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Stress generation in depression: A systematic review of the empirical literature and recommendations for future study

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Abstract

Within the past 20 years, depression research has given increasing consideration to the possibility of complex and reciprocal relations between stress and depression. Not only does stress increase risk for depression (i.e., a stress exposure model of depression), but depression, or depressogenic vulnerabilities, in turn, also increases susceptibility to stressful events that are at least in part influenced by the individual (i.e., stress generation; Hammen, 1991). The present review provides a systematic examination of the stress generation literature to date, with specific focus given to depression and depressogenic risk factors (i.e., past stress, negative cognitive styles, and personality and interpersonal vulnerabilities) as predictors of the stress generation effect, as well as gender differences in stress generation, the sequelae of generated stress, and the relative specificity of this phenomenon to depression. The research thus far appears most consistent in supporting the role of depression in predicting generated stress, although more research is still required. In addition to highlighting these findings, methodological limitations and conceptual gaps in the literature are discussed with the view of informing future research in this area.

Keywords

Stress generation; Depression; Stress

1. Introduction

Depression is one of the most prevalent forms of psychopathology, afflicting approximately 20 to 25% of women and 10 to 17% of men within their lifetime (Kessler et al., 1994; Levinson, 2006). It is also recurrent, with each episode increasing risk of subsequent ones (Kessler, 2002). Current estimates of the recurrence of depression suggest that 50 to 60% of individuals who experience one depressive episode go on to experience a second one, with 70 to 80% of these eventually experiencing a third episode, and 90% of individuals with three past episodes going on to experience a fourth (American Psychiatric Association, 2000; Burcusa & Iacono, 2007; Lewinsohn, Zeiss & Duncan, 1989; Monroe & Harkness, 2005; Solomon et al., 2000). Fully elucidating relations between stress and depression is critical to advancing our understanding of the processes involved in the etiology and often chronic course (i.e., duration, relapse, and recurrence) of this common and debilitating disorder.

In the present article, we begin with a brief discussion of the early history of research on stress and depression, with its emphasis on the stress exposure model. From this context, we then focus on emergence of the stress generation hypothesis and present a review of the

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evidence to date concerning this perspective. As stress generation has been hypothesized to be a product not only of individuals' depressive symptoms, but also of their characteristics and behavioral tendencies (e.g., cognitions, values, and traits; Hammen, 1991, 2006), this review will include a discussion of the literature on depression, past stress, negative cognitive styles, and personality or interpersonal styles in relation to the stress generation process. Several notable reviews of research on stress generation have been published in recent years (i.e., Hammen, 1999, 2006). We attempted to add to these past reviews in several ways. First, based on our inclusion/exclusion criteria detailed below, the rate at which articles in this area are published seems to be steadily increasing each year, doubtless a reflection of the still-growing interest in stress generation. Consequently, since the most recent of these reviews (Hammen, 2006), 21 new articles have been published, representing 37% of extant reports on stress generation based on the present literature search. Thus, the current article provides an update in the form of a comprehensive review of the research on this topic. In addition, we attempted to offer several recommendations for future research, while also elaborating on issues raised by Hammen (2006) that as yet remain unaddressed in the empirical literature.

1.1. Early perspectives on stress and depression: the stress exposure model

That stressful life events are associated with risk for depression is a well-established finding in the research literature (Hammen, 2005; Kessler, 1997; Mazure, 1998; Paykel, 2003). The relation between stress and risk for depression has been documented for episodic, or acute, stresses (Kendler, Karkowski & Prescott, 1998) and chronic stresses (Hammen, Kim, Eberhart & Brennan, 2009; see Hammen, 2005 for a review), and both recent and early negative life events (Gibb, Butler & Beck, 2003; Harkness, Bruce & Lumley, 2006). It has been documented in child (Cole & Turner, 1993), adolescent (Tram & Cole, 2000), young adult (Hankin, Kassel & Abela, 2005), and geriatric samples (Fiske, Gatz & Petersen, 2003; Moos, Schutte, Brennan & Moos, 2005). Moreover, life stress has been implicated in the first onset of depression (Kendler, Karkowski & Prescott, 1999; Lewinsohn, Allen, Seeley & Gotlib, 1999), depressive relapse (Swindle, Cronkite & Moos, 1989), recurrence of depression (Monroe, Roberts, Kupfer & Frank, 1996; see Burcusa & Iacono 2007, for a recent review; but also see Paykel, 2003; Stroud, Davila & Moyer, 2008, for some evidence to indicate that major life stressors are more strongly associated with the first one or two depressive episodes than with later ones), and the exacerbation of depressive symptoms (Lewinsohn, Hoberman & Rosenbaum, 1988).

Guiding much of early research on stress and depression was a tacit assumption that the relation between the two is unidirectional. Specifically, in what has been termed a stress exposure model of depression, it is implied that stressful life events significantly increase individual susceptibility to this disorder. Initial conceptualizations of this model also held that individuals are largely passive recipients of environmental stressors, having little, if any, significant role in the shaping of events within their lives relevant to the development of depression. Thus, early research gave primacy to independent relative to dependent events. Independent, or fateful, life events are those whose occurrence is outside the individual's control (e.g., death of a friend or relative), whereas dependent life events are those whose occurrence is influenced by characteristics of the individual (e.g., getting into an argument). Several mediational and moderational models elaborating on this basic relation between stress and depression have received empirical support, including biological diathesis-stress models (see Levinson, 2006 for a recent review), bio-cognitive mediational models (e.g., Beevers, Wells & McGeary, 2009; Hilt, Sander, Nolen-Hoeksema & Simen, 2007), cognitive diathesis-stress models (e.g., Abramson, Metalsky & Alloy, 1989; Beck, 1967, 1987), cognitive-developmental mediational conceptualizations (e.g., Cole, 1990, 1991), as

well as interpersonal diathesis-stress theories (e.g., Joiner, Metalsky, Katz & Beach, 1999; also see Van Orden, Wingate, Gordon & Joiner, 2005 for a review).

Although several researchers have speculated that depression may be associated with an increased likelihood of subsequent stress (e.g., Compas, Howell, Phares, Williams & Ledoux, 1989; Dohrenwend & Dohrenwend, 1981; Depue & Monroe, 1986), early studies largely treated this issue as a methodological confound, with the principal objective being to investigate the predominant stress exposure perspective (Cui & Vaillant, 1997; Hammen, 1991, 1992). In accurately documenting the causal relation from stress to depression, it was necessary to control, statistically or otherwise address, any stresses that may be the product of prior symptoms of depression or characteristics of the individual (i.e., dependent life stresses). Together with the early view of individuals as passive recipients of life stresses, this may in part account for the greater initial attention given by researchers to the role of independent or fateful life events, relative to dependent life events, in predicting depression, which is nevertheless of important theoretical and empirical interest in its own right (see Daley et al., 1997). Although crucial to establishing the link between exposure to stressful life events and development of depression, the approach taken by these early studies also left outside of consideration the possibility of additional, but equally important, relations between stress and depression (Hammen, 1991).

1.2. The stress generation model of depression

Within the last 20 years, however, the focus of depression research has shifted towards a greater awareness of the complex and reciprocal relation between stress and depression. That is, while the traditional stress exposure model of depression very much remains an important focus of research, increasing consideration also has been given to a complimentary and similarly important process, whereby depression, or depressogenic vulnerability factors, plays an active role in generating the very stresses that place individuals at heightened risk for future depression.

Although, as previously mentioned, several researchers have commented on the possibility of a relation between depression and subsequent stressors, Hammen (1991) was the first clearly to formulate and test the stress generation model of depression. According to the stress generation perspective, depression-prone individuals are not simply passive respondents to stressful events in their lives, but active agents in the creation of depressogenic life stressors. That is, individuals vulnerable to depression, when compared to those without such vulnerability, are likely to experience a higher rate of dependent events, particularly within interpersonal domains, but not independent or fateful events. Moreover, these dependent events are, in some measure, influenced by maladaptive characteristics (e.g., cognitive styles, traits, attachment styles, values and expectations) and behaviors of the individual (Hammen, 1991, 2006). Considering that interpersonal and dependent events, compared to independent ones, seem to be more predictive of depression (Kendler et al., 1999), the generation of dependent life stresses, in turn, may potentially have a role in the maintenance of current depression or increase in the likelihood of subsequent depression onset and recurrence (Hammen, 1991; Joiner, Wingate & Otamendi, 2005). Thus, stress generation to some degree may account for the often chronic course of depression (Belsher & Costello, 1988; Monroe & Harkness, 2005; Solomon et al., 2000).

Before proceeding with a review of the stress generation literature, it should be noted that recognition of the important role of stress generation in depression pathogenesis has also led to revisions of earlier theoretical models and development of new ones integrating both stress exposure and stress generation perspectives within fully transactional models of depression (e.g., Hankin & Abramson, 2001; Joiner, Wingate & Otamendi, 2005). In these transactional or reciprocal models, individual depressogenic characteristics or depressive

symptoms are hypothesized to interact with stress in a bidirectional manner, with depressogenic characteristics or symptoms generating later stress, and prior stress influencing the development of these same characteristics or symptoms.

2. Method

In reviewing the extant literature on stress generation, it is worth noting that the amount of research that may be interpreted as generally in line with the stress generation perspective is quite broad, and could essentially encompass any study that includes putative risk factors (e.g., perfectionism or physical illness) as predictors, and some form of stress (e.g., general distress, quality of peer or romantic relationships) as an outcome of interest. For this reason, in the present review, we only considered articles that provided a specific test of the stress generation hypothesis. Specifically, a key tenet of the stress generation hypothesis is that depression, or certain maladaptive characteristics of the individual associated with depression, contributes to the occurrence of higher rates of dependent, but not independent (or simply general), stress. Thus, studies were included in the present review if they (a) assessed multiple dependent life events by themselves, or distinguished them from independent ones and (b) examined them in relation to relevant predictors, thus offering a fairly clean and direct test of the stress generation hypothesis.

Relevant articles were first identified by individually inspecting all the reports in PsycINFO that cited the original study in which Hammen (1991) first articulated the stress generation hypothesis. The most recent articles that had not yet appeared in the PsycINFO database, or that were published electronically ahead of print, were located through a PubMed search of the phrase “stress generation.” A similar search of the PsycINFO database for the term “stress generation” was conducted, but, based on the inclusion criteria, did not yield any additional articles, leaving an overall total of 57 relevant articles. This literature search was completed on December 11, 2009.

3. Results

3.1. Predictors of stress generation: depression

Preliminary support for the stress generation model came from Hammen (1991) original finding that, relative to treatment-seeking women with chronic physical health conditions, bipolar disorder, and healthy controls, those with a history of recurrent unipolar depression reported higher rates of dependent episodic stressors, especially in the form of conflicts within interpersonal domains. The groups, however, did not differ in rates of independent stressful life events over a one-year prospective period. The finding of increased occurrences of future dependent life stressors has been replicated with diagnoses of depression in children and adolescents (Daley et al., 1997; Hammen & Brennan, 2001; Harkness, Lumley & Truss, 2008; Harkness & Stewart, 2009; Rudolph, 2008; Williamson, Birmaher, Anderson, Al-Shabbout & Ryan, 1995), men (Cui & Vaillant, 1997), women (Hammen, Shih & Brennan, 2004), treatment-seeking mothers (Feske et al., 2001), and adult patients (Chun, Cronkite & Moos, 2004; Harkness, Monroe, Simons & Thase, 1999). Similarly, the stress generation effect has been documented with depressive symptomatology in children and adolescents (Clements, Aber & Seidman, 2008; Hankin, Mermelstein & Roesch, 2007; Kercher & Rapee, 2009; Kercher, Rapee & Schniering, 2009; Shih, Abela & Starrs, 2009), college students (Barker, 2007; Gibb, Beevers, Andover & Holleran, 2006; Joiner, Wingate, Gencoz & Gencoz, 2005; Potthoff, Holahan & Joiner, 1995; Shih, 2006), company trainees (Orth, Robins & Meier, 2009), newly-wed women (Davila, Bradbury, Cohan & Tochluk, 1997), adults (Daley, Hammen, Davila & Burge, 1998), older adults (Moos et al., 2005), and ethnic minorities (Wingate & Joiner, 2004). Several of these studies, however, also reported higher rates of independent stressors (Clements et al., 2008; Harkness & Stewart, 2009;

Kercher et al., 2009; Moos et al., 2005; Wingate & Joiner, 2004). Additionally, a few studies did not find depressive symptoms to be predictive of later dependent stress (Gunthert, Cohen & Armeli, 2002; Sahl, Cohen & Dasch, 2009; Shahar & Priel, 2003). Also worth noting, the majority of these studies either failing to find a stress generation pattern, or observing it for independent stressors, relied on self-report measures of stress, which, as discussed in more detail below, are susceptible to mood-congruent reporting or memory biases (Blaney, 1986; Brown & Harris, 1978). Furthermore, one of these studies (Sahl et al., 2009) assessed stress over a seven-day period, which may have been too brief to detect the stress generation effect of depressed mood.¹

Several recent studies have revealed additional details regarding the role of depression in the generation of stress. In particular, whereas most research in this area includes studies of recurrent depression, Harkness et al. (1999; $n=59$) compared individuals with first-onset depression to those with recurrent depression so as to determine whether the latter generated more stressful events. In line with this possibility, they found that, when compared to first-onset depression, recurrent depression was associated with greater total dependent, but not independent, events in the 12 months preceding the index episode. More recently, Shih and Eberhart (2008; $n=51$) also further delineated the association between depression and stress generation by examining the role of residual depressive symptoms as a mediating factor. Adding to earlier studies documenting the stress generation effect with either depressive symptoms or episodes separately, they found evidence of a relation between all three, with past depressive episodes influencing the generation of future stress through its effects on current subclinical symptoms of depression. In another study involving both clinical depression and subclinical symptomatology (Krackow & Rudolph, 2008; $n=89$), participants in both categories experienced greater interpersonal stress than did those who were asymptomatic. Thus, through direct comparison, this study lent weight to the position that, although in a manner less severe than clinical diagnoses, subclinical depression may also exert a negative influence on individuals via a stress generation process (for more on the debate regarding the conceptualization of depression as a continuous or discrete disorder, see Coyne, 1999; Lewinsohn, Solomon, Seeley & Zeiss, 2000; Prisciandaro & Roberts, 2005; Ruscio & Ruscio, 2000). Aiming to refine current understandings of stress generation and depression through the use of symptom-level analyses, Harkness and Stewart (2009; $n=88$) found that cognitive-affective symptoms as a group (e.g., low self-esteem, guilt, self-blame, pessimism, and sadness) preferentially predicted higher levels of subsequent interpersonal stresses. This finding hints, perhaps, at the possibility that cognitive vulnerabilities may be involved in the stress generation process, as will be explored in more detail below. Collectively, these studies further elucidate and strengthen support for the role of depression in the generation of subsequent dependent stress.

Although studies on the stress generation model with depression have focused almost exclusively on dependent episodic stress, or, in some cases, did not differentiate it from chronic stress, a few have specifically examined the stress generation effect with chronic stress. One very likely reason for the relative neglect of chronic stress is that, given the ongoing and enduring nature of chronic stress as some researchers have defined it, it is understandably challenging to determine its temporal relation with a depressive episode, or depressogenic predictor of interest (Kessler, 1997). Researchers have differed considerably in their definition of chronic stress, ranging from difficulties lasting at least four weeks (Brown & Harris, 1978) to enduring events usually with an indeterminate onset and offset

¹For comparison, studies assessing generated stress over the next briefest time periods, both also involving daily measures of life stress, covered 14 days (the cross-sectional phase of Eberhart & Hammen, 2009; Gunthert et al., 1999, 2002). The shortest time interval assessed in studies that did not use daily assessments of life stress was five weeks (Joiner, Wingate, Gencoz, et al., 2005; Shahar et al., 2004).

(Shih & Eberhart, 2008). In one study (Rudolph et al., 2000; $n=88$) using a clinical sample of children and adolescents, chronic interpersonal stressors, defined as events without an acute onset and offset, were found to be correlated with a diagnosis of depression. Interpretation of this finding is limited, however, by the cross-sectional design of the study. Specifically, although children at risk for depression appeared to generate more stress, the temporal relation between stress and depression onset could not be determined, and could have quite possibly differed between participants. Adopting a relatively more circumscribed definition of chronic stress (i.e., persistent difficulties lasting at least six months; see Hammen et al., 1987 for more details), another cross-sectional study (Hammen et al., 2004) reported a link between past and current diagnoses of depression in mothers and current interpersonal chronic stress. Taking a different approach to studying chronic stress, Davila et al. (1997; $n=154$) found that, in a sample of newly-wed women, depressive symptoms prospectively predicted more chronic marital stress, which, in turn, was associated with increases in depressive symptomatology. Consistent with findings from other studies on gender differences in stress generation, as will be detailed below, this effect was not found for husbands. A second prospective study (Davila, Burge & Hammen, 2000; $n=142$) found depression to be predictive of chronic stress in romantic relationships, but not after Axis II symptomatology was controlled. As several lines of research on the relation between stress and psychopathology collectively point to differences between chronic and episodic stress in terms of neurological and psychosocial processes and sequelae (Hammen et al., 2009; Monroe & Simons, 1991), further investigation of the generation of chronic stress is warranted and crucial for providing a more complete picture of the stress generation process.

3.2. Predictors of stress generation: stress

Depressive symptomatology alone does not seem adequately to account for the stress generation pattern, as heightened levels of negative dependent life stress also have been found to occur during periods of remission (Chun et al., 2004; Daley et al., 1997; Hammen, 1991; Hammen & Brennan, 2002). With this realization, researchers have increasingly concentrated on uncovering the variables that, controlling for depression, may account for stress generation.

Just as past depression consistently has been found to be a strong predictor of future depression (Belsher & Costello, 1988; Lewinsohn et al., 1989), so may past stress, in like manner, predict future stress. A few recent studies have examined this possibility within the context of chronic stress (Daley et al., 1997; Hammen et al., 2009), and childhood maltreatment (Harkness et al., 2008). Specifically, Hammen et al. (2009) conducted a study ($n=816$) assessing the relation between chronic stress (defined as continuing conditions lasting at least the prior six months in multiple domains of functioning) and episodic stress (i.e., events that have relatively clear onset and offset). Support for the stress generation model was found, as chronic stress was linked with dependent acute stress experienced within the past six months. As is the case with retrospective studies in general, some degree of caution is required in interpreting these results. Using similar definitions and assessments of chronic and episodic stress, Daley et al. (1997; $n=134$) found that overall chronic interpersonal stress were found to predict higher episodic dependent stress, particularly conflict-related ones, one year later. In contrast, yet equally consistent with the stress generation hypothesis, no relation was observed between initial chronic interpersonal stress and later episodic independent stress. In a cross-sectional study ($n=58$) focusing on a relatively more specific and distal stressor in the form of childhood maltreatment, Harkness et al. (2008) found that, in a sample of adolescents diagnosed with depression, those with early maltreatment experiences reported significantly higher rates of interpersonal stressful life events in the three months following first onset of depression relative to the three months immediately preceding onset. This difference between pre- and post-onset was not

observed, however, in the case of clinically depressed adolescents with no history of childhood maltreatment. Although the results from the initial studies in this area are promising, more research is needed before firm conclusions can be drawn regarding the roles of chronic interpersonal stress and early childhood adversity in the generation of dependent episodic stress. Furthermore, the mechanism through which chronic stress and early adversity confer risk for subsequent stress is unclear. The potentially mediational roles of cognitive and interpersonal vulnerabilities implicated in stress exposure research, and, as will be discussed below, the stress generation process, await future study.

3.3. Predictors of stress generation: negative cognitive styles

Consistent with Hammen (1991, 2006) assertion that stress generation, in large part, is also the product of enduring maladaptive characteristics and behaviors of the individual, several cognitive and personality factors have been implicated in the generation of dependent stress. As previously mentioned, cognitive-affective symptoms of depression have been found prospectively to predict higher rates of interpersonal stress, which may suggest a role for cognitive influences in the stress generation effect (Harkness & Stewart, 2009). Lending weight to this possibility, Kercher and Rapee (2009; $n=710$) recently found that a composite cognitive vulnerability score, reflecting both negative inferential styles and ruminative tendencies, predicted prospective increases in dependent stress. Similarly, Safford, Alloy, Abramson, and Crossfield (2007), in a study employing a behavioral high-risk design ($n=157$), reported that negative cognitive styles, operationalized as a combination of dysfunctional attitudes and negative inferential styles, prospectively predicted dependent and interpersonal stress, but not independent or achievement-related stress. Although both of these studies offer important advancements in current understanding of enduring vulnerabilities underlying the stress generation effect, in neither is the role of specific cognitive vulnerabilities separately examined. In the most recent study ($n=140$) to address this limitation (Shih et al., 2009), drawing on a sample of children of parents with a history of clinical depression, negative inferential styles predicted interpersonal stress after a one-year period, but not non-interpersonal dependent or independent stress. Higher self-criticism, a second cognitive vulnerability factor, corresponded with subsequent higher interpersonal stress and non-interpersonal dependent stress, but not independent stress. Replicating this finding, Shahar and Priel (2003; $n=603$) reported that self-criticism predicted higher rates of negative events and lower rates of positive ones. Negative events, in turn, predicted distress in the form of depression and anxiety symptoms. Furthermore, self-criticism was found to predict stress across several domains (Shahar, Joiner, Zuroff & Blatt, 2004; $n=198$).

Additional evidence for the role of negative inferential styles in the stress generation process comes from a retrospective study ($n=55$) with a clinical sample of depressed patients (Simons, Angell, Monroe & Thase, 1993). Negative inferential styles were associated with dependent, but not independent, stress prior to the onset of a recent depressive episode. This relation only held, however, for patients with no prior history of depression. Furthermore, no association between dysfunctional attitudes and dependent stresses was observed in either patients with or without previous history of depression. Interpretation of this early study is constrained by its use of an older measure of inferential style (i.e., the Attributional Style Questionnaire [ASQ]; Peterson et al., 1982) which has since been replaced by a more psychometrically sound revision (i.e., the Cognitive Style Questionnaire [CSQ]; Alloy et al., 2000). Worth noting too, however, is a more recent study ($n=162$) by Gibb and colleagues (Gibb et al., 2006) using the CSQ with a college sample. Although initial depressive symptoms predicted weekly stress levels over a six-week period, negative inferential styles neither prospectively predicted subsequent stress, nor did it moderate the relation between

depression and future stress. Thus, although there is some support for the role of negative inferential styles in stress generation, the extant findings are somewhat mixed.

Joiner and his colleagues (Joiner, Wingate, Gencoz, et al., 2005; Joiner, Wingate & Otamendi, 2005) conducted a series of prospective studies delineating the role of hopelessness in stress generation. In a study ($n=169$) elaborating on the hopelessness theory of depression (Abramson et al., 1989) to include the stress generation hypothesis, they found hopelessness was predictive of both greater interpersonal stress and depressive symptoms (Joiner, Wingate & Otamendi, 2005). Moreover, interpersonal stress, but not general stress, served partially to mediate the relation between initial hopelessness and prospective increase in depressive symptoms. Reflecting the reciprocal relation between stress and depression, depressive symptomatology also predicted future stress in a series of studies (Joiner, Wingate, Gencoz, et al., 2005; $n=178$ and 95). Again, hopelessness was shown to be integral to this stress generation process, as it mediated the relation between depression and stress. These findings, however, leave open the possibility that depressive symptoms lead to a more hopeless perspective, which in turn generates the perception of, rather than actual, increase in stress. In assessing this possibility, Joiner, Wingate, Gencoz, et al. (2005) found that hopelessness predicted greater rejection by roommates. This study ($n=97$) focused on a very specific interpersonal stressor, however, and future research would benefit from a measure of a broader range of dependent stress.

Given that, with a few exceptions (e.g., Harkness & Stewart, 2009; Kercher et al., 2009; Wingate & Joiner, 2004), the stress generation effect has been consistently observed to be specific to dependent stresses, particularly ones occurring within interpersonal domains, it is perhaps not surprising that a few studies have focused on cognitive vulnerabilities of a similarly interpersonal nature as possible predictors of the stress generation process. In the first of these studies (Caldwell, Rudolph, Troop-Gordon & Kim, 2004; $n=545$), negative relational self-schemata, comprising social self-worth and self-competence, predicted chronic and episodic peer-related stress occurring over a one-year period. Furthermore, social disengagement, characterized by social helplessness and withdrawal mediated this relation. In contrast, a second study (Sahl et al., 2009; $n=127$), utilizing a daily diary measure of stress, found self-perceived interpersonal competence to be counterintuitively related to daily stress generation. That is, high self-perceived competence in initiating social interactions or relationships interacted with trait hostility to predict greater daily dependent stress. Additionally, in a multi-wave longitudinal study spanning nine months (Segrin, 2001; $n=142$), little evidence was found for a prospective relation between initial self-perceived interpersonal competence and later social stressors.

Overall, there appears to be general support for the role of cognitive vulnerabilities in the stress generation effect, although the findings to date remain somewhat mixed and await further research to clarify possible relations between individual cognitive vulnerabilities and generated stress. Moreover, whereas most of the research in this area has centered on hopelessness and negative inferential styles, both as conceptualized in the hopelessness theory of depression (Abramson et al., 1989), several other cognitive vulnerabilities and theories, including dysfunctional attitudes as formulated in Beck (1967, 1987) theory, rumination, and Cole (1990, 1991) competency-based model of depression, are especially underrepresented in the stress generation literature, and thus may benefit most from future study.

3.4. Predictors of stress generation: personality and interpersonal vulnerabilities

Several studies have explored the generation of dependent or interpersonal stress in relation to a number of individual personality and interpersonal characteristics. As Axis II pathology is a known risk factor for depression (Daley et al., 1999; Iacoviello, Alloy, Abramson,

Whitehouse & Hogan, 2007; Iardi, Craighead & Evans, 1997), generated life stress may act as a potential pathway mediating this relation. In a series of longitudinal studies on this theme, Daley and colleagues (Daley, Burge & Hammen, 2000; Daley, Rizzo & Gunderson, 2006; Daley et al., 1998) found consistent support for the role of Axis II symptomatology in stress generation and depression. In a study ($n=134$) comparing the three personality disorders (PD) clusters (Daley et al., 1998), after accounting for initial depression symptoms, Cluster A symptoms prospectively predicted chronic interpersonal stress over a two-year period, and Cluster B pathology predicted both chronic interpersonal stress and dependent episodic stress over the same time interval. Conversely, Cluster C symptomatology was not prospectively associated with chronic interpersonal stress or dependent episodic stress. Consistent with the stress generation model, no relation was found between any of the three PD clusters and subsequent independent stress. Furthermore, chronic interpersonal stress and dependent episodic stress mediated the relation between Cluster A and B pathology and prospective depression symptoms. Adding to these findings, personality pathology has also been found prospectively to relate to greater interpersonal stress in a sample of low-income, at-risk, minority adolescents (Daley et al., 2006; $n=143$). Cluster B PD symptomatology increased risk for subsequent depression symptoms, with generated interpersonal stress identified as a mediational mechanism. A multi-wave study (Daley et al., 2000; $n=142$) with a sample of young women in romantic relationships found borderline personality disorder (BPD) symptom severity to be positively associated with multiple indices of romantic relationship dysfunction over a four-year period. This stress generation effect was not unique to BPD, however, and was better accounted for by overall Axis II pathology. Similarly, depressive symptomatology generally did not uniquely predict stress in romantic relationships when considered together with Axis II pathology, a finding that suggests that PD symptoms may be particularly relevant to generating relational conflict and stress. Taken together, these studies reveal a general trend, with Clusters A and B being particularly associated with the generation of interpersonal stress.

The personality trait of neuroticism has also been studied in relation to stress generation. In a sample of early adolescent girls ($n=896$), neuroticism was linked with later dependent negative life events occurring over a year (Kercher et al., 2009). It was also associated with greater subsequent negative automatic thoughts, both directly and indirectly through the generation of dependent stressors. Neuroticism was also related to elevated levels of dependent, but not independent, stressful life events in parents of children at risk for major affective disorders (Ellenbogen & Hodgins, 2004). Using a daily diary method ($n=197$), Gunthert, Cohen and Armeli (1999) found neuroticism to be associated with more interpersonal stresses. Interestingly, neuroticism was also associated with the use of poorer coping strategies in response to stress (e.g., hostile reaction or self-blame), which may facilitate the maintenance of current stressors or the generation of future ones.

Exploring this possibility, a few researchers have found support for the role of maladaptive coping and problem-solving strategies in the stress generation effect. In a study ($n=1211$) focusing exclusively on avoidance coping (Holahan, Moos, Holahan, Brennan & Schutte, 2005), this coping style was prospectively predictive of chronic and episodic dependent stress occurring over a four-year interval. Extending these findings to other coping strategies, Barker (2007; $n=241$) assessed problem-focused, emotion-focused, and avoidant coping in relation to subsequent interpersonal and academic hassles experienced over a four-week interval. Again, avoidant coping was prospectively associated with interpersonal hassles. In addition, it mediated the relation between initial depressive symptoms and subsequent interpersonal hassles, but failed to predict academic hassles. In contrast, neither of the more adaptive coping styles (i.e., emotion- and problem-focused coping styles) was related to future hassles. Poor interpersonal problem-solving was observed in a longitudinal study ($n=140$) to predict the occurrence of interpersonal stress (Davila, Hammen, Burge,

Paley & Daley, 1995). It should also be noted, however, that interpersonal problem-solving did not appear to mediate the relation between depression and later interpersonal stress, suggesting that it was not a mechanism through which depression generates stress.

Other researchers have examined different attachment styles as potential predictors of stress generation. In a longitudinal study with clinically depressed adults ($n=68$), four attachment styles (i.e., secure, fearful, dismissing, and preoccupied) were assessed in relation to episodic stress experienced over a three-month treatment period (Bottonari, Roberts, Kelly, Kashdan & Ciesla, 2007). Among initially mildly, but not severely, depressed individuals, dismissing and preoccupied attachment styles were prospectively associated with social or interpersonal events. A dismissing attachment style also predicted dependent stressors. Avoidant and anxious attachment styles have also been shown to be related prospectively with greater interpersonal stressful events, as predicted by an interpersonal stress generation model (Hankin et al., 2005).

Several studies also have considered dependency and reassurance-seeking in relation to stress generation. Shahar and Priel (2003; $n=603$) found dependency was associated with later negative interpersonal and failure-related events, which, in turn, predicted distress in the form of depression and anxiety symptoms. That is, generated negative events appeared to form a mediational route through which dependency may lead to symptoms of distress. Dependency also predicted higher levels of positive events, which was inversely associated with prospective distress. Adding to this result, among children of parents with mood disorders, dependency was not linked with interpersonal or independent stresses, but predicted lower levels of non-interpersonal stress (Shih et al., 2009; $n=140$). Reassurance-seeking was found to predict greater interpersonal stress, but not non-interpersonal or independent stresses. Paralleling this finding, Pothoff et al. (1995; $n=267$) reported that excessive reassurance-seeking was prospectively related to depressive symptoms, and this relation was mediated by the generation of minor social stresses. In another study assessing stress generation across several domains, the stress generation effect of reassurance-seeking appeared limited mostly to intimate relationships (Shahar et al., 2004). In a prospective study with female undergraduates (Eberhart & Hammen, 2009; $n=104$), excessive reassurance-seeking, dependency and attachment styles were evaluated as predictors of stress generation specifically within the domain of romantic relationships, prospectively over a four-week timeframe and using a daily diary method over 14 consecutive days. Conflict stress was predicted by an anxious attachment orientation and excessive reassurance-seeking. In contrast, avoidant attachment, exploitable dependency, and love dependency were not associated with conflict stress generation. Most interpersonal behaviors (i.e., anxious attachment, avoidant attachment, excessive reassurance-seeking, and love dependency) were also associated with conflict stress in romantic relations on a daily basis.

A few studies have examined sociotropy and autonomy as predictors of stress generation. According to Beck (1983), sociotropic individuals' sense of self-worth is primarily based on interpersonal interactions, making them particularly sensitive to social criticism and rejection, whereas autonomous individuals' self-worth is inordinately dependent on independence and goal attainment, making them vulnerable to depression when presented with loss of control or personal failure. Daley et al. (1997; $n=134$) found an autonomous, but not sociotropic, personality style to be associated with elevated levels of episodic stress for dependent and conflict events. Two other studies (Nelson, Hammen, Daley, Burge & Davila, 2001; Shih, 2006) have evaluated these constructs within the context of Beck (1983, 1987) event-congruency hypothesis, but produced inconsistent results. Nelson et al. (2001; $n=115$) observed a general mismatch between personality style and chronic stress; sociotropy interacted with poor problem-solving or low self-perceived interpersonal competence to

predict greater chronic achievement stress, whereas the autonomy subscale of need for control predicted higher rates of chronic interpersonal stress. In contrast, Shih (2006; $n=99$) found that sociotropy predicted greater episodic interpersonal stress in women but not men, and neither sociotropic nor autonomous personalities were predictive of episodic dependent achievement stress. The contrasting results between these two studies may in part be accounted for by the focus on chronic stress in one (Nelson et al., 2001), and episodic stress in the other (Shih, 2006), as there is accumulating research to suggest that differences exist between the two in relation to psychosocial processes and sequelae (Hammen et al., 2009; Monroe & Simons, 1991). It should also be noted that the two studies differed in their measure of sociotropy and autonomy (i.e., the revised Personality Style Inventory [PSI]; Robins et al., 1994; and the Sociotropy-Autonomy Scale [SAS]; Beck et al., 1983), which may provide some explanation for their differing results (Bieling, Beck & Brown, 2000). As inconsistencies in the depression literature relating to these constructs have led to a re-evaluation of the SAS and the development of two-factor solutions for both sociotropy and autonomy that demonstrate stronger associations with psychopathology (Bieling et al., 2000), another possible explanation for the conflicting findings may be found in the reliance on composite sociotropy and autonomy scores in one study (Shih, 2006) and the original sub-scales for autonomy in the other (Nelson et al., 2001). Thus, although there is some preliminary support for sociotropy and autonomy as predictors of dependent stress, further study using the more recent two factor solutions is required to clarify the exact nature of their relation with different types of stress.

Shih and Eberhart (2008; $n=51$) recently examined whether self-reported maladaptive interpersonal behaviors (i.e., difficulty being assertive, being too caring, and aggressiveness) acted as explanatory mechanisms mediating the relation between prior depressive episodes and subsequent interpersonal stress. Although past depression predicted greater difficulty with assertiveness and being too caring, non-assertiveness did not mediate the stress generation effect of depression. A limitation of this study is its reliance on a self-report measure of behavior. In a rare study utilizing behavioral observations, a more objective measure of behavior, a sample of outpatients with remitted depression ($n=101$) was videotaped while being administered a diagnostic interview (Bos, Bouhuys, Geerts, van Os & Ormel, 2007). The first 15 min of the recorded interview were coded for non-verbal expressions of involvement from both participant and interviewer. Greater incongruence in non-verbal communication, which previously had been associated with a worse course of depression (Bos, Bouhuys, Geerts, van Os & Ormel, 2006), was found to predict a greater number of interpersonal, but not independent, stressors over a two-year period.

Although these studies provide general support for interpersonal characteristics, in the form of attachment styles, coping strategies, dependency, sociotropy, autonomy, and reassurance-seeking, as contributors to stress generation, research on the unique effect of different interpersonal vulnerabilities is still relatively lacking (see Shahar et al., 2004, for an exception, albeit without distinguishing between dependent and independent stresses in the relevant mediational analyses). It would be important for future research to address this gap in the literature by evaluating multiple interpersonal vulnerabilities simultaneously in prospectively predicting dependent stress, as this approach would allow for a determination of their individual unique and cumulative or additive contribution to the stress generation effect. Moreover, it would inform current understandings of the mechanisms underlying stress generation if the interrelations between these vulnerabilities in generating dependent stress could be delineated. One possibility, for example, is that anxious attachment styles generate higher levels of interpersonal stress in part through the mediating effect of excessive reassurance-seeking, especially given that reassurance-seeking behavior may be to some degree motivated by an anxious attachment style (Eberhart & Hammen, 2009).

3.5. Gender differences in stress generation

An emerging trend in the research literature is what appears to be a gender difference in the stress generation pattern. Specifically, there is accumulating evidence from several studies, some briefly touched upon earlier, in support of the view that stress generation may be of greater relevance to women than men. This possibility has been articulated by Hankin and Abramson (2001) in an extension of traditional cognitive diathesis-stress models of depression (e.g., Abramson et al., 1989; Beck, 1967, 1987) incorporating stress generation to account for the reciprocal relation between stress and depression. Stated briefly, in their cognitive vulnerability-transactional stress theory of depression, Hankin and Abramson (2001) posit that girls experience greater exposure (and reactivity) to stress, which, when combined with their greater cognitive vulnerability to depression, increases likelihood of elevated depressive symptomatology. These depressive symptoms, in turn, generate even more stressful life events, in a positive-feedback cycle.

Congruent with this model, Rudolph and colleagues (Rudolph & Hammen, 1999; Rudolph et al., 2000; $n=88$) have found in a clinical sample of children and adolescents that, depression was associated with interpersonal stress for both genders, but girls, particularly adolescents, experienced more interpersonal stress than did boys. Mirroring these results, adolescent girls have been shown to experience more dependent episodic stress, especially within interpersonal domains (Shih, Eberhart, Hammen & Brennan, 2006). Additionally, female college students appear more likely to experience depressive symptoms, which in turn predicted more daily interpersonal hassles (Barker, 2007). As noted earlier, depression symptoms have been found to predict elevated chronic marital stress among newly-wed wives, but not their husbands (Davila et al., 1997). Concordant with this finding, initial depressive symptoms have been demonstrated to predict stress in both marital and parent-child relationships among women, but not their husbands (Jones, Beach & Forehand, 2001). A study with a child sample (Shih et al., 2009), however, reported contrasting findings, with boys experiencing more interpersonal and non-interpersonal dependent stress. Furthermore, a few studies with adult samples have found no main effects of gender differences in rates of dependent stress (Safford et al., 2007; Shih, 2006), although in both of these cases, the use of a behavioral high-risk design may have diminished any otherwise detectable gender differences.

The mediational and moderational relations that gender appears to have with stress generation may not be limited to depressive symptoms, but extend to depressogenic cognitive and interpersonal vulnerabilities as well. Female gender has been observed to predict daily interpersonal hassles, with an avoidant coping style functioning as a mediating mechanism (Barker, 2007). Finally, there is some evidence that gender may moderate the effect of negative cognitive styles in generating dependent stressors, with this effect being observed in women but not men (Safford et al., 2007). This effect was not observed, however, in a study with children (Shih et al., 2009). Other studies have found that gender may moderate the stress generation effect of dependency in children (Shih et al., 2009) and sociotropy in adults (Shih, 2006).

In summary, there is some evidence that female gender (a) is associated with the generation of dependent stresses (b) through the mediation of depression; (c) moderates the stress generation effect of depression; (d) is mediated in its relation with generated stress by interpersonal vulnerabilities; and (e) moderates the effect of cognitive and interpersonal predictors of dependent stress. Support for gender differences in stress generation currently appears stronger in children and adolescents than adults. Finally, an important focus for future research is to explore further the manner in which gender relates to cognitive and interpersonal vulnerabilities in the generation of dependent stress.

3.6. Sequelae of generated stress

An important theoretical and clinical consideration is the degree to which stress generation contributes directly to subsequent depressive symptomatology and diagnoses. Is there evidence for its involvement in the pathogenesis of depression? That dependent stressors, particularly interpersonal ones, compared to independent stressors, are known to be more strongly associated with depression (Kendler et al., 1999) is suggestive of this possibility. If such is the case, the stress generation process may prove to be an explanatory factor for depressive chronicity (Belsher & Costello, 1988; Monroe & Harkness, 2005; Solomon et al., 2000).

An accumulating body of research has provided evidence in support of this position. For example, Davila et al. (1995, 1997) have found interpersonal stress to be a mediator of the relation between initial and subsequent depressive symptoms. Stress generation appears also partially to account for the depressogenic influence of certain personality or interpersonal vulnerabilities. Specifically, as discussed above, chronic and episodic dependent stress has been found to mediate the relation between PD pathology and later depressive symptomatology (Daley et al., 1998, 2006). Interpersonal stress also has been reported to mediate the pathway between insecure attachment and subsequent depression symptoms (Hankin et al., 2005). Stress generation has been demonstrated to occupy a similar mediational relation between neuroticism and subsequent depression symptomatology (Kercher et al., 2009), as well as account for the depressogenic effects of excessive reassurance-seeking (Pothoff et al., 1995), avoidance coping (Holahan et al., 2005), self-criticism (Shahar & Priel, 2003; Shahar et al., 2004), dependency (Shahar & Priel, 2003), and hopelessness (Joiner, Wingate, Gencoz, et al., 2005; Joiner, Wingate & Otamendi, 2005).

In a manner consistent with Coyne (1976) interpersonal theory of depression, which holds that depressed individuals tend to have a detrimental effect on others, the depressogenic effects of stress generation also have been shown to extend beyond the individual generating the stress to those around them. For example, children of depressed women appear to be exposed to higher levels of stressors, including those generated by their mothers (Adrian & Hammen, 1993; $n=53$). Furthermore, these children generated more stress themselves, particularly in the form of family and peer conflict events. These findings are congruent with the possibility that stress generation may function as a mechanism underlying the intergenerational transmission of depression. More direct evidence comes from a study (Hammen et al., 2004; $n=816$) in which grandmother and maternal depression were prospectively associated with child depression through the process of maternal chronic interpersonal stress. Additionally, maternal interpersonal stress affected child depression through its intermediary effects on child interpersonal stress. Similarly, another study (Jones et al., 2001) reported that maternal depression symptoms predicted not only subsequent increases in symptoms through the mediational effect of relationship stress, but also depressive symptoms in adolescent offspring.

Collectively, these findings may suggest some interesting refinements in approaches to studying depression recurrence, particularly within the framework of the stress sensitization/“kindling” hypotheses (Post, 1992). To the extent that stress generation confers risk for depressive recurrence, it may lend weight to the stress sensitization model. Preliminary support for this possibility comes from a recent study connecting stress generation to depressive recurrence (Bos et al., 2007), with dependent stress reported to mediate the relation between observed incongruent non-verbal communicative engagement and risk for recurrence in outpatients. In line with this finding, and as mentioned above, Harkness et al. (1999) found that recurrent depressives reported more dependent events, but not independent events, than did first-onset depressives in the 12 months prior to their current

depressive episode. If stress generation does indeed prove to be a mechanism of depressive recurrence, it would follow that research on the changing relation between stress and recurrence over time may benefit from adopting a similar approach taken in stress generation research by distinguishing between dependent and independent stressors, as well as interpersonal and non-interpersonal ones. It may be, for example, that depressed individuals become sensitized to dependent stress, especially interpersonal or conflict stress, but not to independent stress. Finally, Monroe and Harkness (2005) have drawn attention to some additional possible implications of stress generation for research in this area. Specifically, within the perspective of the stress sensitization model, stress generation may be responsible for increasing the rate of depressogenic stress, and thus account for the often observed increasingly shorter time between recurrences (Solomon et al., 2000). Within the context of the stress autonomy model, however, stress generation may bear decreasing relevance as the recurrence of depressive episodes become increasingly unaffected by stressful life events.

3.7. Specificity of stress generation to depression

Is the stress generation phenomenon unique to depression? Hammen (2006) suggested the possibility that stress generation may occur in other disorders, although different types of stress may be more relevant or involve different interactions with disorder-specific vulnerabilities. Shedding light on this issue, several studies have compared the stress generation effects of depression relative to symptoms of other disorders, most commonly, anxiety. Thus far, however, most of the studies involving direct comparison between disorders generally support the view of stress generation being specific to depression. In one study, symptoms of depression, but not anxiety or conduct disorder, were positively correlated with stressful life events (Wingate & Joiner, 2004). Other studies have also reported the stress generation pattern to be specific to depressive symptoms but not anxiety (Gunthert et al., 2002; Joiner, Wingate, Gencoz, et al., 2005). When compared to bipolar disorder, chronic medical illnesses, and healthy controls, depression was prospectively associated with elevated rates of dependent stress, particularly interpersonal stress (Hammen, 1991). Paralleling this finding, the rates of generated dependent stress, especially within interpersonal domains, were highest among children of depressed mothers (Adrian & Hammen, 1993). In another study, however, after controlling for initial depression symptoms, Axis II pathology was found to be associated with stress generated in relational or interpersonal domains, as mentioned above (Daley et al., 2000). In addition, one study examining the outcome of generated stress noted that insecure attachment styles predicted anxiety symptoms through the mediational effect of interpersonal stress (Hankin et al., 2005).

Despite these findings, comorbidity studies suggest that the stress generation pattern may be augmented by the presence of multiple disorders. For example, dependent events appeared to be greater among depressed individuals with anxiety and dysthymia comorbidity, compared to those with none or one of these conditions (Harkness & Luther, 2001). Similarly, comorbid depression and externalizing disorder has been associated with higher levels of interpersonal episodic stress when compared to depression alone (Rudolph et al., 2000). Relative to depression alone, having a general comorbid diagnosis was also revealed in a prospective study to predict higher levels of dependent stress (Daley et al., 1997).

It should also be noted that, recently, a few researchers have examined the stress generation process specifically with other disorders. As the central focus of the current review is depression-related stress generation, their findings will be mentioned only briefly here.

Preliminary results from studies on bipolar disorder have failed to find support for the stress generation effect (Grandin, Alloy & Abramson, 2007; Reilly-Harrington, Alloy, Fresco &

Whitehouse, 1999). Another study on the offspring of parents with bipolar disorder also did not find evidence of a stress generation effect (Ostiguy et al., 2009). Interestingly, these studies (Grandin et al., 2007; Reilly-Harrington et al., 1999; Ostiguy et al., 2009) found bipolar disorder or having a bipolar parent predicted greater rates and severity of independent rather than dependent negative events. Given that this disorder is characterized by behavioral tendencies, such as impulsivity and risk-taking (Holmes et al., 2009), often associated with negative self-consequences, more research is required to clarify our understanding of the relation between bipolar disorder and future stressors. Indeed, bipolar disorder may be associated with the generation of specific types of dependent stressors, namely those related to reward sensitivity and impulsivity (Urosevic et al., 2010). Additionally, maternal reports of adolescents' internalizing and externalizing symptoms were found in one study to predict hassles (Carter, Garber, Ciesla & Cole, 2006). Furthermore, a cross-sectional study of anxious children (Allen & Rapee, 2009) reported more negative dependent events in anxious children, particularly those with comorbid conditions, when compared to controls. Interpretation of this finding, however, is tempered by the inability to draw causal inferences from its cross-sectional design.

4. Conclusions and future directions

In summary, there is now a substantial amount of support for the stress generation effect in depression, with many studies replicating the original finding (Hammen, 1991) that depression is associated with subsequent occurrence of dependent stress. The majority of these studies, however, have focused on episodic stress, and very little attention has been devoted to establishing the generation of chronic stress. Stress generation research has expanded beyond the effects of depressive symptomatology on stress to include preliminary evidence that chronic stress and childhood maltreatment contribute to the subsequent occurrence of dependent stress. The search for other predictors of stress generation has mostly centered on cognitive and personality or interpersonal vulnerabilities. The research on cognitive factors is somewhat mixed, but generally supportive of a stress generation effect. Future research in this area is warranted; in addition to clarifying the role of cognitive vulnerability as outlined in the hopelessness theory of depression (Abramson et al., 1989), it would be particularly important to investigate the contribution of other cognitive factors less well-studied within this context, including dysfunctional attitudes (Beck, 1967, 1987), rumination, and low self-perceived competence in multiple domains (Cole, 1990, 1991). Although studies on personality and interpersonal vulnerabilities have provided more consistent support for their involvement in stress generation, these vulnerabilities have largely been considered in isolation, precluding any evaluation of their unique and potential additive or cumulative effects on stress generation. Future research should also examine the inter-relations between multiple cognitive and interpersonal vulnerabilities in increasing the occurrence of stressful life events. Yet other potential interpersonal mechanisms previously have been proposed – particularly negative feedback-seeking, blame maintenance, and interpersonal conflict avoidance – and remain promising avenues of study (Joiner, 2000).

A gender difference in stress generation has also emerged in the literature, with women generating more dependent stress than do men, thus adding to our understanding of processes involved in gender differences in depression. This trend currently appears relatively more established in children and adolescents than adults.

Generated stress has also been shown in several studies to predict subsequent depression, although this has been mostly in terms of symptomatology rather than clinical depression. The depressogenic effects of stress generation also appear to extend beyond the individual to others around them. The ways in which stress generation may inform research on stress sensitization/"kindling" hypotheses, and its possible relations to the stress sensitivity and

stress autonomy models have been discussed above. Despite Hammen (2006) suggestion that stress generation may not be unique to depression, the research to date, both in direct comparisons to other disorders and when these other disorders are examined alone, points to a degree of specificity in the relation between stress generation and depression. It should be noted, however, that in several studies, comorbidity seems to heighten the stress generation effect in depressed individuals. Also worth mentioning is that studies on the specificity of stress generation to depression have not yet assessed whether different types of stressors may be differentially related to specific disorders, a possibility to be investigated in future studies (Hammen, 2006).

Adding to the suggestions for further research already outlined above, what follows is a discussion of some key issues and recommendations that, it is hoped, may inform future studies in this area. From a methodological standpoint, it is important to note that a common limitation of the extant stress generation literature, accounting for 44% of the 57 articles in the present review, is the reliance on self-report measures of stress instead of structured or semi-structured interviews. The particular relevance of this methodological limitation to stress research has been recognized by several researchers (Hammen, 2005, 2006; Johnson, 2005; Kessler, 1997; Mazure, 1998; Monroe, 2008; Paykel, 2003). A concern with self-report measures within the context of stress generation is that they are very susceptible to participants' subjective interpretations (e.g., mood-congruent reporting or memory biases; Brown & Harris, 1978) and do not allow for the type of contextual information critical to discriminating accurately between independent and dependent stressors, as well as to documenting actual, rather than perceived, stress.

A remedy to these shortcomings of self-report measures of stress is the use of structured or semi-structured interviews. Empirical comparisons between the two approaches have consistently revealed significant differences, particularly the susceptibility of the former to errors in reporting (e.g., through misinterpretation of questionnaire items relative to *a priori* criteria; Hammen, 2005; also see Monroe, 2008, for a recent review). Of direct relevance to stress generation research, Simons et al. (1993) found that, relative to an interview-based assessment, a self-report measure of stress was associated with more events and higher severity ratings, the difference between measures in part being accounted for by negative cognitive styles. Stress generation of dependent events was found for the interview-based method. These findings speak to the cleaner and more conservative test of stress generation that may be achieved with semi-structured interviews. An added benefit of interview-based assessments is the greater precision they allow in dating events (Hammen, 2005; Johnson, 2005). For these reasons, interview-based measures of stress have come to be widely viewed as the gold-standard for documenting stressful life events (Kessler, 1997; Mazure, 1998; Monroe, 2008; Paykel, 2003).

A somewhat related issue pertains to accuracy in the recollection of stressful life events, an issue dependent on the type of event. Major life events tend to be remembered for about a year (Johnson, 2005), whereas more minor events often to fade from memory after briefer intervals (Brown & Harris, 1982). Consequently, it may be beneficial for future research to assess stressful life events over briefer intervals (e.g., five months; Brown & Harris, 1982) than has been the case in several previous studies. Additionally, behavioral observations and daily diaries, used in a few of the studies covered here, offer possibilities for interesting and fine-grained analyses of the relations between individual variables and stress in a way that may compliment or supplement research using semi-structured interviews.

Another methodological issue relates to the operationalization of stress in the literature. Specifically, a number of studies have attempted to test the stress generation hypothesis, yet did not differentiate between dependent and independent stresses in their analyses, instead

examining the generation of stress more generally. To the extent that such a distinction is central to this theoretical perspective, and insofar as the stress generation effect is specific to dependent but not independent stress, not to distinguish between the two likely leads to a dilution of any existing relation between dependent stress and the predictor variables of interest. Thus, the failure to distinguish between these two forms of stress does not allow for a clean and direct test of stress generation, necessitating the exclusion of several otherwise excellent and informative studies from the current review.

In studies that do make the distinction between dependent and independent events, a related consideration is the strategy used to make this determination. Generally, two approaches have been followed. First, several studies make this decision *a priori*, particularly in the case of those using self-report life events checklists, where the lack of contextual information precludes the possibility of more sensitive discriminations. A second approach, more commonly employed with interview-based assessments, involves presenting several raters with interview-derived contextual information for each event and having them independently rate the event on a Likert scale for dependence versus independence. The average across raters would then serve as a basis for classifying an event as dependent or independent. A challenge with making this distinction is that it is often difficult to tease apart to what degree an event, particularly within interpersonal domains, is truly dependent on an individual's behavior rather than that of other people involved. These two approaches, by treating dependence and independence dichotomously, do not adequately allow for this consideration. Perhaps, then, a third approach, involving treating dependence and independence as different ends of a continuous variable, would allow for a more sensitive assessment of the stress generation process.

These methodological issues aside, several interesting possibilities exist as to how future research may further refine our current understanding of the nature of stressors relevant to the stress generation process. Thus far, it seems fairly well established that the stress generation effect is specific to dependent stress, particularly within interpersonal domains. Finer-level analyses of these dependent stresses may also be possible, however, by considering domain-specific stresses (e.g., work-, peer-, and family-related stress; Hammen, 2006). An interesting related possibility, not yet fully addressed, is that the generated stressors may match one's underlying responsible vulnerabilities. That is, one's pattern of generated stress may be unique to one's vulnerability. To the extent that a match between stress and vulnerability significantly heightens risk for depressive onset (i.e., event-congruency hypothesis; Beck, 1983, 1987), this is an important consideration. The findings to date in this area, limited to sociotropy and autonomy, are few and mixed, thus awaiting future studies to clarify the possible congruency between vulnerability and generated stress. What also remains to be determined is what aspects or properties of stress are involved in the stress generation process. Specifically, does stress generation involve increases in the *number* of stressful events, *severity* of individual events generated, or the *duration* of events? Although all are likely, additional research is needed directly to assess these possibilities.

It would also be interesting to assess the properties of generated stress within the framework of the social zeitgeber theory (Ehlers, Frank & Kupfer, 1988), according to which life stressors increase risk for depression through disruptions in routine social and biological circadian rhythms. In support of this theory, depressed individuals appear more vulnerable than others to the effects of social rhythm disruption (SRD) events (Haynes, McQuaid, Ancoli-Israel & Martin, 2006). Integrating this model with the stress generation perspective, it may be that depression-prone individuals generate higher rates not only of dependent stressful events, but particularly ones characterized by SRD. If this indeed turns out to be the

case, SRD may contribute towards a more complete understanding of the stress generation process and its possible influence on the course of depression.

The explanatory power of stress generation in depressive course is of considerable theoretical and clinical importance, and as noted above, has received growing support. Although most studies examining this process in relation to subsequent depression have centered on depressive symptomatology in terms of symptom count or severity, it may also be worth assessing if stress generation mediates the effect of individual vulnerabilities on functional impairment. Furthermore, only one study to date (i.e., Bos et al., 2007) has evaluated stress generation as it affects the onset or recurrence of clinically significant depression. Researchers also have yet to examine how this process, and the underlying vulnerabilities it mediates, may account for the two other aspects of depression chronicity (i.e., depressive relapse and episode duration). Also left unexplored are its contributions to the duration and number of residual symptoms (i.e., partial remission). Alternatively, given that residual symptoms have been found to predict dependent stress (Shih & Eberhart, 2008), this relation may serve an explanatory pathway through which depressive relapse occurs before full remission is achieved.

Another promising topic for future study is the influence of developmental contexts on changes in the stress generation pattern. A well-known finding in the literature is that rates of depression begin to increase markedly around age 13, particularly in girls (Hankin & Abramson, 2001). That stress generation may to some degree account for the rise in prevalence of depression at this age is an intriguing possibility. Congruent with this idea, the transition to early adolescence is characterized by a notable increase in life stressors (Wagner & Compas, 1990). Early adolescence is also a period of increasing individuation and autonomy, especially within interpersonal domains (Bhavnagri & Parke, 1991; Parke & Bhavnagri, 1989). Thus, although the stress generation effect has been documented in both adolescent and adult samples, it would not be unreasonable to suspect that it becomes more pronounced as individuals transition through early adolescence and into adulthood, with the corresponding development and stabilization of cognitive and interpersonal vulnerabilities associated with stress generation, and the more direct role individuals have in navigating and shaping their social context and self-identity. Preliminary support for this position comes from two cross-sectional studies utilizing the same sample comparing pre-adolescent to adolescent boys and girls (Rudolph & Hammen, 1999; Rudolph et al., 2000). A longitudinal study (Shih et al., 2009), however, has yielded mixed results.

In addition to the possibility of a general *increase* in stress generation with age, the *pattern* of generated stress may also differ in significant and meaningful ways. Specifically, changes in stress generation patterns may correspond in some measure to the shifting focus of interpersonal relationships from parents and other authority figures in childhood to peers in adolescence. In childhood, parents and teachers form much of an individual's social context and support, whereas adolescence is characterized by diminishing parental influence and a matching increase in focus on relationships with peers (Bhavnagri & Parke, 1991; Buhrmester & Furman, 1987; Furman & Buhrmester, 1985, 1992; Marsh & Craven, 1991; Parke & Bhavnagri, 1989; Steinberg & Silverberg, 1986). Stress generation may similarly be most evident within family – particularly parental – interactions during childhood, and peer contexts in adolescence and adulthood. That is, cross-sectional within-age comparisons may be predicted to yield significantly higher rates of parent-related dependent stress than peer-related ones during childhood, with the trend being reversed during adolescence. Longitudinal across-age comparisons, in contrast, may reveal rates of parent-related dependent stress to be higher in childhood compared to adolescence, with the pattern reversed in the case of peer-related stress. More prospective studies are essential to determining the potential changing influence of development on stress generation.

In the search for mediators and moderators of the stress generation process, it would be useful to include a consideration of potential resilience factors. In the one study to date examining the influence of social support on the stress generation effect (Davila et al., 1997), social support perceptions and behaviors in marital relationships mediated the relation between depressive symptoms and prospective stress in women. Barker (2007) found self-esteem to be predictive of interpersonal hassles through the mediational effect of depressive symptoms. Despite these preliminary findings, the role of protective factors remains understudied.

Finally, stress generation research may also be extended to evaluate the possibility that, in addition to generating higher levels of dependent stressful life events, depression-prone individuals generate lower levels of dependent positive life events. To the extent that positive life events may counterbalance the depressogenic effects of negative ones (Shahar & Priel, 2002, but see also Tram & Cole, 2000), this is an important clinical consideration. Returning briefly to the concept of resilience factors, it would also be interesting to assess whether they serve to reduce rates of dependent negative events, and to increase the occurrence of positive ones in the same manner that depressogenic vulnerabilities are predictive of stress generation. Research in this area may shed light on the mechanisms underlying the protective effects of resilience factors.

Much progress has been made in two decades of research in enhancing our knowledge of the transactional relation between stress and depression. Nevertheless, several methodological limitations characterize much of the existing literature, specifically in the measurement of stresses. In addition to highlighting these issues, it is hoped that the current review may serve as a useful guide towards several promising lines of research that remain to be explored.

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