found no evidence that deviant peer group affiliation leads to depression. Possibly affiliating with peers provides protective benefits against depression, even if these peers are deviant. Further, social skill deficits and problems in social behaviours may directly give rise to depression, bypassing the involvement of peer relationship problems. There is also mixed evidence for associations between a positive illusory bias and depression. Positive illusory bias may prevent depression by protecting against low self-esteem. In line with this, Steca et al. (2014) reported that a high self-perceived social competence protects against depression. Contrary to this, results from Casement et al. (2014) showed that discrepancies in social competence reports between parents (low competence) and their children (high competence) predict depressive outcomes.

There are reasons to assume that friendship difficulties increase with age, and that their relative role in the pathways to depression, as compared to negative assessments and victimisation, increases with time. First, since both negative assessments and victimisation lead to difficulties in friendships (Juvonen et al., 2003) eventually problems in friendships will increase with time. Second, friendship difficulties impede remission from depression (Barchia & Bussey, 2010; Bond et al., 2007; Goodyer et al., 1991; Meland et al., 2010), prolonging the duration of depression and increasing the probability of additional peer difficulties. Third, with increasing age, children attach greater importance to friendships (Cole et al., 1996). This growing salience is likely to increase the depression risk in case of friendship difficulties with age.

In the pathways from ADHD to peer problems and further to depression, the secondary development of disruptive and aggressive behaviours may flag worsening of prognosis. Over and above the risk associated with ADHD, these behaviours increase depression risk both directly and indirectly, through further enhancing peer problems (Wilson, 2003). In contrast to disruptive-aggressive behaviours, the secondary development of positive illusory bias may not necessarily lead to a worse prognosis. As discussed above, positive illusory bias may increase the risk for peer difficulties but may also protect from depression (Hoza et al., 2010).

Results on ADHD-subtype differences and peer problems were mixed. While some studies reported higher peer difficulties in children with ADHD-C, others reported greater problems in children with ADHD-I. These differences may be better understood if we consider peer interactions

in the long term. Children with ADHD-C are likely to face problems immediately at initial peer encounters (Hodgens et al., 2000). Thus, initially, ADHD-C will be associated with worse peer problems than ADHD-I. Withdrawn behaviours, common to ADHD-I (Bauermeister et al., 2005), are not perceived as a threat immediately but may start to annoy peers in the long term. Accustomed to the passivity of children with ADHD-I, peers may also reduce their interaction attempts. Eventually peer problems in ADHD-I may increase, reaching similar levels as ADHD-C. We speculate that, with increasing age, the peer problems of ADHD-I may supersede those of ADHD-C for the following three reasons. First, while passivity in ADHD-I leads to social disconnection, the assertive nature of children with ADHD-C may attract attention from peers, particularly during adolescence. This could reduce chances of social isolation in those with ADHD-C. Second, the social isolation in ADHD-I may increase susceptibility to victimisation, worsening peer problems. Third, symptoms of ADHD-C remit with increasing age, while symptoms of ADHD-I remain stable over time (Hart, Lahey, Loeber, Applegate, & Frick, 1995; Hinshaw et al., 2006). Persistence of ADHD is associated with worse peer problems. Continuity of ADHD-I may consequently lead to greater problems in peer relationships over time.

Results from the reviewed studies suggest that girls with ADHD face more peer relationship problems than boys. Girls with ADHD are less hostile and more relationship-oriented and consequently more likely to make friends than boys with ADHD (Arnold, 1996; de Boo & Prins, 2007). Nevertheless, friendships of girls with ADHD are often dissatisfactory and marked with conflicts (Young et al., 2005). Therefore, even though girls with ADHD may have more friends than boys, they are not necessarily better off in the friendship domain. Additionally, symptoms of ADHD are considered gender inappropriate in girls, and peers assess them more harshly than they assess boys (Diamantopoulou et al., 2005; Kerr, Lambert, Stattin, & Klackenberg-Larsson, 1994). This gender-bias in peer assessments may explain why girls have more peer problems than boys despite their similar social skills.

Gender differences exist in the pathways from peer problems to depression as well. With the exception of one study (MacPhee & Andrews, 2006), the reviewed results show that negative peer assessments are more likely to be associated with depression in girls than in boys, with low popularity as the only exception to this rule. This exceptional role of low popularity suggests gender differences in sensitivity to type of peer assessments. Peer problems leading to depression are more likely to be affection-related in girls, and achievement-related in boys (Kornienko & Santos, 2014;

Moksnes et al., 2013; Oldehinkel et al., 2007). Thus, girls may be affected by isolating negative peer appraisals such as rejection, while boys may be affected more by peer problems that indicate social failure such as popularity.

This review indicates pathways through which peer problems may develop in children with ADHD and further increase the risk for depression, in an attempt to extend the knowledge yielded by previous studies on the association of peer problems with depression in children with ADHD (Becker et al., 2013; Drabick et al., 2006; Humphrey et al., 2007; Humphreys et al., 2013; McQuade et al., 2014; Mikami & Hinshaw, 2003; Ostrander et al., 2006; Roy et al., 2015) (See Table 1). Results from the current review extend this knowledge and suggest that, besides the peer problems identified by these previous studies (negative peer assessments, victimisation and low social competence), a lack of friends and a poor quality of friendships may also be involved in the development of depression. Additional new findings that emerged relate to the increased susceptibility for depression in particular groups of children with ADHD. First, children developing disruptive-aggressive behaviours may be at a greater risk for depression. Second, the risk for depression may increase with age in children with the ADHD-I subtype. Third, girls with ADHD are more likely to be depressed following peer problems than boys with ADHD. Fourth, continuation of ADHD leads to worse depression by allowing a greater time-period for development and progression of peer difficulties. Persistence of ADHD can also lead to the development of disruptive and aggressive behaviours in response to peer problems, which further reinforce the paths to depression.

Clinical Implications

Improvements in the peer relations of children with ADHD may prevent future depression. However, interventions aimed at improving peer functioning have been largely unsuccessful (Barkley, 2004; de Boo & Prins, 2007). Medications only marginally improve peer functioning (Bagwell et al., 2001; Molina et al., 2009; Nijmeijer et al., 2008) and cannot normalize the peer relationships (Hubbard & Newcomb, 1991). The absence of reliable and effective interventions points to the pressing need for newer therapies. Newer interventions can focus on and benefit from exploiting protective factors that offset the peer problem-depression relationship. The effects of peer problems on depression are attenuated by friendships, modifications in social behaviours, and academic or sport achievements (Barchia & Bussey, 2010; Bond et al., 2007; Ladd, 2006; Martin et al., 2003; Meland et al., 2010). Accordingly, building friendships (Barchia & Bussey, 2010; Bond et

al., 2007; Meland et al., 2010; Mikami, 2010; Nijmeijer et al., 2008), modification of behaviour to a more pro-social and helpful manner of interacting with peers (Mrug et al., 2007; Stormshak et al., 1999), and improvements in academics and sports (Blechman et al., 1986; Cole, 1990; Cole, 1991) can be potential intervention tactics.

So far, attempts at increasing friendships in ADHD have been effective to some extent (Hoza, Mrug, Pelham, Greiner, & Gnagy, 2003; Mikami, 2010). Hoza et al. (2003) found that pairing up of non-affected peers and children with ADHD improved peer functioning. Similarly, medications have been found to improve friendship choices and self-appraisals of social behaviours (Smith et al., 2000). Thus, friendship-based interventions such as buddy-pairing (Hoza et al., 2003; Mikami, 2010; Nijmeijer et al., 2008) can complement the effect of medications. The combination of friendship-based interventions with medications can be made more effective by providing interventions for modifying social behaviour. Additionally, children with ADHD may be encouraged to participate and excel in sports and academics to add to the effects of these interventions.

Efforts towards developing sensitive school and community environments that are positive towards children with ADHD can aid in reducing peer problems. Despite receiving therapy that induce a reduction in ADHD symptoms, peer difficulties continue and social networks of children with ADHD do not resemble that of other normative children (Nijmeijer et al., 2008). Therefore, a different tactic that makes school and community environments conducive for these children may have a better effect than the tried and tested social interventions. Early research in this line has already shown promising results: in a recently conducted randomised trial, training classmates to interact positively towards children with ADHD improved peer relations by a far greater margin than that achievable by the existing social training interventions alone (Mikami et al., 2013). Recent evidence also suggests that peer problems can be attenuated by increasing parent and teacher involvement during peer interactions (Mikami, Jia, & Na, 2014).

Recommendations for future research

A number of gaps exist in our understanding of pathways from ADHD to depression through peer problems. First, it is still not entirely clear why children with ADHD develop a particular type of peer functioning difficulty. Differences in ADHD-subtype, gender and age all partly explain the propensity for developing one peer problem over the other, but very few studies have directly compared the three broad categories of peer problems regarding their predictive factors. It is also

not known to what extent children with ADHD may develop multiple peer problems. Second, the relationship of socially aggressive behaviours with bullying has not been adequately assessed. Only one study reported on bullying behaviours in children with ADHD (Ismail et al., 2014). It is possible that incidents of bullying reflect social aggression, particularly reactive aggression and self-defence against victimisation. Further research is needed to understand the specific type of aggressive behaviours associated with ADHD and their relationship to bullying. Third, most studies assessed depressive outcomes of peer problems in adolescents. Specific to children with ADHD, depression may begin much earlier in childhood (Roy et al., 2014b). Fourth, recent studies have recognised the impact of internet usage on children and adolescents' peer functioning. Cyber-bullying in particular has been reported to predict depression (Elgar et al., 2014; Gámez-Guadix, Orue, Smith & Calvete, 2013). Currently, it is not known if cyber-bullying is also common amongst children with ADHD, and if such incidents influence the development of depression.

Conclusion

This review illustrates possible paths through which peer problems may arise in children with ADHD and further lead to depression. The pathways described in this review may not be the only mechanisms at work. Nevertheless, their cognizance can expedite early diagnosis and prevent development of depression. In describing the development of depression, we demonstrate lacunae in our knowledge and set the stage for further empirical work. We emphasize the need for further research on the developmental mechanisms of peer problems and depression in children with ADHD. In sum, knowledge from such studies shall assist in predicting impairments early on and may be utilised for development of newer intervention techniques against depression.

Table 6.1 Studies examining the association of peer problems with depressive outcomes in children with ADHD: summary table

Study	Broad aims	Study design	Participant characteristics	Key findings
Becker et al. (2013)	Determined the moderating effects of gender on the pathways from peer functioning problems to internalising disorders in children with ADHD-inattentive subtype	Cross-sectional	188 children with a diagnosis of ADHD (110 boys, 78 girls) aged 7-11 years	Peer functioning problems were more strongly associated with internalising problems in girls than boys
Drabick et al. (2006)	Examined psychosocial risk factors for depression in ADHD	Prospective	248 boys with ADHD aged 6-10 years	Social problems predicted depression in ADHD
Humphrey et al. (2007)	Examined correlation of peer victimisation with psychosocial adjustment in ADHD	Retrospective	91 boys and 25 girls with ADHD aged 4-18 years	Peer victimisation in children with ADHD was positively correlated with depression
Humphreys et al. (2013)	Determined the mediating effects of peer relationships in pathways from ADHD to depression	Cross-sectional and prospective	(Study 1: 230 participants (163 boys, 67 girls), including children with (n=120) and without ADHD aged 5-10 years at baseline)	Peer functioning problems were concurrently and prospectively associated with depression in children with ADHD
McQuade et al. (2012)	Examined moderating effects of ADHD diagnosis and peer status in the longitudinal relation between self-perceived social acceptance and changes in adjustment	Prospective	182 boys and 42 girls with ADHD compared to 94 and 29 girls without ADHD aged 8-13 years	Self-perceived social competence moderated the relationship of ADHD and depression
Mikami and Hinshaw (2003)	Examined effects of peer rejection on anxious/depressed behaviour in girls with ADHD	Short-term prospective with a follow-up period weeks	91 girls with ADHD compared to 58 girls ADHD, aged 6-13 years	Peer rejection was related to higher depressed anxious behaviour in girls with ADHD
Mrug et al.	Examined effects of peer	Prospective	362 participants (both	Peer rejection in ADHD

Study	Broad aims	Study design	Participant	Key findings
(2012)	rejection and lack of dyadic friendships on long-term emotional and behavioural problems in ADHD		genders) with ADHD aged 7-18 years	predicted global impairment but not depressive outcomes specifically. Dyadic friendships did not attenuate effects of peer rejection
Ostrander et al. (2006)	Examined mediation of depression in ADHD by parent, teacher and self-reported social competence	Cross-sectional	148 participants (both genders) with ADHD and controls aged 6-12 years	Depression was mediated self and others' appraisals self-competence
Roy et al. (2015)	Determined mediating effects of peer problems in pathways from ADHD to depression	Prospective	728 participants (335 boys, 393 girls) aged 11-19 years	Peer dislike and victimisation increased risk for depression in children with ADHD, especially girls

Figure 6.1 Postulated pathways from ADHD to the development of depression through peer problems

