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Empirical evidence of cognitive vulnerability for depression among children and adolescents: A cognitive science and developmental perspective

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Abstract

We summarize and integrate research on cognitive vulnerability to depression among children and adolescents. We first review prospective longitudinal studies of the most researched cognitive vulnerability factors (attributional style, dysfunctional attitudes, and self-perception) and depression among youth. We next review research on information processing biases in youth. We propose that the integration of these two literatures will result in a more adequate test of cognitive vulnerability models. Last, we outline a program of research addressing methodological, statistical, and scientific limitations in the cognitive vulnerability literature.

Keywords

Cognitive vulnerability; Information processing; Depression

1. Introduction

Using a developmental and cognitive science framework, we review and integrate recent research on cognitive vulnerability to depression among children and adolescents. First, we review prospective longitudinal studies assessing relations between putative cognitive vulnerabilities and the occurrence of depression. We then propose that the incorporation of experimental paradigms and the assessment of information processing biases among children may facilitate the testing of alternative cognitive vulnerability models. Last, we outline a program of research addressing methodological, statistical, and scientific limitations in this literature.

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1.1. Development of depression

Major depressive disorder (MDD) often begins during adolescence, is chronic and recurrent, and frequently places youth at risk for recurrent MDD during adulthood. Between 20% and 50% percent of adolescents report experiencing subsyndromal levels of depression (Kessler, Avenevoli, & Merikangas, 2001; Petersen, Compas, Brooks-Gunn, & Stemmler, 1993). Lifetime prevalence rates of 1.5% (e.g., Costello et al., 1996) and 7% (e.g., Kessler et al., 2005) have been reported for depressive disorders among children and adolescents, respectively. Depression during adolescence shares features of the depression that occurs during adulthood (e.g., Lewinsohn, Allen, Seeley, & Gotlib, 1999; Pine, Cohen, Gurley, Brook, & Ma, 1998). Adolescence, then, represents a critical period of vulnerability. Seventy-five percent of adults with MDD experience their first depressive episode during childhood or adolescence, whereas only 25% experience onset of MDD in adulthood (Kim-Cohen et al., 2003). That said, patterns of depressive symptoms may differ over the course of development given the cognitive, social, emotional, and biological changes that transpire (Cicchetti & Toth, 1998; Weiss & Garber, 2003). In addition, the observed gender difference in depression emerges in early adolescence (e.g., Angold, Erkanli, Silberg, Eaves, & Costello, 2002; Weissman, Warner, Wickramaratne, Moreau, & Olfson, 1997). Depression is a common, persistent, and pernicious occurrence in the lives of youth. Any comprehensive model of vulnerability for depression must address these observations.

1.2. Theoretical hypotheses of cognitive vulnerability models

Several models have been proposed to explain the development and maintenance of depression among youth. Cognitive vulnerability models stand at the forefront of research activity. Beck (1967) defined cognitive vulnerability as the presence of maladaptive self-schema reflecting themes of helplessness and unlovability that become activated by negative life events or negative moods. Many cognitive vulnerability theories employ a vulnerability-stress paradigm (e.g., Abramson, Seligman, & Teasdale, 1978; Beck, 1967), whereby cognitive factors interact with environmental stressors to increase risk for emotional disorders. Indeed, stressful life experiences predict depression among children and adolescents (see Grant et al., 2004a; Grant, Compas, Thurm, McMahon, & Gipson, 2004b). This relationship appears to be bidirectional, as depressive symptoms also predict increases in objectively assessed stressors among youth (Grant et al., 2004b). The assessment of stress in the study of cognitive vulnerability is crucial, as exposure to mild uncontrollable stress during adolescence can impair cognitive functioning (Steinberg, 2004).

Specific criteria for defining cognitive vulnerability factors have been put forth. First, a cognitive vulnerability factor must temporally precede depression and exhibit stability over time (e.g., Alloy et al., 1999; Ingram, Miranda, & Segal, 1998). Second, construct validity must be established, in that the cognitive vulnerability factor must demonstrate predictive validity not better accounted for by an extraneous variable. Third, cognitive vulnerability factors are believed to be specific to particular disorders. For example, if dysfunctional attitudes serve as a vulnerability for depression, they must not also predict conduct disorder (discriminant validity). Fourth, vulnerability is viewed as an endogenous process that is conceptualized as latent (e.g., Ingram et al., 1998). That is, the vulnerability must represent an enduring characteristic of the child, and not their family, relationships, or environment. These general and specific theoretical hypotheses guide the scientific exploration of cognitive vulnerability.

1.3. Cognitive development

Adolescence represents a phase wherein cognitive vulnerability may occur and is likely to emerge. The cognitive developmental ‘prerequisites’ are present and can emerge (Alloy, Abramson, Walshaw, Keyser, & Gerstein, 2006). The adolescent transition is characterized by the emergence of a more self-directed and self-regulated mind (Keating, 2004). Self-regulation

is advanced through an executive suite of capabilities (Donald, 2001) as central conceptual structures coordinate across domains (Keating, 1996). A developing executive control monitors and manages cognitive resources during adolescence (Kuhn & Pease, 2006). Thus, across development, increasing executive functioning ability translates to an increasingly 'top down' mode of cognition.

A parallel coordination of information processing, or 'bottom-up' components allows for the strategic use of emerging cognitive resources. In such, information processing and cognitive reasoning operate in concert. Indeed, recent work reveals that advances in level of reasoning are supported by 'bottom-up' changes in efficiency and working memory (Demetriou, Christou, Spanoudis, & Platsidou, 2002). These processes, in turn, are reciprocally affected by 'top down' cognition. Moreover, processing speed increases from early childhood through mid-adolescence (Demetriou et al., 2002). For example, adolescents are better able to ignore irrelevant stimuli on the Stroop task than children (Demetriou, Efklides, & Platsidou, 1993). Increasing processing speed leads to greater efficiency in top down processes, including social problem solving. Such research suggests that adolescents possess the cognitive prerequisites for vulnerabilities to depression. If cognitive vulnerability is a valid model representing the onset of depression among youth, we expect children to be capable of demonstrating maladaptive cognitions, which, in interaction with the stress of the adolescent transition, result in depressive disorders.

2. Attributional style

Attributional style is the cognitive vulnerability factor that has garnered the most research and theoretical attention. First proposed as a means of addressing limitations in the original theory of learned helplessness (Seligman, 1975), Abramson et al. (1978) proposed that depressed individuals attribute negative events to internal, global, and stable causes. In contrast, viewing the causes of negative events as external, specific, and unstable represents a positive or adaptive style, and may buffer or protect an individual from depression. A negative attributional style is hypothesized to be a proximal contributor to the onset of depression. In further theoretical modification, hopelessness theory (Abramson, Metalsky, & Alloy, 1989), introduced three separate cognitions that contribute to depression—a low sense of efficacy following life stress, viewing negative events as having negative consequences, and viewing the causes of these events as global and stable. These cognitions evolve into hopelessness, which is hypothesized to be a proximal and sufficient cause of depression. Hopelessness depression reflects motivational deficits and dysphoric affect stemming from a negative attributional style (Abramson, Alloy, & Metalsky, 1988). An elaborated cognitive vulnerability-transactional stress depression model (Hankin & Abramson, 2001) accounts for the general development of depression as well as specific outcomes, such as the emergence of a gender difference in depression. In this model, negative events contribute to initial elevations of general negative affect. Cognitive vulnerabilities such as a negative attributional style, then, moderate risk for depression. Depression, in turn, can lead to more negative life events, creating a pathogenic cycle. The aforementioned models all seek to explicate the relations between attributional style and depression.

2.1. Review

Twenty-one studies support the prospective effects of attributional style on depressed mood in children and adolescents (see Table 1). Young children are capable of drawing inferences about events and evidence potential for demonstrating a stable attributional style. In one study, third graders demonstrated greater pessimism in their attributions than seventh graders, were more likely to catastrophize, and viewed themselves as flawed following negative life events (Abela & Payne, 2003). Consistent with prediction, the interaction of life events and attributional style appears to be a more potent predictor of depression as children age (Abela, 2001;Conley,

Haines, Hilt, & Metalsky, 2001;Nolen-Hoeksema, Girgus, & Seligman, 1992). Adolescents who demonstrate a positive attributional style in sixth grade continue along the same linear trajectory (in the positive direction) over time (Garber et al., 2002). Similarly, adolescents who manifest a negative attributional style in sixth grade continue on a trajectory to a more negative attributional style. Taken together, findings indicate that children and adolescents are capable of developing the attributions that have been linked with depression. Longitudinal evidence suggests that as early as middle childhood, negative attributions may place children on a trajectory toward an increasingly negative and pernicious attributional style.

The nature and strength of associations between attributional style and depression may vary with development in function and/or content. We note Cole and Turner's (Cole & Turner, 1993; Turner & Cole, 1994) suggestion that attributional style mediates, rather than moderates, associations between life stress and depression in early- to mid-childhood. From this perspective, young children's negative attributions stem from adverse life events and are internalized as negative attributional styles, creating vulnerability to depression. During adolescence, a more stable attributional style interacts with life stress to produce depressive symptoms (Cole & Turner, 1993; Turner & Cole, 1994). Recent evidence supports this model. Attributional style mediated and moderated relations between life events and depression among fifth graders; whereas only a mediational role was present in fourth graders (Gibb & Alloy, 2006). Congruent with Cole and Turner's (1993; Turner & Cole, 1994) model, these observations suggest a developmental shift in the relations between cognition, life events, and mood.

On the other hand, we note the ‘weakest link’ hypothesis, which proposes that an individual's most depressogenic inference leads to vulnerability to depression (Abela & Sarin, 2002). As such, an individual's most depressogenic inference represents their degree of vulnerability. This model is descriptive in that individual attributions (global, stable, and self) appear relatively independent among youth (Abela, 2001). In contrast, stability of the weakest link among youth is moderate (test retest reliability=0.38) across six weeks. The weakest link model allows for the possibility that attributional errors can vary from setting to setting. In an investigation of this hypothesis among seventh graders, the interaction of life stress by weakest link predicted increases in hopelessness depression symptoms (Abela & Sarin, 2002). Recent tests of this model are also supportive (Abela & Payne, 2003; Abela et al., 2006). As such, the weakest link hypothesis represents a refinement of attributional models of cognitive vulnerability, but would be strengthened through: 1) explication of why a child would develop one weak link, as opposed to another, and 2) how a child's weakest link may vary over time and across settings.

Developmental psychopathology models suggest that the cognitive, social, environmental, and self-regulatory factors associated with risk to depression transactionally influence one another. The integration of reciprocal models to the study of attributional style represents an important conceptual advance. Latent factor growth modeling of longitudinal data illustrates the parallel increases in negative attributional style and depression severity. Adolescents with initially higher and increasing levels of depressive symptoms also demonstrate increasingly negative attributions (Garber, Keiley, & Martin, 2002). Attributional style and depression may be mutually dependent. In a comparison of mediation, moderation, and reciprocal models, a reciprocal model gained the most support, wherein initial levels of depressive symptoms predicted residual change in levels of stress and attributional style over the follow-up (Gibb & Alloy, 2006). Evidence also supports depression as leading to negative attributional style (Bennett & Bates, 1995; Gibb et al., 2006; McCarty et al., 2007; Nolen-Hoeksema et al., 1992). In sum, reciprocal models allow for dynamic modeling within a developmental psychopathology perspective.

Studies reviewed thus far support relations between attributions and depressive symptoms among youth. Attributions are related to past episodes and predict current and first episodes of depression (Lewinsohn, Clarke, Seeley, & Rohde, 1994). The interaction of life events and attributional style predict onset of MDD, but only at high levels of stress (Lewinsohn, Joiner, & Rohde, 2001). In the only study of children, evidence did not support attributional style as a vulnerability to MDD onset (Hammen, Adrian, & Hiroto, 1988). An attributional weakest link does, however, predict depressive symptoms among children of depressed parents (Abela et al., 2006). Such findings are preliminary and warrant replication.

Turning to measurement, we note several developments. Almost every study reviewed uses the Children's Attributional Style Questionnaire (CASQ; Seligman et al., 1984; CASQ-R; Kaslow, & Nolen-Hoeksema, 1991). Many researchers, however, call for better instruments, acknowledging the psychometric weaknesses of the CASQ. The CASQ measures attributional style in line with the reformulated theory of learned helplessness, rather than hopelessness theory. One new measure, the Adolescent Cognitive Style Questionnaire (ACSQ; Hankin & Abramson, 2002), assesses the entire negative attributional construct proposed by hopelessness theory. Moreover, the CASQ has poor internal consistency (coefficient alphas=0.4–0.6; Gladstone & Kaslow, 1995). According to guidelines (e.g., Nunnally & Bernstein, 1994), internal consistencies below 0.7 may lead to increases in Type II error. Recently developed measures include the Children's Cognitive Style Questionnaire (CCSQ; Abela, 2001) and the Children's Attributional Style Interview (CASI; Conley et al., 2001) allow for more reliable assessment of attributional style. Future research can rely on these more psychometrically sound measures, thereby increasing the likelihood of accurately detecting developmental differences in attributional style.

It is noteworthy, however, that despite measurement limitations, the bulk of the current evidence remains supportive of attributional style as a cognitive vulnerability. Evidence is more consistent among adolescent, as opposed to child, samples. Research in this area will be facilitated by the recent development of structured interviews assessing the attributional style of young children (Conley et. al, 2001).

3. Dysfunctional attitudes

Evidence supporting dysfunctional attitudes as a vulnerability to depression derives from a set of studies. Following theory, which places dysfunctional attitudes at the center of the etiology of depression (Beck 1967, 1983), prospective studies with adults support the role of dysfunctional attitudes in the development of depression (Alloy et al., 1999; Joiner, Metalsky, Lew, & Klocek, 1999; Kwon & Oei, 1994). Results from the Temple–Wisconsin Cognitive Vulnerability to Depression project (CVD; Alloy et al., 2006) indicate that first onset of a depressive disorder is significantly more likely among individuals with high levels of dysfunctional attitudes and a negative attributional style than among individuals with low levels of these cognitions. In another example, increases in depression symptoms result from the interaction of dysfunctional attitudes and a negative university admissions life stressor among high school seniors (Abela & D'Alessandro, 2002). These data support dysfunctional attitudes as a cognitive vulnerability to depression among adults.

3.1. Review

Six studies among youth (Abela & Sullivan, 2003; Lewinsohn et al., 1994; Lewinsohn et al., 2001; McCreary, Joiner, Schmidt, & Ialongo, 2004) prospectively assess the effects of dysfunctional attitudes on depression (see Table 1). In all studies, dysfunctional attitudes, either alone or in interaction with life stress, predict depression. The interaction of dysfunctional attitudes and life stress predicts a diagnosis of depression at the level of a trend (Lewinsohn et al., 2001). This example is a conservative test; however, as the effects of important covariates

such as co-morbid non-mood disorders and family psychiatric history are controlled. 'Pessimism' (which includes items from Weissman and Beck's (1978) scale) predicts first onset of depression (Lewinsohn et al., 1994). Higher levels of dysfunctional attitudes are observed among girls who met clinical cutoff scores for depression over the course of two years (Marcotte, Levesque, & Fortin, 2006). Overall, evidence supports dysfunctional attitudes in the prediction of MDD among youth.

However, it is not clear that dysfunctional attitudes serve as a cognitive vulnerability strictly to first onset depression, since 'pessimism' is also associated with current and past depression (Lewinsohn et al., 1994). More pernicious and stable maladaptive cognitions may result from repeated activation during episodes of depressed mood. Dysfunctional attitudes may increase vulnerability to first onset of major depression during adolescence, as well as increase vulnerability to future episodes. Parallel to findings within the attributional style literature, dysfunctional attitudes may transactionally relate to mood.

Dysfunctional attitudes have not been explored in children until recently. This work is facilitated by the development of the Children's Dysfunctional Attitudes Scale (CDAS; D'Allessandro, & Abela, 2000). A test of Beck's cognitive diathesis–stress theory of depression revealed a significant interaction of dysfunctional attitudes by hassles, but only among children with high self-esteem (Abela & Sullivan, 2003). The self-esteem effect ran contrary to hypotheses. Another study identified a significant interaction – this time in line with hypotheses – among children with high levels of dysfunctional attitudes and low levels of self-esteem in the prediction of moderately severe depression (Abela & Skitch, 2007). Contrary to hypothesis, however, this interaction also applied to children with low levels of dysfunctional attitudes and high self-esteem. Age did not modify these relations despite children as young as six being included, suggesting that young children can experience the deleterious effects of dysfunctional attitudes. In sum, studies with children yield complex results, which may be due to developmental or measurement issues. Self-esteem in particular appears to impact the way in which dysfunctional attitudes impact children at risk for depression. Within adolescent samples, dysfunctional attitudes appear to represent a vulnerability factor; however, it has yet to be demonstrated that the reverse relation is not also true.

4. Self-perception

A competency-based model asserts that negative events in a child's life lead to maladaptive self-cognitions that predispose a child to depression (Cole, 1990). Cole's model posits that negative self-perceptions regarding competence may serve as a cognitive vulnerability factor for depression. This reasoning is congruent with cognitive models of depression in emphasizing self-schemata as proximal to depression onset (e.g., Abramson et al., 1978, 1988). Negative self-perceptions are believed to result from the negative competency evaluations of significant others, such as parents and teachers. A child's self-perception of competency may interact with others' appraisals to influence depression. Studies testing Cole's model represent a majority of existing research in this area. We examine the existing literature to evaluate self-perception as a cognitive vulnerability to depression in youth.

Definitional issues are important when reviewing this literature. Self-concept and self-esteem represent broad constructs and encompass a range of components including cognitive processes, personality style, affective processes, and motivational domains. Harter's (1985) scale of self-perceived competence is one of the most frequently employed measures of self-esteem among youth. Germane to research on vulnerability for depression are scales assessing perceptions of personal competence, rather than omnibus measures of self-worth. Accordingly, we do not review studies that include only Harter's general self-worth scale. This stems from

a desire to incorporate a wide range of possible cognitive vulnerabilities, yet still restrict our review to cognitive, as opposed to personality, phenomena.

4.1. Review

Table 1 presents prospective studies that explore self-perception and depression. Evidence supporting negative self-perception as a proximal vulnerability to depressive symptoms is found in eight (Cole, Jacquez, & Maschman, 2001;Cole, Martin, & Powers, 1997;Cole, Martin, Powers, & Truglio, 1996;Hilsman & Garber, 1995;Kistner, Balthazor, Risi, & Burton, 1999;Measelle et al., 1998;Ohannessian, Lerner, Lerner, & von Eye, 1999;Tram & Cole, 2000) of the fourteen studies. Mixed evidence is found in three studies (Cole, Martin, Peeke, Seroczynski, & Fier, 1999;Hoffman, Cole, Martin, Tram, & Seroczynski, 2000;Kistner, David-Ferdon, Repper, & Joiner, 2006), with an additional three studies (Cole, Martin, Peeke, Seroczynski, & Hoffman, 1998;Lewinsohn et al., 1994;McGrath & Repetti, 2002) presenting evidence that depression predicts self-perception. Thus, the empirical base for self-perception as a cognitive vulnerability in youth is decidedly mixed.

Evidence that self-perception results from depression, or that the relation may be reciprocal, is drawn from a few well-designed studies. Among fourth graders followed prospectively through sixth grade, depression symptoms predict change in children's negative self-evaluations (McGrath & Repetti, 2002). Reciprocal relations are also illustrated in a study of third and fifth graders (Kistner et al., 2006). Similarly, inaccurate self-perception predicts increases in depressive symptoms and depressive symptoms, in turn, predict decreased accuracy in self-perception (Kistner et al., 2006). Academic overestimation predicts depression at many grade levels, but the reverse relation yields stronger effects (Cole, 1999). Underestimated competency predicts increases in depression within few grade levels; however, the reverse relation is found in all grades (Cole, 1998). Partial support for reciprocal models is also found by Hoffman et al. (2000). These studies support the reciprocal, or transactional, relations between self-perception and depression.

Yet another possibility is that relations shift across development with self-perception leading to depression earlier in development, while later in development the opposite relation may emerge. A developmental task of middle childhood is the construction of a personal sense of one's own competencies (Garber, 1984). Children may become increasingly capable of drawing realistic judgments about their competence as they grow. From a developmental psychopathology framework, it is plausible that normative developmental stressors influence emerging perception regarding competence, thereby increasing risk of depressive symptoms (e.g., Cicchetti & Toth, 1998). As such, inaccurate or negative self-perception may serve as a mediator of the relation between life stress and depression. Tram and Cole (2000) assessed these effects among ninth graders. Support was consistent for a mediational model whereby negative events predicted changes in self-perception, and self-perception predicted changes in depressive symptoms. In contrast, little evidence for moderation emerged. In this regard, self-perception may represent a mechanism, whereby salient life events affect mood.

Few studies examining relations between self-perception and mood have included simultaneous assessment of life events. This is surprising and may contribute to discrepant findings, as adverse events may be necessary to activate a child's latent negative self-perception in a particular domain. In one study, a ‘grade deficit stressor’ was employed in a sample of sixth graders wherein children were asked to define their own level of acceptable grades (Hilsman & Garber, 1995). Children with negative self-perception of their academic achievement expressed more depressive symptoms after receiving unacceptable grades than did students without negative self-perception. The inclusion of life stress assessment in the study of self-perception must be incorporated in future research to adequately test the role of self-perception as a cognitive vulnerability factor.

We propose that the presence of reciprocal, or transactional, relations between self-perception and depression may account for the mixed state of the literature. Findings may also differ depending on which aspects of self-perception are studied, at which points of development assessments are conducted, and what levels of baseline depression are included. Temporal and causal precedence have not yet been well-established. The literature offers support for self-perception as contributing to depression, but offers parallel support for self-perception as resulting from depression. Self-perception does not predict onset of first-episode MDD among youth (Lewinsohn et al., 1994). Self-perception does, however, relate to current and past depression. Thus, it is currently unclear whether Cole's (1990) model maps well onto a clinical diagnosis of depression. The possibility remains that self-perception may simply represent a concomitant of depressed mood. We also believe, in line with Cole (1990), that early in development, self-perception may serve as a mechanism, whereby life events affect levels of depression. That is, negative self-perception may mediate this relationship. Later in development, self-perception may come to moderate this association.

Methodological difficulties may also contribute to discrepancies between studies. Harter's (1985) measure, although systematically constructed from a strong conceptual base, may contribute to divergent findings. Some subscales demonstrate minimally acceptable reliability (Harter, 1985), warranting psychometric refinement. Harter's (1985) multifaceted scale may also lead to confusion among younger children. Researchers may wish to use the Pictorial Scale of Perceived Competence and Acceptance for Young Children (PSPCSA; Harter, 2002; Harter & Pike, 1984), which does not rely entirely on language comprehension and allows for assessment of young children. Lastly, it is possible that the construct of self-perception is too conceptually broad. Theoretical coherence in this area of study may lead to more congruent findings. In sum, research on self-perception among youth has not conclusively established whether it represents a cognitive vulnerability factor.

5. An integrative perspective

Overall, this body of literature implicates several cognitive factors in vulnerability for depression among youth. As we have seen, research to date is not definitive and has produced complex results. Over-reliance on self-report measures is a notable weakness. It is clear that children are capable of experiencing the type of cognitions under discussion; however, whether or not a child can reliably hold these cognitions consciously in mind and report them is currently debatable. Similarly, the questionable reliability of extant measures is problematic.

Due to these challenges, we propose that incorporating information processing paradigms into the study of cognitive vulnerability allows for a more developmentally sensitive and adequate test. Indeed, we note that Clark and Beck (1999) define the cognitive model “as an information processing theory… understood in terms of the structures, processes, and products involved in the representation and transformation of information” (pp. 109–110). According to the cognitive model, biases in information processing are core aspects of depression. Information processing paradigms, such as the Stroop and dot-probe tasks, measure cognitive processes outside of the child's awareness. Such measures may offer more objective tests of cognitive operations, while also allowing for experimental manipulation. Lower order phenomena, such as attentional biases, may represent the mechanisms that lead to cognitive vulnerability products. If this is the case, the developmental study of these processes would allow researchers to explore the origins of maladaptive cognitions. Moreover, information processing biases may represent markers for broader cognitive vulnerability factors. Studies incorporating both self-report cognitive content and information processing paradigms allow researchers to refine cognitive vulnerability models, fostering theoretical and empirical advancements in psychopathology research.

On the other hand, information processing paradigms often suffer from questionable reliability and validity. Relations between theoretical constructs and information processing paradigms are often unclear (Vasey, Dalgleish, & Silverman, 2003). Convergent validity with other measures hypothesized to tap similar underlying concepts is lacking. Similarly, little is known about the reliability of information processing measures (Vasey et al., 2003). This low reliability can reduce statistical power (e.g., Nicewander & Price, 1983). Moreover, as Vasey et al. (2003) point out, the clinical utility of these measures in children is not established. Nevertheless, information processing paradigms offer a valuable framework for conceptualizing and studying cognition in psychopathology (Vasey et al., 2003). While experimental paradigms have pitfalls, they do not have the same pitfalls as self-report methods. It is likely that higher order and lower order cognition reciprocally relate in the development of specific cognitive vulnerabilities. As we have seen, top down cognition constrains the manner in which information is processed at lower levels of the system, and vice versa (e.g., Dalgleish, 2002). The consequences of these two processes in interaction may be greater than either cognitive process in isolation. Integration of these methods would allow for the assessment of such interactive effects.

An integrative cognitive approach to vulnerability for depression represents a critical step in establishing a cognitive science base to guide empirically supported treatments (e.g., Cacioppo et al., 2007; Matthews, 2006). In order to advance this integrative perspective, we briefly review the information processing literature testing emotional stimuli in children and adolescents. The information processing studies we review are not longitudinal. However, we explore cross-sectional findings and discuss how these paradigms can be applied to the study of cognitive vulnerability. Samples include children and adolescents with a diagnosis of depression, varying levels of depressive symptoms, recovered depressed, and children of depressed mothers. We do not review the procedures involved in information paradigms, but refer the reader to Matthews and MacLeod (1994) and Garber and Kaminski (2000).

5.1. Review

Table 2 presents studies of information processing biases and depression among children and adolescents. Level of depression is associated with greater recall of negative information relative to positive information in youth (Bishop, Dalgleish, & Yule, 2004;Cole & Jordan, 1995;Drummond, Dritschel, Astell, O'Carroll, & Dalgleish, 2006;Rudolph, Hammen, & Burge, 1997;Taylor & Ingram, 1999;Zupan, Hammen, & Jaenicke, 1987; for null results see Dalgleish et al., 2003; and Hammen & Zupan, 1984). This association is also found among children and adolescents with a diagnosis of MDD (Neshat-Doost, Moradi, Taghavi, Yule, & Dalgleish, 2000). Depressed youth demonstrate higher rates of rehearsal of negative memories (Kuyken & Howell, 2000). They recall positive information less well (Whitman & Leitenberg, 1990) and reveal significantly fewer positive autobiographical memories (Drummond et al., 2006). Lower rates of positive adjective endorsement also occur among psychiatric inpatient youth (Gencoz, Voelz, Gencoz, Pettit, & Joiner, 2001). Furthermore, depressed youth rate more negative words as self-descriptive (Timbremont & Braet, 2004). Youth at risk for depression demonstrate memory biases for negative self-descriptions (Hammen, 1988). These self-descriptions can interact with life stress to result in onset or exacerbation of depression (Hammen & Goodman-Brown, 1990). In sum, information processing paradigms reveal a bias toward negative stimuli among youth with symptoms or a diagnosis of depression.

Information processing paradigms also highlight overgeneral memory biases among depressed children and adolescents (Kuyken, Howell, & Dalgleish, 2006; Park, Goodyer, & Teasdale, 2002). Rumination appears to exacerbate this effect (Park et al., 2002). There is also evidence that depression impairs the memory of negative events. Children and adolescents with clinically significant levels of depression (as measured by the CDI) show impaired memory

for negative events (Hughes, Worchel, Stanton, Stanton, & Hall, 1990). Depression severity is also related to less specific negative memories among adolescents in residential treatment (Swales, Williams, & Wood, 2001). Deficits in memory for fearful faces are exhibited among children of depressed parents (Pine et al., 2004). In contrast, no such effect is found in reaction times to the detection of threatening versus non-threatening faces (Hadwin et al., 2003). Lastly, depressed youth present with significantly longer reaction times to negative emotional working memory tasks compared to neutral tasks (Ladouceur et al., 2005). Thus, depression is related to memory biases in youth, but these relations are complex and worthy of additional study.

Research regarding relations between deployment of attention and mood is similarly complex. More attention is given to negative stimuli by depressed youth than the non-depressed (Kyte, Goodyer, & Sahakian, 2005), and slower response rates on an attention cuing task are found among children of parents with depression (Perez-Edgar, Fox, Cohn, & Kovacs, 2006). However, studies with attentional dot-probe tasks for words do not support attentional biases in depressed youth (Dalgleish et al., 2003; Neshat-Doost et al., 2000; Taghavi, Neshat-Doost, Moradi, Yule, & Dalgleish, 1999). Children with MDD are more easily distracted by negative pictures than neutral pictures, whereas control children are more distracted by positive pictures (Ladouceur et al., 2005). Moreover, recent work suggests that daughters of depressed mothers selectively attend to negative facial expressions, whereas control daughters selectively attend to positive facial expressions (Joorman, Talbot, & Gotlib, 2007). In this study, a dot-probe task was used, but faces instead of words were selected as stimuli. Of note, facial expression paradigms result in more consistent findings than verbal within the adult literature, as do studies using longer stimulus durations (e.g., Gotlib et al., 2004). In sum, relations between depression and attention in youth are not yet well understood.

This body of literature affirms that symptomatically depressed youth demonstrate memory and attention biases. However, these studies are overwhelmingly cross-sectional and do not explicate whether these biases contribute to the etiology or maintenance of depression. Results from longitudinal studies with adults suggest that information processing paradigms may reveal key processing biases underlying depression. Cognitive biases predict change in depressive symptoms in community samples (Rude, Wenzlaff, Gibbs, Vane, & Whitney, 2002). Pregnant mothers recalling more negative words on a self-referential encoding task demonstrate more symptoms of depression following childbirth (Bellow & Hill, 1991). Among adults with MDD, greater recall of positive words on the self-referential encoding task uniquely predicts a decrease in depression symptoms (Johnson, Joorman, & Gotlib, 2007). A tendency to shift attention toward negative information following an emotional prime interacts with life stress to predict increases in symptoms of depression seven weeks later (Beevers & Carver, 2003). Thus, there is good evidence that information processing paradigms are useful in predicting depression longitudinally among adults.

Among the youth-focused information processing research, only one study followed participants longitudinally and tested relations with depression (Hammen, 1988). A child's memory bias toward negative self-descriptions predicted affective diagnosis across six months (Hammen, 1988). However, this relation was only observed at the level of a trend. In a related literature, Martin et al. (2003) observed higher levels of Stroop interference among children who attached greater importance to friendships and whose peers rated them as having few friends. This interference predicts increases in depressive symptoms over a six month period. Martin and colleagues propose that the Stroop paradigm may be more sensitive to children's social concerns than traditional paper-and-pencil measures. A limited body of evidence suggests that information processing paradigms may predict depression across time. Clearly, more research is necessary to establish the prospective relations between these lower order processes and depression among youth.

The relations between information processing and cognitive content measures are relatively unknown among youth as well. In an adult example, individuals at high cognitive risk for depression in the CVD exhibited more self-referent information processing biases than individuals with low cognitive risk (Alloy, Abramson, Murray, Whitehouse, & Hogan, 1997). Similarly, among high cognitive risk participants, the self-referent information processing task battery (SRIP; Alloy et al., 1997) partially mediated cognitive risk effects (Steinberg, Oelrich, Alloy, & Abramson, 2004). Within the same sample, the negative SRIP composite interacted with cognitive risk to predict first onset, but not recurrence of depression. While there is some evidence that these constructs relate among adults, how these cognitive processes relate among youth is currently unknown. A recent study (Reid, Salmon, & Lovibond, 2006), however, interviewed children about their attributional style and gathered data on attention allocation and memory recall. Information processing and cognitive content biases were congruent and associated with psychopathology, although not to depression specifically. The integrative study of information processing biases and cognitive content vulnerabilities may result in theoretical refinement of cognitive models of depression among youth.

We conclude that information processing paradigms offer a useful tool for investigating cognitive vulnerability for depression among youth. However, the information processing studies reviewed assess youth with a range of internalizing diagnoses. Many of these studies did not propose specific hypotheses in relation to differing diagnoses, clouding the theoretical utility of results. Moreover, a notable distinction between the cognitive content and information processing literature is the use of emotional priming. Emotional priming – the experimental induction of mood for the purposes of tapping latent cognition – is used successfully within the information processing literature, but has not yet been incorporated into prospective longitudinal studies of cognitive vulnerability among youth. On the other hand, information processing studies rarely investigate the effects of life stress on the accuracy of information processing. Emotional priming prior to measuring cognitive content via questionnaires allows for a more powerful and adequate test of cognitive vulnerability models, as the induction of a negative mood state may allow individuals to report latent schema (e.g., Persons & Miranda, 1992). Integrating the assessment of stress, or implementing a stressor in the lab, would similarly result in an effective assessment of cognitive biases within information processing paradigms. Consequently, a combination of information processing paradigms and self-report questionnaires permits researchers to evaluate whether these higher and lower level cognitions do, in fact, influence one another in the development of psychopathology.

6. Discussion

Several cognitive models of vulnerability for depression have been proposed during recent years, and have attracted empirical attention. Derived from research on cognitive concomitants of depression among adults, they propose that the establishment of maladaptive schema, negative attributional style, and impaired self-perception may place youth at risk for major depression. Although evidence supporting each of these models has emerged, conceptual challenges remain, and no single model adequately accounts for the full range of factors implicated in risk for depression.

We envision significant advances in our understanding of cognitive vulnerability for depression through the incorporation of information processing paradigms into existing models. Capturing the relations between vulnerability factors and depression may be facilitated through the study of youth within a cognitive-developmental framework. Interdisciplinary collaboration between developmental and clinical scientists will allow for broad conceptual integration.

The use of emotional priming strategies and methodologies borrowed from research in experimental cognitive psychology may shed light on cognitive vulnerability factors among young children. According to Beck et al. (1979), schemata "may be latent but can be activated by specific circumstances which are analogous to experiences initially responsible for embedding the negative attitude" (p. 16). Germane to a discussion of latent schemata, the mood-state hypothesis proposes that cognitive vulnerabilities are accessible only during negative mood states (Persons & Miranda, 1992). This hypothesis is based on an associative-network model in which mood states cue related thoughts (e.g., Bower, 1987). Persons and Miranda (1992) argue that, because depressogenic cognitions develop when one experiences negative affect, cognition and affect are linked in memory. When not experiencing a negative mood, cognitions related to negative affect may be inactive. Adolescents may experience more negative life events than children (e.g., Ge et al., 1994), offering opportunities for latent cognitive schemata to become activated. The lower average rates of stress in early childhood raise the possibility that cognitive vulnerability factors may be present, but not activated. If, despite emotional priming, cognitive vulnerability factors do not appear to be associated with depressive symptoms among children as they are with adults, a developmental difference would be identified. Given the possibility that lower order and higher order cognition appear to develop in tandem and reciprocally influence one another, the inclusion of information processing paradigms will clarify the role of lower order and higher order cognitive vulnerabilities. In sum, latent measurement of cognitive vulnerability through information processing paradigms may allow for a broader understanding of cognition in psychopathology and address theoretical hypotheses regarding cognitive vulnerability models.

Have the theoretical hypotheses of cognitive vulnerability models gained strong support in studies of youth (e.g., Alloy et al., 1999; Ingram et al., 1998)? First, the stability of cognitive vulnerability factors among children and adolescents remains unclear. Data suggest that a degree of stability exists within adolescent samples, whereas among pre-pubertal youth, only short term stability of cognitive content have been reported. We note that Just et al. (2001) question the assumption that cognitive vulnerability represents an immutable trait. We propose that in the downward extension of cognitive vulnerability models to youth, allowance must be made for the variable nature of developing cognition. Second, findings to date have not demonstrated temporal precedence of proposed cognitive vulnerability factors. Future research must assess prior episodes and follow young samples to make the detection of these phenomena feasible and likely. Third, research suggests that a number of cognitive factors may be implicated in vulnerability for depression. These factors have rarely been examined simultaneously within the same sample. Little is known, then, about how they may interact in placing youth at risk for depression. Literatures surrounding each of the putative risk factors have evolved independently. Synthesis, through integrative research paradigms is needed. Fourth, some evidence has emerged for the specificity criterion (e.g., Gencoz et al., 2001; Robinson et al., 1995). Given the centrality of this hypothesis to cognitive models of psychopathology, additional research is needed. Last, the endogenous and latent nature of cognitive vulnerability in youth is likely. Cognitive vulnerability factors appear to reside within the child. However, an increased attention to ecologically valid life stress assessment, as well as the incorporation of information processing paradigms and emotional priming into research design, allows for more thorough investigation. In sum, the central hypotheses of cognitive vulnerability models have yet to be put to the test. We believe cognitive vulnerability research incorporating information processing paradigms will more adequately address these theoretical hypotheses.

6.1. Future research

Several lines of research will advance study and are detailed in Table 3. Framing the study of cognitive vulnerability within the broader domain of cognitive development will be essential.

Age is, at best, a crude marker of ontogenetic change (Rutter & Sroufe, 2000). Specific markers of cognitive development must be realized. Sensitivity must be given to how depression and cognitive vulnerability manifest in relation to the development of cognitive capacities and the attainments of childhood and adolescence (Cicchetti & Rogosch, 2002). In addition to the integration of information processing paradigms, the inclusion of neuropsychological measurement will be informative. Tracking normative trajectories of cognitive and brain maturity will embed research on the etiology of mood disorders within a developmental context. For example, a widely used tool, the Cambridge Neuropsychological Test Automated Battery (CANTAB; see http://www.camcog.com), assesses executive functioning (for an example see Kyte, Goodyer, & Sahakian, 2005). Such measurement allows for analysis of specific links between changes in depression and the development of cognitive abilities. In sum, these lines of inquiry move scientists and clinicians toward a cognitive and developmental base for the study and treatment of psychopathology.

In addition, integration with research in developmental biology and functional neuroimaging will advance our understanding of the development of psychopathology among youth. For example, cortisol and psychophysiology assessment within studies of cognitive vulnerability may promote the identification of possible phenotypic and endophenotypic markers of risk (e.g., Gottesman & Gould, 2003). As Bearden and Freimer (2006) note, the study of heritable traits that can be reliably measured is fruitful in the study of psychiatric disorders. Identifying specific processes and behaviors, or ‘behavioral endophenotypes’, advances the study of psychopathology (Cacioppo et al., 2007; Prathikanti & Weinberger, 2005). In line with this argument, information processing paradigms may allow for pre-morbid identification of vulnerability at younger ages. Linking these literatures is imperative work for psychopathology researchers.

The study of cognitive models of vulnerability for depression has illuminated mechanisms and factors important for adolescent health. Much work, however, remains. This area is complex whereby individual, group, developmental, biological, and environmental factors impact cognition and depression. What is clear from existing cognitive vulnerability research is that adolescence represents a phase wherein cognitive vulnerability is likely to become apparent. However, given the present difficulty establishing temporal primacy of cognitive diatheses to depression, we recommend research with younger populations (e.g., ages 7–12 years) that incorporates information processing paradigms. A developmental framework permits assessment of the child, accounting for their stage of growth within the dynamic, continuous, and reciprocal interactions of the environment. Such investigation firmly places cognitive vulnerability research within the developmental psychopathology perspective. Not only will this work advance the scientific study of psychopathology, but it will produce implications for treatment and prevention of disorder among youth (e.g., Cacioppo et al., 2007; Matthews, 2006).

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Table 1

Prospective cognitive content studies of vulnerability to depression among youth

Study	Sample	*N*	Age (range) and mean	Depression status	Depression measure	Vulnerability measure	Time frame	Control baseline depression?	Life stress interaction tested?	Summary of findings
Attributional style										
Abela (2001)	School	382	3rd (8.9) and 7th (12.9)	Sx	CDI	CCSQ, CASQ	6 w	X	CLES	CASQ × CLES predicted increases in depressive sx in 7th, but not 3rd graders. Attributions about consequences × CLES predicted depression in 3rd and 7th, Attributions about self × CLES predicted depression increases in 3rd and 7th grade girls, but not boys
Abela and Payne (2003)	School	314	3rd (8.8) and 7th (12.8)	Sx	CDI	CCSQ, CASQ	6 w	X	CHAS	Gender and SE moderators of 'weakest link' × CHAS. Boys with low SE and girls with high SE significant interaction predicting increases in HS depression sx
Abela and Sarin (2002)	School	79	(12.3)	Sx	CDI	CCSQ, CASQ	10 w	X	CLES × weakest link	CLES × 'weakest link' predicted increases in HS depression sx only
Abela, Skitch, Adams, and Hankin (2006)	Children of depressed parent	140	6–14 (9.8)	Sx	CDI	CASQ, CCSQ	1 y	X	Stress of parental onset of depression	Gender × weaklink × parental depression stressor. Children with depressogenic inferential styles greater elevations in depression following elevations in parent's level of depression. Stronger association in girls
Bennett and Bates (1995)	School	95	11–13 (12)	Sx	CDI	CASQ-R	6 m	X	CHS, LES	CHS × CASQ predicted CDI, no main effect of CASQ. More support found against vulnerability models
Brozina and Abela (2006)	School	480	8–13 (10.5)	Sx	CDI	CASQ, CCSQ	6 w	X	CHAS	CASQ × CHAS to predict increase in depression, but only for those with low depression at t1
Conley et al. (2001)	School	147	5–10 (8.2)	Sx	CDI	CASI, CASQ-R	3 w	X	DHQ	CASI main effect, CASI × DHQ × age slightly higher levels of depression in older children than for younger (all findings for positive subscale)
Dixon, and Ahrens (1992)	Summer camp	84	9–12(11)	Sx	CDI	KASTAN-R	1 m	X	Own measure	Hassles and hassles × attribution significant
Garber et al. (2002)	School, but 78% of children had mothers with a history of mood disorders	240	(11.9)	Sx	CDI	CASQ	5 y	X	LEIA	Adolescents becoming more negative in CASQ over time also reporting higher depression over time. Initial level of stress associated with trajectory of depression sx. Reciprocal models also supported
Gibb and Alloy (2006)	School	448	9–11(9.8)	Sx	CDI	CASQ-R	6 m	X	Peer victimization, CTQ-EA	In 4th graders CASQ mediates only, 5th grade mediator and moderator effects. Depression also predicted negative changes in

Study	Sample	*N*	Age (range) and mean	Depression status	Depression measure	Vulnerability measure	Time frame	Control baseline depression?	Life stress interaction tested?	Summary of findings
										CASQ. Best fitting models include reciprocal relations
Gibb et al. (2006)	School	448	9–11(9.8)	Sx	CDI	CASQ-R	6 m	X	Peer victimization, CTQ-EA	Depression predicted negative change in CASQ-R
Hammen et al. (1988)	Children of depressed mothers	79	(12.5)	Dx	K-SADS, CDI	CASQ	6 m	X	Brown and Harris	Main effect for stress, but not CASQ
Hankin, Abramson, and Siler (2001)	School	270	14–18 (16.2)	Sx	BDI, HDSQ-R	CASQ-R	5 w	X	APES	CASQ × APES predicted increases in depression sx. Gender moderated this interaction for BDI, so held for boys but not girls. Held for HS depression sx for both genders, HS did not mediate relations
Hilsman and Garber (1995)	School	439	(11.4)	Sx	CES-D, Depressive Adjective Checklist	CASQ	Approx 2 w	X	Grade deficit stressor	Depressive sx predicted by interactions of negative explanatory style with stressors
Lewinsohn et al. (1994)	School	1508	(16.5)	Dx	K-SADS, CES-D	Items from KASTAN-R	1 y	X	Measured, but no interactions assessed	Attributions predicted current, past, and first episode depression. OR for current highest
Lewinsohn et al. (2001)	School	1507	(16.6)	Dx	K-SADS, CES-D	CASQ	1 y	X	Brown and Harris	CASQ × LE predict MDD onset, but at higher levels of stress
Mccarty, Vander Stoep, and McCauley (2007)	School	331	(12.0)	Sx	MFQ	CASQ-R	1 y	X		Support for ‘scar’ models. Baseline depression predictive of more negative attributional style
Nolen-Hoeksema, Girgus, and Seligman et al. (1986)	School	168	(8–11)	Sx	CDI	CASQ	1 y	X	LEQ	CASQ predicted depression changes at some time points over the year. Interaction with life stress was significant
Nolen-Hoeksema et al. (1992)	School	352	3rd and 4th graders	Sx	CDI	CASQ	5 y	X	LEQ	As children grew older, pessimistic explanatory style significant predictor of later depression. Among younger children, life events only. Modest support for diathesis–stress. Some evidence of scar hypothesis
Panak and Garber (1992)	School	521	3rd–5th graders	Sx	CDI	CASQ	1 y	X	Peer rejection (a developmental life stress assessment)	Interaction between stress (increase in peer rejection) and CASQ predicted depression
Prinstein and Aikins (2004)	School	158	15–17 (16.31)	Sx	CDI	CASQ	17 m	X	Peer rejection (a developmental life stress assessment)	Peer rejection × CASQ predictive of dep. for girls. Main effect for attributional style overall
Prinstein, Chea, and Guyer (2005)	School	159	15–17 (16.31)	Sx	CDI	Own	17 m	X	Peer victimization	Higher levels of critical self-referent attributions associated with prospective increases in depressive symptoms under conditions of high levels of boys' peer victimization
Robinson, Garber, and Hilsman (1995)	School	371	(12.0)	Sx	CDI	CASQ	15 m	X	Developed for study based on Compas (1987) major events and hassles, transition to junior high	Main effect stressors, perceived self-worth. CASQ main and interaction with stressors, 3 way interaction with self-worth

Study	Sample	*N*	Age (range) and mean	Depression status	Depression measure	Vulnerability measure	Time frame	Control baseline depression?	Life stress interaction tested?	Summary of findings
Schwartz and Koenig (1996)	School	397	14–18 (16.0)	Sx	BDI	ASQ	1.5 m	X	LEQ	Attributions predicted depression
Southall and Roberts (2002)	School	115	14–19 (16.5)	Sx	BDI	CASQ	14 w	X	LES	3 way significant interaction and SE × CASQ in non-symptomatic at baseline
Spence, Sheffield, and Donovan (2002)	School	733	12–14 (12.91)	Sx	BDI	CASQ-R	1 y	X	NLE	CASQ-R main effect
Toner and Heaven (2005)	School	112	(12.5)	Sx	"the way I feel" based on ILQ and BDS	PASS-1 peer-social attributional style scale	2 y			A post-hoc combined generality attribution (both positive and negative events to stable/global factors) predicted depression
Dysfunctional attitudes										
Abela and Skitch (2007)	Children of depressed parents	140	6–14 (10.0)	Sx	CDI	CDAS	Every 6 w for 1 y	X	CHAS	CDAS × CHAS significant for children with low self-esteem, also significant for children with low CDAS and high self-esteem
Abela and Sullivan (2003)	School	184	(12.8)	Sx	CDI	CDAS	6 w	X	CHAS	CDAS × CHAS predicted increased depression, in those with high, but not low levels of self-esteem
Lewinsohn et al. (2001)	School	1507	(16.6)	Dx	K-SADS, CES-D	DAS	1 y	X	Brown and Harris	DAS × NLE (p=.086) trend at high levels of stress CASQ × LE predict MDD onset at higher levels of stress, little effect vs. low levels of stress
Lewinsohn et al. (1994)	School	1508	(16.5)	Dx	K-SADS, CES-D	Items from DAS, labeled 'pessimism'	1 y	X	Measured, but no interactions assessed	'Pessimism' predicted current, past, and first episode depression. OR for current highest
Marcotte et al. (2006)	School	644	13–16 (14.13)	Sx	BDI	DAS	2 y			Girls who became depressed (met clinical BDI cutoff) over study demonstrated increased DAS scores
McCreary et al. (2004)	School	219	(11.8)	Sx	BHIF, DISC-IV Conduct Disorder Module	CAPS	1 y	X		Socially prescribed perfectionism significantly predicted (via partial correlations) both depression and anxiety sx in African American boys. SPP showed specificity for predicting depression after controlling for t2 anxiety and conduct sx
Self-perception										
Cole et al. (1996)	School	631	(8.9) at beginning of study	Sx	CDI	Harter's SPPC	4 y	X		Self-perceived competence negatively related to later depression
Cole et al. (1997)	School	1459	3rd (8.8) and 6th (11.9)	Sx	CDI	Harter's SPPC	3 y	X		Underestimated competency predicted increases in depression in 1 of 6 grade levels. Depression predicted increases in underestimation over time in all grade levels
Cole et al. (2001)	School	807	3rd (8.9) and 6th (11.9) graders	Sx	CDI	Harter's SPPC	3 y	X		Academic overestimation significant at 4 of 6 time points in predicting depression, however,

Study	Sample	*N*	Age (range) and mean	Depression status	Depression measure	Vulnerability measure	Time frame	Control baseline depression?	Life stress interaction tested?	Summary of findings
										reverse relation greater beta weights
Cole, Martin et al. (1998)	School	617	3rd (8.4) and 6th (11.4) graders	Sx	CDI	Harter's SPPC, PNMC, TRS	6 m	X		Self-perceptions of competence predicted change in depression scores over time. These competencies mediated relation between competency appraisals by others and depression
Cole, Martin et al. (1999)	School	945	3rd (8.37) and 6th (11.36) graders	Sx	CDI, parent CDI, PNID, TRID	Harter's SPPC, PNMC, TRS	6 m	X		Social competence (latent variable of all cognitive measures) predicted depression for 6th graders
Hilsman and Garber (1995)	School	439	(11.4)	Sx	CES-D, Depressive Adjective Checklist	Harter's SPPC	Approx 2w	X	Grade deficit stressor	Students who reported lack of competence expressed more depression after receiving unacceptable grades
Hoffman et al. (2000)	School	360	10.8–13.5 (11.9)	Sx	CDI	Harter's SPPC, TRS, PRS, PNMC	Approx 6 m	X		Reflective and discrepant self-appraisals predicted subsequent depressive symptoms. Depression predicted discrepant, but not reflective
Kistner et al. (1999)	School	108, 68 at follow-up	4th and 5th graders at start	Sx	CDI, RADS	Harter's SPPC	7 y	X		Perceived acceptance, but not actual acceptance, predicted depression 7 years later
Kistner et al. (2006)	School	667	(9.4)	Sx	CDI	Harter's SPPC	6 m	X		Inaccurate self-perceptions predicted increases in depressive symptoms and depressive symptoms predicted decreased accuracy. Bias did not predict change in depression, rather depression predicted negative bias
Kistner, David-Ferdon, Lopez, and Dunkl (2007)	School	641	3rd–5th graders	Sx	CDI	Harter's SPPC	6 m	X		Self-perception did not predict changes in depression
Lewinsohn et al. (1994)	School	1508	(16.5)	Dx	K-SADS, CES-D	Items from Harter's SPPC	1 y	X	Measured, but no interactions assessed	Social self-perception predicted current depression and previous depression, but not first onset
Measelle, Ablow, Cowan, and Cowan (1998)	Community	97	(4.6)	Sx	BPI	BPI	3 y			Depression-anxiety subscale significantly negatively correlated with competence and motivation in Kindergarten and 1st grade
McGrath and Repetti (2002)	School	248	(9.5)	Sx	CDI, TRF	Harter's SPPC	3 y	X		Negative self-perceptions and underestimations not associated with change in depression
Ohannessian et al. (1999)	School	75	(11.8)	Sx	CES-D	Harter's SSPC	1 y			Gender predicts depression until self-perception of athletic competence is added as covariate
Tram and Cole (2000)	School	468	13–17 (14.5)	Sx	CDI, PNID, TRID	Harter's SPPC	Approx 6 m	X	APES	Self-perceived competence predicted change in depressive symptoms

Note. Age ranges and means reported when available. Grades reported when age data was not available. Sx = symptoms; Dx = diagnosis; CDI = Children's Depression Inventory; CCSQ = Children's Cognitive Style Questionnaire; CASQ = Children's Attributional Style Questionnaire; CASQ-R = Children's Attributional Style Questionnaire-Revised; CLES = The Children's Negative Life Events Scale; CHAS and CHS = Hassles Scale for Children; weakest = weakest link; LES = Life Events Scale; CASI = The Children's Attributional Style Interview; DHQ = Daily Hassles Questionnaire; KASTAN-R = Children's Attributional Style Questionnaire-Revised; LEIA = Life Events Interview for Adolescents; CTQ-EA = Childhood Trauma Questionnaire — Emotional Abuse Subscale; K-SADS = Schedule for Affective Disorders and Schizophrenia for School-Age Children; Brown and Harris = Brown and Harris; 1978; BDI = Beck Depression Inventory; HDSQ-R = Hopelessness Depressive Symptoms Questionnaire-Revised; APES = Adolescent Perceived Events Scale; CES-D = The Center for Epidemiological Studies Depression Scale for Children; MFQ = The Mood and Feelings Questionnaire; LEQ = Life Events Questionnaire; NLE = Negative Life Events assessed as modified version of Life Event Record; ILQ = Illinois Loneliness Questionnaire; BDS = Birleson Depression Scale; PASS-1 = Peer-social Attributional Style Scale; ASQ = Attributional Style Questionnaire; CDAS = Children's Dysfunctional Attitudes Scale; BHIF = Baltimore How I Feel; DISC-IV = NIMH Diagnostic Interview Schedule for Children Version IV; CAPS = Child and Adolescent Perfectionism Scale; CRSQ = Children's Response Styles Questionnaire; RADS = Reynolds Adolescent Depression Scale; PSI = The Problem-Solving Inventory; SSLES = Secondary School Students' Life Events Scale; Harter's SPPC = Harter's Self-perception Profile for Children; PNMC = Peer Nominations Measure of Competence; TRS = Teacher's Rating Scale of Child's Actual Behavior; PRS = Parental Rating Scale; PNMC = Peer Nominations of Multiple Competencies; BPI = Berkeley Puppet Interview; PNID = Peer Nomination Index of Depression; TRID = Teacher's Rating Index of Depression.

Table 2

Information processing among youth

Study	*N*	Age (range) mean	Depression measure	Sample	Cognitive measure	Summary of findings
Bishop et al. (2004)	121	(5–11)	DSRS	High and low non-clinically depressed children as assessed by DSRS) from school	Emotional stories recall task	Higher depression showed enhanced recall of negative stories relative to positive stories compared to low depressed group.
Cole and Jordan (1995)	394	(9–15)	CDI	School	Incidental recall	Higher depression recall fewer positive self-referential words, only significant in grade 8.
Dalgleish et al. (1997)	80	(9–18)	DRSS	15 diagnosed depressed, 22 diagnosed anxious, 43 controls	Dot probe, Stroop, subjective probability, and word memory	Depressed estimated negative events equally likely to happen to them as others.
Dalgleish et al. (1998)	71	(9–18)	MFQ	24 recovered depressed (K-SADS) and 47 school control	Subjective Probability Questionnaire	Recovered depressed rate negative events as less likely to occur, all estimated negative more likely to happen to others than themselves.
Dalgleish et al. (2003)	67	(7–18)	DSRS	MDD, PTSD, GAD patients and school control	Dot probe, Stroop, subjective probability, and word memory	No depression biases in comparison to other groups, but depressed group was significantly higher than others on anxiety self-report.
Drummond et al. (2006)	70	(7–11)	CDI	School sample with CDI	cutoff AMT	Young dysphoric children recall more specific negative and fewer specific positive. Older dysphoric difficulty in retrieving specific negative memories. In general, children's specific negative recall improves with age. Dysphoric had significantly fewer positive AMs.
Gencoz et al. (2001)	58	(9–17)	CDI	Psychiatric inpatients with various chart diagnoses, 44% non-bipolar mood	SRET	Lower rates of positive adjective endorsement and recall associated with depression, but not anxiety.
Hadwin et al. (2003)	38 in exp 1	(6–10)	CDI	School	Visual search for threatening and non-threatening faces	No effects of depression on search time.
Hammen (1988)	79	(8–16)	CDI, K-SADS	16 children of depressed mothers, 10 of bipolar, 18 of medically ill mothers, 35 of normal	Self-Schema Task	When controlling for baseline CDI, trend toward self-schema scores as predictor of affective diagnosis.
Hammen and Goodman-Brown (1990)	64	(8–16)	K-SADS	12 children of depressed mothers, 12 of bipolar, 14 of medically ill, 26 of normal	Self-Schema Task	Significant association between onset or exacerbation of depression and the experience of stressors relevant to child's self-schema. Particularly marked effect for children of depressed mothers.
Hammen and Zupan (1984)	61	(7–12)	CDI	School	Incidental Recall, Self-Schema Task,	Non-depressed higher proportion of positive self-descriptive words (but not significant), no evidence of negative bias in depressed.
Hughes et al. (1990)	322	(10–13)	CDI, PNID	School with cutoff	Recall and recognition	Significant interaction between group status and valence of story events for recognition. Depression symptoms impair memory for negative story events.

Study	*N*	Age (range) mean	Depression measure	Sample	Cognitive measure	Summary of findings
Joorman et al. (2007)	41	(9–14)	CDI-S	21 girls of mothers with recurrent MDD, 20 girls of mothers with no history of Axis 1	Dot probe with faces	High risk daughters selectively attended to negative facial expressions. Control daughters selectively attended to positive facial expressions
Kelvin et al. (1999)	102	14.0	MFQ	Community sample defined as at risk by level of emotionality	AMALSS with prime	Adolescents with high emotionality endorsed more negative self-descriptors after a dysphoric, but not neutral, mood induction.
Kuyken and Howell (2000)	65	(12–18)	BDI-II	DSM-IV diagnosis of MDD recruited from community	AMT	Depressed more likely to retrieve memories from observer perspective and more recent time period. Also rehearsed negative memories and rated as more personally important.
Kuyken et al. (2006)	62	(12–18)	BDI-II	DSM-IV diagnosis from SCID recruited from community	AMT	MDD and no trauma demonstrated overgeneral memory bias.
Kyte et al. (2005)	79	15.3	MFQ	30 patients diagnosed with first onset MDD (K-SADS) and school control	CANTAB, WCS, affective Go-No-Go, decision making	Depressed greater attention to sad stimuli, more impulsive when making decisions.
Ladouceur et al. (2005)	75	(8–16)	CDI, BDI	16 MDD diagnosed (K-SADS) from inpatient and outpatient clinics: 17 anxiety, 24 co-morbid depression and anxiety, 18 low-risk normal control recruited from community	Emotional n-back (working memory task)	MDD and co-morbid significantly longer reaction times on negative emotional backgrounds compared to neutral.
Martin et al. (2003)	63	3rd and 6th graders	CDI	Children with low and high peer-rated popularity	Emotional Stroop with negative social words	For unpopular children, greater friendship valuing and greater negative social word Stroop interference predicted increases in depressive symptoms across 6 months.
Murray et al. (2001)	95	5.0	None	55 children of mothers with depression (SADS-L) and 40 control	Verbal and nonverbal expressions card game	When dealt a losing hand, exposed children made more negative expressions compared to non-exposed children.
Neshat-Doost et al. (1997)	64	(9–18)	CDI, MFQ	19 DSM-IV/ICD-10 depressed, CDI, MFQ cutoff, 19 mixed anxious/depressed and 26 controls recruited from clinics	Stroop	No significant differences.
Neshat-Doost et al. (1998)	38	(10–17)	CDI, DSRS, MFQ	19 patients with ICD-10 diagnosis and cutoff score on CDI, DSRS, and MFQ and 19 school controls	Recall and recognition memory tasks	Depressed group recalled significantly more negative adjectives, this depression related bias became stronger with age. No bias in recognition task.
Neshat-Doost et al. (2000)	55	(9–17)	DSRS	19 with DSM-IV MDD diagnosis, 24 school controls	Attentional dot-probe task	No support for attentional bias.
Park et al. (2002)	155	(12–17)	MFQ, HDRS	96 clinically referred adolescents with MDD,	AMT	Adolescents with current MDD more categoric overgeneral

Study	*N*	Age (range) mean	Depression measure	Sample	Cognitive measure	Summary of findings
				26 non-depressed psychiatric, and 33 community controls (K-SADS)		memories than controls, but not more than non-depressed.
Park, Goodyer, and Teasdale (2004)	134	(12–17)	MFQ, HDRS	75 first onset MDD, 26 non-depressed psychiatric assessed (K-SADS-PL) and 33 community controls	AMT with prime	Rumination increased overgeneral memories to negative cues in MDD patients.
Perez-Edgar et al. (2006)	33	(6–10)	None	16 children of parents with child onset depression (COD) diagnosed (SCID) versus community control	Posner task under neutral and affective conditions	Children of parents with COD were slower in their response rates compared with control children, subtle deficits in selective attention.
Pine et al. (2004)	152	(9–19)	PARIS	19 children of depressed parents (SCID) and 133 anxiety or healthy	Face memory task	MDD offspring significant deficits in memory selectively for fearful faces, but not happy or angry faces. MDD not associated with face-memory accuracy.
Possel et al. (2006)	92	(13–15)	SBB-DES	School children divided into groups based on depression measure	SRET	No significant differences on SRET.
Prieto, Cole, and Tageson (1992)	50	(8–12)	CDI	15 clinic-depressed, 18 clinic-non-depressed, and 17 control children	Self-Schema Task	Significantly more positive words recalled by non-depressed children. This relation did not hold after effects of word recognition controlled.
Reid et al. (2006)	133	(8–14)	CDI	School	Self-Schema Task, Attentional dot probe, Attribution vignettes	Psychopathology (externalizing and internalizing) was associated with hypervigilance for threat cues, negative interpretations of social situations, internal attributions, perception of hostile intent, and recall of negative self-descriptions. None of these relations were specific to depression.
Rudolph et al. (1997)	81	(8–12)	CDI	School	Story task with recall and level of processing task	Depressed children significantly greater recall of negative maternal attributes than non-depressed on recall from story task. Non-depressed demonstrated greater recall of positive attributes on level of processing task.
Swales et al. (2001)	46	14.2	BDI	Residential patients with ICD-10 psychiatric diagnosis and school control	AMT	More depressed less specific, but many patients recalling the same traumatic memory (parasuicide) over and over.
Taghavi et al. (1999)	67	(9–18)	DSRS	24 anxious, 19 mixed anxious-depressed primary diagnosis DSM-IV, 24 normal school controls	Attentional dot-probe task	No attentional bias in mixed anxious-depressed children.
Taylor and Ingram (1999)	86	(8–12)	CDI	40 offspring of depressed mothers	SRET with prime	Primed at risk children demonstrated a less positive self-

Study	*N*	Age (range) mean	Depression measure	Sample	Cognitive measure	Summary of findings
				(SCID) high-risk and 46 low-risk		concept and a higher proportion of negative endorsed words recalled.
Timbremont and Braet (2004)	44	(8–16)	CDI	19 depressed, 15 never depressed, and 10 remitted depressed (CDI cutoff) in residential facility	SRET with prime	Remitted depressed rated more negative words as self-descriptive.
Vrielynck, Deplus, and Philippot (2007)	60	(9–13) 11.5	MDI-C	15 depressed children, 25 never depressed clinical, and 20 control	AMT	Depressed children gave fewer specific memories.
Whitman and Leitenberg (1990)	52	4th–6th grade	CDI	26 with score at least 1 SD above normative mean on CDI and 26 school controls	Word association task	Evidence that depressed recall positive less well.
Zupan, Hammen, and Jaenicke (1987)	81	(8–16)	CDI	20 children of women with depression (K-SADS), 21 not depressed	Self-schema incidental memory task	Depressed demonstrated recall of negative self-descriptive adjectives.

Note. Age ranges and means reported when available. Grades reported when age data was not available. AMT = autobiographical memory task; SRET = self-referent encoding task; AMALSS = Assessment of Mood Activated Latent Self-schema; CANTAB = Cambridge Neuropsychological Test Automated Battery; WCS = Wisconsin Card Sorting Task; DSRS = The Depression Self-Rating Scale; K-SADS = Schedule for Affective Disorders and Schizophrenia for School-Age Children; CDI = Children's Depression Inventory; SCID = Structured Clinical Interview for the Diagnostic and Statistical Manual for Mental Disorders; SADS-L = Schedule for Affective Disorders and Schizophrenia — Long; MFQ = The Mood and Feelings Questionnaire; ICD-10 = International Statistical Classification of Diseases and Related Health Problems 10th Revision; DSM-IV = Diagnostic and Statistical Manual of Mental Disorders — 4th edition.

Table 3

Recommendations for further research

Assessment	• Community children followed from middle childhood through entry to middle school.
	• Careful assessment of prior depression episodes to distinguish vulnerability from scar.
	• Attention to pubertal maturation, cognitive development, latent and explicit measures of cognitive vulnerability and stress.
	• Onset of clinical disorder assessed every six months.
	• Youth followed through remission and relapse to establish whether vulnerabilities apply to first onset only.
	• Study of rumination and problem solving as possible cognitive vulnerabilities.
	• Integration of emotional priming and information processing paradigms.
Analyses	• Map normal and abnormal trajectories through growth mixture modeling to increase the likelihood that reciprocal effects between cognition and mood will be captured.
	• Analyses which account for initial level of depression, as models may only apply to asymptomatic at baseline sub-samples.
	• Integrative and transactional models (e.g. Hankin & Abramson, 2001) assessing the roles of vulnerabilities in relation to one another.
Interdisciplinary collaboration	• Establish developmental trajectories and ‘normal benchmarks’ of cognitive processes, allowing cognitive vulnerability factors to be distinguished from normative developmental differences.
	• Cortisol assessment allowing for integration with biological underpinnings of depression.
	• Establish a taxonomy system with established age norms for stress (Grant et al., 2004a) to facilitate developmental frameworks and allow for comparison of stressors across samples.